Short Form Sanction Paper- Instructions

5 Key Milestones

Milestone	Target Date: (Month/Year)
Program Sanction	March 2015
Preliminary Engineering	See Appendix
Procurement	See Appendix
Final Engineering	See Appendix
Delivery	See Appendix
Construction Start	See Appendix
Construction Finish	See Appendix
As Builts	See Appendix
Annual Program Closure	April 2016

6 Statements of Support

6.1.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Role	Name	Responsibilities
Investment Planner	Glen Diconza	Endorses relative to 5-year business plan or emergent work
Resource Planning D-Sub	Mark Phillips	Endorses resources, cost, schedule
Distribution Planning	Alan T. Labarre	Endorses scope, design, design standard
Engineering and Design	Sue Martuscello	Endorses scope, design, design standard

6.1.2 Reviewers

The reviewers have provided feedback on the content/language of the paper.

Reviewer List	Name
Finance	Keith Fowler
Regulatory	Peter Zschokke
Jurisdictional Delegates	James Patterson
Procurement	Art Curran
Control Centers	Michael Gallagher

6.1.3 List References

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1	Distribution Substation Breaker and Recloser Strategy – October 2009
2	560 Amp VSA Recloser Replacement, SMS 401.40.1
3	GE VIR Recloser Replacement, SMS 401.41.1

Short Form Sanction Paper- Instructions

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7 ***Decisions***

I:

(a) APPROVE this paper and the investment of $1.040M and a tolerance of +/-10%

(b) NOTE that Alex Neary is the Program Manager and has the approved financial delegation.

(c) NOTE: In the event that any Blanket/Program projects are not approved prior to the start of the FY2017 fiscal year, the FY2016 approval limits will remain in effect until such time as the FY2017 blanket/program projects are approved by USSC and/or other appropriate authority for approval.

Signature.....Date..3/30/2015

Ross Turrini, Senior Vice President, Network Strategy (Acting)

8 Other Appendices

8.1 List of Circuit Breakers and Reclosers for Replacement

Project Funding No.	Work Order No.	Station	Equip Description	Equip Position	Total	Final Design Complete (EDC)	Material Delivered	Construction Start (CS)	Ready For Load (RFL)	Construction Finish (CF)
C032278	90000151235	Barrington 4	VSA	4F2 VCR	1	Sep-15	Apr-15	May-15	May-15	May-15
C032278	90000151245	Kent County 22	34.5KS1500 12B	3310 OCB	1	Oct-15	Apr-15	May-15	May-15	May-15
			345GS1500	3311 OCB	1	Oct-15	Apr-15	May-15	May-15	May-15
			345GS1500	3312 OCB	1	Oct-15	Apr-15	May-15	May-15	May-15
			345GS1500	3309 OCB	1	Oct-15	Apr-15	May-15	May-15	May-15
			345GS1500	10-12 OCB	1	Oct-15	Apr-15	May-15	May-15	May-15
C032278	90000151239	Wolf Hill	FK-34.5-1500-3	2210 OCB	1	Nov-15	May-15	Jun-15	Jun-15	Jun-15
C032278	90000151240	Valley Sub 102	230GC250	102k23 Fdr OCB	1	Nov-15	May-15	Jun-15	Jun-15	Jun-15
C032278	10013024121	Lipitt Hill 79	AM 13.8 500 7H	1-2 ACB	1	May-15	Sep-15	Oct-15	Oct-15	Oct-15
				79F2 ACB	1	May-15	Sep-15	Oct-15	Oct-15	Oct-15
				79F1 ACB	1	May-15	Sep-15	Oct-15	Oct-15	Oct-15
					1	May-15	Sep-15	Oct-15	Oct-15	Oct-15
					1	May-15	Sep-15	Oct-15	Oct-15	Oct-15
C032278	90000139446	Davisville 84	VACG	84T2 VCB	1	May-15	Sep-15	Oct-15	Oct-15	Oct-15
				1-2 VCB	1	May-15	Sep-15	Oct-15	Oct-15	Oct-15
				84T1 VCB	1	May-15	Sep-15	Oct-15	Oct-15	Oct-15
C032278	90000139448	Clark St 65	AM- 4.16-75-1	65J2 ACB	1	May-15	Aug-15	Sep-15	Sep-15	Sep-15
C032278	90000139450	Lakewood 57	OZ-210	57J4 OCB	1	May-15	Jul-15	Aug-15	Aug-15	Aug-15
			OZ-15-250	57J5 OCB	1	May-15	Jul-15	Aug-15	Aug-15	Aug-15
			FK-32C	57J3 OCB	1	May-15	Jul-15	Aug-15	Aug-15	Aug-15
				Total	20					

8.2 Sanction Request Breakdown by Project

N/A

USSC Closure Paper

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Title:	Substation Breaker and Recloser Asset Replacement Program – Rhode Island – FY16 Closure	**Sanction Paper #:**	USSC-15-070C
Project #:	C032278	**Sanction Type:**	Closure
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	July 5th, 2016
Author:	Alexander Neary	**Sponsor:**	Carol Sedewitz, Electric Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	Alexander Neary

1 *Executive Summary*

This paper is presented to close project numbers C032278. The total spend was $1.822M. The latest sanctioned amount for this project was $0.782M

The final spend amount is $1.822M broken down into:

$1.797M Capex
$0.002M Opex
$0.023M Removal

2 *Project Summary*

This is the closure of the annual sanction of the Substation Breaker and Recloser Asset Replacement Program (ARP). Under this program, certain circuit breaker and recloser families have been targeted for replacement, as well as other breakers and reclosers due to poor condition. This program is in line with the approved Substation Breaker and Recloser Strategy.

USSC Closure Paper

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3 Over / Under Expenditure Analysis

3.1 Summary Table

Actual Spending ($M)			
Project #	Description		Total Spend
C032270	OS ARP Breakers & Reclosers	Capex	1.797
		Opex	0.002
		Removal	0.023
		Total	1.822
Total		Capex	1.797
		Opex	0.002
		Removal	0.023
		Total	1.822

Project Sanction Summary Table			
Project Sanction Approval ($M)			Total Spend
		Capex	1.000
		Opex	0.020
		Removal	0.020
		Total Cost	1.040
Sanction Variance ($M)			Total Spend
		Capex	(0.797)
		Opex	0.018
		Removal	(0.003)
		Total Variance	(0.782)

3.2 Analysis

The total annual spend for the program was $1.822M, which is $0.782M more than the sanctioned amount of $1.040M. The reason for the variance is due to field conditions at Lippitt Hill which prolonged and complicated breaker construction. Operational issues due to outage restrictions extended the construction duration as well as increased costs due to necessary overtime work. Engineering and material issues which delayed certain breaker replacements were additional minor contributors to the overages.

4 Improvements / Lessons Learned

To address these challenges, the following steps have been taken:

1. Prior to FY16, a field constructability review which had been held between substation engineering and LO&M was removed from ARP schedules. This meeting has been added back into schedules to give sight to any potential operational difficulties.

2. Additional resources have been identified to support material procurement. A meeting was held once material difficulties were identified in FY16, and substation engineering noted that an additional resource has been added to assist with materials purchasing. This resource will allow for the better coordination of materials and will prevent delays due to material ordering process bottlenecks.

5 *Closeout Activities*

The following closeout activities have been completed.

Activity	Completed
All work has been completed in accordance with all National Grid policies	(•) Yes ( ) N/A
All relevant costs have been charged to project	(•) Yes ( ) N/A
All work orders and funding projects have been closed	( ) Yes (•) N/A
All unused materials have been returned	(•) Yes ( ) N/A
All as-builts have been completed	(•) Yes ( ) N/A
All lessons learned have been entered appropriately into the lesson learned database	(•) Yes ( ) N/A

6 Statements of Support

6.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Department	Individual	Responsibilities
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses D-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	Suzan Martuscello	Endorses Substation scope, design, conformance with design standards
Engineering/Design	Alan LaBarre	Endorses D-Sub scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications

6.2 Reviewers

The reviewers have provided feedback on the content/language of the paper.

Function	Individual
Finance	Patricia Easterly
Regulatory	Peter Zschokke
Jurisdictional Delegates	James Patterson
Control Center	Michael Gallagher

USSC Closure Paper

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7 *Decisions*

I approve this paper.

Signature.....Date....7/15/11.....

Executive Sponsor – Christopher Kelly, Acting Senior Vice President, Electric Process & Engineering

C035586

Relay Replacement Strategy - RI

5360-Narragansett Electric and Gas
Project Revision Detail Report

Fund Project Number:	C035586	**USSC #:**	FY18 Program
Revision:	15	**Budget Version:**	
Project Title:	Relay Replacement Strategy Co 49DxT		
Project Description:	Relay Replacement Strategy Co 49DxT		

Project Status:	open		
Responsible Person:	ALEXANDER, THOM/	**Initiator:**	McCusker, Jeffrey M
Spending Rationale:	Asset Condition	**Funding Type:**	P Dist by Transmission Sub RI
Budget Class:	Asset Replacement		
Capital by Category:			
Program Code:			
Project Risk Score:	35	**Project Complexity Score:**	18

Project Schedule / Expenditures

Revision Status:	Approved		
Est Start Date:	4/1/2017	**Est Complete Date:**	3/31/2018
Est In-Service Date:	3/31/2018		
TTD Actuals:	$3,826,521	**As Of:**	10/10/2017

Cost Breakdown	Capital	Expense	Removal	Total	Credits
	$47,840	$0	$0	$47,840	$0

Justification / Risk Identification:

<Enter data here>

Project Scope:

Relay Replacement Strategy Co 49DxT

Project Alternatives Considered:

<Enter data here>

Additional Notes:

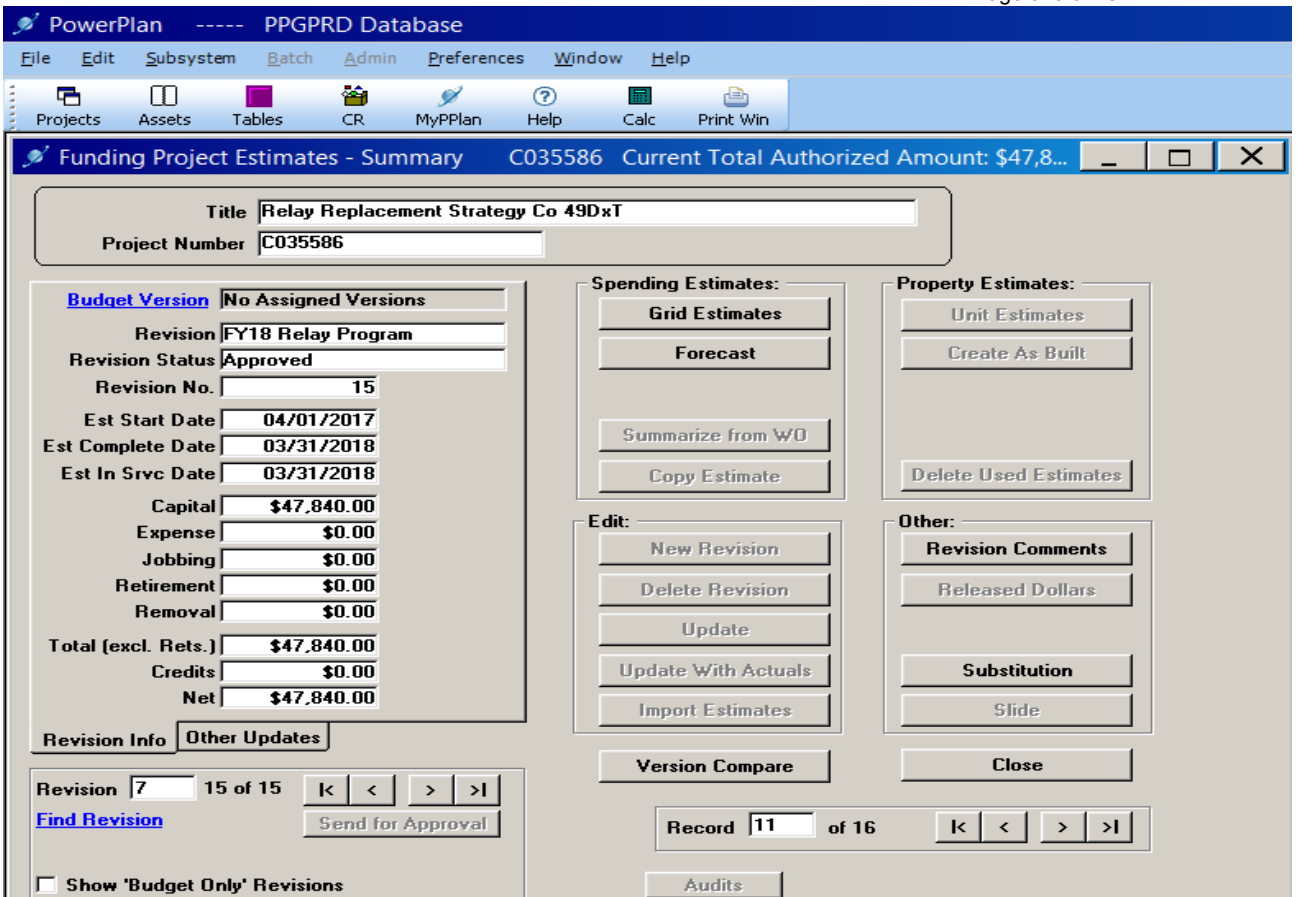
Related Projects:

Project Number: **Project Name:**

Approvals

Line 1:	**Date**	4/27/2017 15:21:09	**Approver**	labara	Approver 1
Line 2:	**Date**		**Approver**		
Line 3:	**Date**		**Approver**		
Line 4:	**Date**		**Approver**		
Line 5:	**Date**		**Approver**		

*****Project Authorization is for Approved Revision Total Estimated Cost +10%*****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Title Relay Replacement Strategy Co 49DxT
Project Number C035586
Budget Version No Assigned Versions
Revision FY18 Relay Program
Revision Status Approved
Revision No. 15
Est Start Date 04/01/2017
Est Complete Date 03/31/2018
Est In Srvc Date 03/31/2018
Capital $47,840.00
Expense $0.00
Jobbing $0.00
Retirement $0.00
Removal $0.00
Total (excl. Rets.) $47,840.00
Credits $0.00
Net $47,840.00
Revision Info
Other Updates
Revision 7 15 of 15
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
Update
Update With Actuals
Import Estimates
Other:
Revision Comments
Released Dollars
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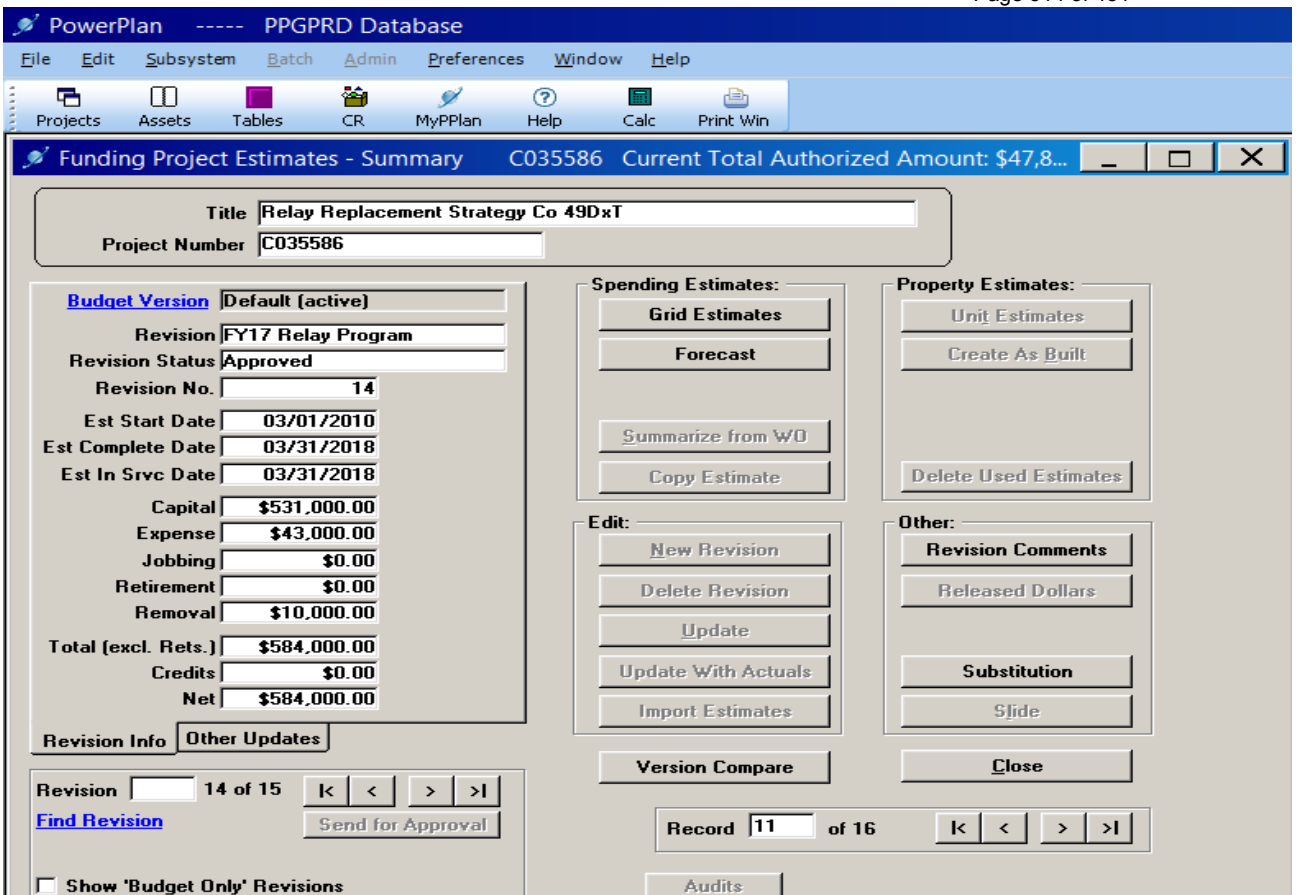
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File Edit Subsystem Batch Admin Preferences Window Help
Projects Assets Tables CR MyPPlan Help Calc Print Win
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Title Relay Replacement Strategy Co 49DxT
Project Number C035586
Budget Version Default (active)
Revision FY17 Relay Program
Revision Status Approved
Revision No. 14
Est Start Date 03/01/2010
Est Complete Date 03/31/2018
Est In Srvc Date 03/31/2018
Capital $531,000.00
Expense $43,000.00
Jobbing $0.00
Retirement $0.00
Removal $10,000.00
Total (excl. Rets.) $584,000.00
Credits $0.00
Net $584,000.00
Revision Info
Other Updates
Revision 14 of 15
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
Update
Update With Actuals
Import Estimates
Other:
Revision Comments
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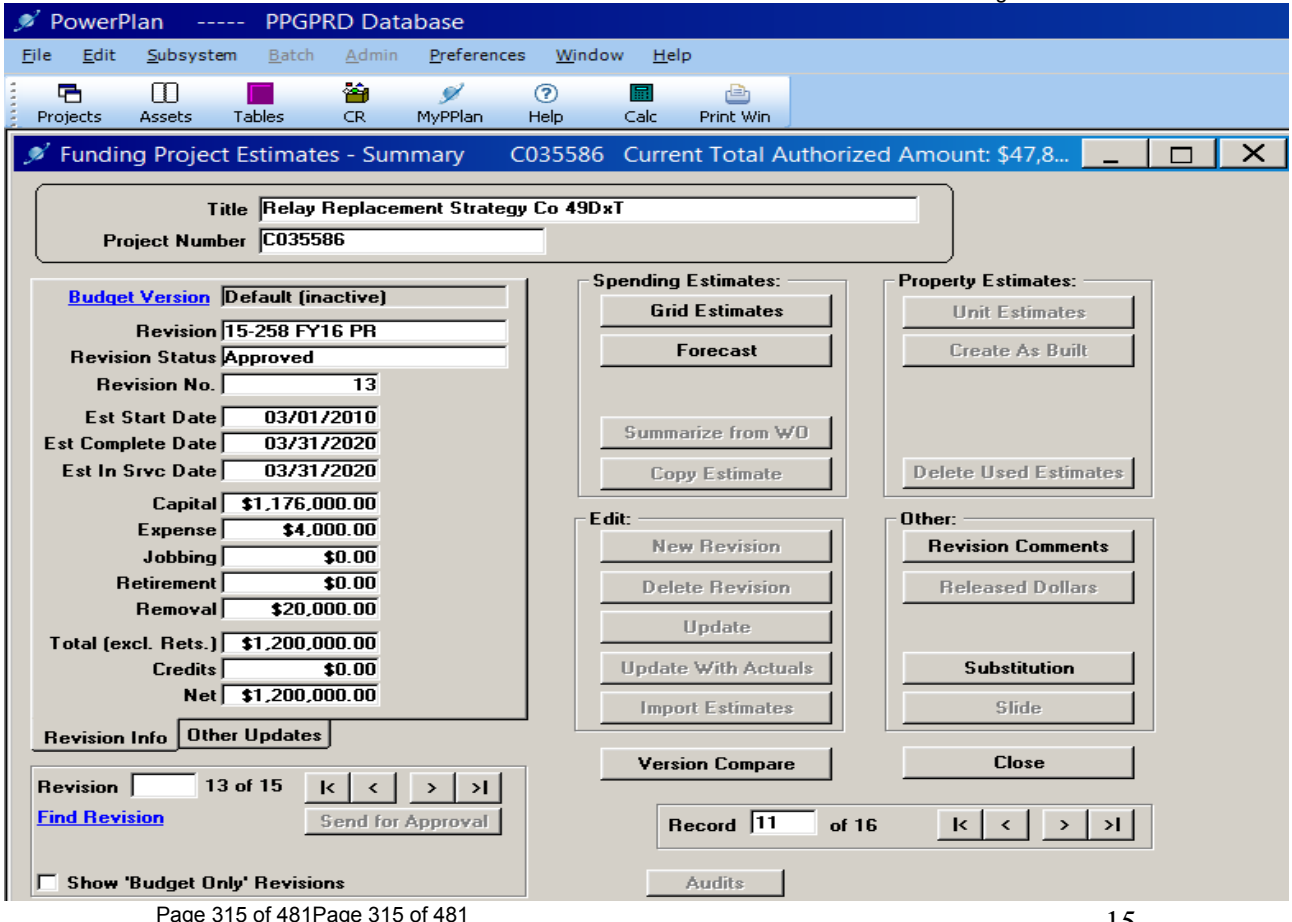
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Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C035586 Current Total Authorized Amount: $47,8...
Title Relay Replacement Strategy Co 49DxT
Project Number C035586
Budget Version Default (inactive)
Revision 15-258 FY16 PR
Revision Status Approved
Revision No. 13
Est Start Date 03/01/2010
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $1,176,000.00
Expense $4,000.00
Jobbing $0.00
Retirement $0.00
Removal $20,000.00
Total (excl. Rets.) $1,200,000.00
Credits $0.00
Net $1,200,000.00
Revision Info
Other Updates
Revision 13 of 15
Find Revision
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Show 'Budget Only' Revisions
Spending Estimates:
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Forecast
Summarize from WO
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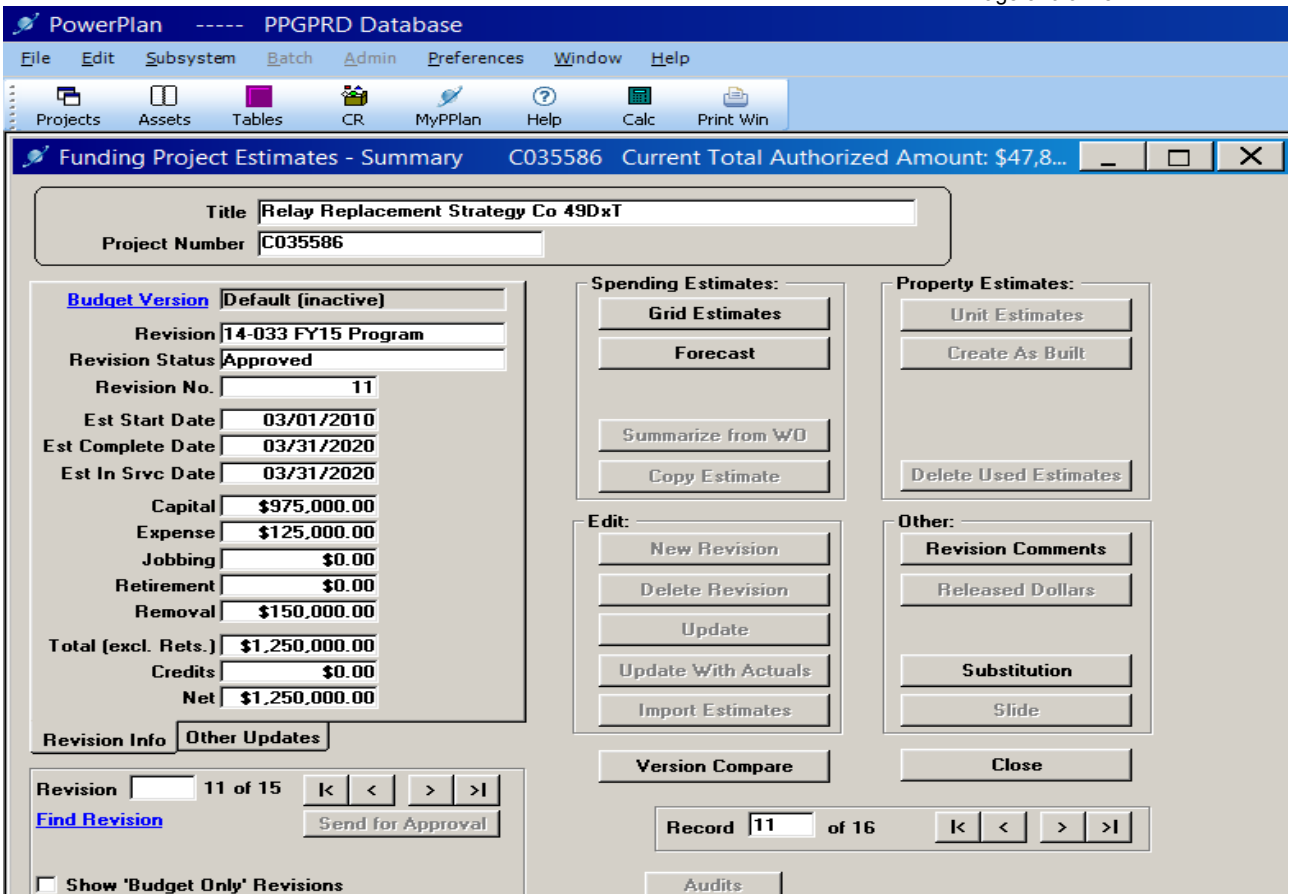
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Title Relay Replacement Strategy Co 49DxT
Project Number C035586
Budget Version Default (inactive)
Revision 14-033 FY15 Program
Revision Status Approved
Revision No. 11
Est Start Date 03/01/2010
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $975,000.00
Expense $125,000.00
Jobbing $0.00
Retirement $0.00
Removal $150,000.00
Total (excl. Rets.) $1,250,000.00
Credits $0.00
Net $1,250,000.00
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Other Updates
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Spending Estimates:
Grid Estimates
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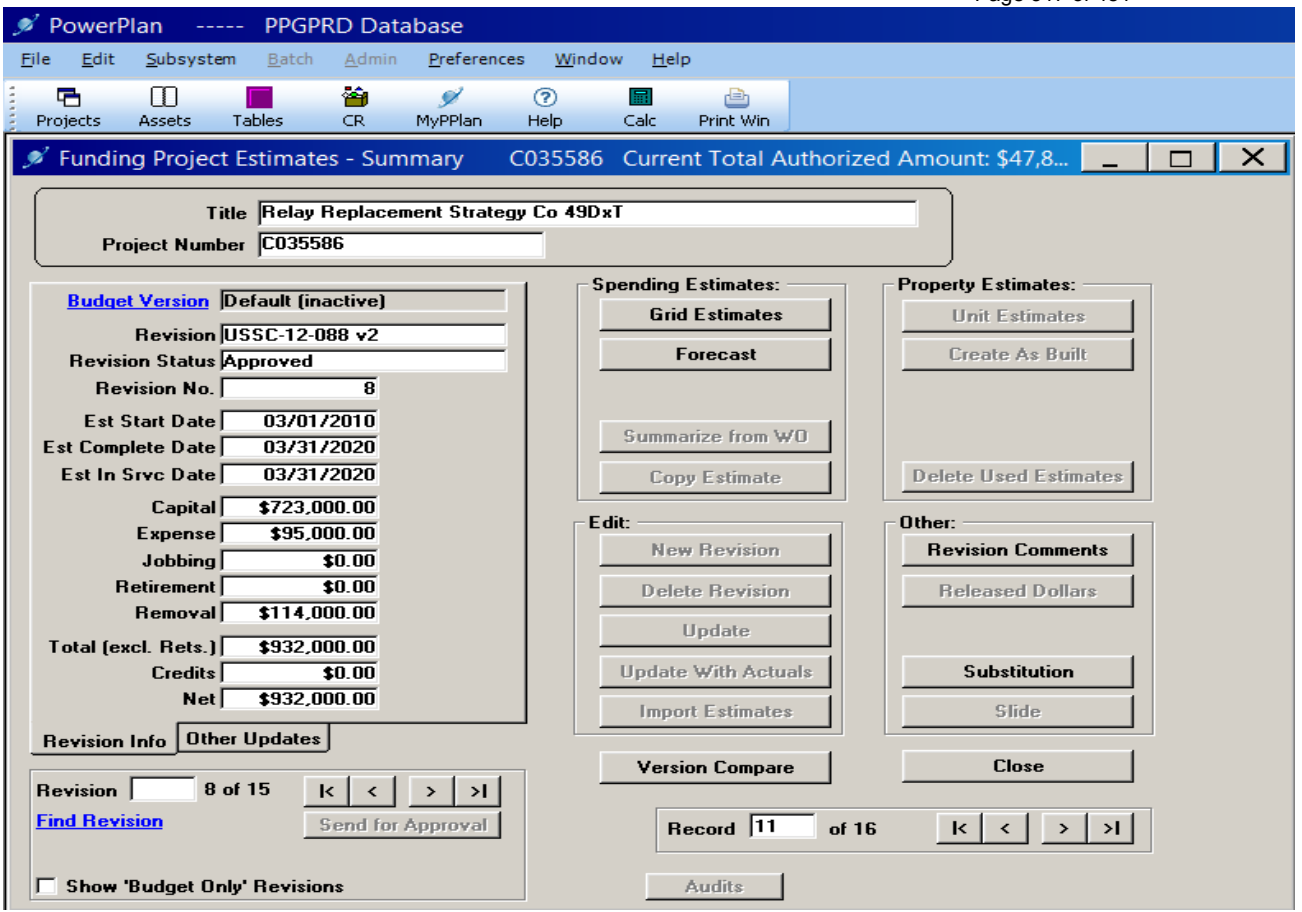
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Title Relay Replacement Strategy Co 49DxT
Project Number C035586
Budget Version Default (inactive)
Revision USSC-12-088 v2
Revision Status Approved
Revision No. 8
Est Start Date 03/01/2010
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $723,000.00
Expense $95,000.00
Jobbing $0.00
Retirement $0.00
Removal $114,000.00
Total (excl. Rets.) $932,000.00
Credits $0.00
Net $932,000.00
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Other Updates
Revision 8 of 15
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
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Summarize from WO
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US Sanction Paper

Title:	Relay Replacements - RI	**Sanction Paper #:**	USSC-12-088v2
Project #:	C35586, C35587	**Sanction Type:**	Partial Sanction
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	12/12/12
Author:	David Arthur / Sonny Anand	**Sponsor:**	Cheryl A. Warren – Vice President Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	David Arthur

1 Executive Summary

1.1 Sanctioning Summary:

This paper requests partial sanction of Project Funding # C35586 and C35587 in the amount **$1.200M** and a tolerance of **+/- 10%** for the purposes of preliminary engineering, final design and material procurement for all stations included in the Relay Replacement Strategy (SG157).

This sanction amount is $1.200M in the amount of:

$0.936M Capex
$0.120M Opex
$0.144M Removal

NOTE the potential investment of **$3.270M** and a tolerance of **+25% / - 50%** contingent upon submittal and approval of a Project Sanction papers for all the funding numbers.

1.2 Brief Description:

The Relay Replacements Strategy (SG157) was approved in October 2010 detailing replacement of existing electro-mechanical and solid state relays throughout the New England system. The strategy targeted specific families of relays with the highest probability of failure, which is a total of approximately 5% of the total electro-mechanical and solid state relay population. The families identified were transmission line differential, transformer differential, reclosing and under-frequency types.

The relays requiring replacement are obsolete, not supported by the manufacturer, have no available spare parts and have demonstrated a trend of decreasing reliability. If the relays identified fail or mis-operate, there is a risk of prolonged outages and a corresponding negative reliability impact.

The breakdown of relays requiring replacement detailed in the appendix.

US Sanction Paper

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This sanction paper specifically requests approval for final design and procurement of materials for all stations within the strategy

1.3 Summary of Projects:

Project Number	Project Title	Estimate Amount
C35586	Relay Replacements Co 49 Distribution	$ 2.50
	Total	$ 2.50

Project Number	Project Title	Estimate Amount
C35587	Relay Replacements Co 49 Transmission	$ 0.77
	Total	$ 0.77

1.4 Associated Projects:

Project Number	Project Title	Estimate Amount
C35583	Relay Replacement - Co 10	$ 1.99
C35584	Relay Replacement - Co 5	$ 4.78
C41464	Tewksbury #22 Ln 338 Relay Replacement	$ 0.35
	Total	$ 7.12

1.5 Prior Sanctioning History (including relevant approved Strategies):

Date	Governance Body	Sanctioned Amount	Paper Title	Sanction Type
October 2010	**AMIC**	**$14.840M**	**Relay Replacement Strategy – SG157**	**Strategy**
February 2011	**AMIC**	**$0.330M**	**Preliminary Engineering for Relay Replacements**	**PWS**
April 2012	**USSC**	**$0.500M**	**Underfrequency Final Design**	**Partial**

1.6 Next Planned Sanction Review:

Date (Month/Year)	Purpose of Sanction Review
July 2013	Partial Sanction – Construction Riverside, Valley, Franklin Sq, Woonsocket, Admiral St, Washington Stations

US Sanction Paper

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1.7 Category:

Category	Reference to Mandate, Policy, or NPV Assumptions
O Mandatory ⊙ Policy- Driven O Justified NPV	Provide for the network's safe, efficient and reliable operation

1.8 Asset Management Risk Score

Asset Management Risk Score: 41

Primary Risk Score Driver: (Policy Driven Projects Only)

⊙ Reliability O Environment O Health & Safety O Not Policy Driven

1.9 Complexity Level: (if applicable)

O High Complexity ⊙ Medium Complexity O Low Complexity O N/A

Complexity Score: 20

1.10 Process Hazard Assessment

A Process Hazard Assessment (PHA) is required for this project:

O Yes ⊙ No

US Sanction Paper

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1.11 Business Plan:

Business Plan Name & Period	Project included in approved Business Plan?	Over / Under Business Plan	Project Cost relative to approved Business Plan ($)
FY13-FY17 (T)	⊙ Yes O No	O Over ⊙ Under	$0.200M
FY13-FY17 (D)	⊙ Yes O No	O Over ⊙ Under	$0.170M
	⊙ Yes O No	O Over ⊙ Under	

1.12 If cost > approved Business Plan how will this be funded?

Re-allocation of funds within the portfolio will be managed by Resource Planning to meet jurisdictional budgetary, statutory and regulatory constraints.

1.13 Current Planning Horizon:

1.13.1 Current Planning Horizon (C35586):

		Current Planning Horizon						
	Prior Yrs	Yr. 1 2012/13	Yr. 2 2013/14	Yr. 3 2014/15	Yr. 4 2015/16	Yr. 5 2016/17	Yr. 6 + 2017/18	Total
CapEx	$ 0.01	$ 0.09	$ 0.20	$ 0.95	$ 0.70	$ -	$ -	$ 1.95
OpEx	$ -	$ 0.01	$ 0.03	$ 0.12	$ 0.09	$ -	$ -	$ 0.25
Removal	$ -	$ 0.01	$ 0.03	$ 0.15	$ 0.11	$ -	$ -	$ 0.30
CIAC/Reimbursement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ 0.01	$ 0.11	$ 0.26	$ 1.22	$ 0.90	$ -	$ -	$ 2.50

1.13.2 Current Planning Horizon (C35587):

		Current Planning Horizon						
	Prior Yrs	Yr. 1 2012/13	Yr. 2 2013/14	Yr. 3 2014/15	Yr. 4 2015/16	Yr. 5 2016/17	Yr. 6 + 2017/18	Total
CapEx	$ 0.02	$ 0.06	$ 0.20	$ 0.23	$ 0.06	$ 0.03	$ -	$ 0.61
OpEx	$ -	$ 0.01	$ 0.03	$ 0.03	$ 0.01	$ 0.00	$ -	$ 0.07
Removal	$ -	$ 0.01	$ 0.03	$ 0.04	$ 0.01	$ 0.00	$ -	$ 0.09
CIAC/Reimbursement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ 0.02	$ 0.08	$ 0.26	$ 0.30	$ 0.08	$ 0.03	$ -	$ 0.77

US Sanction Paper

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1.14 Resources:

Resource Sourcing			
Engineering & Design Resources to be provided	☑ Internal		☑ Contractor
Construction/Implementation Resources to be provided	☑ Internal		☐ Contractor
Resource Delivery			
Availability of internal resources to deliver project:	O Red	O Amber	⊙ Green
Availability of external resources to deliver project:	O Red	O Amber	⊙ Green
Operational Impact			
Outage impact on network system:	O Red	O Amber	⊙ Green
Procurement impact on network system:	O Red	O Amber	⊙ Green

1.15 Key Issues (include mitigation of Red or Amber Resources):

1	Transmission Level Relay Completion & Project Spend: The forecasted project spend included in this paper does not account for other project schedules or combining the work with other projects.
2	Transmission Level Relays: Subsequent revisions to this sanction paper will be submitted addressing the relay replacement construction

1.16 Key Milestones:

1.16.1 Key Milestones (Underfrequency Relay Design Package 1)

Milestone	**Target Date: (Month/Year)**
Planning Sanction	April 2012
Engineering and Design Complete (EDC)	March 2013
Project Sanction	April 2013
Facilities Rating to ISO	N/A
Construction Start	May 2013
Construction Complete	March 2014
Ready for Load	March 2014
Project Closeout (UF Work Orders)	September 2014

1.16.2 Milestones (Transmission Level – Riverside / Valley)

Milestone	**Target Date: (Month/Year)**
Planning Sanction	April 2012
Engineering and Design Complete (EDC)	May 2014
Project Sanction	July 2014
Facilities Rating to ISO	July 2014
Construction Start	September 2014
Construction Complete	December 2014
Ready for Load	December 2014
Project Closeout (Work Orders)	June 2014

1.16.3 Milestones (Transmission Level – Woonsocket / Admiral St. / Franklin Sq. / Washington)

Milestone	**Target Date: (Month/Year)**
Planning Sanction	December 2012
Engineering and Design Complete (EDC)	August 2013
Project Sanction	October 2013
Construction Start	March 2014
Facilities Rating to ISO	July 2014
Construction Complete	December 2014
Ready for Load	December 2014
Project Closeout (Work Orders)	June 2014

1.17 Climate Change:

Are financial incentives (e.g. carbon credits) available?		O Yes	⊙ No
Contribution to National Grid's 2050 80% emissions reduction target:	⊙ Neutral	O Positive	O Negative
Impact on adaptability of network for future climate change:	⊙ Neutral	O Positive	O Negative

1.18 List References:

1	Multiple (116) New England Substations – Obsolete Relay & Comm. Equipment Replacements dated July 18, 2010
2	Relay Replacements Strategy (SG157) dated October 2010
3	New England Station Underfrequency Replacement Program – Technical Requirements Document dated October 25, 2011
4	Riverside, Valley, Woonsocket, Admiral St, Franklin Sq, Washington Relay Replacements – Technical Requirements Documents

2 Decisions

The US Sanctioning Committee (USSC) at a meeting held on December 12, 2012:

(a) APPROVED the investment of $1.2M and a tolerance of +/- 25 % for the purposes of preliminary engineering, final design and material procurement for all stations included in the Relay Replacement Strategy (SG157).

(b) NOTED the potential investment $3.27M to and a tolerance of +25 / -50%, contingent upon submittal and approval of a Project Sanction paper following completion of final engineering and design.

(c) NOTED that David Arthur is the Project Manager and Sonny Anand has the approved financial delegation to undertake the activities stated in (a).

Signature.....Date 1/8/13

Lee S. Eckert
US Chief Financial Officer
Chairman, US Sanctioning Committee

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3 Sanction Paper Detail

Title:	Relay Replacements - RI	**Sanction Paper #:**	USSC-12-088v2
Project #:	C35586, C35587	**Sanction Type:**	Partial Sanction
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	12/12/12
Author:	David Arthur / Sonny Anand	**Sponsor:**	Cheryl A. Warren – Vice President Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	David Arthur

3.1 Background

This Relay Replacements Strategy (SG157) outlines a six year strategy to replace electro-mechanical and solid state relays in New England that are obsolete and cannot be maintained any longer.

The protection afforded by relays is critical to the stability of the electric transmission system. The relays are designed to protect high-value system components from the effects of system failures and to quickly isolate system failures so that no additional damage can occur.

Protection and Telecom Operations personnel identified several families of electro-mechanical and solid state relays that are no longer sustainable on the transmission system. These relays suffer from lack of manufacturer support such that technical support and spare parts are no longer available. The targeted relays were selected based on family history, performance, field O&M experience and available manufacturer support. Challenges with the aging electro-mechanical fleet of relays include settings drift, worn parts, spare parts depletion and attrition of the internal knowledge base. Many of the remaining relays in stock have been scavenged and can no longer be redeployed to the system.

While in the longer-term thousands of electro-mechanical and solid state relays may need replacement based on a simple life cycle analysis, the strategy identified an immediate need to replace the worst performing relay families. These relays include line differential, transformer differential, reclosing and under-frequency types. Although the under-frequency relays are connected to the distribution system, their function is to protect the transmission system.

3.2 Drivers

This strategy is driven by the need to ensure that reliable protective relay systems are in place to preserve the integrity and stability of the transmission system. The protection system protects against faults and ensures the continued safe and reliable operation of the transmission system.

The transmission system is protected by nearly 22,000 relays. The majority of these relays (88%) are electro-mechanical or solid state types. Many electromechanical and solid state relays are deteriorated or no longer supported by the manufacturer. A replacement plan targeting the worst performing or obsolete relay families is required before equipment failure occurs and reliability degrades.

Protective relays limit the extent and duration of outages thus improving key system performance metrics such as CAIDI, SAIDI and SAIFI. For example, a mis-operation by a relay could result in a potential loss of between 5 million and 20 million customer-minutes. This translates to a SAIDI of between 1.5 to 6 minutes. Failure or mis-operation of key protection and control system components may have the effect of negatively impacting our ability to deliver power resulting in customer outages and poor public perception. Failure to stay within the system reliability targets can result in fines by state regulators.

Replacement with modern microprocessor based relays will supply information not previously available from electromechanical relays. With the availability of this real time data, future applications can be developed such that more of the transmission system can be automated and designed to respond automatically to system events. The speed of data acquisition and analysis would present system operators with a better understanding of system anomalies and recommendations for remedial actions. For example, distance-to-fault data will now be available to identify fault location with greater accuracy than currently possible. This data will be brought back to the control center for use by operations and engineering personnel.

Proper protection operation is required by certain regulatory bodies. Compliance with certain FERC, NERC, NPCC regulations are mandatory and failure to comply can result in substantial fines.

3.3 Project Description

The complete list of relays to be replaced under this project is included the appendix.

This sanction paper updates the scope of the Relay Replacement Program. Relay replacements have been incorporated into the scope of other on-going projects in the portfolio to take advantage of design and construction efficiencies. If the relay replacements were to continue as stand alone projects design and construction would be delayed due to availability of drawings.

3.4 Benefits Summary

The benefit of this project will be increased reliability of the transmission protection and control system where known poor performing relay families are replaced with microprocessor based relays. Protective relays that are functioning properly are essential to a rapid isolation of faults on the system, protecting customers from potential outages and protecting equipment from damage. The new relays will also yield additional operational data that was not previously available, permitting better analysis of system failures to prevent reoccurrences.

Replacement will eliminate incremental maintenance time and costs associated with these relays, allowing relay maintenance personnel to focus on other critical protection Issues.

3.5 Business Issues

Failure to complete the relay replacements will not allow the overall goals of the Relay Replacement Strategy project to be met and transmission system will continue to have reliability risks.

The continued deployment of microprocessor based relays will require a work force with the appropriate skills. It is likely that current employees may require training. Newly hired employees will be required to have the necessary skills to design, operate and maintain microprocessor based equipment.

Deployments of microprocessor based relays are a relatively recent phenomena such that there is insufficient evidence to determine the typical useful life of these assets.

3.6 Alternatives

Alternative 1 – Adopt Replace-on-Fail Plan:
This option adopts a plan to only replace the targeted relays once they fail.

Such a plan would naturally result in decreased system reliability due to the increased rates of failure and the duration of subsequent outages.

Increased failure frequency or extended outages as a result of this option may result in performance fines by our regulators.

Alternative 2 – Defer Replacements:
This option may result in an increased failure rate possibly resulting in outages due to relays failing before they are scheduled for replacement.

This option only defers the project during which time additional relays will reach obsolescence increasing the scope of the project.

This option would also delay the advent of a more comprehensive asset management strategy for the relay population.

Alternative 3 – Do Nothing:
This option would allow the current situation to persist.

Relays would continue to deteriorate at a rate greater than our capability to replace them.

The targeted relays will not be able to be further maintained and will require ad-hoc replacement with digital relays. This would likely be a more expensive approach.

3.7 Safety, Environmental and Project Planning Issues

Safety

Employees and/or contractors will be in close proximity to voltages and currents from VT's and CT's respectively and must be aware of the possible ramifications of contact with them. In the control house, work will be performed on secondary circuits to include current circuits, voltage circuits, breaker control circuits and protective relay circuits. Caution will have to be exercised when working with secondary circuits. Personnel will have to take appropriate measures such as making sure to avoid open current circuits and isolating protective relay trip circuits to avoid inadvertent tripping. Appropriate insulated tools and personal protective equipment shall be worn as necessary when working on energized equipment.

Personnel shall ensure they are following the latest procedures for the work they are undertaking in the appropriate region. This will be accomplished by ensuring oversight with adequate supervision.

Environmental

Whereas most work will be completed within the existing control house, there should be no environmental issues.

If transmission level relay preliminary engineering determines control houses are to be replaced, all proper environmental issues need to be addressed and will be properly identified during the preliminary engineering phase. Upon completion of the preliminary engineering, all appropriate permits will be acquired where necessary prior to work taking place.

In some instances excavation will be required for conduit installation to provide telecommunication services. Specific review will be completed at each substation when scope is confirmed.

Planning

The replacement of the relays and associated equipment will require coordination among personnel doing the physical installation; those setting and testing the relays; and those installing the communication facilities.

The replacement of these relays in some locations will require coordination with neighboring utilities, and Non-Utility Generation companies. These entities may be required to change their relay systems as well. The Project Manager will coordinate contact with the neighboring utilities and non-utility generators with the assistance of the Transmission Commercial Department.

The relay replacement strategy is subject to the availability of National Grid resources or contractors to complete the tasks. The Project Manager will determine annually whether internal, external or a mix of resources is to be utilized.

Transmission / Transformer Level: Transmission outages will be required for the Transmission Level Replacements. The transmission level replacements work will be packaged to included work required at remote ends which will reduce outages required. Transmission Asset Strategy has requested to review the work to potentially incorporate replacements with upcoming and ongoing projects. The current project spend and delivery plan in this paper does not account for this review.

Underfrequency Design Delivery: Due to the significant number of substations requiring underfrequency design packages bundling stations by PTO service area will be issued. A total of eight (8) packages have been proposed. Subsequent revisions to this sanction paper will request construction dollars to complete the packages as they have been completed.

Underfrequency Planning Estimate: Due to the significant number of substations requiring work a typical estimate was determined based on site visits and engineering of typical sites. This value was assumed for each substation. The estimate will be revised as required based on actual costs after construction is completed at a certain number of stations and project costs updated in subsequent sanction papers for the transmission level work.

3.8 Execution Risk Appraisal

Number	Detailed Description of Risk / Opportunity	Probability	Impact		Score		Strategy	Pre-Trigger Mitigation Plan	Residual Risk	Post Trigger Mitigation Plan
			Cost	Schedule	Cost	Schedule				
1	Lead on structures or asbestos in cable	1	2	1	2	1	Accept	Pre-Test	N/A	Ensure costs are captured in Project Grade Estimate
2	Storm Work	2	2	2	4	4	Accept	Consistently review weather and be aware of upcoming events	N/A	Determine if additional crews or hours are feasible to make up lost time
3	Equipment Breakdown	1	1	1	1	1	Accept	N/A	N/A	Ensure equipment is repaired or back-up equipment is available
4	Vandelism / Accidents	1	1	1	1	1	Accept	N/A	N/A	Address material loss
5	Loss of Outage	2	2	2	4	4	Accept	Maintain conistant contact with OPR to verify if there are potential issues	N/A	Determine if additional crews or hours are feasible to make up lost time
6	Drawing availablity	3	1	2	3	6	Mitigate	Identify drawing check-out issues / related work early in process	N/A	Direct Assign design when possible

Total Risk $: *$16,000*
Total Risk Wks: *3*

3.9 Permitting

Permit Name	Probability Required (Certain/ Likely/ Unlikely)	Duration	Status (Complete/ In Progress Not Applied For)	Estimated Completion Date
Road Opening / Petition	Unlikely	1 Month	Not Applied For	Per Project

3.10 Investment Recovery

3.10.1 Investment Recovery and Regulatory Implications

Investment recovery will be through standard rate recovery mechanisms approved by appropriate regulatory agencies.

3.10.2 Customer Impact

This project results in an indicative first full year revenue requirement when the asset is placed in service equal to approximately $0.512 million. This is indicative only. The actual revenue requirement will differ depending upon the timing of the next rate case and/or the timing of the next filing in which the project is included in rate base.

3.10.3 CIAC / Reimbursement

$M	Prior Yrs	Yr. 1 2012/13	Yr. 2 2013/14	Yr. 3 2014/15	Yr. 4 2015/16	Yr. 5 2016/17	Yr. 6 + 2017/18	Total
CIAC/Reimbursement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

3.11 Financial Impact to National Grid

3.11.1 Cost Summary Table

3.11.1.1 Cost Summary Table (C35586):

Project Number	Project Title	Project Estimate	Spend	Prior Yrs	Current Planning Horizon Yr. 1 2012/13	Yr. 2 2013/14	Yr. 3 2014/15	Yr. 4 2015/16	Yr. 5 2016/17	Yr. 6 + 2017/18	Total
C35586	Relay Replacements Co 49 Distribution	Conceptual	CapEx	$ 0.01	$ 0.09	$ 0.20	$ 0.95	$ 0.70	$ -	$ -	$ 1.95
			OpEx	$ -	$ 0.01	$ 0.03	$ 0.12	$ 0.09	$ -	$ -	$ 0.25
			Removal	$ -	$ 0.01	$ 0.03	$ 0.15	$ 0.11	$ -	$ -	$ 0.30
			Total	$ 0.01	$ 0.11	$ 0.26	$ 1.22	$ 0.90	$ -	$ -	$ 2.50

3.11.1.2 Cost Summary Table (C35587):

Project Number	Project Title	Project Estimate	Spend	Prior Yrs	Current Planning Horizon Yr. 1 2012/13	Yr. 2 2013/14	Yr. 3 2014/15	Yr. 4 2015/16	Yr. 5 2016/17	Yr. 6 + 2017/18	Total
C35587	Relay Replacements Co 49 Transmission	Conceptual	CapEx	$ 0.02	$ 0.06	$ 0.20	$ 0.23	$ 0.06	$ 0.03	$ -	$ 0.61
			OpEx	$ -	$ 0.01	$ 0.03	$ 0.03	$ 0.01	$ 0.00	$ -	$ 0.07
			Removal	$ -	$ 0.01	$ 0.03	$ 0.04	$ 0.01	$ 0.00	$ -	$ 0.09
			Total	$ 0.02	$ 0.08	$ 0.26	$ 0.30	$ 0.08	$ 0.03	$ -	$ 0.77

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3.11.2 Project Budget Summary Table

3.11.2.1 Project Budget Summary Table (C35586):

Project Costs per Business Plan

		Current Planning Horizon						
	Prior Yrs (Actual)	Yr. 1 2012/13	Yr. 2 2013/14	Yr. 3 2014/15	Yr. 4 2015/16	Yr. 5 2016/17	Yr. 6 + 2017/18	Total
CapEx	$ -	$ 0.80	$ 0.90	$ 0.30	$ 0.20	$ 0.20	$ -	$ 2.40
OpEx	$ -	$ 0.02	$ 0.03	$ 0.01	$ 0.01	$ 0.01	$ -	$ 0.07
Removal	$ -	$ 0.06	$ 0.07	$ 0.02	$ 0.02	$ 0.02	$ -	$ 0.19
Total Cost in Bus. Plan	$ -	$ 0.89	$ 1.00	$ 0.33	$ 0.22	$ 0.22	$ -	$ 2.66

Variance (Business Plan-Project Estimate)

		Current Planning Horizon						
	Prior Yrs (Actual)	Yr. 1 2012/13	Yr. 2 2013/14	Yr. 3 2014/15	Yr. 4 2015/16	Yr. 5 2016/17	Yr. 6 + 2017/18	Total
CapEx	$ (0.01)	$ 0.71	$ 0.70	$ (0.65)	$ (0.50)	$ 0.20	$ -	$ 0.45
OpEx	$ -	$ 0.01	$ 0.00	$ (0.11)	$ (0.08)	$ 0.01	$ -	$ (0.18)
Removal	$ -	$ 0.05	$ 0.04	$ (0.12)	$ (0.09)	$ 0.02	$ -	$ (0.11)
Total Cost in Bus. Plan	$ (0.01)	$ 0.78	$ 0.74	$ (0.89)	$ (0.68)	$ 0.22	$ -	$ 0.17

3.11.2.2 Project Budget Summary Table (C35587):

Project Costs per Business Plan

		Current Planning Horizon						
	Prior Yrs (Actual)	Yr. 1 2012/13	Yr. 2 2013/14	Yr. 3 2014/15	Yr. 4 2015/16	Yr. 5 2016/17	Yr. 6 + 2017/18	Total
CapEx	$ -	$ 0.53	$ 0.17	$ 0.01	$ -	$ -	$ -	$ 0.71
OpEx	$ -	$ 0.07	$ 0.02	$ 0.00	$ -	$ -	$ -	$ 0.09
Removal	$ -	$ 0.13	$ 0.04	$ 0.00	$ -	$ -	$ -	$ 0.18
Total Cost in Bus. Plan	$ -	$ 0.72	$ 0.24	$ 0.01	$ -	$ -	$ -	$ 0.97

Variance (Business Plan-Project Estimate)

		Current Planning Horizon						
	Prior Yrs (Actual)	Yr. 1 2012/13	Yr. 2 2013/14	Yr. 3 2014/15	Yr. 4 2015/16	Yr. 5 2016/17	Yr. 6 + 2017/18	Total
CapEx	$ (0.02)	$ 0.46	$ (0.03)	$ (0.23)	$ (0.06)	$ (0.03)	$ -	$ 0.10
OpEx	$ -	$ 0.06	$ (0.01)	$ (0.03)	$ (0.01)	$ (0.00)	$ -	$ 0.01
Removal	$ -	$ 0.12	$ 0.01	$ (0.03)	$ (0.01)	$ (0.00)	$ -	$ 0.09
Total Cost in Bus. Plan	$ (0.02)	$ 0.64	$ (0.02)	$ (0.29)	$ (0.08)	$ (0.03)	$ -	$ 0.20

3.11.3 Cost Assumptions

The project budget was developed with the following assumptions:

- Underfrequency costs developed using Success Enterprises (SE) and supplemented with the Estimating departments construction estimate
- Underfrequency typical costs includes at 150-ft estimated conduit and cable run from the relay to the control house
- Contingency included as part of the SE estimates

- The underfrequency relay costs for each substation have been assumed to be typical. Each substation was not visited
- Riverside / Valley Transmission Level costs have been developed using SE. The remaining transmission level estimates are conceptual grade from the Conceptual Engineering Report
- Risk from the agreed upon risk register has not been included in the costs
- Construction will be completed by local PTO and construction resources
- Transmission Level Relay construction schedules have been assumed.

3.11.4 Net Present Value / Cost Benefit Analysis

This is not an NPV project.

3.11.5 Additional Impacts

No additional impacts have been identified for this project.

3.12 Statements of Support

3.12.1 Supporters

Role	Name	Responsibilities
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Investment Planning	Antoinette Stores	Endorses relative to transmission 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses T-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	John Gavin	Endorses Substation scope, design, conformance with design standards
Engineering/Design	Rob Sheridan	Endorses D-Line scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications
Engineering/Design	Peter Altenburger	Asset Management Transmission
Engineering/Design	Carol Sedewitz	Transmission Planning
Project Management	Sonny Anand	Endorses Resources, cost estimate, schedule

3.12.2 Reviewers

Reviewer List	Name
Finance	Karen Hamel
Regulatory	Gideon Katsh
Jurisdictional Delegates	Jennifer Grimsley

4 Appendices

4.1 Project Cost Breakdown

	Co. 10 C35583	Co. 5 C35584	Co. 49 C35586	Co. 49 C35587
Permtting & Licensing	$ -	$ -	$ -	$ -
Engineering	$ 1,384,437	$ 3,095,423	$ 1,622,938	$ 525,984
Construction	$ 178,771	$ 494,857	$ 256,854	$ 72,193
Materials	$ 245,068	$ 678,375	$ 352,109	$ 98,965
General	$ 185,124	$ 512,445	$ 265,983	$ 74,758
Total	$ 1,993,400	$ 4,781,100	$ 2,497,884	$ 771,900

4.2 Relay Replacements – Transmission Level Scope

Station	Funding Number	Type	Line	Comment
ADAMS 21	C35584	ACR	360	
	C35584	ACR	560	
	C35584	CO-9		
	C35584	HDD	3TR	
ADMIRAL ST 9	C35586	CT51A	Q143	
	C35586	CT51A	R144	
	C35586	RFL3253	Q143	
	C35586	RFL3253	R144	
	C35586	RFL9000	Q143	Added with PCR#6 -9/20/12
	C35586	RFL9000	R144	Added with PCR#6 -9/20/12
AYER 201	C35584	CEY15	V22E	
BELL ROCK SY 118		DLP	L14	Removed from Scope - to be completed with Somerset SY Re-Build
		DLP	N12	Removed from Scope - to be completed with Somerset SY Re-Build
BELMONT 98	C35584	DLP	U2	
CARPENTER HILL	C35583	DLP	U173	
	C35583	DLP	W123	
DEERFIELD 4 SY	C35583	12BDD15B1A	3TR	
	C35583	DLP	E5	
	C35583	DLP	F6	
DEERFIELD 5 SY	C35583	ACR	252	
	C35583	ACR	5910	
DEXTER 36		DLP	L14	Removed from Scope - to be completed with Somerset SY Re-Build
		DLP	M13	Removed from Scope - to be completed with Somerset SY Re-Build
		GCX17	L14	Removed from Scope - to be completed with Somerset SY Re-Build
EAST HOLBROOK 2	C35584	HZ	398-537	
	C35584	TD-5		
FRANKLIN SQ	C35586	DLP	Q143	
	C35586	DLP	R144	
	C35586	RFL-9300	Q143	Added with PCR#6 -9/20/12
	C35586	RFL-9300	R144	Added with PCR#6 -9/20/12
	C35586	Optimho	Q143	Added with PCR#6 -9/20/12
	C35586	Optimho	R144	Added with PCR#6 -9/20/12
HARRIMAN 8 SY	C31690	ACR	A127	Removed from Scope - to be completed under Harriman Relay Replacement project (C36190)
	C31690	ACR	B128	Removed from Scope - to be completed under Harriman Relay Replacement project (C36190)
	C35883	ACR	E131	
MEADOW ST 552	C35583	DLP	F6	
	C35583	DLP	F6E	
MEADOWBROOK 16	C35584	CEY15	I161W	
	C35584	CEY16	I161W	
MILLBURY 2	C35583	CT51A	Q143	See PCR #6 - Admiral St Additions
	C35583	CT51A	R144	See PCR #6 - Admiral St Additions
MILLBURY 3		REZ1	323	will be removed and scrapped as part of the Millbury #3 345kV Expansion
NASHUA ST 25	C35583	DLP	Q141	
PARKVIEW 94	C35584	DLP	U2	
PROSPECT ST 219	C35584	ACR	22T	
READ ST 9	C35584	GCX17	V148	
RIVERSIDE 108	C38967	GCX17	H17	Removed from Scope - to be completed with NEEWS
	C43553	GCX17	J16	Removed from Scope - to be completed with New Highland Dr Project C43553
	C35586	SLY	R9	
ROBINSON AVE	C35583	CEY15	V148	
	C35583	CEY16	V148	
	C35583	GCX15	Q10	
	C35583	GCX15	V148	
SHUTESBURY 704	C35584	DLP	E5	
	C35584	DLP	E5W	
SOMERSET SY		DLP	M13	Removed from Scope - to be completed with Somerset SY Re-Build
		DLP	N12	Removed from Scope - to be completed with Somerset SY Re-Build
		DLP	S8	Removed from Scope - to be completed with Somerset SY Re-Build
		DLP	T7	Removed from Scope - to be completed with Somerset SY Re-Build
		DLP	U6	Removed from Scope - to be completed with Somerset SY Re-Build

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STAPLES 112	C35587	GCX15	J16	Removed from Scope - to be completed with New Highland Dr Project C43553
TEWKSBURY 22A		ACR	337	Removed from Scope - to be included in station re-build
		ACR	339	Removed from Scope - to be included in station re-build
		ACR	3739	Removed from Scope - to be included in station re-build
		ACR	3897	Removed from Scope - to be included in station re-build
	C35583	LKD	338	completed under C41464 on 10/7/12 to be transferred to C35583
		RAZFE	337	Removed from Scope - to be included in station re-build
		RAZFE	338	Removed from Scope - to be included in station re-build
VALLEY 102	C35586	SLY	R9	
WARE 501	C35584	DLP	E5	
	C35584	DLP	E5W	
	C35584	DLP	F6	
	C35584	DLP	F6W	
	C35584	DLP	O15	
WARREN 5	C35583	CEY15	E183	
	C35583	CEY15	F184	
WASHINGTON 126	C35587	DLP	V148N	
	C35587	DLP	V148S	
WEST FARNUM		DLP	S171N	Removed from Scope - to be completed with NEEWS
		DLP	T172N	Removed from Scope - to be completed with NEEWS
WEST METHUEN 63	C35583	ACR	5133	
WOOD RIVER 85	C35586	CR51A	1870	
	C35586	CS27B	1870	
	C35586	CT51A	1870	
WOONSOCKET	C35587	DLP	Q143	
	C35587	DLP	R144	
	C38967	DLP	S171N	Removed from Scope - to be completed with NEEWS
	C38967	DLP	T172N	Removed from Scope - to be completed with NEEWS
	C35587	DLP	V148	
	C35587	RFL3253	Q143	
	C35587	RFL3253	R144	

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Relay Replacements – Underfrequency Scope

Station	Funding Number	Type	Line	Comment
ADAMS 21	C35584	KF	UFLS	
ADMIRAL ST 9	C35586	KF	UFLS	
ANDOVER	C35584	KF	UFLS	
APPONAUG	C35586	KF	UFLS	
ARCTIC	C35586	KF	UFLS	
AUBURN	C35586	KF	UFLS	
AUBURN	C35586	SFF	UFLS	
AYER 201	C35584	KF	UFLS	
BARRON AVE		KF	UFLS	Removed from Scope - Granite State
BELMONT 98	C35584	KF	UFLS	
BLOSSOM ST	C35584	KF	UFLS	
CHARTLEY POND	C35584	KF	UFLS	
CONCORD RD	C35584	SFF	UFLS	
COVENTRY	C35586	KF	UFLS	
CRAFT HILL		KF	UFLS	Removed from Scope - Granite State
DEPOT ST		KF	UFLS	Removed from Scope - to be completed under Depot St Project
DEXTER 36	C35586	KF	UFLS	
DIVISION ST	C35586	KF	UFLS	
DYER ST	C35586	KF	UFLS	
EAST BEVERLY	C35584	SFF	UFLS	
EAST MAIN ST	C35584	KF	UFLS	
EAST WINCHENDON	C35584	KF	UFLS	
EASTON	C35584	SFF	UFLS	
ELMWOOD INDOOR		SFR	UFLS	Removed from Scope - Elmwood Indoor substation has been decommissioned. See 1/23/12 Chris Arujo email
ELWOOD OUTDOOR	C35586	KF	UFLS	
FARNIM PIKE		KF	UFLS	Removed from Scope - Farnum Pike was rebuilt with a new control house. There isn't an independent UF relay presently. All UF functions are activated through the specific SEL-351 feeder relays.
FORREST ST	C35584	KF	UFLS	
FRANKLIN SQ	C35586	KF	UFLS	
GENEVA	C35586	KF	UFLS	
GLOUCESTER	C35584	KF	UFLS	
GREENDALE	C35584	KF	UFLS	
HARRIS AVE	C35586	KF	UFLS	
HATHAWAY	C35584	KF	UFLS	
HILLSIDE	C35584	KF	UFLS	Removed from Scope - Hillside will be demolished
HUMPHREY	C35584	KF	UFLS	
HUNTINGTON PARK		SFR	UFLS	Huntington Park only has one feeder. The UF relay was removed per Graham Ehret in 2007. The e-mail correspondence between us is attached.
JOHNSTON	C35586	KF	UFLS	
LANGWORTHY CORNER	C35586	KF	UFLS	
LAWRENCE	C35584	KF	UFLS	
LEBANON		KF	UFLS	Removed from Scope - Granite State
LIPPETT HILL	C35586	SFR	UFLS	
LYNN	C35584	SFR	UFLS	
MALDEN	C35584	SFF	UFLS	
MEDFORD	C35584	KF	UFLS	
MELROSE	C35583	KF	UFLS	
METHUEN	C35584	KF	UFLS	
MILL ST	C35584	KF	UFLS	
NASONVILLE	C35586	KF	UFLS	
NEWBURYPORT	C35584	KF	UFLS	
NORTH ABINGTON	C35584	KF	UFLS	
NORTH BEVERLY	C35584	KF	UFLS	
NORTH CHELMSFORD	C35584	KF	UFLS	
NORTHBORO RD	C35584	KF	UFLS	
NORTON	C35584	SFF	UFLS	
NORWELL	C35584	SFF	UFLS	
PARK ST	C35584	KF	UFLS	
PAWTUCKET	C35586	KF	UFLS	
PAWTUCKET	C35586	SFF	UFLS	
PELHAM		KF	UFLS	Removed from Scope - Granite State
PLAINVILLE	C35584	KF	UFLS	
PLEASANT ST	C35584	KF	UFLS	
PONDVILLE	C35584	KF	UFLS	
PROSPECT ST 219	C35584	KF	UFLS	
QUINN	C35584	KF	UFLS	
RANDOLPH	C35584	KF	UFLS	
READ ST 9	C35584	KF	UFLS	
REVERE	C35584	KF	UFLS	
RISINGDALE	C35584	SFF	UFLS	

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RIVER RD	C35584	KF	UFLS	
SALEM 1	C35584	KF	UFLS	
SALEM 2	C35584	KF	UFLS	
SALEM 3	C35584	KF	UFLS	
SCITUATE	C35584	KF	UFLS	
SOUTH MARLBOROUGH	C35584	SFF	UFLS	
SOUTH WEYMOUTH	C35584	KF	UFLS	
SPRAGUE ST	C35586	KF	UFLS	
STAPLES 112	C35587	KF	UFLS	
STOUGHTON	C35584	KF	UFLS	
SWANSEA	C35584	SFF	UFLS	
VALLEY 102	C35586	KF	UFLS	
VILAS BRIDGE		KF	UFLS	Removed from Scope - Granite State
WALNUT ST	C35584	KF	UFLS	
WARWICK	C35586	SFF	UFLS	
WATER ST	C35584	KF	UFLS	
WATERMAN AVE	C35586	KF	UFLS	
WENDEL DEPOT	C35584	KF	UFLS	
WESMINISTER	C35584	KF	UFLS	
WEST CHARLTON	C35584	SFF	UFLS	
WEST CRANSTON	C35586	KF	UFLS	
WEST GREENVILLE	C35586	SFF	UFLS	
WEST HORWARD	C35586	KF	UFLS	
WEST NEWBURY	C35584	SFF	UFLS	
WESTERLY		BE1	UFLS	Westerly substation damaged during the 2010 floods and all feeders were rebuilt at the substation with Form 6 station reclosers. No UF relay was installed. Substation design work would have to be done to add UF tripping. This substation is also scheduled to be removed from service once a few others in South County are built.
WORTHEN ST	C35584	KF	UFLS	

4.3 Photographs

Photo #1 – Typical Underfrequency Relay – Exterior Panel

Photo #2 – Typical Underfrequency Relay – Control House Panel

D + T

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Title:	Relay Replacements Program - RI	**Sanction Paper #:**	USSC-14-033
Project #:	C035586, C035587, C049354 D+T T+T D Sub	**Sanction Type:**	Sanction
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	4/8/2014
Author:	David Arthur/Tom Alexander	**Sponsor:**	Cheryl A. Warren – Vice President Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	Tom Alexander/Mark Phillips

1 Executive Summary

1.1 Sanctioning Summary

This paper requests sanction of Project Funding # C035586, C035587, C049354 in the amount **$2.530M** and a tolerance of **+/- 10%** for the purposes of preliminary engineering, final design, and material procurement and construction for all stations within fiscal year 2015.

This sanction amount is $2.530M broken down into:

$1.974M Capex
$0.253M Opex
$0.303M Removal

2 Project Detail

2.1 Project Description, Justification, Customer Issues, Drivers and Benefits

The Relay Replacements Strategy (SG157) was approved in October 2010 detailing replacement of existing electro-mechanical and solid state relays throughout the New England system. The strategy targeted specific types of relays with the highest probability of failure, which is a total of approximately 5% of the total electro-mechanical and solid state relay population. The types identified were transmission line differential, transformer differential, reclosing and under-frequency types. The relays requiring replacement are: a) obsolete, b) not supported by the manufacturer, c) have limited spare parts availability, and d) have demonstrated a trend of decreasing reliability.

The targeted relays were selected based on type history, performance, field O&M experience and available manufacturer support. Challenges with the aging electro-mechanical fleet of relays include settings drift, worn parts, spare parts depletion and

attrition of the internal knowledge base. Many of the remaining relays in stock have been scavenged and can no longer be redeployed to the system. While in the longer-term, thousands of electro-mechanical and solid state relays may need replacement based on a simple life cycle analysis, this strategy has identified an immediate need to replace the worst performing relay families.

If the relays identified fail or miss-operate, there is a risk of prolonged outages and a corresponding negative reliability impact. [redacted] The relays are designed to protect high-value system components from the effects of system failures and to quickly isolate system failures so that no additional damage can occur. Protective relays limit the extent and duration of outages thus improving key system performance metrics such as CAIDI, SAIDI and SAIFI. For example, a miss-operation by a relay could result in a potential loss of between 5 million and 20 million customer-minutes. This translates to a SAIDI of between 1.5 to 6 minutes. Failure or miss-operation of key protection and control system components may have the effect of negatively impacting our ability to deliver power resulting in customer outages and poor public perception. Failure to stay within the system reliability targets can result in fines by state regulators.

Replacement with modern microprocessor based relays will supply information not previously available from electromechanical relays. With the availability of this real time data, future applications can be developed such that more of the transmission system can be automated and designed to respond automatically to system events. The speed of data acquisition and analysis would present system operators with a better understanding of system anomalies and recommendations for remedial actions. For example, distance-to-fault data would be available to identify fault location with greater accuracy than currently possible. This data would be brought back to the control center for use by operations and engineering personnel.

Proper protection operation is required by certain regulatory bodies. Compliance with FERC, NERC, NPCC regulations are mandatory and failure to comply can result in substantial fines.

2.1.1 Alternatives:

Alternative 1 – Adopt Replace-on-Fail Plan:
This option adopts a plan to only replace the targeted relays once they fail.

Such a plan would naturally result in decreased system reliability due to the increased rates of failure and the duration of subsequent outages.

Increased failure frequency or extended outages as a result of this option may result in performance fines by our regulators.

Alternative 2 – Defer Replacements:
This option may result in an increased failure rate possibly resulting in outages due to relays failing before they are scheduled for replacement.

This option only defers the project during which time additional relays will reach obsolescence, thus increasing the scope of the project.

This option would also delay the advent of a more comprehensive asset management strategy for the relay population.

Alternative 3 – Do Nothing:
This option would allow the current situation to persist.

Relays would continue to deteriorate at a rate greater than our capability to replace them.

The targeted relays will not be able to be further maintained and will require ad-hoc replacement with digital relays. This would likely be a more expensive approach.

2.2 Investment Recovery

Investment recovery will be through standard rate recovery mechanisms approved by appropriate regulatory agencies

2.2.1 Customer Impact

This project results in an indicative first full year revenue requirement when the asset is placed in service equal to approximately $0.660 million. This is indicative only. The actual revenue requirement will differ depending upon the timing of the next rate case and/or the timing of the next filing in which the project is included in rate base.

3 Related Projects, Scoring, Budgets

3.1 Summary of Projects:

3.1.1 Transmission:

Project Number	Project Type (Elec only)	Project Title	Estimate Amount ($M)	
C035587	T-Sub	Relay Replacements - RI	$	0.960
		Total	$	0.960

3.1.2 Distribution:

Project Number	Project Type (Elec only)	Project Title	Estimate Amount ($M)	
C035586	D-Sub	Relay Replacements - RI	$	1.250
C049354	D-Sub	Relay Replacements - RI	$	0.320
		Total	$	1.570

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3.2 Prior Sanctioning History (including relevant approved Strategies):

Date	Governance Body	Sanctioned Amount	Paper Title	Sanction Type
October 2010	AMIC	$14.840M	Relay Replacement Strategy – SG157	Strategy
February 2011	AMIC	$0.330M	Preliminary Engineering for Relay Replacements	PWS
December 2012	USSC	$1.200M	Relay Replacements – RI	Partial

3.3 Next Planned Sanction Review

Date (Month/Year)	Purpose of Sanction Review
February 2015	FY15/16 Annual Program Sanction

3.4 Category:

Category	Reference to Mandate, Policy, or NPV Assumptions
○ Mandatory ◉ Policy- Driven ○ Justified NPV	Provide for the network's safe, efficient and reliable operation

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3.5 Asset Management Risk Score

Asset Management Risk Score: 35

Primary Risk Score Driver: (Policy Driven Projects Only)

◉ Reliability ○ Environment ○ Health & Safety ○ Not Policy Driven

3.6 Complexity Level:

○ High Complexity ○ Medium Complexity ◉ Low Complexity ○ N/A

Complexity Score: 18

4 *Financial*

4.1 Business Plan:

Business Plan Name & Period	Project included in approved Business Plan?	Over / Under Business Plan	Project Cost relative to approved Business Plan ($)
Transmission FY15-FY19	◉ Yes ○ No	◉ Over ○ Under ○ NA	$0.630M
Distribution FY15-FY19	◉ Yes ○ No	◉ Over ○ Under ○ NA	$1.150M

4.1.1 If cost > approved Business Plan how will this be funded?

Re-allocation of funds within the portfolio will be managed by Resource Planning to meet jurisdictional budgetary, statutory and regulatory constraints.

4.2 CIAC / Reimbursement

$M	Prior Yrs	Yr. 1 2013/14	Yr. 2 2014/15	Yr. 3 2015/16	Yr. 4 2016/17	Yr. 5 2017/18	Yr. 6 + 2018/19	Total
CIAC/Reimbursement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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4.3 Cost Summary Table

4.3.1 Transmission

					Current Planning Horizon ($M)						
					Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6 +	
Project Number	Project Title	Project Estimate Level (%)	Spend	Prior Yrs	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
C035587	Relay Replacements - RI	+10% / - 10%	CapEx	-	-	0.749	-	-	-	-	0.749
			OpEx	-	-	0.096	-	-	-	-	0.096
			Removal	-	-	0.115	-	-	-	-	0.115
			Total	-	-	0.960	-	-	-	-	0.960
Total Project Sanction			CapEx	-	-	0.749	-	-	-	-	0.749
			OpEx	-	-	0.096	-	-	-	-	0.096
			Removal	-	-	0.115	-	-	-	-	0.115
			Total	-	-	0.960	-	-	-	-	0.960

4.3.2 Distribution

					Current Planning Horizon ($M)						
					Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6 +	
Project Number	Project Title	Project Estimate Level (%)	Spend	Prior Yrs	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
C035586	Relay Replacements - RI	+10% / - 10%	CapEx	-	-	0.975	-	-	-	-	0.975
			OpEx	-	-	0.125	-	-	-	-	0.125
			Removal	-	-	0.150	-	-	-	-	0.150
			Total	-	-	1.250	-	-	-	-	1.250
C049354	Relay Replacements - RI	+10% / - 10%	CapEx	-	-	0.250	-	-	-	-	0.250
			OpEx	-	-	0.032	-	-	-	-	0.032
			Removal	-	-	0.038	-	-	-	-	0.038
			Total	-	-	0.320	-	-	-	-	0.320
Total Project Sanction			CapEx	-	-	1.225	-	-	-	-	1.225
			OpEx	-	-	0.157	-	-	-	-	0.157
			Removal	-	-	0.188	-	-	-	-	0.188
			Total	-	-	1.570	-	-	-	-	1.570

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4.4 Project Budget Summary Table

4.4.1 Transmission

Project Costs per Business Plan

		Current Planning Horizon ($M)						
	Prior Yrs	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6 +	
	(Actual)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
CapEx	$ -	$ -	$ 0.257	$ -	$ -	$ -	$ -	$ 0.257
OpEx	$ -	$ -	$ 0.033	$ -	$ -	$ -	$ -	$ 0.033
Removal	$ -	$ -	$ 0.040	$ -	$ -	$ -	$ -	$ 0.040
Total Cost in Bus. Plan	$ -	$ -	$ 0.330	$ -	$ -	$ -	$ -	$ 0.330

Variance (Business Plan-Project Estimate)

		Current Planning Horizon ($M)						
	Prior Yrs	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6 +	
	(Actual)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
CapEx	$ -	$ -	$ (0.492)	$ -	$ -	$ -	$ -	$ (0.492)
OpEx	$ -	$ -	$ (0.063)	$ -	$ -	$ -	$ -	$ (0.063)
Removal	$ -	$ -	$ (0.075)	$ -	$ -	$ -	$ -	$ (0.075)
Total Cost in Bus. Plan	$ -	$ -	$ (0.630)	$ -	$ -	$ -	$ -	$ (0.630)

4.4.2 Distribution

Project Costs per Business Plan

		Current Planning Horizon ($M)						
	Prior Yrs	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6 +	
	(Actual)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
CapEx	$ -	$ -	$ 0.400	$ -	$ -	$ -	$ -	$ 0.400
OpEx	$ -	$ -	$ 0.012	$ -	$ -	$ -	$ -	$ 0.012
Removal	$ -	$ -	$ 0.008	$ -	$ -	$ -	$ -	$ 0.008
Total Cost in Bus. Plan	$ -	$ -	$ 0.420	$ -	$ -	$ -	$ -	$ 0.420

Variance (Business Plan-Project Estimate)

		Current Planning Horizon ($M)						
	Prior Yrs	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6 +	
	(Actual)	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
CapEx	$ -	$ -	$ (0.825)	$ -	$ -	$ -	$ -	$ (0.825)
OpEx	$ -	$ -	$ (0.145)	$ -	$ -	$ -	$ -	$ (0.145)
Removal	$ -	$ -	$ (0.180)	$ -	$ -	$ -	$ -	$ (0.180)
Total Cost in Bus. Plan	$ -	$ -	$ (1.150)	$ -	$ -	$ -	$ -	$ (1.150)

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5 Statements of Support

5.1.1 Supporters

Role	Name	Responsibilities
Investment Planning	Michelle Park	Endorses relative to distribution 5-year business plan or emergent work
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses D-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	John Gavin	Endorses Substation scope, design, conformance with design standards
Engineering/Design	Alan LaBarre	Endorses D-Sub scope, design, conformance with design standards
Engineering/Design	Carol Sedewitz	Endorses T-Sub scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications

5.1.2 Reviewers

Reviewer List	Name
Finance	Keith Fowler
Regulatory	Peter Zschokke
Jurisdictional Delegates	Nabil Hitti & Jennifer Grimsley
Control Center	Joe Cutler

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6 Decisions:

I:

(a) APPROVE the investment of $2.53M and a tolerance of +/- 10 % for the purpose of final design, material procurement and construction for FY15.

(b) NOTE that Tom Alexander is the Project Manager and Mark Phillips has the approved financial delegation to undertake the activities stated in (a).

Signature.....Date....4/28/14

Executive Sponsor – Marie Jordan, Senior Vice President, Network Strategy

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8.1 Relay Replacements – MA Scope

C035586

Uf	ADMIRAL ST 9
T-Level	ADMIRAL ST 9
T-Level	FRANKLIN SQ
Uf	FRANKLIN SQ
Tx	VALLEY 102 (tx)
T-Level	VALLEY 102
Uf	VALLEY 102
T-Level	WARREN 5
T-Level	WOOD RIVER 85

C035587

T-Level	STAPLES 112
Uf	STAPLES 112
T-Level	WASHINGTON 126
T-Level	WOONSOCKET

C049354

Uf	ARCTIC
Uf	AUBURN
Uf	DIVISION ST
Uf	DYER ST
Uf	ELWOOD OUTDOOR
Uf	GENEVA
Uf	HARRIS AVE
Uf	JOHNSTON
Uf	LIPPETT HILL
Uf	NASONVILLE
Uf	PAWTUCKET
Uf	SPRAGUE ST
Uf	WEST CRANSTON
Uf	WEST GREENVILLE
Uf	WEST HORWARD

USSC Closure Paper

Title:	Relay Replacements Program - RI	**Sanction Paper #:**	USSC-14-033C
Project #:	C035586, C035587, C049354	**Sanction Type:**	Closure
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	7/07/2015
Author:	Tom Alexander	**Sponsor:**	John Gavin – VP Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	Tom Alexander/Mark Phillips

1 *Executive Summary*

This paper is presented to close the FY15 sanction paper (USSC-14-033) for the RI Relay Program (FPs C035586, C035587, & C049354). The total spend was $2.639M. The latest sanctioned amount for this project was $2.530M.

The final spend amount is $2.639M broken down into:

$2.613 Capex
$0.005 Opex
$0.021 Removal

2 *Project Summary*

The Relay Replacements Strategy (SG157) was approved in October 2010 detailing replacement of existing electro-mechanical and solid state relays throughout the New England system. The strategy targeted specific types of relays with the highest probability of failure, which is a total of approximately 5% of the total electro-mechanical and solid state relay population. The types identified were transmission line differential, transformer differential, reclosing and under-frequency types. The relays requiring replacement are: a) obsolete, b) not supported by the manufacturer, c) have limited spare parts availability, and d) have demonstrated a trend of decreasing reliability.

USSC Closure Paper

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The FY15 RI Relay Program included the following projects:

C035586 Projects	Status	Relays
Admiral St 9 T-Level & UF relay replacements	In-Service	5
Franklin Sq T-Level & UF relay replacements	In-Service	3
Valley 102 T-Level relay, UF relay, & RTU replacements	EDC, In-Construction	4
Warren 5 T-Level & UF relay replacements	Approved TSD, Design Initiated	2
Wood River T-Level & UF relay replacements	EDC	3
Arctic 49 UF relay replacement	EDC	1
Dyer St 29 UF relay replacement	EDC	1
Division St 61 UF relay replacement	Preliminary Engineering	1
Auburn 73 UF relay replacement	Preliminary Engineering	2
C035587 Projects	**Status**	**Relays**
Washington Sub 126 T-Level & UF relay replacements	In-Service	2
Woonsocket T-Level relay replacements	In-Service	7
Staples 112 T-Level relay, UF relay, CCVT, & Wavetrap replacements	In-Service	5
Harris Ave 12 UF relay replacement	Preliminary Engineering	1
C049354 Projects	**Status**	**Relays**
West Greenville 45 UF relay replacement	EDC	1
Nasonville 127929 UF relay replacement	EDC	2
Sprague St 36 UF relay replacement	EDC	1
Geneva 71 UF relay replacement	Preliminary Engineering	1
Johnston 18 UF relay replacement	Preliminary Engineering	1
West Howard 154 UF relay replacement	Preliminary Engineering	3

3 Over / Under Expenditure Analysis

3.1 Summary Table

Actual Spending ($M)			
Project #	**Description**		**Total Spend**
C035586	Relay Replacement Strategy CO 49DXT	Capex	1.676
		Opex	0.013
		Removal	(0.027)
		Total	1.662
Project #	**Description**		**Total Spend**
C035587	Relay Replacement Strategy CO 49TXT	Capex	0.869
		Opex	(0.008)
		Removal	0.048
		Total	0.909
Project #	**Description**		**Total Spend**
C049354	NEC Relay Replacement CO.49-SG157	Capex	0.068
		Opex	0.000
		Removal	0.000
		Total	0.068
Total		Capex	2.613
		Opex	0.005
		Removal	0.021
		Total	2.639

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Project Sanction Summary Table			
Project Sanction Approval ($M)			**Total Spend**
Project #	**Description**		
C035586	Relay Replacement Strategy CO 49DXT	**Capex**	0.975
		Opex	0.125
		Removal	0.150
		Total Cost	**1.250**
Project #	**Description**		
C035587	Relay Replacement Strategy CO 49TXT	**Capex**	0.749
		Opex	0.096
		Removal	0.115
		Total Cost	**0.960**
Project #	**Description**		
C049354	NEC Relay Replacement CO.49-SG157	**Capex**	0.250
		Opex	0.032
		Removal	0.038
		Total Cost	**0.320**
		Capex	1.974
		Opex	0.253
		Removal	0.303
		Total Sanction	**2.530**
Sanction Variance ($M)			**Total Spend**
Project #	**Description**		
C035586	Relay Replacement Strategy CO 49DXT	**Capex**	(0.701)
		Opex	0.112
		Removal	0.177
		Total Cost	**(0.412)**
Project #	**Description**		
C035587	Relay Replacement Strategy CO 49TXT	**Capex**	(0.120)
		Opex	0.104
		Removal	0.067
		Total Cost	**0.051**
Project #	**Description**		
C049354	NEC Relay Replacement CO.49-SG157	**Capex**	0.182
		Opex	0.032
		Removal	0.038
		Total Cost	**0.252**
		Capex	(0.639)
		Opex	0.248
		Removal	0.282
		Total Variance	**(0.109)**

USSC-14-033
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3.2 Analysis

Progression of the RI Relay Program at various sites was accomplished for FY15 while keeping within the tolerances of the latest sanctioned amount

The charge split for the FY15 sanction was based on the strategy paper SG-157 which accounted for 78%CapEx, 10%OpEx, & 12%CoR. In reality, the relay projects fall more in line with a 98%CapEx, 1%OpEx, & 1%CoR split which resulted in a large variance in CapEx investment.

4 Improvements / Lessons Learned

- Outage plans are often difficult to lock in and adhere to as the t-level projects in RI tend to conflict with several other on-going projects. Continued communication between the construction site supervisor and the outage coordinator allowed for the submission of revised transmission outage applications when necessary and helped to align the three station outage required for Woonsocket, Franklin Sq, and Admiral St.
- The overlapping of program work at a few of these stations makes it difficult to mitigate drawing conflicts and avoid interferences between the different installation groups. Transparency and frequent communication allowed us to combine work at Woonsocket, Staples, and Valley to better efficiencies and share outages.

5 Closeout Activities

The following closeout activities have been completed (where applicable).

Activity	Completed
All work has been completed in accordance with all National Grid policies	(•) Yes ( ) N/A
All relevant costs have been charged to project	(•) Yes ( ) N/A
All work orders and funding projects have been closed	(•) Yes ( ) N/A
All unused materials have been returned	(•) Yes ( ) N/A
All as-builts have been completed	(•) Yes ( ) N/A
All lessons learned have been entered appropriately into the lesson learned database	(•) Yes ( ) N/A

6 Statements of Support

6.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Department	Individual	Responsibilities
Investment Planning	Michelle Park	Endorses relative to distribution 5-year business plan or emergent work
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses D-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	Suzan Martuscello	Endorses Substation scope, design, conformance with design standards
Engineering/Design	Alan LaBarre	Endorses D-Sub scope, design, conformance with design standards
Engineering/Design	Kasia Kulbacka	Endorses T-Sub scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications

6.2 Reviewers

The reviewers have provided feedback on the content/language of the paper.

Function	Individual
Finance	Keith Fowler, Phil Horowitz
Regulatory	Peter Zschokke
Jurisdictional Delegates	Carol Sedewitz & James Patterson
Control Center	Joe Cutler

USSC Closure Paper

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7 ***Decisions***

I approve this paper.

Signature.....Date.....

Executive Sponsor – Ross Turrini, Acting Senior Vice President, Network Strategy

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Short Form Sanction Paper

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Title:	Relay Replacement Program - RI	**Sanction Paper #:**	USSC-15-258
Project #:	C035586 & C049354	**Sanction Type:**	Sanction
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	10/27/2015
Author:	Tom Alexander	**Sponsor:**	John Gavin, VP Electric Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	Tom Alexander/Mark Phillips

1 Executive Summary

1.1 Sanctioning Summary

This paper requests sanction of Project Funding # C035586 and C049354 in the amount $1.220M and a tolerance of +/- 10% for the purposes of final engineering, material procurement, and construction for active projects within fiscal year 2016.

This sanction amount is $1.220M broken down into:

1.196M Capex
0.004M Opex
0.020M Removal

2 Program Detail

2.1 Background

The Relay Replacements Strategy (SG157) was approved in October 2010 detailing replacement of existing electro-mechanical and solid state relays throughout the New England system. The strategy targeted specific types of relays with the highest probability of failure, which is a total of approximately 5% of the total electro-mechanical and solid state relay population. The types identified were transmission line differential, transformer differential, reclosing and under-frequency types. The relays requiring replacement are: a) obsolete, b) not supported by the manufacturer, c) have limited spare parts availability, and d) have demonstrated a trend of decreasing reliability.

The targeted relays were selected based on type history, performance, field O&M experience and available manufacturer support. Challenges with the aging electro-mechanical fleet of relays include settings drift, worn parts, spare parts depletion and attrition of the internal knowledge base. Many of the remaining relays in stock have been scavenged and can no longer be redeployed to the system. While in the longer-term, thousands of electro-mechanical and solid state relays may need replacement

based on a simple life cycle analysis, this strategy has identified an immediate need to replace the worst performing relay families.

2.2 Drivers

The primary driver of this paper is reliability. If the relays identified fail or malfunction, there is a risk of prolonged outages and a corresponding negative reliability impact. The protection afforded by relays is critical to the stability of the electric transmission system. The relays are designed to protect high-value system components from the effects of system failures and to quickly isolate system failures so that no additional damage can occur. Protective relays limit the extent and duration of outages thus improving key system performance metrics such as CAIDI, SAIDI and SAIFI. For example, a malfunctioning relay could result in a potential loss of between 5 million and 20 million customer-minutes. This translates to a SAIDI of between 1.5 to 6 minutes. Failure or the malfunctioning of key protection and control system components may have the effect of negatively impacting our ability to deliver power resulting in customer outages and poor public perception. Failure to stay within the system reliability targets may result regulatory action.

2.3 Benefits

Replacement with modern microprocessor based relays will supply information not previously available from electromechanical relays. With the availability of this real time data, future applications can be developed such that more of the transmission system can be automated and designed to respond automatically to system events. The speed of data acquisition and analysis would present system operators with a better understanding of system anomalies and recommendations for remedial actions. For example, distance-to-fault data would be available to identify fault location with greater accuracy than currently possible. This data would be brought back to the control center for use by operations and engineering personnel.

2.4 Business & Customer Issues

As required by FERC, NERC, NPCC regulations, proper protection operation is currently in place. The relay replacement program is a means to uphold proper protection by updating applicable equipment to mitigate the probability of failure.

2.5 Alternatives

Alternative 1 – Adopt Replace-on-Fail Plan:
This option adopts a plan to only replace the targeted relays once they fail.

Such a plan would naturally result in decreased system reliability due to the increased rates of failure and the duration of subsequent outages.

Increased failure frequency or extended outages as a result of this option may result in failure to meet performance targets set by our regulators.

Alternative 2 – Defer Replacements:
This option may result in an increased failure rate possibly resulting in outages due to relays failing before they are scheduled for replacement.

This option only defers the project during which time additional relays will reach obsolescence, thus increasing the scope of the project.

This option would also delay the advent of a more comprehensive asset management strategy for the relay population.

Alternative 3 – Do Nothing:
This option would allow the current situation to persist.

Relays would continue to deteriorate at a rate greater than our capability to replace them.

The targeted relays will not be able to be further maintained and will require ad-hoc replacement with digital relays. This would likely be a more expensive approach.

2.6 Investment Recovery

Investment recovery will be through standard rate recovery mechanisms approved by appropriate regulatory agencies

2.6.1 Customer Impact

This project results in an indicative first full year revenue requirement when the asset is placed in service equal to approximately $0.660M. This is indicative only. The actual revenue requirement will differ, depending upon the timing of the next rate case and/or the timing of the next filing in which the project is included in rate base.

3 Related Projects, Scoring, Budgets

3.1 Summary of Projects

Distribution:

Project Number	Project Type (Elec only)	Project Title	Estimate Amount ($M)
C035586	D-Sub	Relay Replacement - RI	1.200
C049354	D-Sub	Relay Replacement - RI	0.020
		Total	1.220

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3.2 Associated Projects

N/A

3.3 Prior Sanctioning History

Date	Governance Body	Sanctioned Amount	Potential Project Investment	Paper Title	Sanction Type	Tolerance
April 2014	USSC	$2.530M	N/A	Relay Replacements - RI	Sanction	+/-10%
December 2012	USSC	$1.200M	N/A	Relay Replacements - RI	Partial	+/- 25%
February 2011	AMIC	$0.330M	N/A	Preliminary Engineerin for Relay Replacements	PWS	+/-25%
October 2010	AMIC	$14.840M	N/A	Relay Replacement Strategy – SG157	Strategy	-25/+50%

3.4 Category

Category	Reference to Mandate, Policy, NPV, or Other
○ Mandatory	Provide for the network's safe, efficient and reliable operation
◉ Policy- Driven	
○ Justified NPV	
○ Other	

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3.5 Asset Management Risk Score

Asset Management Risk Score: 35 .

Primary Risk Score Driver: (Policy Driven Projects Only)

◉ Reliability ○ Environment ○ Health & Safety ○ Not Policy Driven

3.6 Complexity Level

○ High Complexity ○ Medium Complexity ◉ Low Complexity ○ N/A

Complexity Score: 18 .

3.7 Next Planned Sanction Review

Date (Month/Year)	Purpose of Sanction Review
July 2016	FY16 Program Closure Paper

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4 Financial

4.1 Business Plan

Business Plan Name & Period	Project included in approved Business Plan?	Over / Under Business Plan	Project Cost relative to approved Business Plan ($)
FY16-FY20 Budget File: New England Distribution	◉ Yes ○ No	○ Over ◉ Under ○ NA	$0.242M

4.1.1 If cost > approved Business Plan how will this be funded?

Re-allocation of funds within the portfolio will be managed by Resource Planning to meet jurisdictional budgetary, statutory and regulatory requirements.

4.2 CIAC / Reimbursement

N/A

4.3 Cost Summary Table

Project Number	Project Title	Project Estimate Level (%)	Spend	Prior Yrs	Current Planning Horizon ($M) Yr. 1 2015/16	Yr. 2 2016/17	Yr. 3 2017/18	Yr. 4 2018/19	Yr. 5 2019/20	Yr. 6 + 2020/21	Total
C035586	Relay Replacement - RI	+/- 10%	CapEx	-	1.176	-	-	-	-	-	1.176
			OpEx	-	0.004	-	-	-	-	-	0.004
			Removal	-	0.020	-	-	-	-	-	0.020
			Total	-	1.200	-	-	-	-	-	1.200
C049354	Relay Replacement - RI	+/- 10%	CapEx	-	0.020	-	-	-	-	-	0.020
			OpEx	-	-	-	-	-	-	-	-
			Removal	-	-	-	-	-	-	-	-
			Total	-	0.020	-	-	-	-	-	0.020
Total Project Sanction			CapEx	-	1.196	-	-	-	-	-	1.196
			OpEx	-	0.004	-	-	-	-	-	0.004
			Removal	-	0.020	-	-	-	-	-	0.020
			Total	-	1.220	-	-	-	-	-	1.220

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4.4 Project Budget Summary Table

Project Costs Per Business Plan

		Current Planning Horizon ($M)						
$M	Prior Yrs (Actual)	Yr. 1 2015/16	Yr. 2 2016/17	Yr. 3 2017/18	Yr. 4 2018/19	Yr. 5 2019/20	Yr. 6 + 2020/21	Total
CapEx	0.000	0.940	0.000	0.000	0.000	0.000	0.000	0.940
OpEx	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.019
Removal	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.019
Total Cost in Bus. Plan	0.000	0.978	0.000	0.000	0.000	0.000	0.000	0.978

Variance (Business Plan-Project Estimate)

		Current Planning Horizon ($M)						
$M	Prior Yrs (Actual)	Yr. 1 2015/16	Yr. 2 2016/17	Yr. 3 2017/18	Yr. 4 2018/19	Yr. 5 2019/20	Yr. 6 + 2020/21	Total
CapEx	0.000	(0.256)	0.000	0.000	0.000	0.000	0.000	(0.256)
OpEx	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.015
Removal	0.000	(0.001)	0.000	0.000	0.000	0.000	0.000	(0.001)
Total Cost in Bus. Plan	0.000	(0.242)	0.000	0.000	0.000	0.000	0.000	(0.242)

5 Key Milestones

Milestone	Target Date: (Month/Year)
FY16 Sanction Paper	October 2015
FY16 Closure Paper	July 2016

6 Statements of Support

6.1.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Role	Individual	Responsibilities
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses D-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	Suzan Martuscello	Endorses Substation scope, design, conformance with design standards
Engineering/Design	Alan LaBarre	Endorses D-Sub scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications

6.1.2 Reviewers

The reviewers have provided feedback on the content/language of the paper.

Reviewer List	Individual
Finance	Keith Fowler
Regulatory	Peter Zschokke
Jurisdictional Delegates	James Patterson
Control Center	Joe Cutler

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7 Decisions

I:

(a) APPROVE this paper and the investment of $1.220M and a tolerance of +/-10%

(b) NOTE that Tom Alexander is the Project Manager and Mark Phillips has the approved financial delegation.

(c) NOTE: In the event that any Program projects are not approved prior to the start of the FY16 fiscal year, the FY15 approval limits will remain in effect until such time as the FY16 blanket projects are approved by USSC and/or other appropriate authority for approval.

Signature.....Date.....19/26/15

Marie Jordan, Senior Vice President, Electric Process & Engineering

USSC-15-258
Uncontrolled When Printed

USSC Closure Paper

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Title:	Relay Replacement Program - RI	**Sanction Paper #:**	USSC-15-258C
Project #:	C035586 & C049354	**Sanction Type:**	Closure
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	5/31/2016
Author:	Andrew Dorr/Tom Alexander	**Sponsor:**	Carol Sedewitz – Acting VP Electric Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	Andrew Dorr/Tom Alexander/Mark Phillips

1 *Executive Summary*

This paper is presented to close the FY16 sanction paper (USSC-15-258) for the RI Relay Program (FPs C035586 &C049354). The total spend was $1.208M. The latest sanctioned amount for this project was $1.220M.

*The final spend amount for **FP# C035586** is $1.181M broken down into:*
$1.161M Capex
$0.004M Opex
$0.016M Removal

*The final spend amount for **FP# C049354** is $0.027M broken down into:*
$0.027M Capex
$0.000M Opex
$0.000M Removal

2 *Project Summary*

The Relay Replacements Strategy (SG157) was approved in October 2010 detailing replacement of existing electro-mechanical and solid state relays throughout the New England system. The strategy targeted specific types of relays with the highest probability of failure, which is a total of approximately 5% of the total electro-mechanical and solid state relay population. The types identified were transmission line differential, transformer differential, reclosing and under-frequency types. The relays requiring replacement are: a) obsolete, b) not supported by the manufacturer, c) have limited spare parts availability, and d) have demonstrated a trend of decreasing reliability.

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C035586 Projects	Status	Relays
Valley 102 T-Level relay, UF relay, & RTU replacements	Construction Complete 2/2016	5
Warren 5 T-Level & UF relay replacements	EDC 11/2015	2
Wood River T-Level & UF relay replacements	CS 3/2016	3
Admiral St T-Level Relay Replacements	WO Closed 3/2016	
Franklin Sq T-Level Relay Replacements	WO Closed 3/2016	
Arctic 49 UF relay replacement	Removed from the Program	1
Dyer St 29 UF relay replacement	EDC 11/2015	1
Division St 61 UF relay replacement	EDC 11/2015	1
Auburn 73 UF relay replacement	EDC 11/2015	2
C049354 Projects	**Status**	**Relays**
West Greenville 45 UF relay replacement	EDC 11/2015	1
Nasonville 127929 UF relay replacement	EDC 11/2015	2
Sprague St 36 UF relay replacement	EDC 11/2015	1
Geneva 71 UF relay replacement	EDC 11/2015	1
Johnston 18 UF relay replacement	EDC 11/2015	1
West Howard 154 29 UF relay replacement	Removed from the Program	3

3 *Over / Under Expenditure Analysis Summary Table*

Actual Spending ($M)			
Project #	**Description**		**Total Spend**
C035586	Relay Replacement Strategy CO 49 DxT	**Capex**	1.161
		Opex	0.004
		Removal	0.016
		Total	**1.181**
Project #	**Description**		**Total Spend**
C049354	NEC Relay Replacement CO.49-SG157	**Capex**	0.027
		Opex	0.000
		Removal	0.000
		Total	**0.027**
Total		**Capex**	1.188
		Opex	0.004
		Removal	0.016
		Total	**1.208**

Project Sanction Summary Table			
Project Sanction Approval ($M)			**Total Spend**
		Capex	1.196
		Opex	0.004
		Removal	0.020
		Total Cost	**1.220**
Sanction Variance ($M)			**Total Spend**
		Capex	0.008
		Opex	0.000
		Removal	0.004
		Total Variance	**0.012**

3.1 Analysis

All objectives for the project were completed, keeping within tolerances of latest sanctioned amount.

4 Improvements / Lessons Learned

- The overlapping of program work at a few of these stations makes it difficult to mitigate drawing conflicts and avoid interferences between the different installation groups. Transparency and frequent communication allowed us to combine work at Valley to better capture efficiencies and share outages.
- The charge split in the budget was based on the strategy paper SG-157 which accounted for 78% CapEx, 10% OpEx, & 12% CoR. In reality, the relay projects fall more in line with a 98% CapEx, 1% OpEx, & 1% CoR split which resulted in a variance in CapEx investment.

5 Closeout Activities

The following closeout activities have been completed (where applicable).

Activity	Completed
All work has been completed in accordance with all National Grid policies	◉ Yes ○ N/A
All relevant costs have been charged to project	◉ Yes ○ N/A
All work orders and funding projects have been closed	◉ Yes ○ N/A
All unused materials have been returned	◉ Yes ○ N/A
All as-builts have been completed	◉ Yes ○ N/A
All lessons learned have been entered appropriately into the lesson learned database	◉ Yes ○ N/A

6 Statements of Support

6.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Department	Individual	Responsibilities
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses D-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	Suzan Martuscello	Endorses Substation scope, design, conformance with design standards
Asset/Planning	Alan LaBarre	Endorses D-Sub scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications
Electric Project Management	Jammie Simonds	Endorses Cost Estimate

6.2 Reviewers

The reviewers have provided feedback on the content/language of the paper.

Function	Individual
Finance	Patricia Easterly
Regulatory	Peter Zschokke
Jurisdictional Delegates	James Patterson
Control Center	Michael Gallagher

USSC Closure Paper

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7 ***Decisions***

I approve this paper.

Signature.....Date.....6/4/11

Executive Sponsor – Christopher Kelly, Acting Senior Vice President, Electric Process and Engineering

C040644

Telecom Small Capital Work - RI

5360-Narragansett Electric and Gas
Project Revision Detail Report

Fund Project Number:	C040644	**USSC #:**	FY16 Program
Revision:	3	**Budget Version:**	Default
Project Title:	Telecom Small Capital Work - RI		
Project Description:	Telecom small capital work.		

Project Status:	open		
Responsible Person:	TILLER, ROBERT	**Initiator:**	Holden, Eric H
Spending Rationale:	Non-Infrastructure	**Funding Type:**	P Gen Plant-No Furn Electric PAM
Budget Class:	Telecommunications Capital - Dist		
Capital by Category:			
Program Code:			
Project Risk Score:	49	**Project Complexity Score:**	15

Project Schedule / Expenditures

Revision Status:	Approved		
Est Start Date:	4/1/2013	**Est Complete Date:**	3/31/2018
Est In-Service Date:	3/31/2018		
TTD Actuals:	$795,953	**As Of:**	10/10/2017

Cost Breakdown	Capital	Expense	Removal	Total	Credits
	$175,000	$0	$0	$175,000	$0

Justification / Risk Identification:

<Enter data here>

Project Scope:

This program is set up to accomodate telecom small capital work.

Project Alternatives Considered:

<Enter data here>

Additional Notes:

DoA $175K from the FY16 Program Budget

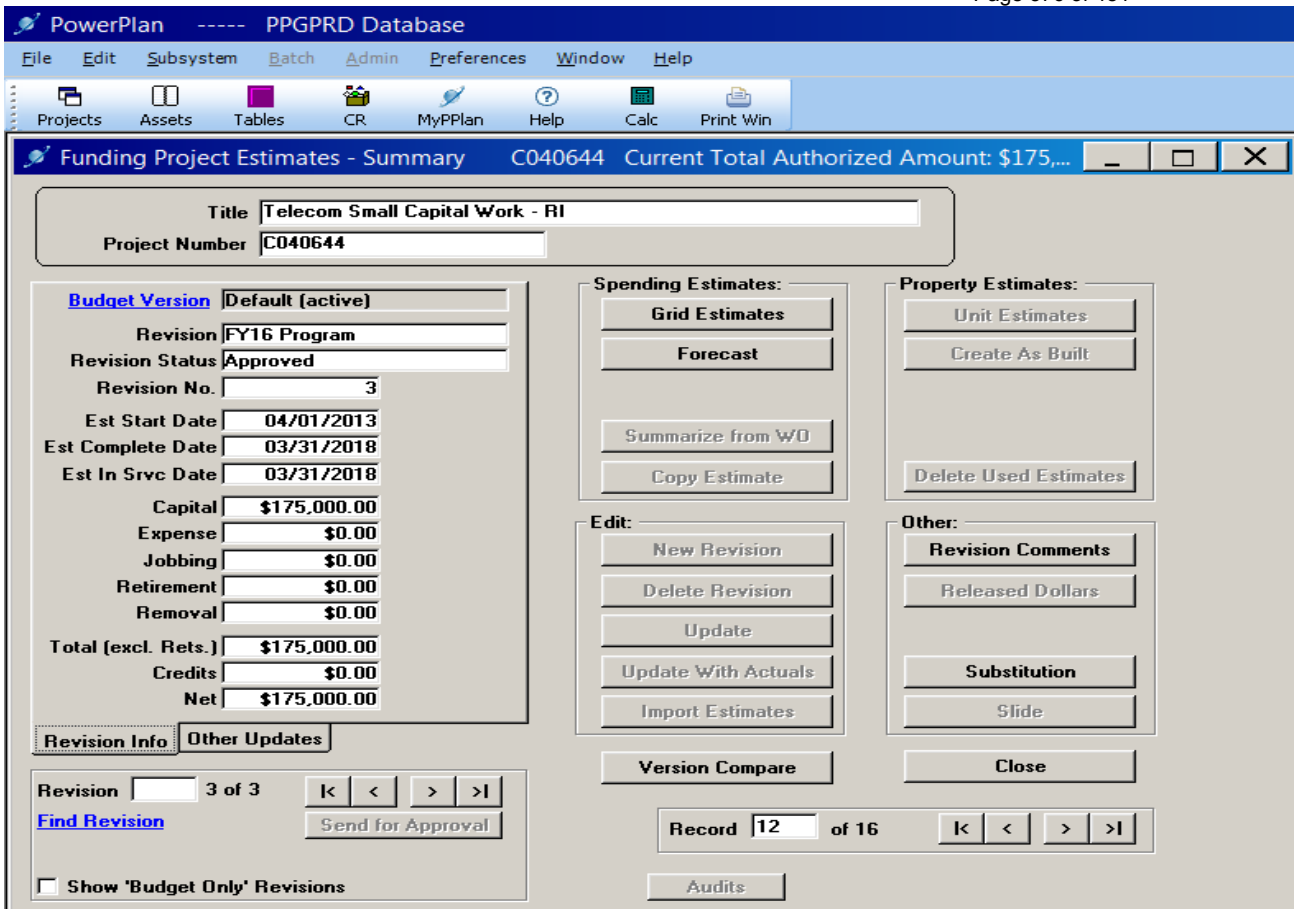
Related Projects:

Project Number: **Project Name:**

Approvals

Line 1:	**Date**	4/24/2015 13:09:21	**Approver**	labara	Approver 1
Line 2:	**Date**		**Approver**		
Line 3:	**Date**		**Approver**		
Line 4:	**Date**		**Approver**		
Line 5:	**Date**		**Approver**		

*****Project Authorization is for Approved Revision Total Estimated Cost +10%*****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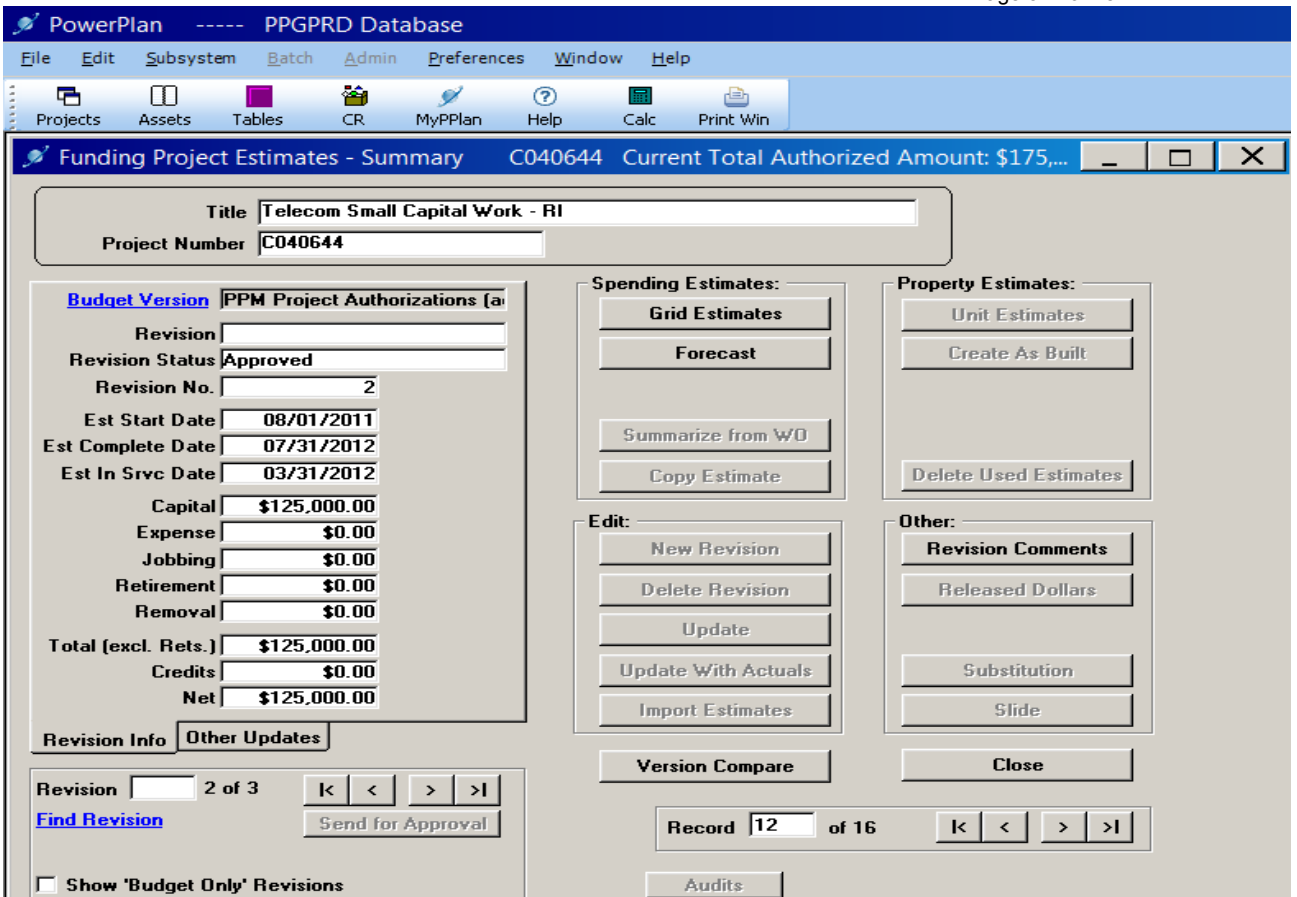
Title Telecom Small Capital Work - RI
Project Number C040644
Budget Version Default (active)
Revision FY16 Program
Revision Status Approved
Revision No. 3
Est Start Date 04/01/2013
Est Complete Date 03/31/2018
Est In Srvc Date 03/31/2018
Capital $175,000.00
Expense $0.00
Jobbing $0.00
Retirement $0.00
Removal $0.00
Total (excl. Rets.) $175,000.00
Credits $0.00
Net $175,000.00
Revision Info
Other Updates
Revision 3 of 3
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
Update
Update With Actuals
Import Estimates
Other:
Revision Comments
Released Dollars
Substitution
Slide
Version Compare
Close
Record 12 of 16
Audits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File Edit Subsystem Batch Admin Preferences Window Help
Projects Assets Tables CR MyPPlan Help Calc Print Win
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Title Telecom Small Capital Work - RI
Project Number C040644
Budget Version PPM Project Authorizations (a
Revision
Revision Status Approved
Revision No. 2
Est Start Date 08/01/2011
Est Complete Date 07/31/2012
Est In Srvc Date 03/31/2012
Capital $125,000.00
Expense $0.00
Jobbing $0.00
Retirement $0.00
Removal $0.00
Total (excl. Rets.) $125,000.00
Credits $0.00
Net $125,000.00
Revision Info
Other Updates
Revision 2 of 3
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
Update
Update With Actuals
Import Estimates
Other:
Revision Comments
Released Dollars
Substitution
Slide
Version Compare
Close
Record 12 of 16
Audits

C049354

NEC Relay Replacement - SG157

5360-Narragansett Electric and Gas
Project Revision Detail Report

Fund Project Number:	C049354	**USSC #:**	FY18 Program
Revision:	8	**Budget Version:**	
Project Title:	NEC Relay Replacement Co.49- SG157		
Project Description:	This project is needed to capture costs of remaining Co, 49 relay replacements in RI as part of SG157 approved Dec 2010. This new funding project is needed as we cannot create new wo's under FP# C035586 DxT		

Project Status:	open		
Responsible Person:	ALEXANDER, THOM/	**Initiator:**	Csizmesia, Kelley M
Spending Rationale:	Asset Condition	**Funding Type:**	P Electric Distribution Sub RI
Budget Class:	Asset Replacement		
Capital by Category:			
Program Code:			
Project Risk Score:	35	**Project Complexity Score:**	18

Project Schedule / Expenditures

Revision Status:	Approved		
Est Start Date:	4/1/2017	**Est Complete Date:**	3/31/2018
Est In-Service Date:	3/31/2018		
TTD Actuals:	$326,034	**As Of:**	10/10/2017

Cost Breakdown	Capital	Expense	Removal	Total	Credits
	$163,680	$2,680	$3,110	$169,470	$0

Justification / Risk Identification:

Project Scope:

Project Alternatives Considered:

Additional Notes:

Re-Sanction from $125,130 to $166,235 document attached. Revised estimate is higher than current FY17 DOA by approximately $41k. Revised spend is based on FY17 actuals. Previous sanction did not account for the total forecasted value of construction at W.Greenville, Geneva, Sprague, and Nasonville. In addition, the engineering and design support required at Geneva due to asbestos concerns for where the new relay was designed to be installed.

Re-Sanction from $74K to $125,130 document attached. Revised estimate is higher than original FY17 DOA by

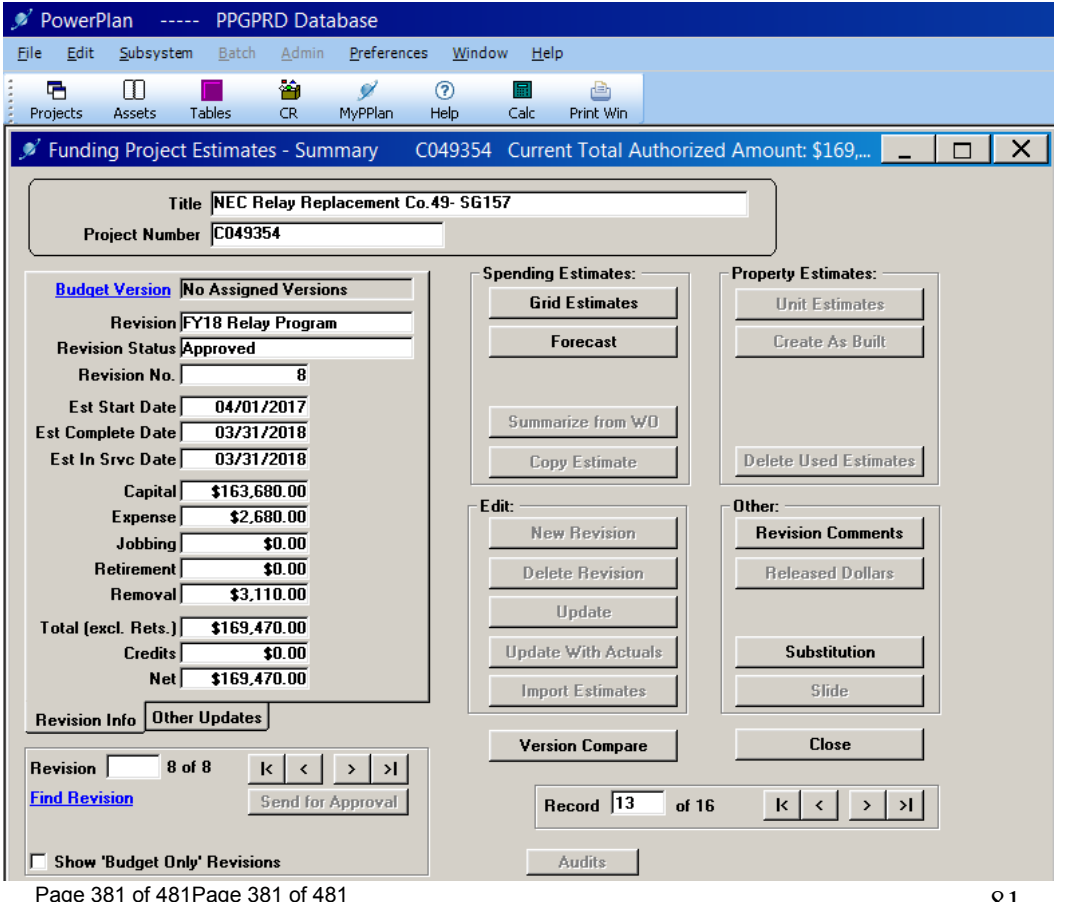
Related Projects:

Project Number:	Project Name:

Approvals

Line 1:	**Date**	4/27/2017 13:45:29	**Approver**	padila	DOA - Distribution Lev
Line 2:	**Date**	4/27/2017 13:55:58	**Approver**	Diconza, Glen L	DOA - Distribution Lev
Line 3:	**Date**	4/28/2017 08:15:11	**Approver**	McGrath, James M	DOA - Distribution Lev
Line 4:	**Date**	5/4/2017 20:54:48	**Approver**	Constable, Ryan	DOA - Distribution Lev
Line 5:	**Date**		**Approver**		

*****Project Authorization is for Approved Revision Total Estimated Cost +10%*****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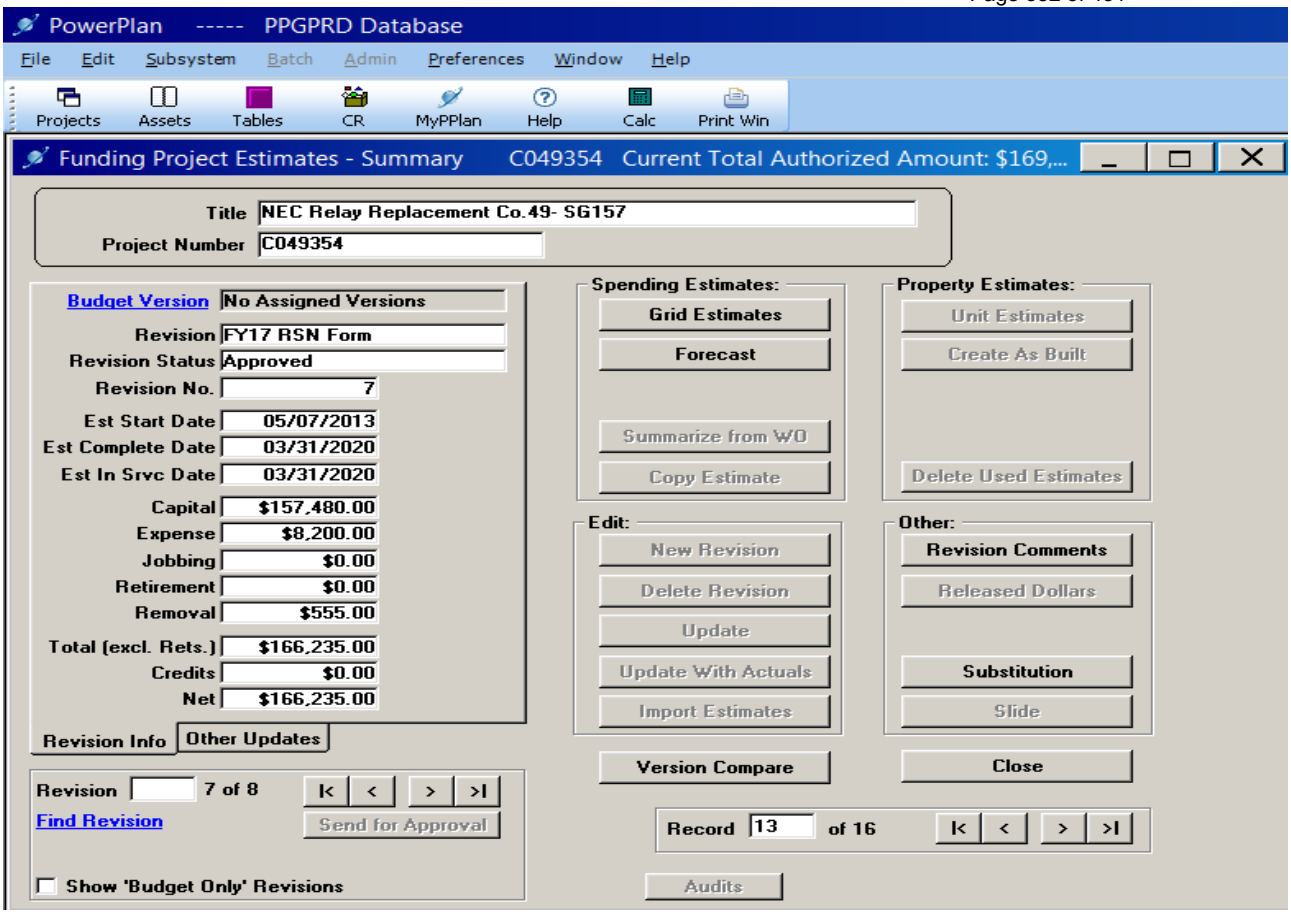
Funding Project Estimates - Summary C049354 Current Total Authorized Amount: $169,...
Title NEC Relay Replacement Co.49- SG157
Project Number C049354
Budget Version No Assigned Versions
Revision FY18 Relay Program
Revision Status Approved
Revision No. 8
Est Start Date 04/01/2017
Est Complete Date 03/31/2018
Est In Srvc Date 03/31/2018
Capital $163,680.00
Expense $2,680.00
Jobbing $0.00
Retirement $0.00
Removal $3,110.00
Total (excl. Rets.) $169,470.00
Credits $0.00
Net $169,470.00
Revision Info
Other Updates
Revision 8 of 8
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
Update
Update With Actuals
Import Estimates
Other:
Revision Comments
Released Dollars
Substitution
Slide
Version Compare
Close
Record 13 of 16
Audits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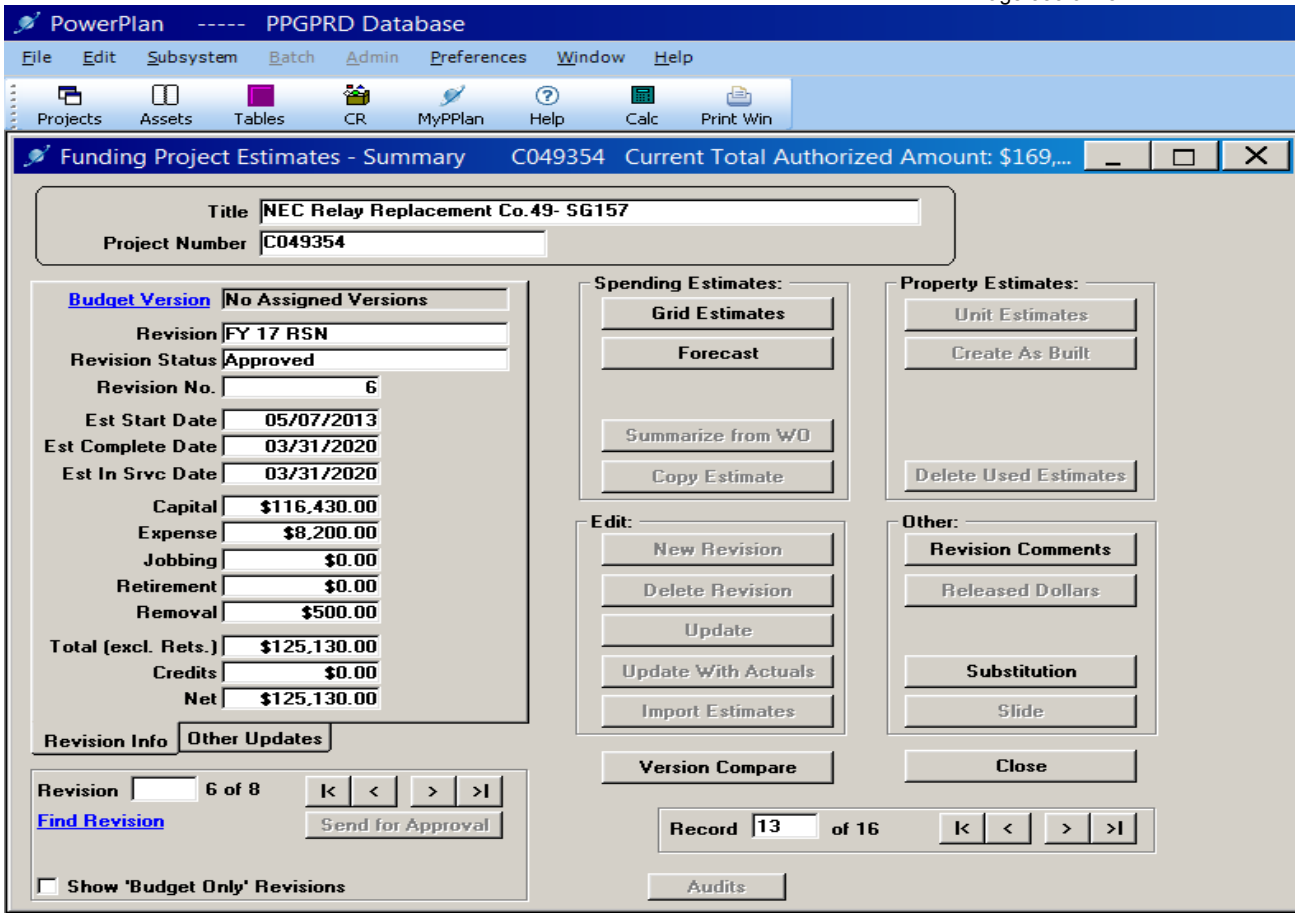
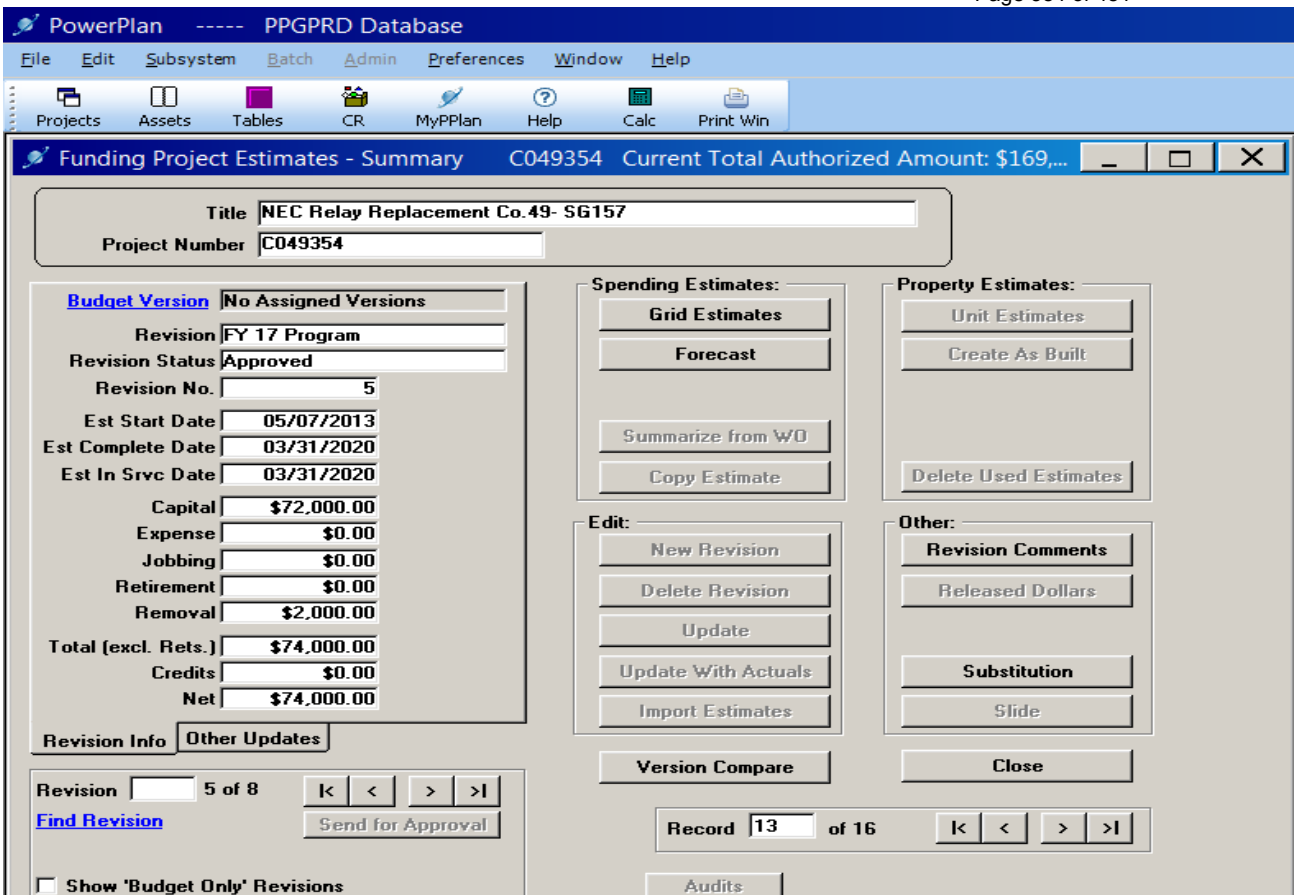
Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C049354 Current Total Authorized Amount: $169,...
Title NEC Relay Replacement Co.49- SG157
Project Number C049354
Budget Version No Assigned Versions
Revision FY17 RSN Form
Revision Status Approved
Revision No. 7
Est Start Date 05/07/2013
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $157,480.00
Expense $8,200.00
Jobbing $0.00
Retirement $0.00
Removal $555.00
Total (excl. Rets.) $166,235.00
Credits $0.00
Net $166,235.00
Revision Info
Other Updates
Revision 7 of 8
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
Update
Update With Actuals
Import Estimates
Other:
Revision Comments
Released Dollars
Substitution
Slide
Version Compare
Close
Record 13 of 16
Audits


PowerPlan ----- PPGPRD Database
File Edit Subsystem Batch Admin Preferences Window Help
Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C049354 Current Total Authorized Amount: $169,...
Title NEC Relay Replacement Co.49- SG157
Project Number C049354
Budget Version No Assigned Versions
Revision FY 17 RSN
Revision Status Approved
Revision No. 6
Est Start Date 05/07/2013
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $116,430.00
Expense $8,200.00
Jobbing $0.00
Retirement $0.00
Removal $500.00
Total (excl. Rets.) $125,130.00
Credits $0.00
Net $125,130.00
Revision Info
Other Updates
Revision 6 of 8
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
Update
Update With Actuals
Import Estimates
Other:
Revision Comments
Released Dollars
Substitution
Slide
Version Compare
Close
Record 13 of 16
Audits


PowerPlan ----- PPGPRD Database
File Edit Subsystem Batch Admin Preferences Window Help
Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C049354 Current Total Authorized Amount: $169,...
Title NEC Relay Replacement Co.49- SG157
Project Number C049354
Budget Version No Assigned Versions
Revision FY 17 Program
Revision Status Approved
Revision No. 5
Est Start Date 05/07/2013
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $72,000.00
Expense $0.00
Jobbing $0.00
Retirement $0.00
Removal $2,000.00
Total (excl. Rets.) $74,000.00
Credits $0.00
Net $74,000.00
Revision Info
Other Updates
Revision 5 of 8
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
Update
Update With Actuals
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Other:
Revision Comments
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Version Compare
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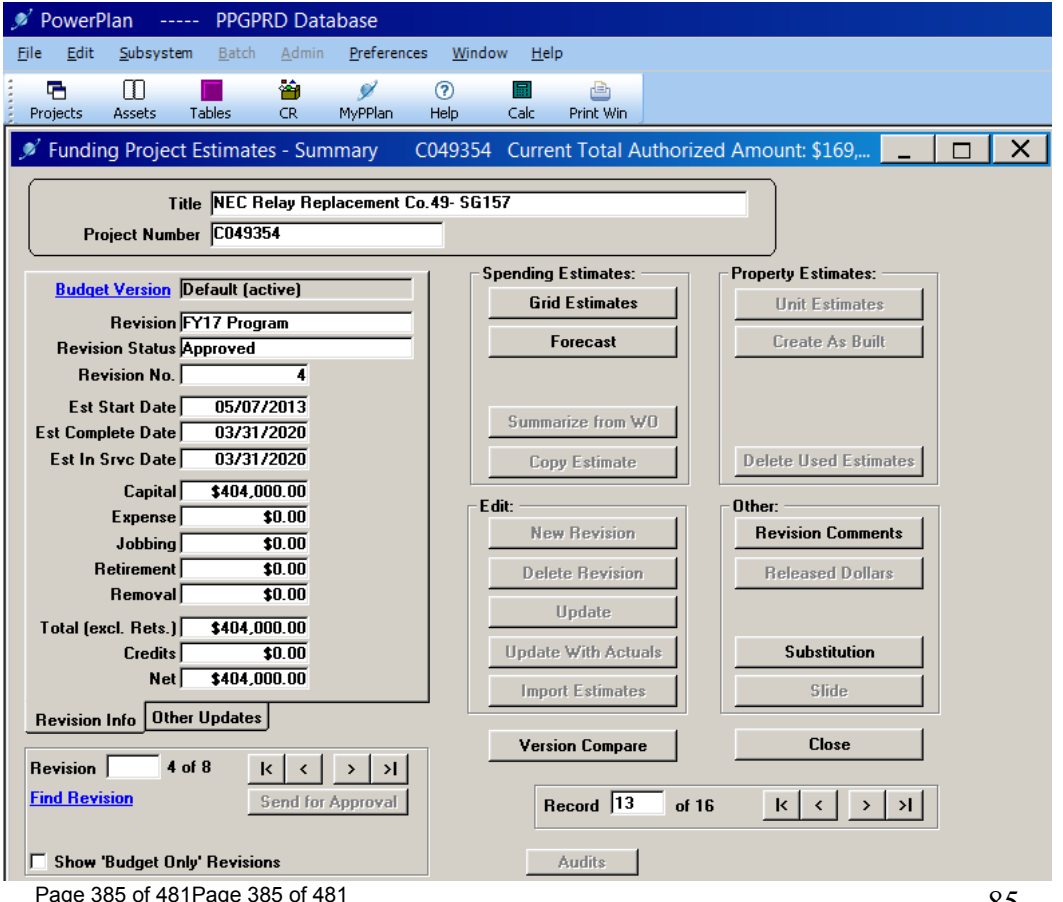
Record 13 of 16
Audits


PowerPlan ----- PPGPRD Database
File Edit Subsystem Batch Admin Preferences Window Help
Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C049354 Current Total Authorized Amount: $169,...
Title NEC Relay Replacement Co.49- SG157
Project Number C049354
Budget Version Default (active)
Revision FY17 Program
Revision Status Approved
Revision No. 4
Est Start Date 05/07/2013
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $404,000.00
Expense $0.00
Jobbing $0.00
Retirement $0.00
Removal $0.00
Total (excl. Rets.) $404,000.00
Credits $0.00
Net $404,000.00
Revision Info
Other Updates
Revision 4 of 8
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
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Update With Actuals
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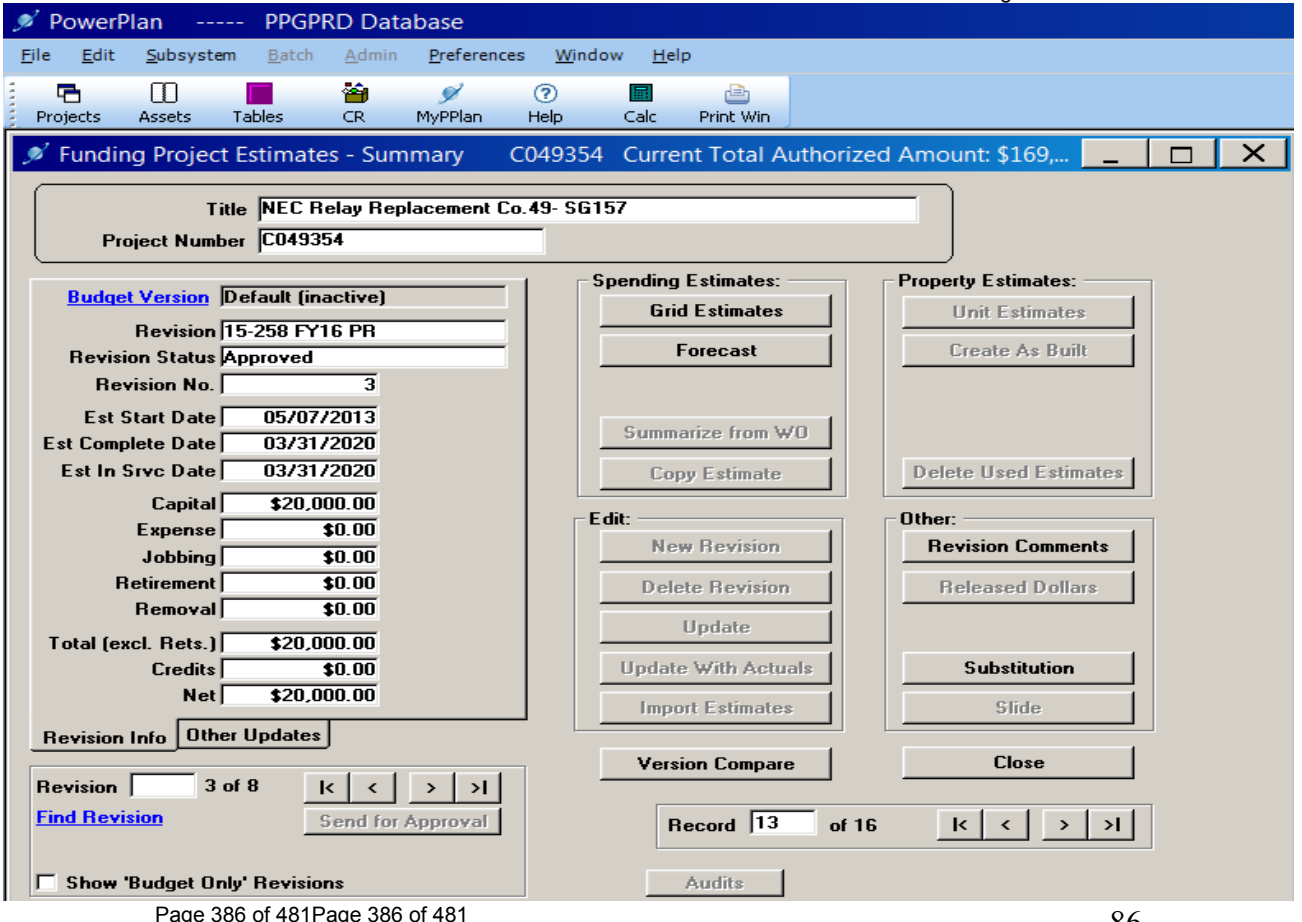
PowerPlan ----- PPGPRD Database
File Edit Subsystem Batch Admin Preferences Window Help
Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C049354 Current Total Authorized Amount: $169,...
Title NEC Relay Replacement Co.49- SG157
Project Number C049354
Budget Version Default (inactive)
Revision 15-258 FY16 PR
Revision Status Approved
Revision No. 3
Est Start Date 05/07/2013
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $20,000.00
Expense $0.00
Jobbing $0.00
Retirement $0.00
Removal $0.00
Total (excl. Rets.) $20,000.00
Credits $0.00
Net $20,000.00
Revision Info
Other Updates
Revision 3 of 8
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
New Revision
Delete Revision
Update
Update With Actuals
Import Estimates
Other:
Revision Comments
Released Dollars
Substitution
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Record 13 of 16
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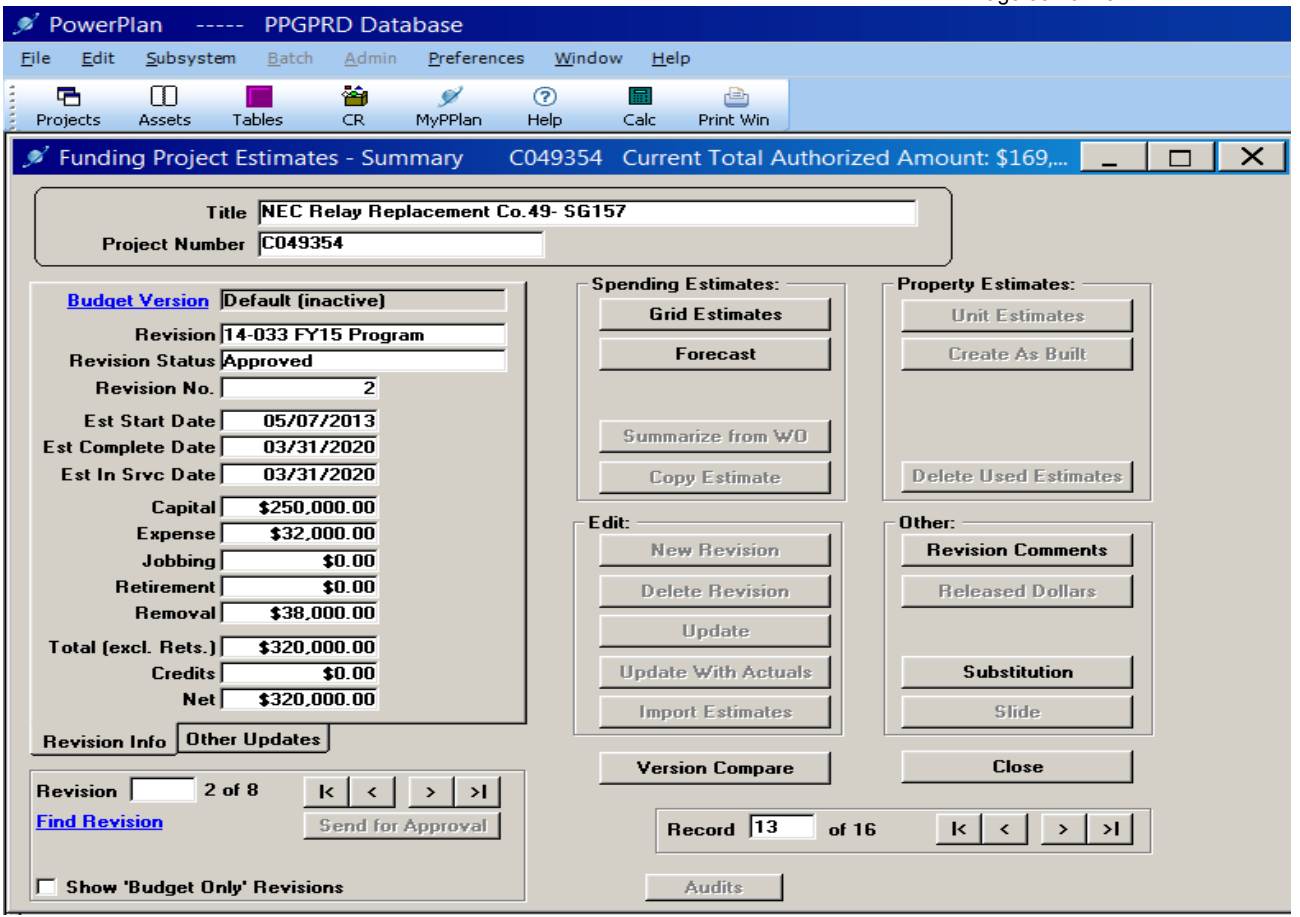
PowerPlan ----- PPGPRD Database
File Edit Subsystem Batch Admin Preferences Window Help
Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C049354 Current Total Authorized Amount: $169,...
Title NEC Relay Replacement Co.49- SG157
Project Number C049354
Budget Version Default (inactive)
Revision 14-033 FY15 Program
Revision Status Approved
Revision No. 2
Est Start Date 05/07/2013
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $250,000.00
Expense $32,000.00
Jobbing $0.00
Retirement $0.00
Removal $38,000.00
Total (excl. Rets.) $320,000.00
Credits $0.00
Net $320,000.00
Revision Info
Other Updates
Revision 2 of 8
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
Forecast
Summarize from WO
Copy Estimate
Property Estimates:
Unit Estimates
Create As Built
Delete Used Estimates
Edit:
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Delete Revision
Update
Update With Actuals
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Revision Comments
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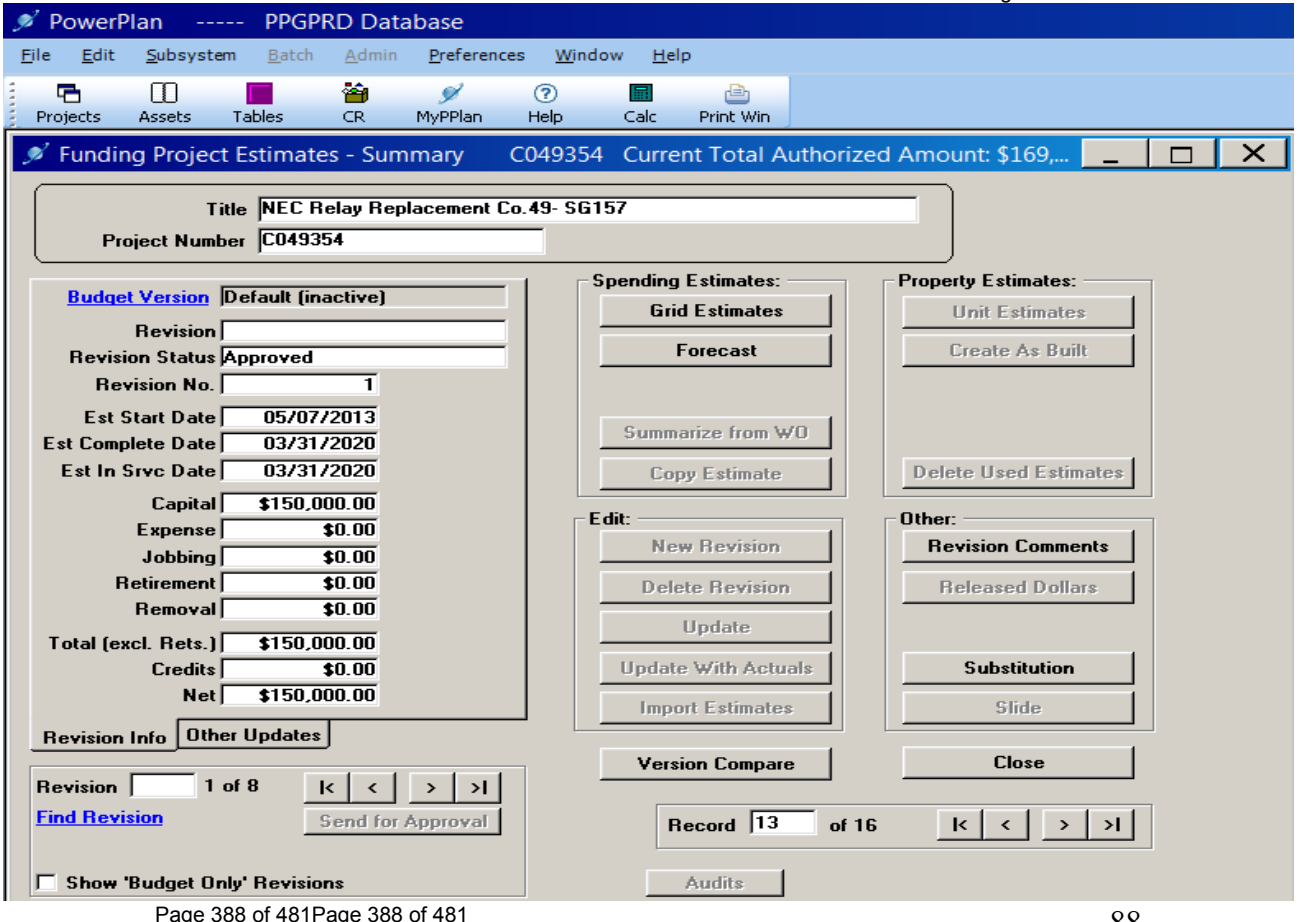
Record 13 of 16
Audits


PowerPlan ----- PPGPRD Database
File Edit Subsystem Batch Admin Preferences Window Help
Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C049354 Current Total Authorized Amount: $169,...
Title NEC Relay Replacement Co.49- SG157
Project Number C049354
Budget Version Default (inactive)
Revision
Revision Status Approved
Revision No. 1
Est Start Date 05/07/2013
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $150,000.00
Expense $0.00
Jobbing $0.00
Retirement $0.00
Removal $0.00
Total (excl. Rets.) $150,000.00
Credits $0.00
Net $150,000.00
Revision Info
Other Updates
Revision 1 of 8
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
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Delete Revision
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Import Estimates
Other:
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Released Dollars
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Audits

Change in DOA Request Form (Less than Million)

Version 9.0

Note: Fill data in the grey area and email form to **Mario Carlino** and the appropriate IP analyst.
Gas - Tracy Nguyen
Electric - Janice Flynn

*Date:	3/27/2017
*Operating Company:	The Narragansett Electric Co.
*PowerPlant Project Id:	C049354
*Project Name:	NEC Relay Replacement Program Co.49 - SG157
*Project Engineer:	Multiple
*Project Manager:	Tom Alexander

Latest Project Estimate

*Date of Latest Sanction:	10/4/2016

Total	Capex	Opex	Removal
$74,000	$74,000	$0	$0

Revised Project Estimate

Total	Capex	Opex	Removal
$125,130	$116,430	$8,200	$500

Cash Flows

Previous FY	Capex	Opex	Removal
$0	$0	$0	$0

Current FY	Capex	Opex	Removal
$125,130	$116,430	$8,200	$500

FY+1	Capex	Opex	Removal
$0			

FY+2	Capex	Opex	Removal
$0			

Customer Contribution

Reason for Revision

☑	Revised forecast either exceeds or is lower than the Approved Amount - Project Still In Process
	New Project Estimated Completion Date: 3/31/2018
☐	Actual Spending either exceeds or is lower than the Approved Amount – Project is Complete

Reason for Increased Spending (Please expand the row height if box doesn't fit)

☐	**Change in Scope (Material, Labor or Other)**
	FY17 Relay replacement work plan was revised to include construction completion of the Geneva UF replacement Project ($15k).

1

Change in DOA Request Form (Less than Million)

☐	**Resource Allocation (Schedule, Delay, OT, or Contractor)**
☑	**Low / High Estimate**
	Revised estimate is higher than original FY17 DOA by approximately $51k. Revised estimate is based FY17 actuals per revised work plan and transfer of Harris. Harris Ave UF Relay Replacement was incorrectly initiated and exceuted under the program's transmission FP. A new work order was opened under C049354 and the applicable $35k transferred to correct the accounting and close the project.
☐	**External Forces (Permitting Requirements, Weather, Contractor Issues, etc)**

In-service Dates

*Original In-service Date:	3/31/2020
*Revised In-service Date:	3/31/2018

Change in DOA Request Form (Less than Million)

Version 9.0

Note: Fill data in the grey area and email form to **Mario Carlino** and the appropriate IP analyst.
Gas - Tracy Nguyen
Electric - Janice Flynn

*Date:	4/10/2017
*Operating Company:	The Narragansett Electric Co.
*PowerPlant Project Id:	C049354
*Project Name:	NEC Relay Replacement Program Co.49 - SG157
*Project Engineer:	Multiple
*Project Manager:	Tom Alexander

Latest Project Estimate

*Date of Latest Sanction:	3/27/2017

Total	Capex	Opex	Removal
$125,130	$116,430	$8,200	$500

Revised Project Estimate

Total	Capex	Opex	Removal
$166,235	$157,480	$8,200	$555

Cash Flows

Previous FY	Capex	Opex	Removal
$0	$0	$0	$0

Current FY	Capex	Opex	Removal
$166,235	$157,480	$8,200	$555

FY+1	Capex	Opex	Removal
$0			

FY+2	Capex	Opex	Removal
$0			

Customer Contribution

Reason for Revision

☑	Revised forecast either exceeds or is lower than the Approved Amount - Project Still In Process	
	New Project Estimated Completion Date:	3/31/2018

☐	Actual Spending either exceeds or is lower than the Approved Amount – Project is Complete

Reason for Increased Spending (Please expand the row height if box doesn't fit)

☐	**Change in Scope (Material, Labor or Other)**
☐	**Resource Allocation (Schedule, Delay, OT, or Contractor)**

1

Change in DOA Request Form (Less than Million)

☑	**Low / High Estimate**
	Revised estimate is higher than current FY17 DOA by approximately $41k. Revised spend is based on FY17 actuals. Previous sanction did not account for the total forecasted value of construction at W.Greenville, Geneva, Sprague, and Nasonville. In addition, the engineering and design support required at Geneva due to asbestos concerns for where the new relay was designed to be installed.
☐	**External Forces (Permitting Requirements, Weather, Contractor Issues, etc)**

In-service Dates

*Original In-service Date:	3/31/2020
*Revised In-service Date:	3/31/2018

This document has been redacted for Critical Energy Infrastructure Information (CEII).
5/2/2014

D + T

Short Form Sanction Paper

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Title:	Relay Replacements Program - RI	**Sanction Paper #:**	USSC-14-033
Project #:	C035586, C035587, C049354 D+T T+T D Sub	**Sanction Type:**	Sanction
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	4/8/2014
Author:	David Arthur/Tom Alexander	**Sponsor:**	Cheryl A. Warren – Vice President Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	Tom Alexander/Mark Phillips

1 Executive Summary

1.1 Sanctioning Summary

This paper requests sanction of Project Funding # C035586, C035587, C049354 in the amount **$2.530M** and a tolerance of **+/- 10%** for the purposes of preliminary engineering, final design, and material procurement and construction for all stations within fiscal year 2015.

This sanction amount is $2.530M broken down into:

$1.974M Capex
$0.253M Opex
$0.303M Removal

2 Project Detail

2.1 Project Description, Justification, Customer Issues, Drivers and Benefits

The Relay Replacements Strategy (SG157) was approved in October 2010 detailing replacement of existing electro-mechanical and solid state relays throughout the New England system. The strategy targeted specific types of relays with the highest probability of failure, which is a total of approximately 5% of the total electro-mechanical and solid state relay population. The types identified were transmission line differential, transformer differential, reclosing and under-frequency types. The relays requiring replacement are: a) obsolete, b) not supported by the manufacturer, c) have limited spare parts availability, and d) have demonstrated a trend of decreasing reliability.

The targeted relays were selected based on type history, performance, field O&M experience and available manufacturer support. Challenges with the aging electro-mechanical fleet of relays include settings drift, worn parts, spare parts depletion and

attrition of the internal knowledge base. Many of the remaining relays in stock have been scavenged and can no longer be redeployed to the system. While in the longer-term, thousands of electro-mechanical and solid state relays may need replacement based on a simple life cycle analysis, this strategy has identified an immediate need to replace the worst performing relay families.

If the relays identified fail or miss-operate, there is a risk of prolonged outages and a corresponding negative reliability impact. [redacted] The relays are designed to protect high-value system components from the effects of system failures and to quickly isolate system failures so that no additional damage can occur. Protective relays limit the extent and duration of outages thus improving key system performance metrics such as CAIDI, SAIDI and SAIFI. For example, a miss-operation by a relay could result in a potential loss of between 5 million and 20 million customer-minutes. This translates to a SAIDI of between 1.5 to 6 minutes. Failure or miss-operation of key protection and control system components may have the effect of negatively impacting our ability to deliver power resulting in customer outages and poor public perception. Failure to stay within the system reliability targets can result in fines by state regulators.

Replacement with modern microprocessor based relays will supply information not previously available from electromechanical relays. With the availability of this real time data, future applications can be developed such that more of the transmission system can be automated and designed to respond automatically to system events. The speed of data acquisition and analysis would present system operators with a better understanding of system anomalies and recommendations for remedial actions. For example, distance-to-fault data would be available to identify fault location with greater accuracy than currently possible. This data would be brought back to the control center for use by operations and engineering personnel.

Proper protection operation is required by certain regulatory bodies. Compliance with FERC, NERC, NPCC regulations are mandatory and failure to comply can result in substantial fines.

2.1.1 Alternatives:

Alternative 1 – Adopt Replace-on-Fail Plan:
This option adopts a plan to only replace the targeted relays once they fail.

Such a plan would naturally result in decreased system reliability due to the increased rates of failure and the duration of subsequent outages.

Increased failure frequency or extended outages as a result of this option may result in performance fines by our regulators.

Alternative 2 – Defer Replacements:
This option may result in an increased failure rate possibly resulting in outages due to relays failing before they are scheduled for replacement.

This option only defers the project during which time additional relays will reach obsolescence, thus increasing the scope of the project.

This option would also delay the advent of a more comprehensive asset management strategy for the relay population.

Alternative 3 – Do Nothing:
This option would allow the current situation to persist.

Relays would continue to deteriorate at a rate greater than our capability to replace them.

The targeted relays will not be able to be further maintained and will require ad-hoc replacement with digital relays. This would likely be a more expensive approach.

2.2 Investment Recovery

Investment recovery will be through standard rate recovery mechanisms approved by appropriate regulatory agencies

2.2.1 Customer Impact

This project results in an indicative first full year revenue requirement when the asset is placed in service equal to approximately $0.660 million. This is indicative only. The actual revenue requirement will differ depending upon the timing of the next rate case and/or the timing of the next filing in which the project is included in rate base.

3 Related Projects, Scoring, Budgets

3.1 Summary of Projects:

3.1.1 Transmission:

Project Number	Project Type (Elec only)	Project Title	Estimate Amount ($M)	
C035587	T-Sub	Relay Replacements - RI	$	0.960
		Total	$	0.960

3.1.2 Distribution:

Project Number	Project Type (Elec only)	Project Title	Estimate Amount ($M)	
C035586	D-Sub	Relay Replacements - RI	$	1.250
C049354	D-Sub	Relay Replacements - RI	$	0.320
		Total	$	1.570

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3.2 Prior Sanctioning History (including relevant approved Strategies):

Date	Governance Body	Sanctioned Amount	Paper Title	Sanction Type
October 2010	AMIC	$14.840M	Relay Replacement Strategy – SG157	Strategy
February 2011	AMIC	$0.330M	Preliminary Engineering for Relay Replacements	PWS
December 2012	USSC	$1.200M	Relay Replacements – RI	Partial

3.3 Next Planned Sanction Review

Date (Month/Year)	Purpose of Sanction Review
February 2015	FY15/16 Annual Program Sanction

3.4 Category:

Category	Reference to Mandate, Policy, or NPV Assumptions
○ Mandatory ◉ Policy- Driven ○ Justified NPV	Provide for the network's safe, efficient and reliable operation

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3.5 Asset Management Risk Score

Asset Management Risk Score: 35

Primary Risk Score Driver: (Policy Driven Projects Only)

⊙ Reliability O Environment O Health & Safety O Not Policy Driven

3.6 Complexity Level:

O High Complexity O Medium Complexity ⊙ Low Complexity O N/A

Complexity Score: 18

4 Financial

4.1 Business Plan:

Business Plan Name & Period	Project included in approved Business Plan?	Over / Under Business Plan	Project Cost relative to approved Business Plan ($)
Transmission FY15-FY19	⊙ Yes O No	⊙ Over O Under O NA	$0.630M
Distribution FY15-FY19	⊙ Yes O No	⊙ Over O Under O NA	$1.150M

4.1.1 If cost > approved Business Plan how will this be funded?

Re-allocation of funds within the portfolio will be managed by Resource Planning to meet jurisdictional budgetary, statutory and regulatory constraints.

4.2 CIAC / Reimbursement

$M	Prior Yrs	Yr. 1 2013/14	Yr. 2 2014/15	Yr. 3 2015/16	Yr. 4 2016/17	Yr. 5 2017/18	Yr. 6 + 2018/19	Total
CIAC/Reimbursement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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4.3 Cost Summary Table

4.3.1 Transmission

					Current Planning Horizon ($M)						
					Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6 +	
Project Number	Project Title	Project Estimate Level (%)	Spend	Prior Yrs	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
C035587	Relay Replacements - RI	+10% / - 10%	CapEx	-	-	0.749	-	-	-	-	0.749
			OpEx	-	-	0.096	-	-	-	-	0.096
			Removal	-	-	0.115	-	-	-	-	0.115
			Total	-	-	0.960	-	-	-	-	0.960
Total Project Sanction			CapEx	-	-	0.749	-	-	-	-	0.749
			OpEx	-	-	0.096	-	-	-	-	0.096
			Removal	-	-	0.115	-	-	-	-	0.115
			Total	-	-	0.960	-	-	-	-	0.960

4.3.2 Distribution

					Current Planning Horizon ($M)						
					Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6 +	
Project Number	Project Title	Project Estimate Level (%)	Spend	Prior Yrs	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
C035586	Relay Replacements - RI	+10% / - 10%	CapEx	-	-	0.975	-	-	-	-	0.975
			OpEx	-	-	0.125	-	-	-	-	0.125
			Removal	-	-	0.150	-	-	-	-	0.150
			Total	-	-	1.250	-	-	-	-	1.250
C049354	Relay Replacements - RI	+10% / - 10%	CapEx	-	-	0.250	-	-	-	-	0.250
			OpEx	-	-	0.032	-	-	-	-	0.032
			Removal	-	-	0.038	-	-	-	-	0.038
			Total	-	-	0.320	-	-	-	-	0.320
Total Project Sanction			CapEx	-	-	1.225	-	-	-	-	1.225
			OpEx	-	-	0.157	-	-	-	-	0.157
			Removal	-	-	0.188	-	-	-	-	0.188
			Total	-	-	1.570	-	-	-	-	1.570

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4.4 Project Budget Summary Table

4.4.1 Transmission

Project Costs per Business Plan

		Current Planning Horizon ($M)						
	Prior Yrs (Actual)	Yr. 1 2013/14	Yr. 2 2014/15	Yr. 3 2015/16	Yr. 4 2016/17	Yr. 5 2017/18	Yr. 6 + 2018/19	Total
CapEx	$ -	$ -	$ 0.257	$ -	$ -	$ -	$ -	$ 0.257
OpEx	$ -	$ -	$ 0.033	$ -	$ -	$ -	$ -	$ 0.033
Removal	$ -	$ -	$ 0.040	$ -	$ -	$ -	$ -	$ 0.040
Total Cost in Bus. Plan	$ -	$ -	$ 0.330	$ -	$ -	$ -	$ -	$ 0.330

Variance (Business Plan-Project Estimate)

		Current Planning Horizon ($M)						
	Prior Yrs (Actual)	Yr. 1 2013/14	Yr. 2 2014/15	Yr. 3 2015/16	Yr. 4 2016/17	Yr. 5 2017/18	Yr. 6 + 2018/19	Total
CapEx	$ -	$ -	$ (0.492)	$ -	$ -	$ -	$ -	$ (0.492)
OpEx	$ -	$ -	$ (0.063)	$ -	$ -	$ -	$ -	$ (0.063)
Removal	$ -	$ -	$ (0.075)	$ -	$ -	$ -	$ -	$ (0.075)
Total Cost in Bus. Plan	$ -	$ -	$ (0.630)	$ -	$ -	$ -	$ -	$ (0.630)

4.4.2 Distribution

Project Costs per Business Plan

		Current Planning Horizon ($M)						
	Prior Yrs (Actual)	Yr. 1 2013/14	Yr. 2 2014/15	Yr. 3 2015/16	Yr. 4 2016/17	Yr. 5 2017/18	Yr. 6 + 2018/19	Total
CapEx	$ -	$ -	$ 0.400	$ -	$ -	$ -	$ -	$ 0.400
OpEx	$ -	$ -	$ 0.012	$ -	$ -	$ -	$ -	$ 0.012
Removal	$ -	$ -	$ 0.008	$ -	$ -	$ -	$ -	$ 0.008
Total Cost in Bus. Plan	$ -	$ -	$ 0.420	$ -	$ -	$ -	$ -	$ 0.420

Variance (Business Plan-Project Estimate)

		Current Planning Horizon ($M)						
	Prior Yrs (Actual)	Yr. 1 2013/14	Yr. 2 2014/15	Yr. 3 2015/16	Yr. 4 2016/17	Yr. 5 2017/18	Yr. 6 + 2018/19	Total
CapEx	$ -	$ -	$ (0.825)	$ -	$ -	$ -	$ -	$ (0.825)
OpEx	$ -	$ -	$ (0.145)	$ -	$ -	$ -	$ -	$ (0.145)
Removal	$ -	$ -	$ (0.180)	$ -	$ -	$ -	$ -	$ (0.180)
Total Cost in Bus. Plan	$ -	$ -	$ (1.150)	$ -	$ -	$ -	$ -	$ (1.150)

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5 Statements of Support

5.1.1 Supporters

Role	Name	Responsibilities
Investment Planning	Michelle Park	Endorses relative to distribution 5-year business plan or emergent work
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses D-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	John Gavin	Endorses Substation scope, design, conformance with design standards
Engineering/Design	Alan LaBarre	Endorses D-Sub scope, design, conformance with design standards
Engineering/Design	Carol Sedewitz	Endorses T-Sub scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications

5.1.2 Reviewers

Reviewer List	Name
Finance	Keith Fowler
Regulatory	Peter Zschokke
Jurisdictional Delegates	Nabil Hitti & Jennifer Grimsley
Control Center	Joe Cutler

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6 Decisions:

I:

(a) APPROVE the investment of $2.53M and a tolerance of +/- 10 % for the purpose of final design, material procurement and construction for FY15.

(b) NOTE that Tom Alexander is the Project Manager and Mark Phillips has the approved financial delegation to undertake the activities stated in (a).

Signature.....Date....4/28/14

Executive Sponsor – Marie Jordan, Senior Vice President, Network Strategy

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8.1 Relay Replacements – MA Scope

C035586

Uf	ADMIRAL ST 9
T-Level	ADMIRAL ST 9
T-Level	FRANKLIN SQ
Uf	FRANKLIN SQ
Tx	VALLEY 102 (tx)
T-Level	VALLEY 102
Uf	VALLEY 102
T-Level	WARREN 5
T-Level	WOOD RIVER 85

C035587

T-Level	STAPLES 112
Uf	STAPLES 112
T-Level	WASHINGTON 126
T-Level	WOONSOCKET

C049354

Uf	ARCTIC
Uf	AUBURN
Uf	DIVISION ST
Uf	DYER ST
Uf	ELWOOD OUTDOOR
Uf	GENEVA
Uf	HARRIS AVE
Uf	JOHNSTON
Uf	LIPPETT HILL
Uf	NASONVILLE
Uf	PAWTUCKET
Uf	SPRAGUE ST
Uf	WEST CRANSTON
Uf	WEST GREENVILLE
Uf	WEST HORWARD

USSC Closure Paper

Title:	Relay Replacements Program - RI	**Sanction Paper #:**	USSC-14-033C
Project #:	C035586, C035587, C049354	**Sanction Type:**	Closure
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	7/07/2015
Author:	Tom Alexander	**Sponsor:**	John Gavin – VP Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	Tom Alexander/Mark Phillips

1 *Executive Summary*

This paper is presented to close the FY15 sanction paper (USSC-14-033) for the RI Relay Program (FPs C035586, C035587, & C049354). The total spend was $2.639M. The latest sanctioned amount for this project was $2.530M.

The final spend amount is $2.639M broken down into:

$2.613 Capex
$0.005 Opex
$0.021 Removal

2 *Project Summary*

The Relay Replacements Strategy (SG157) was approved in October 2010 detailing replacement of existing electro-mechanical and solid state relays throughout the New England system. The strategy targeted specific types of relays with the highest probability of failure, which is a total of approximately 5% of the total electro-mechanical and solid state relay population. The types identified were transmission line differential, transformer differential, reclosing and under-frequency types. The relays requiring replacement are: a) obsolete, b) not supported by the manufacturer, c) have limited spare parts availability, and d) have demonstrated a trend of decreasing reliability.

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The FY15 RI Relay Program included the following projects:

C035586 Projects	Status	Relays
Admiral St 9 T-Level & UF relay replacements	In-Service	5
Franklin Sq T-Level & UF relay replacements	In-Service	3
Valley 102 T-Level relay, UF relay, & RTU replacements	EDC, In-Construction	4
Warren 5 T-Level & UF relay replacements	Approved TSD, Design Initiated	2
Wood River T-Level & UF relay replacements	EDC	3
Arctic 49 UF relay replacement	EDC	1
Dyer St 29 UF relay replacement	EDC	1
Division St 61 UF relay replacement	Preliminary Engineering	1
Auburn 73 UF relay replacement	Preliminary Engineering	2
C035587 Projects	**Status**	**Relays**
Washington Sub 126 T-Level & UF relay replacements	In-Service	2
Woonsocket T-Level relay replacements	In-Service	7
Staples 112 T-Level relay, UF relay, CCVT, & Wavetrap replacements	In-Service	5
Harris Ave 12 UF relay replacement	Preliminary Engineering	1
C049354 Projects	**Status**	**Relays**
West Greenville 45 UF relay replacement	EDC	1
Nasonville 127929 UF relay replacement	EDC	2
Sprague St 36 UF relay replacement	EDC	1
Geneva 71 UF relay replacement	Preliminary Engineering	1
Johnston 18 UF relay replacement	Preliminary Engineering	1
West Howard 154 UF relay replacement	Preliminary Engineering	3

3 Over / Under Expenditure Analysis

3.1 Summary Table

Actual Spending ($M)			
Project #	**Description**		**Total Spend**
C035586	Relay Replacement Strategy CO 49DXT	Capex	1.676
		Opex	0.013
		Removal	(0.027)
		Total	1.662
Project #	**Description**		**Total Spend**
C035587	Relay Replacement Strategy CO 49TXT	Capex	0.869
		Opex	(0.008)
		Removal	0.048
		Total	0.909
Project #	**Description**		**Total Spend**
C049354	NEC Relay Replacement CO.49-SG157	Capex	0.068
		Opex	0.000
		Removal	0.000
		Total	0.068
Total		Capex	2.613
		Opex	0.005
		Removal	0.021
		Total	2.639

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Project Sanction Summary Table			
Project Sanction Approval ($M)			**Total Spend**
Project #	**Description**		
C035586	Relay Replacement Strategy CO 49DXT	**Capex**	0.975
		Opex	0.125
		Removal	0.150
		Total Cost	**1.250**
Project #	**Description**		
C035587	Relay Replacement Strategy CO 49TXT	**Capex**	0.749
		Opex	0.096
		Removal	0.115
		Total Cost	**0.960**
Project #	**Description**		
C049354	NEC Relay Replacement CO.49-SG157	**Capex**	0.250
		Opex	0.032
		Removal	0.038
		Total Cost	**0.320**
		Capex	1.974
		Opex	0.253
		Removal	0.303
		Total Sanction	**2.530**
Sanction Variance ($M)			**Total Spend**
Project #	**Description**		
C035586	Relay Replacement Strategy CO 49DXT	**Capex**	(0.701)
		Opex	0.112
		Removal	0.177
		Total Cost	**(0.412)**
Project #	**Description**		
C035587	Relay Replacement Strategy CO 49TXT	**Capex**	(0.120)
		Opex	0.104
		Removal	0.067
		Total Cost	**0.051**
Project #	**Description**		
C049354	NEC Relay Replacement CO.49-SG157	**Capex**	0.182
		Opex	0.032
		Removal	0.038
		Total Cost	**0.252**
		Capex	(0.639)
		Opex	0.248
		Removal	0.282
		Total Variance	**(0.109)**

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3.2 Analysis

Progression of the RI Relay Program at various sites was accomplished for FY15 while keeping within the tolerances of the latest sanctioned amount

The charge split for the FY15 sanction was based on the strategy paper SG-157 which accounted for 78%CapEx, 10%OpEx, & 12%CoR. In reality, the relay projects fall more in line with a 98%CapEx, 1%OpEx, & 1%CoR split which resulted in a large variance in CapEx investment.

4 Improvements / Lessons Learned

- Outage plans are often difficult to lock in and adhere to as the t-level projects in RI tend to conflict with several other on-going projects. Continued communication between the construction site supervisor and the outage coordinator allowed for the submission of revised transmission outage applications when necessary and helped to align the three station outage required for Woonsocket, Franklin Sq, and Admiral St.
- The overlapping of program work at a few of these stations makes it difficult to mitigate drawing conflicts and avoid interferences between the different installation groups. Transparency and frequent communication allowed us to combine work at Woonsocket, Staples, and Valley to better efficiencies and share outages.

5 Closeout Activities

The following closeout activities have been completed (where applicable).

Activity	Completed
All work has been completed in accordance with all National Grid policies	(•) Yes ( ) N/A
All relevant costs have been charged to project	(•) Yes ( ) N/A
All work orders and funding projects have been closed	(•) Yes ( ) N/A
All unused materials have been returned	(•) Yes ( ) N/A
All as-builts have been completed	(•) Yes ( ) N/A
All lessons learned have been entered appropriately into the lesson learned database	(•) Yes ( ) N/A

6 Statements of Support

6.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Department	Individual	Responsibilities
Investment Planning	Michelle Park	Endorses relative to distribution 5-year business plan or emergent work
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses D-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	Suzan Martuscello	Endorses Substation scope, design, conformance with design standards
Engineering/Design	Alan LaBarre	Endorses D-Sub scope, design, conformance with design standards
Engineering/Design	Kasia Kulbacka	Endorses T-Sub scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications

6.2 Reviewers

The reviewers have provided feedback on the content/language of the paper.

Function	Individual
Finance	Keith Fowler, Phil Horowitz
Regulatory	Peter Zschokke
Jurisdictional Delegates	Carol Sedewitz & James Patterson
Control Center	Joe Cutler

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7 ***Decisions***

I approve this paper.

Signature.....Date.....

Executive Sponsor – Ross Turrini, Acting Senior Vice President, Network Strategy

USSC-14-033
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Short Form Sanction Paper

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Title:	Relay Replacement Program - RI	**Sanction Paper #:**	USSC-15-258
Project #:	C035586 & C049354	**Sanction Type:**	Sanction
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	10/27/2015
Author:	Tom Alexander	**Sponsor:**	John Gavin, VP Electric Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	Tom Alexander/Mark Phillips

1 Executive Summary

1.1 Sanctioning Summary

This paper requests sanction of Project Funding # C035586 and C049354 in the amount $1.220M and a tolerance of +/- 10% for the purposes of final engineering, material procurement, and construction for active projects within fiscal year 2016.

This sanction amount is $1.220M broken down into:

1.196M Capex
0.004M Opex
0.020M Removal

2 Program Detail

2.1 Background

The Relay Replacements Strategy (SG157) was approved in October 2010 detailing replacement of existing electro-mechanical and solid state relays throughout the New England system. The strategy targeted specific types of relays with the highest probability of failure, which is a total of approximately 5% of the total electro-mechanical and solid state relay population. The types identified were transmission line differential, transformer differential, reclosing and under-frequency types. The relays requiring replacement are: a) obsolete, b) not supported by the manufacturer, c) have limited spare parts availability, and d) have demonstrated a trend of decreasing reliability.

The targeted relays were selected based on type history, performance, field O&M experience and available manufacturer support. Challenges with the aging electro-mechanical fleet of relays include settings drift, worn parts, spare parts depletion and attrition of the internal knowledge base. Many of the remaining relays in stock have been scavenged and can no longer be redeployed to the system. While in the longer-term, thousands of electro-mechanical and solid state relays may need replacement

based on a simple life cycle analysis, this strategy has identified an immediate need to replace the worst performing relay families.

2.2 Drivers

The primary driver of this paper is reliability. If the relays identified fail or malfunction, there is a risk of prolonged outages and a corresponding negative reliability impact. The protection afforded by relays is critical to the stability of the electric transmission system. The relays are designed to protect high-value system components from the effects of system failures and to quickly isolate system failures so that no additional damage can occur. Protective relays limit the extent and duration of outages thus improving key system performance metrics such as CAIDI, SAIDI and SAIFI. For example, a malfunctioning relay could result in a potential loss of between 5 million and 20 million customer-minutes. This translates to a SAIDI of between 1.5 to 6 minutes. Failure or the malfunctioning of key protection and control system components may have the effect of negatively impacting our ability to deliver power resulting in customer outages and poor public perception. Failure to stay within the system reliability targets may result regulatory action.

2.3 Benefits

Replacement with modern microprocessor based relays will supply information not previously available from electromechanical relays. With the availability of this real time data, future applications can be developed such that more of the transmission system can be automated and designed to respond automatically to system events. The speed of data acquisition and analysis would present system operators with a better understanding of system anomalies and recommendations for remedial actions. For example, distance-to-fault data would be available to identify fault location with greater accuracy than currently possible. This data would be brought back to the control center for use by operations and engineering personnel.

2.4 Business & Customer Issues

As required by FERC, NERC, NPCC regulations, proper protection operation is currently in place. The relay replacement program is a means to uphold proper protection by updating applicable equipment to mitigate the probability of failure.

2.5 Alternatives

Alternative 1 – Adopt Replace-on-Fail Plan:
This option adopts a plan to only replace the targeted relays once they fail.

Such a plan would naturally result in decreased system reliability due to the increased rates of failure and the duration of subsequent outages.

Increased failure frequency or extended outages as a result of this option may result in failure to meet performance targets set by our regulators.

Alternative 2 – Defer Replacements:
This option may result in an increased failure rate possibly resulting in outages due to relays failing before they are scheduled for replacement.

This option only defers the project during which time additional relays will reach obsolescence, thus increasing the scope of the project.

This option would also delay the advent of a more comprehensive asset management strategy for the relay population.

Alternative 3 – Do Nothing:
This option would allow the current situation to persist.

Relays would continue to deteriorate at a rate greater than our capability to replace them.

The targeted relays will not be able to be further maintained and will require ad-hoc replacement with digital relays. This would likely be a more expensive approach.

2.6 Investment Recovery

Investment recovery will be through standard rate recovery mechanisms approved by appropriate regulatory agencies

2.6.1 Customer Impact

This project results in an indicative first full year revenue requirement when the asset is placed in service equal to approximately $0.660M. This is indicative only. The actual revenue requirement will differ, depending upon the timing of the next rate case and/or the timing of the next filing in which the project is included in rate base.

3 Related Projects, Scoring, Budgets

3.1 Summary of Projects

Distribution:

Project Number	Project Type (Elec only)	Project Title	Estimate Amount ($M)
C035586	D-Sub	Relay Replacement - RI	1.200
C049354	D-Sub	Relay Replacement - RI	0.020
		Total	1.220

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3.2 Associated Projects

N/A

3.3 Prior Sanctioning History

Date	Governance Body	Sanctioned Amount	Potential Project Investment	Paper Title	Sanction Type	Tolerance
April 2014	USSC	$2.530M	N/A	Relay Replacements - RI	Sanction	+/-10%
December 2012	USSC	$1.200M	N/A	Relay Replacements - RI	Partial	+/- 25%
February 2011	AMIC	$0.330M	N/A	Preliminary Engineerin for Relay Replacements	PWS	+/-25%
October 2010	AMIC	$14.840M	N/A	Relay Replacement Strategy – SG157	Strategy	-25/+50%

3.4 Category

Category	Reference to Mandate, Policy, NPV, or Other
○ Mandatory	Provide for the network's safe, efficient and reliable operation
◉ Policy- Driven	
○ Justified NPV	
○ Other	

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3.5 Asset Management Risk Score

Asset Management Risk Score: 35 .

Primary Risk Score Driver: (Policy Driven Projects Only)

◉ Reliability ○ Environment ○ Health & Safety ○ Not Policy Driven

3.6 Complexity Level

○ High Complexity ○ Medium Complexity ◉ Low Complexity ○ N/A

Complexity Score: 18 .

3.7 Next Planned Sanction Review

Date (Month/Year)	Purpose of Sanction Review
July 2016	FY16 Program Closure Paper

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4 Financial

4.1 Business Plan

Business Plan Name & Period	Project included in approved Business Plan?	Over / Under Business Plan	Project Cost relative to approved Business Plan ($)
FY16-FY20 Budget File: New England Distribution	◉ Yes ○ No	○ Over ◉ Under ○ NA	$0.242M

4.1.1 If cost > approved Business Plan how will this be funded?

Re-allocation of funds within the portfolio will be managed by Resource Planning to meet jurisdictional budgetary, statutory and regulatory requirements.

4.2 CIAC / Reimbursement

N/A

4.3 Cost Summary Table

Project Number	Project Title	Project Estimate Level (%)	Spend	Prior Yrs	Current Planning Horizon ($M) Yr. 1 2015/16	Yr. 2 2016/17	Yr. 3 2017/18	Yr. 4 2018/19	Yr. 5 2019/20	Yr. 6 + 2020/21	Total
C035586	Relay Replacement - RI	+/- 10%	CapEx	-	1.176	-	-	-	-	-	1.176
			OpEx	-	0.004	-	-	-	-	-	0.004
			Removal	-	0.020	-	-	-	-	-	0.020
			Total	-	1.200	-	-	-	-	-	1.200
C049354	Relay Replacement - RI	+/- 10%	CapEx	-	0.020	-	-	-	-	-	0.020
			OpEx	-	-	-	-	-	-	-	-
			Removal	-	-	-	-	-	-	-	-
			Total	-	0.020	-	-	-	-	-	0.020
Total Project Sanction			CapEx	-	1.196	-	-	-	-	-	1.196
			OpEx	-	0.004	-	-	-	-	-	0.004
			Removal	-	0.020	-	-	-	-	-	0.020
			Total	-	1.220	-	-	-	-	-	1.220

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4.4 Project Budget Summary Table

Project Costs Per Business Plan

		Current Planning Horizon ($M)						
$M	Prior Yrs (Actual)	Yr. 1 2015/16	Yr. 2 2016/17	Yr. 3 2017/18	Yr. 4 2018/19	Yr. 5 2019/20	Yr. 6 + 2020/21	Total
CapEx	0.000	0.940	0.000	0.000	0.000	0.000	0.000	0.940
OpEx	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.019
Removal	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.019
Total Cost in Bus. Plan	0.000	0.978	0.000	0.000	0.000	0.000	0.000	0.978

Variance (Business Plan-Project Estimate)

		Current Planning Horizon ($M)						
$M	Prior Yrs (Actual)	Yr. 1 2015/16	Yr. 2 2016/17	Yr. 3 2017/18	Yr. 4 2018/19	Yr. 5 2019/20	Yr. 6 + 2020/21	Total
CapEx	0.000	(0.256)	0.000	0.000	0.000	0.000	0.000	(0.256)
OpEx	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.015
Removal	0.000	(0.001)	0.000	0.000	0.000	0.000	0.000	(0.001)
Total Cost in Bus. Plan	0.000	(0.242)	0.000	0.000	0.000	0.000	0.000	(0.242)

5 Key Milestones

Milestone	Target Date: (Month/Year)
FY16 Sanction Paper	October 2015
FY16 Closure Paper	July 2016

6 Statements of Support

6.1.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Role	Individual	Responsibilities
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses D-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	Suzan Martuscello	Endorses Substation scope, design, conformance with design standards
Engineering/Design	Alan LaBarre	Endorses D-Sub scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications

6.1.2 Reviewers

The reviewers have provided feedback on the content/language of the paper.

Reviewer List	Individual
Finance	Keith Fowler
Regulatory	Peter Zschokke
Jurisdictional Delegates	James Patterson
Control Center	Joe Cutler

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7 Decisions

I:

(a) APPROVE this paper and the investment of $1.220M and a tolerance of +/-10%

(b) NOTE that Tom Alexander is the Project Manager and Mark Phillips has the approved financial delegation.

(c) NOTE: In the event that any Program projects are not approved prior to the start of the FY16 fiscal year, the FY15 approval limits will remain in effect until such time as the FY16 blanket projects are approved by USSC and/or other appropriate authority for approval.

Signature.....Date.....19/26/15

Marie Jordan, Senior Vice President, Electric Process & Engineering

USSC-15-258
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Title:	Relay Replacement Program - RI	**Sanction Paper #:**	USSC-15-258C
Project #:	C035586 & C049354	**Sanction Type:**	Closure
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	5/31/2016
Author:	Andrew Dorr/Tom Alexander	**Sponsor:**	Carol Sedewitz – Acting VP Electric Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	Andrew Dorr/Tom Alexander/Mark Phillips

1 *Executive Summary*

This paper is presented to close the FY16 sanction paper (USSC-15-258) for the RI Relay Program (FPs C035586 &C049354). The total spend was $1.208M. The latest sanctioned amount for this project was $1.220M.

*The final spend amount for **FP# C035586** is $1.181M broken down into:*
$1.161M Capex
$0.004M Opex
$0.016M Removal

*The final spend amount for **FP# C049354** is $0.027M broken down into:*
$0.027M Capex
$0.000M Opex
$0.000M Removal

2 *Project Summary*

The Relay Replacements Strategy (SG157) was approved in October 2010 detailing replacement of existing electro-mechanical and solid state relays throughout the New England system. The strategy targeted specific types of relays with the highest probability of failure, which is a total of approximately 5% of the total electro-mechanical and solid state relay population. The types identified were transmission line differential, transformer differential, reclosing and under-frequency types. The relays requiring replacement are: a) obsolete, b) not supported by the manufacturer, c) have limited spare parts availability, and d) have demonstrated a trend of decreasing reliability.

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C035586 Projects	Status	Relays
Valley 102 T-Level relay, UF relay, & RTU replacements	Construction Complete 2/2016	5
Warren 5 T-Level & UF relay replacements	EDC 11/2015	2
Wood River T-Level & UF relay replacements	CS 3/2016	3
Admiral St T-Level Relay Replacements	WO Closed 3/2016	
Franklin Sq T-Level Relay Replacements	WO Closed 3/2016	
Arctic 49 UF relay replacement	Removed from the Program	1
Dyer St 29 UF relay replacement	EDC 11/2015	1
Division St 61 UF relay replacement	EDC 11/2015	1
Auburn 73 UF relay replacement	EDC 11/2015	2
C049354 Projects	**Status**	**Relays**
West Greenville 45 UF relay replacement	EDC 11/2015	1
Nasonville 127929 UF relay replacement	EDC 11/2015	2
Sprague St 36 UF relay replacement	EDC 11/2015	1
Geneva 71 UF relay replacement	EDC 11/2015	1
Johnston 18 UF relay replacement	EDC 11/2015	1
West Howard 154 29 UF relay replacement	Removed from the Program	3

3 *Over / Under Expenditure Analysis Summary Table*

Actual Spending ($M)			
Project #	**Description**		**Total Spend**
C035586	Relay Replacement Strategy CO 49 DxT	**Capex**	1.161
		Opex	0.004
		Removal	0.016
		Total	**1.181**
Project #	**Description**		**Total Spend**
C049354	NEC Relay Replacement CO.49-SG157	**Capex**	0.027
		Opex	0.000
		Removal	0.000
		Total	**0.027**
Total		**Capex**	1.188
		Opex	0.004
		Removal	0.016
		Total	**1.208**

Project Sanction Summary Table			
Project Sanction Approval ($M)			**Total Spend**
		Capex	1.196
		Opex	0.004
		Removal	0.020
		Total Cost	**1.220**
Sanction Variance ($M)			**Total Spend**
		Capex	0.008
		Opex	0.000
		Removal	0.004
		Total Variance	**0.012**

3.1 Analysis

All objectives for the project were completed, keeping within tolerances of latest sanctioned amount.

4 Improvements / Lessons Learned

- The overlapping of program work at a few of these stations makes it difficult to mitigate drawing conflicts and avoid interferences between the different installation groups. Transparency and frequent communication allowed us to combine work at Valley to better capture efficiencies and share outages.
- The charge split in the budget was based on the strategy paper SG-157 which accounted for 78% CapEx, 10% OpEx, & 12% CoR. In reality, the relay projects fall more in line with a 98% CapEx, 1% OpEx, & 1% CoR split which resulted in a variance in CapEx investment.

5 Closeout Activities

The following closeout activities have been completed (where applicable).

Activity	Completed
All work has been completed in accordance with all National Grid policies	◉ Yes ○ N/A
All relevant costs have been charged to project	◉ Yes ○ N/A
All work orders and funding projects have been closed	◉ Yes ○ N/A
All unused materials have been returned	◉ Yes ○ N/A
All as-builts have been completed	◉ Yes ○ N/A
All lessons learned have been entered appropriately into the lesson learned database	◉ Yes ○ N/A

6 Statements of Support

6.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Department	Individual	Responsibilities
Investment Planning	Glen DiConza	Endorses relative to distribution 5-year business plan or emergent work
Resource Planning	Mark Phillips	Endorses D-Sub Resources, cost estimate, schedule, and Portfolio Alignment
Engineering/Design	Suzan Martuscello	Endorses Substation scope, design, conformance with design standards
Asset/Planning	Alan LaBarre	Endorses D-Sub scope, design, conformance with design standards
Engineering/Design	Len Swanson	Protection and Telecommunications
Electric Project Management	Jammie Simonds	Endorses Cost Estimate

6.2 Reviewers

The reviewers have provided feedback on the content/language of the paper.

Function	Individual
Finance	Patricia Easterly
Regulatory	Peter Zschokke
Jurisdictional Delegates	James Patterson
Control Center	Michael Gallagher

USSC Closure Paper

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7 ***Decisions***

I approve this paper.

Signature.....Date.....6/4/11

Executive Sponsor – Christopher Kelly, Acting Senior Vice President, Electric Process and Engineering

C055392

RI UG Cable Replacement Program - Secondary

5360-Narragansett Electric and Gas
Project Revision Detail Report

Fund Project Number:	C055392	**USSC #:**	USSC-17-150 FY18Pr
Revision:	10	**Budget Version:**	
Project Title:	RI UG Cable Repl Program - Secondar		
Project Description:	Underground Secondary Cable Replacement Rhode Island: Proactively replace underground cable on Secondary Distribution systems. These replacements will be completed through geographical areas targeting cables typically found in older urban areas considering their past performance, the history of failures within		

Project Status:	open		
Responsible Person:	WYMAN, ANNE	**Initiator:**	Shakir, Sahir
Spending Rationale:	Asset Condition	**Funding Type:**	P Electric Distribution Line RI
Budget Class:	Asset Replacement		
Capital by Category:			
Program Code:			
Project Risk Score:	36	**Project Complexity Score:**	16

Project Schedule / Expenditures

Revision Status:	Approved		
Est Start Date:	6/6/2014	**Est Complete Date:**	3/31/2024
Est In-Service Date:	3/31/2024		
TTD Actuals:	$1,871,353	**As Of:**	10/10/2017

Cost Breakdown	Capital	Expense	Removal	Total	Credits
	$1,468,000	$176,000	$176,000	$1,820,000	$0

Justification / Risk Identification:

The Company is proactively replacing underground cables in Rhode Island as documented in the report titled "Rhode Island Underground Cable Replacement Program - Study Report" dated August 15, 2014 by Sahir Shakir. This program includes a multi-year project for proactive replacement of underground secondary cable, targeting specific geographic areas for replacement.

Project Scope:

FY17 target areas for secondary cable in Providence are as follows: College Hill neighborhood.
Install approximately 10,000 ft of 600 V cable in various conductor sizes and miscellaneous underground equipment.
Remove approximately 10,000 ft of 600 V cable of various conductor sizes and miscellaneous underground equipment.

Project Alternatives Considered:

General cable replacement alternatives were analyzed in development of the Underground Cable Replacement Strategy. No new alternative analysis is necessary for underground cable rehabilitation or replacement work aligned with the strategy.

Additional Notes:

CL 3/9/16 - Estimate rev 9 conceptual estimate: $900,000 ($423K capital, $162K O&M, $315K removal).
CL 4/16/15 - Estimate rev 8: revised Cap/Exp/Rem splits ($235K capital, 90K O&M, 175K removal),
CL 3/31/15 - Estimate rev 7 conceptual estimate: $500,000 ($465,000 capital, $35,000 removal).

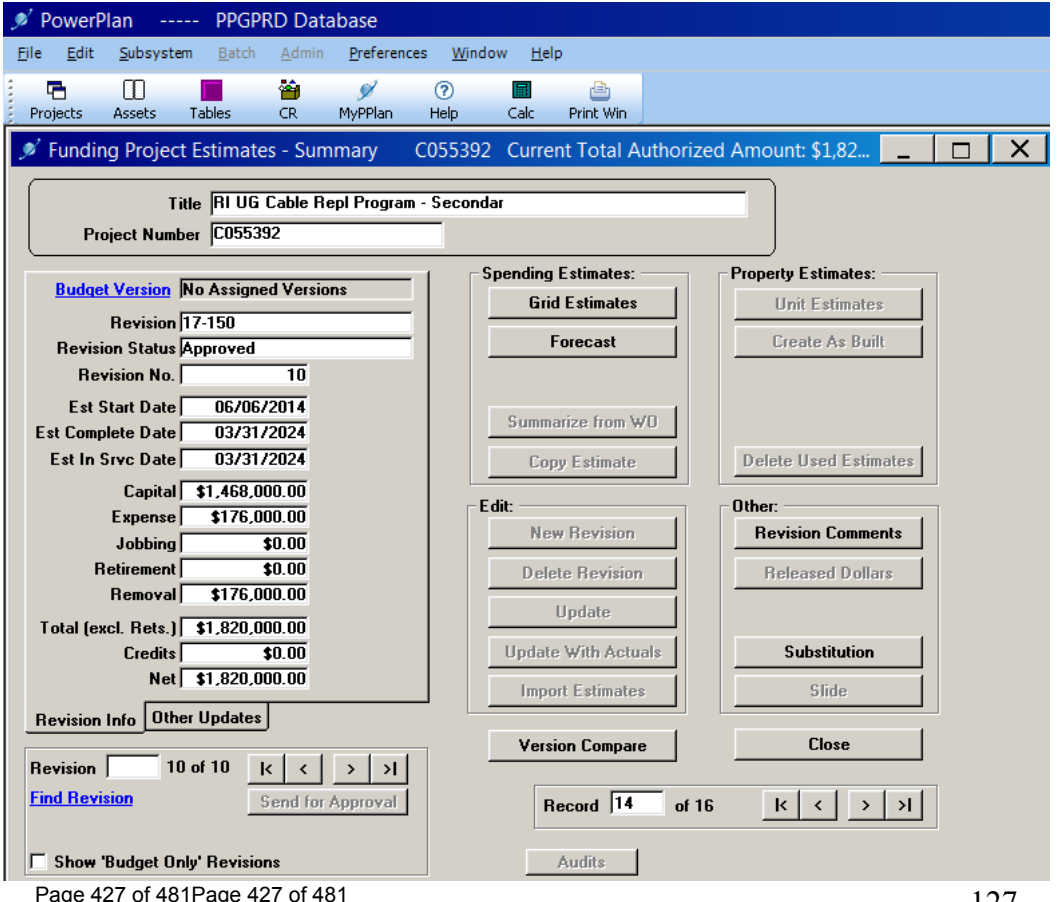
Related Projects:

Project Number:	Project Name:

Approvals

Line 1:	**Date**	4/13/2017 14:19:44	**Approver**	monted	USSC Approver
Line 2:	**Date**		**Approver**		
Line 3:	**Date**		**Approver**		
Line 4:	**Date**		**Approver**		
Line 5:	**Date**		**Approver**		

*****Project Authorization is for Approved Revision Total Estimated Cost +10% *****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Project Number C055392
Budget Version No Assigned Versions
Revision 17-150
Revision Status Approved
Revision No. 10
Est Start Date 06/06/2014
Est Complete Date 03/31/2024
Est In Srvc Date 03/31/2024
Capital $1,468,000.00
Expense $176,000.00
Jobbing $0.00
Retirement $0.00
Removal $176,000.00
Total (excl. Rets.) $1,820,000.00
Credits $0.00
Net $1,820,000.00
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Revision 10 of 10
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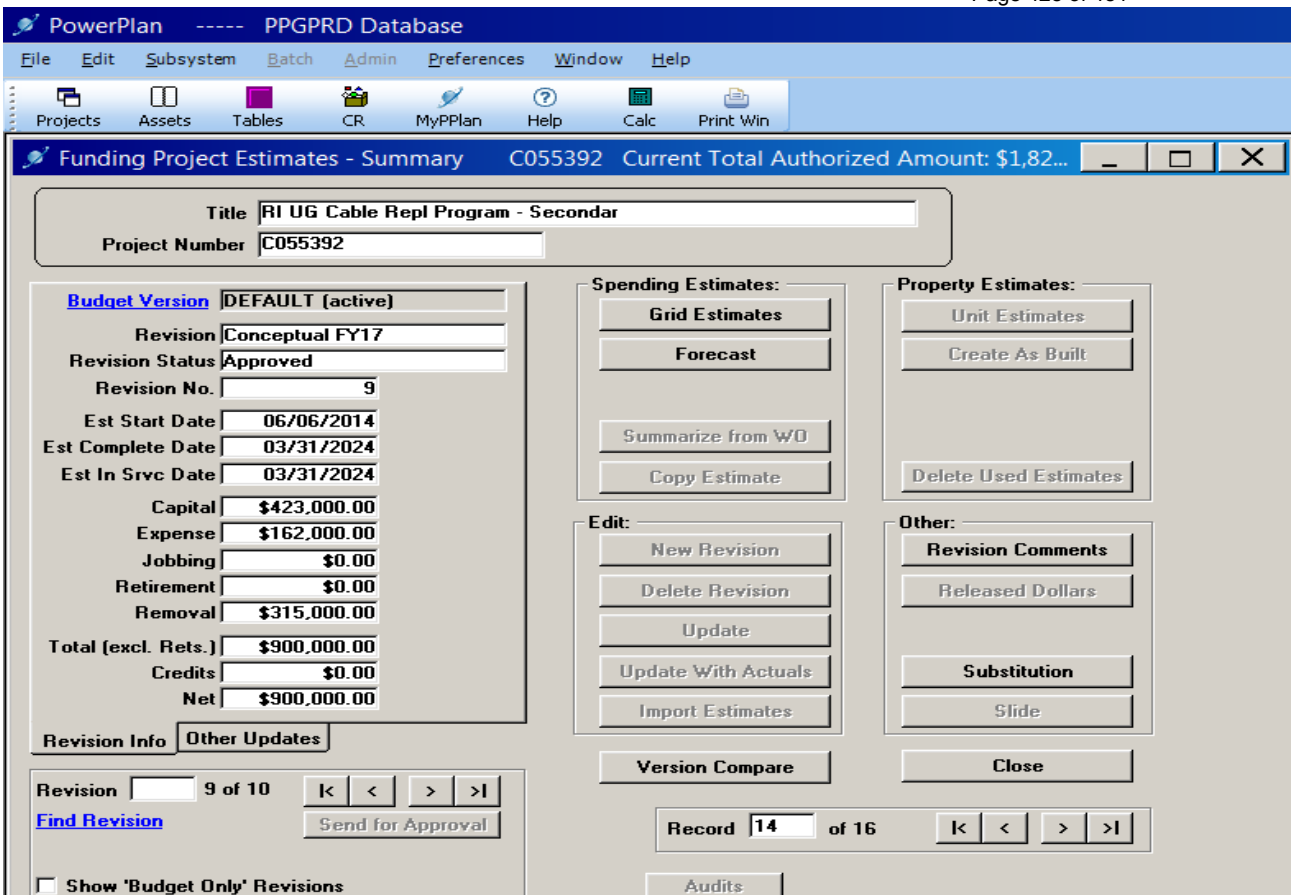
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Project Number C055392
Budget Version DEFAULT (active)
Revision Conceptual FY17
Revision Status Approved
Revision No. 9
Est Start Date 06/06/2014
Est Complete Date 03/31/2024
Est In Srvc Date 03/31/2024
Capital $423,000.00
Expense $162,000.00
Jobbing $0.00
Retirement $0.00
Removal $315,000.00
Total (excl. Rets.) $900,000.00
Credits $0.00
Net $900,000.00
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Other Updates
Revision 9 of 10
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Send for Approval
Show 'Budget Only' Revisions
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Forecast
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Copy Estimate
Property Estimates:
Unit Estimates
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Delete Used Estimates
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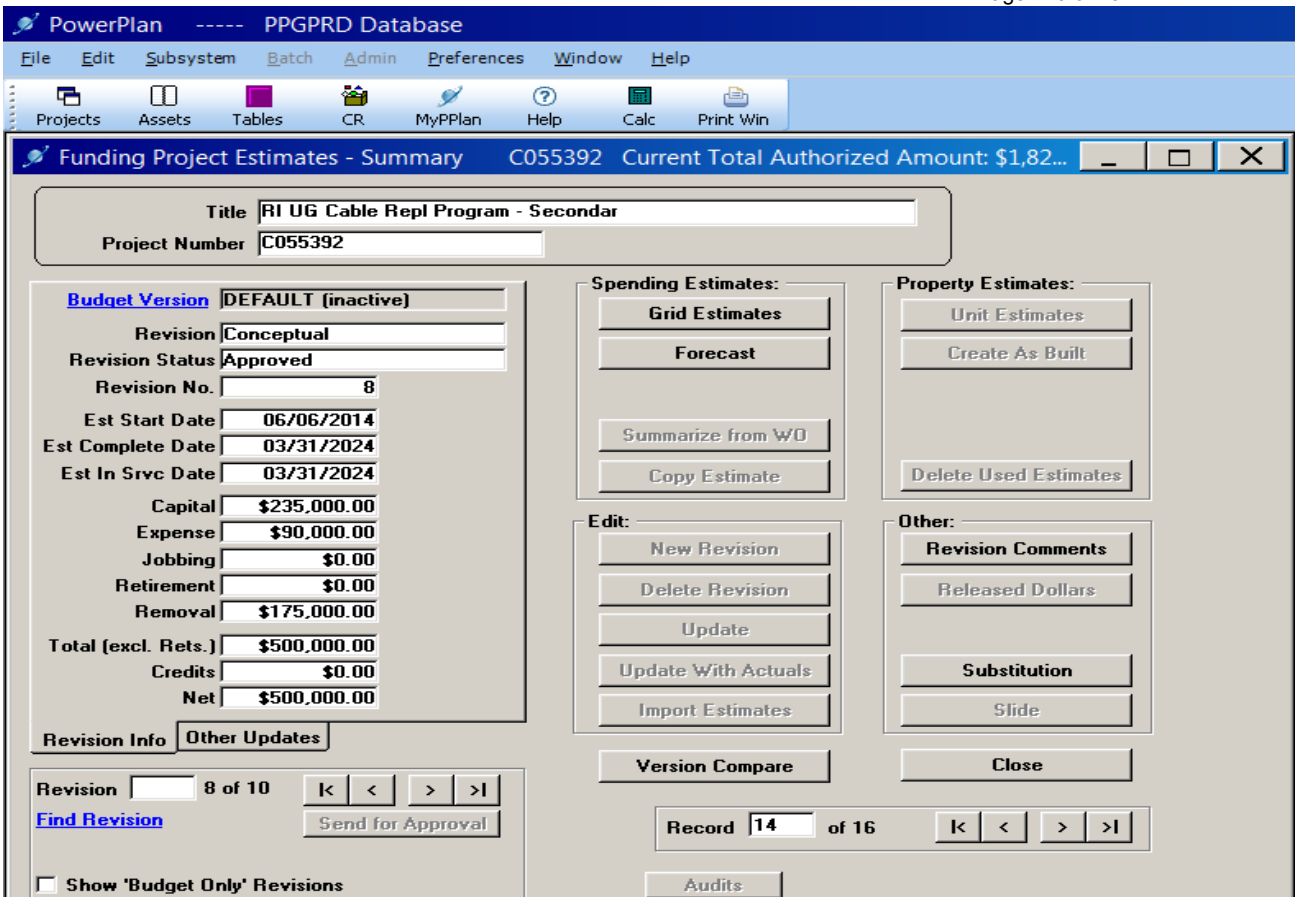
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Project Number C055392
Budget Version DEFAULT (inactive)
Revision Conceptual
Revision Status Approved
Revision No. 8
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Est Complete Date 03/31/2024
Est In Srvc Date 03/31/2024
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Removal $175,000.00
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Grid Estimates
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Unit Estimates
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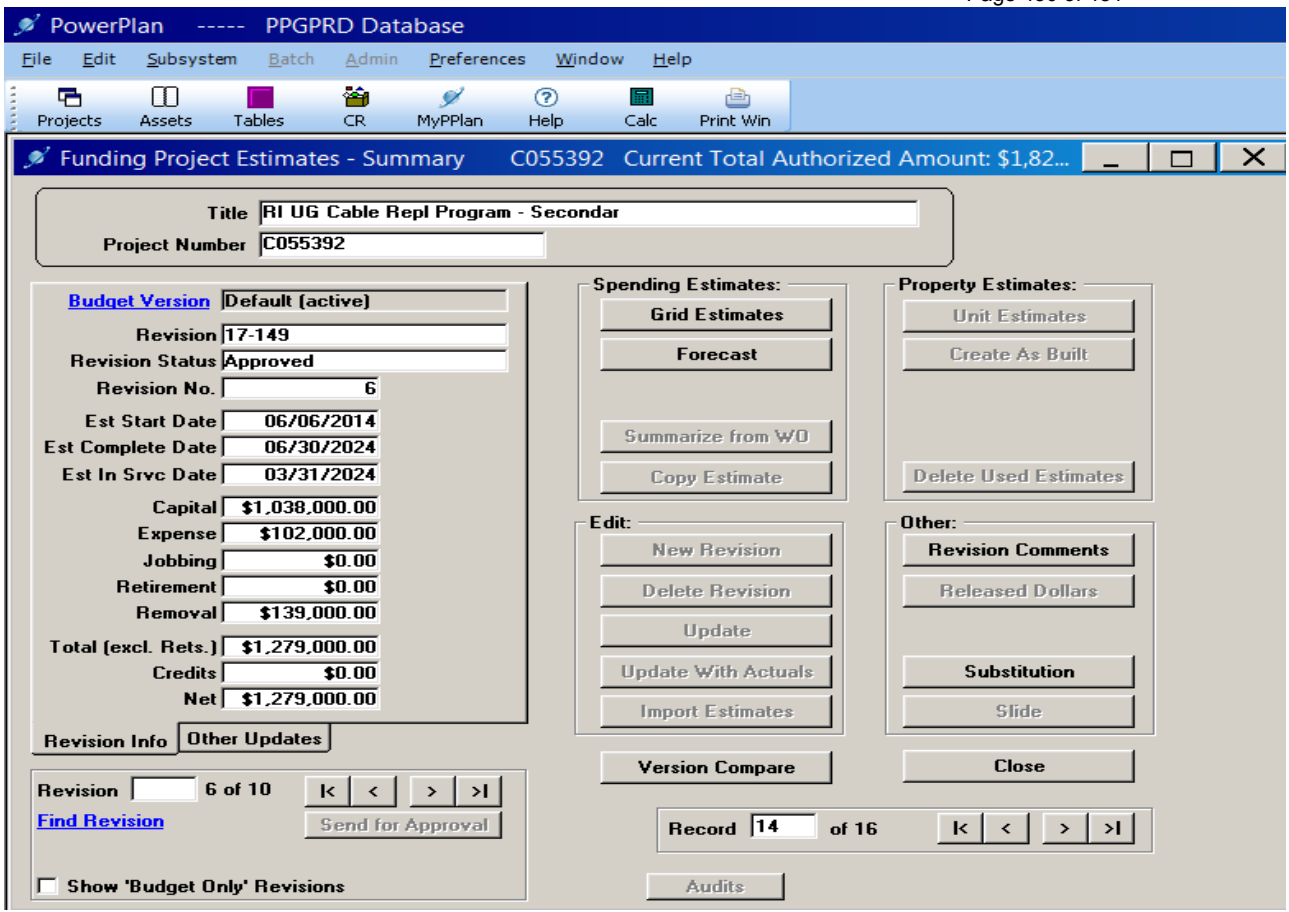
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Revision 17-149
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Est In Srvc Date 03/31/2024
Capital $1,038,000.00
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Jobbing $0.00
Retirement $0.00
Removal $139,000.00
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Credits $0.00
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Revision Info
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Audits

nationalgrid

Rhode Island Underground Cable Replacement Program – Study Report

Sahir Shakir

August 15, 2014

Rhode Island Underground Cable Program

Sahir Shakir

August 15, 2014

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Executive Summary

National Grid's underground electric infrastructure (principally electric cables and manhole and duct systems) is extensive. Such infrastructure is most common in the urban centers within the Company's service territory. Asset age and condition varies and certain vintages of cable insulation have demonstrated less reliable performance than others. When they occur, underground asset failures can (and have) resulted in manhole cover dislodgements. Such events are often visible to the public and raise understandable concern with regulators, businesses, and public safety officials. Although such contingency events and possible outcomes can not be completely eliminated, it is the Company's opinion that the frequency with which such events occur can be reduced with programmatic cable replacements.

The program documented with this study report will proactively replace underground cable on Sub-Transmission, Distribution Primary, and Distribution Secondary cable systems in the Rhode Island service territory. These replacements will result from the execution of both specific and programmatic projects.

A list of candidate sub-transmission and distribution primary cable replacement projects was first developed and prioritized using a criticality scoring model (CSM) that weighed factors such as asset age, past performance, customers served, proximity to assets experiencing prior failures, cable insulation type, among others. This candidate project list allowed for long range program budgeting and resource planning and also provided a starting point for further engineering review and the development of specific project proposals. The operating characteristics of and availability of data on secondary cable systems does not currently allow for the application of a CSM for candidate project selection. As such, the program identified and prioritized specific geographic areas within which secondary cable assets would first undergo detailed inspection followed by targeted asset replacement and/or consolidation.

The sub-transmission and distribution primary cable replacement candidate project list was reviewed in detail by a cross functional team of Company representatives having local knowledge and experience with the Rhode Island underground system infrastructure. Team input/discussion, which included consideration of the recommendations of the "Providence Area – Long Term Supply and Distribution Study" dated May, 2014, determined the specific sub-transmission and distribution primary cable projects and area secondary cable work to advance during FY16-18.

It is presently expected that under this program the following costs will be incurred throughout FY16-18:

- Sub-Transmission cable replacements (approximately 4 miles) - $2M
- Distribution Primary cable replacements (approximately 8.3 miles) - $5M
- Distribution Secondary cable replacements (approximately 3.8 miles) - $5M

Over a ten year horizon, it is expected that a total of approximately 95 miles of cable replacements will be directed by this program at a total estimated cost of $68M.

Program Justification

1.0 Purpose and Scope

National Grid distribution engineers monitor the electrical distribution system's performance and when necessary develop projects to address concerns (reliability, thermal, voltage, etc.) either existing or anticipated. In the past, targeted underground cable replacement projects have been undertaken based on asset physical condition, deterioration, or age. Often times, such projects have been coupled with the scope of projects executed to address system thermal and/or voltage performance concerns. Underground cable replacement projects have also been executed in response (reactively) to acute or chronic service reliability concerns with a specific circuit or portion thereof. The Company is now putting forth this proactive underground cable replacement program that considers multiple factors related to underground cable asset performance and the consequences of failure. This will result in regular annual program funding directed to cable replacement activities and allow for specific asset replacement objectives to be set and tracked.

This program focuses on the conventional underground systems generally found in more urban areas of the service territory. The cables are predominantly installed in manhole and duct systems, yet some may be direct-buried. Cables utilized in residential neighborhoods (Underground Residential Developments (URD)) and industrial/commercial parks (Underground Commercial Developments (UCD)) are not a subject of this program.

2.0 Program Description

2.1 Background

2.1.1 System Description

National Grid's underground electric infrastructure (principally electric cables and manhole and duct systems) is extensive. Cable operating voltages and functionalities vary. Operating voltages and usages include:

- Sub-transmission from 11 – 34.5 kilovolts (kV),
- Distribution Primary from 4 – 13.8 kV,
- Secondary from 0 – 600 volts (V),

At all operating voltages listed above, portions of the distribution system are either operated in a radial or networked fashion.

The age of the underground system varies considerably. As such, underground cables with various vintages of insulation exist. Predominant insulation types include:

- Cross Linked Polyethylene (XLPE),
- Polyethylene (PE),
- Ethylene Propylene Rubber (EPR),
- Other rubber insulations
- Paper Insulated Lead covered Cable (PILC)

Generally, National Grid's underground systems perform very reliably and typically have more redundancy (operational flexibility to respond to system contingencies) than overhead systems. As such, the standard and complete response to contingency events has mostly been reactive repair or replacement of failed equipment. When elements of the system have experienced chronic (repeated) performance concerns (ex. multiple cable failures), targeted projects (ex. circuit cable replacement) have been executed to resolve the situation. National Grid has observed variability in the performance of the various types of cable insulation with certain vintages of XLPE being less reliable than others. In addition, given the fact that significant amounts of PILC cable have been in service for more than 60 years, concerns about the need for replacement due to normal deterioration have begun to surface both at National Grid and in the industry as a whole.

Recently, there have been several failures in Providence, Rhode Island that have resulted in manhole cover dislodgements and/or smoking manholes, which have caused concern among public safety officials, regulators, and the public regarding the performance of the Company's underground systems. These recent events included:

- September 10, 2013, network vault; failure of a termination in primary terminal chamber of a network transformer
- November 18, 2013, manhole; failure of radial secondary cable
- December 15, 2013, duct line; failure of network secondary cable
- April 21, 2014, duct line; failure of network primary cable

2.1.2 Industry Benchmarking

The Company has reviewed the cable replacement plans of several utilities including Commonwealth Edison (ComEd) in Chicago, Potomac Electric Power Company (Pepco) in Washington DC, Consolidated Edison (ConEd) in NYC and Indianapolis Power & Light (IPL) in Indianapolis. Significant findings:

- The volume of planned replacements varied significantly between companies, and any planned replacements were limited to medium voltage class (distribution primary) cable.
- No utilities indicated that they have a proactive secondary cable replacement program.
- The primary cable replacement programs varied from none, to limited opportunistic programs (in which project scopes based on other drivers were marginally expanded to accommodate localized asset replacement); to a significant cable replacement programs
- A significant program at ComEd is targeting the replacement of 526 miles cable, primarily PILC in urban areas. This volume represents approximately 15% of the PILC cable ComEd indicated they have in service in Chicago. ConEd in NYC has had a long ongoing significant effort to replace PILC cable on their system. These PILC cable replacement programs appear to have resulted from concerns about future system performance due to normal deterioration that comes with extensive years in service.

2.2 Program

In response to events and in consideration of the Company's industry benchmarking, National Grid has chosen to develop an underground cable replacement program. The Company has moved to an approach where it evaluates its asset replacement programs utilizing a criticality scoring model (CSM) with standardized weighting factors for: Safety (20%), Customer Impact (20%), Asset Condition (40%) and Reliability (20%) (Refer to Appendix 1).

Criterion used to populate the CSM is customized for each program under consideration. The key criterion, and their relative impact in the criticality scoring model for distribution primary cable and sub-transmission cable used in this program's development, is shown in Appendix 2. The main drivers considered in the evaluation are: recorded manhole events (Safety), number of customers served (Customer), cable age (Asset Condition), cable insulation type (Asset Condition), and the number of cable splices installed due to in service failure on the existing cable system (Reliability).

Data is weighted exponentially by level as shown at the top of the tables found in Appendix 2, with most risk assigned the highest level and score. Each data set within each category receives a weight based on subject matter expert opinion. In the Excel based scoring tool used for this program, the weighting of each data set and the criteria for each level within the data set can be altered. This allows scoring to be varied depending on the availability of data and the requirements of each jurisdiction. In this case, weighting was varied to restrict scoring to a key set of available scoring categories, or drivers.

The safety risk component of the criticality score is based on the potential of a manhole event and the public risk should the event occur. A manhole event can range from smoke emitting from a manhole to an explosion that causes manhole cover dislodgement. An extensive study performed for ConEd found that previous manhole events are an indicator of future manhole events. The data in this study indicated that 20% of the serious manhole events occurred in the 10% of the manholes that were involved in previous manhole events. At National Grid, manhole events may be recorded in three separate databases. Manhole events were manually collated and matched to the Company's

Geographic Information System (GIS). GIS was used to score each feeder by counting the number of "event manholes" each feeder passes through. In this program, safety related risks were the only drivers that can achieve Level 5 scoring.

Asset condition risk is primarily based on cable age in this program. While age alone is not indicative of cable performance, the longer cable is in service the greater normal deterioration it has potentially experienced. In older urban areas, a significant proportion of cables have been in service for well over 50 years, some for over 80 years. Age varies from cable segment to segment due to various replacement and upgrades over time. The age information used for scoring is based on age ranges assigned based on local engineering knowledge. The insulation type information was gathered from the GIS system for each cable segment (for weights applied in scoring, refer to appendix 3). The data quality of some of this information is suspect and as such weighting for insulation type was reduced in the model. Manhole conditions (such as cable racking, cracked insulation and weakening splices) directly affect cable performance. Inspection results are specific to manholes with no reference to feeders or circuits. The inspection and maintenance information was correlated with GIS information to develop potential impacts on individual circuits based on the inspection results and the manholes the circuits occupy.

The number of previous failure-related splices is the most significant reliability driver in the model and allowed for consideration of cables that supply no customers directly (such as sub-transmission and distribution cables supplying the secondary network system) but were still failing,. A more consistent usage of National Grid's online splice log will enhance future evaluations. A recent review of UG Electric Operating Procedure (EOP) 009 identified a need to improve splice log use and to update some splice log features.

Generally, the criticality scoring model uses available information to identify candidate cables for planned replacement. This candidate list is then provided for cross functional review and specific cable replacement projects are generated based on further evaluation. In developing the specific scope of planned cable replacement projects, all underground segments of targeted circuits are evaluated, including laterals and cable to/from sectionalizing riser poles serving backyard distribution.

The availability of secondary system data does not presently allow for population and application of a similar CSM. As such, Secondary cable replacement scoping and prioritization will focus on geographic areas and will be developed by employee experts with consideration of underground system density, past performance, pedestrian activities, and other considerations.

Using the criticality scoring model a program that results in an average annual replacement rate of an estimated 12 percent of the high risk cables located within our targeted conventional underground areas was developed. It is expected the program will require time to ramp up and the planned annual replacement rate is shown in Figure 1.

Figure 1 Program Based Cable Replacement Levels

System Wide Goals Miles Replaced Per Fiscal Year Including All Drivers						
Cable System	**FY16**	**FY17**	**FY18**	**FY19**	**FY20-25**	**Total**
Primary	1.7	2.5	4.2	5.8	35.0	49.2
Subtransmission	1.0	1.0	2.0	3.0	18.0	25.0
Secondary	0.8	1.2	1.9	2.3	13.8	20.0
Total	**3.4**	**4.7**	**8.1**	**11.1**	**66.8**	**94.2**

Separate program funding streams will be established for distribution, sub-transmission, and secondary replacement. The output of the distribution and sub-transmission scoring tool will be used for budgeting, resource planning and to identify candidate cable replacement projects. Sub-transmission and distribution cable replacement projects will be on a feeder basis, with each project justified, engineered, scoped and approved individually. To reserve funding for future year spending on distribution and sub-transmission cable replacement, specific project placeholders will be used. Secondary cable replacement funding will be accounted for on a program basis, with work performed against a jurisdiction funding project with annually approved funding levels.

The quality of the data evaluated in the CSM varied and is expected to improve over time. As such, this program's CSM will be refreshed biannually to properly reflect recent system performance and improved data availability.

Over a ten year horizon, it is expected that approximately 94.2 miles of cable will be replaced in accordance with this program at a total estimated cost of $68M.

3.0 Benefits

3.1 Safety and Environmental

Much of the cable to be replaced through this program will be PILC cable. There is an environmental benefit to removing PILC cable because this will reduce the amount of lead on the system.

Underground asset failures can (and have) resulted in manhole cover dislodgements. Such events are often visible to the public and raise understandable concern with regulators, businesses, and public safety officials. Although the consequence of a manhole event can be severe, the likelihood of a manhole event remains low. This program is expected to further reduce the likelihood of manhole events by proactively replacing cable based on its condition and past performance.

The impact of a cable failure on manhole dislodgement may be affected by the type of manhole cover installed. In addition to proactive cable replacement, National Grid is piloting the installation of vented manhole covers in conjunction with secondary cable replacement activities.

3.2 Reliability

The time to locate and respond to cable failures is typically longer than on the overhead system. Therefore, cable systems are often designed with an emergency plan and greater redundancy, and have a limited impact on customer reliability statistics. However, if cable performance deteriorates significantly, the likelihood of concurrent failures increases. The consequences of multiple secondary network failures or multiple sub-transmission failures would be significant. Cable failures can result in increased operations and loading on parallel equipment, further increasing the risk of failure on the rest of the system. Proactive replacement of aged cable in these systems is expected to reduce the risk of concurrent failures and the potential for large scale customer outages.

3.3 Customer/Regulatory

Underground cable systems typically supply urban areas, including critical loads such as police stations, fire stations, and hospitals. Outages on the underground system typically take longer to isolate and repair. This mitigates the risk of long-term sustained customer interruptions occurring in these urban areas.

3.4 Efficiency

Addressing the cable in a prioritized fashion and re-evaluating the CSM on a regular basis will result in the most cost efficient plan and permit lessons learned from recently completed projects to be applied to subsequent projects. A proactive approach should mitigate premiums paid for emergency replacements and allow for efficient material procurement. Coordinating planned work with the list of replacement feeders and circuits should foster project development and delivery efficiencies in investigation (engineering and manhole survey), mobilization and civil construction costs.

4.0 Estimated Costs

Figure 2 shows the cumulative risk, as determined by the scoring methodology, mitigated by a cumulative program cost for replacing distribution primary cables. Candidate feeders were ranked for efficiency (risk score mitigated per feeder project cost).

Figure 2 Cumulative Risk Mitigation for Replacement of Distribution Primary Cables

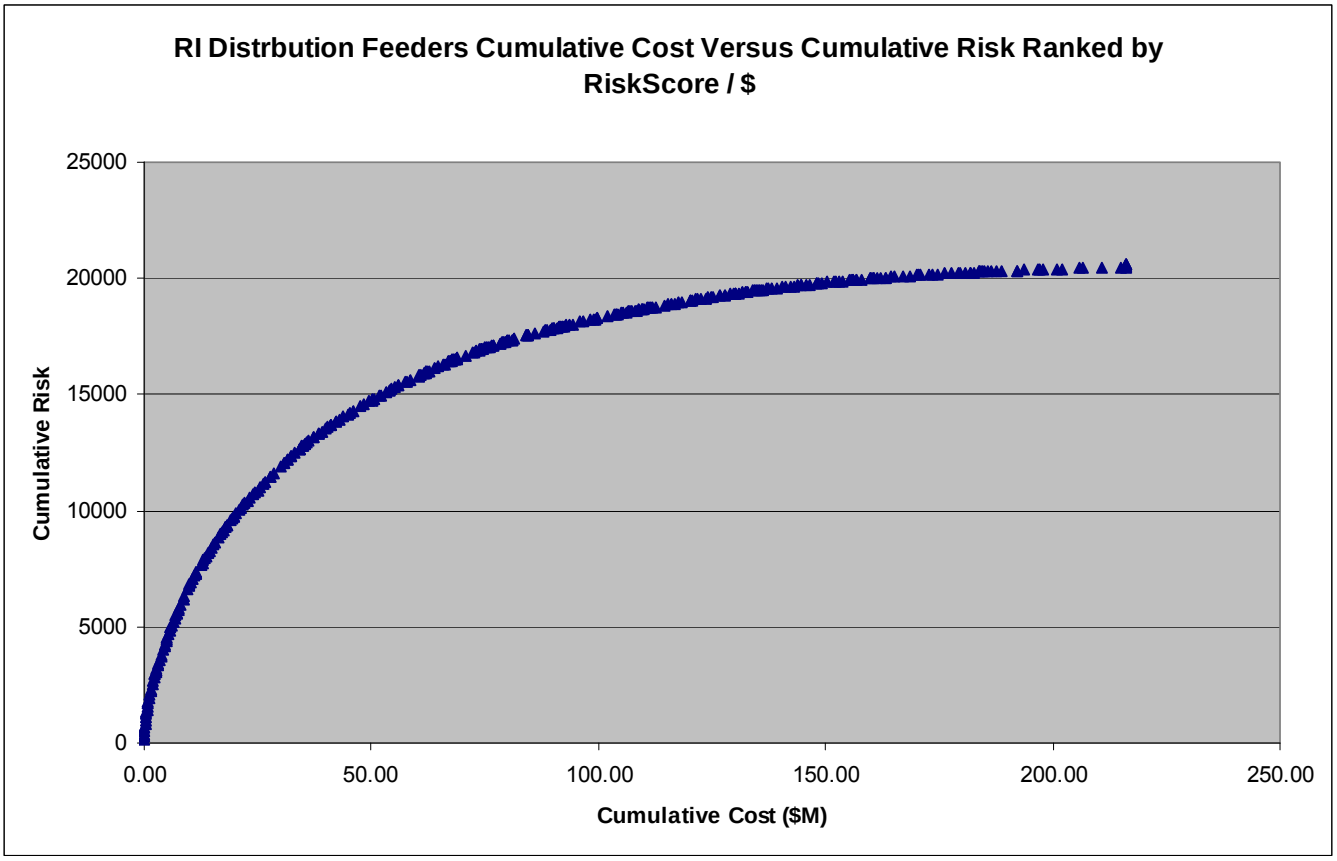


Figure 3 depicts each distribution cable's risk score versus replacement cost.

Figure 3 Distribution Primary Feeder Cable Replacement Candidate Projects

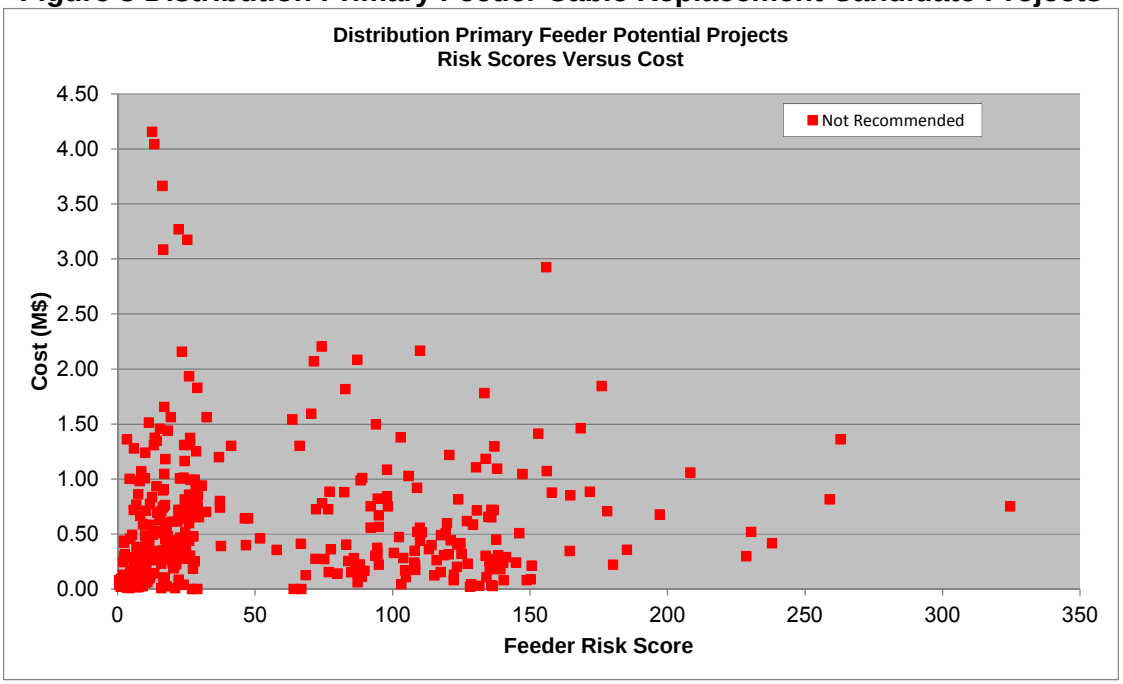


Figure 4 shows the cumulative risk, as determined by the scoring methodology, mitigated by a cumulative program cost for replacing sub-transmission circuits. Candidate circuits were ranked for efficiency (risk score mitigated per crcuit project cost).

Figure 4 Cumulative Risk Mitigation for Sub-transmission Circuits

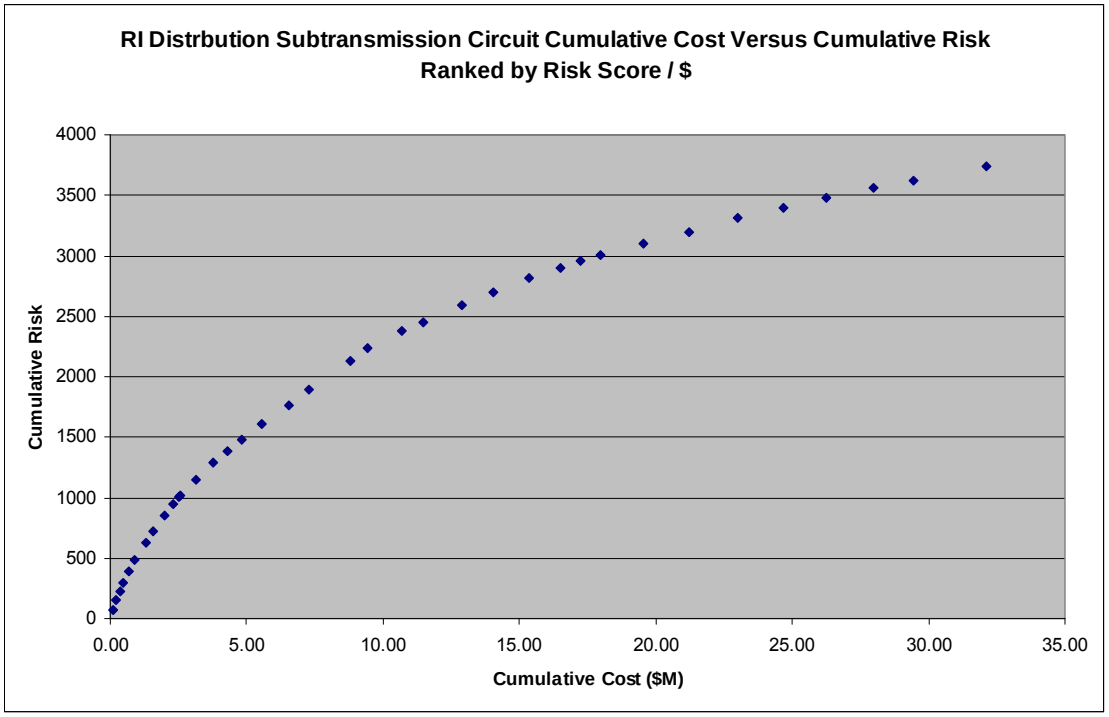
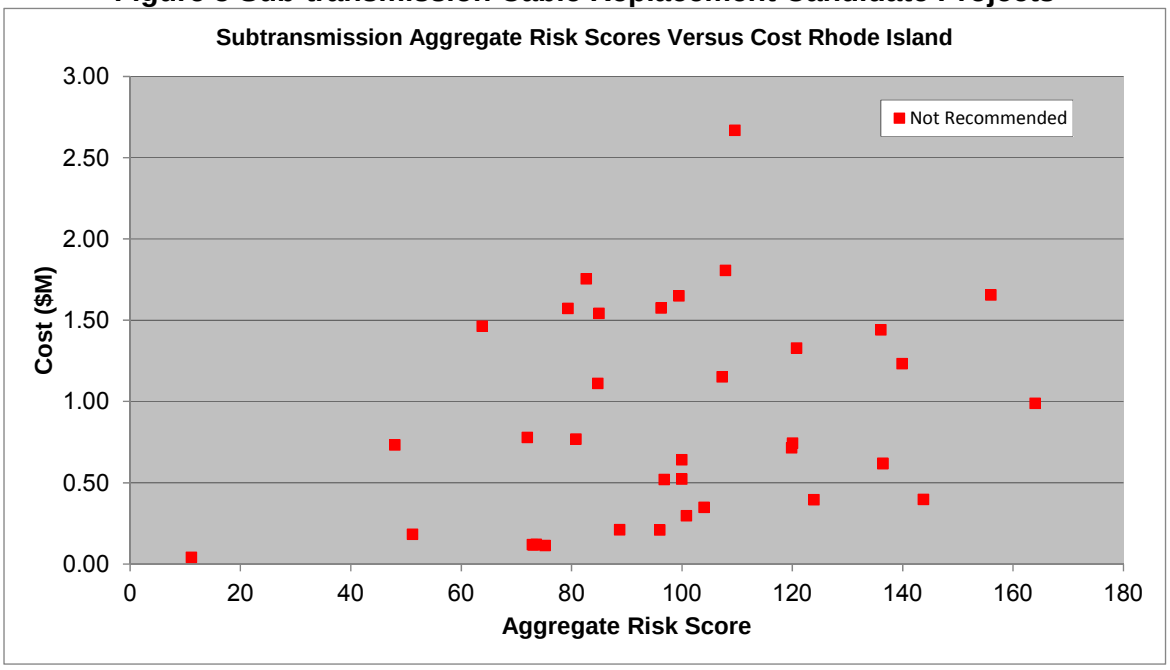


Figure 5 shows the risk score versus cost for each sub-transmission cable within the program scope.

Figure 5 Sub-transmission Cable Replacement Candidate Projects



Secondary (radial and network) cable replacement projects will be geographically based. Work will be performed against a program project until preset funding levels are approached. After ramp up, a cash flow of $3M per year is expected with an annual goal of 2.3 miles per year.

Figure 6 represents an investment grade cash flow for total program costs over a ten year horizon. This cost includes duct bank upgrade or replacement that may be necessary to facilitate cable replacement, which will vary project to project. Estimated program spending has been developed considering both resource requirements and the need to address cable assets of highest risk at a reasonable pace. The costs do not include cable replacement performed under other drivers (ex. Capacity).

Figure 6 Investment Grade Cash Flow

Cash Flow Per Fiscal Year ($M)						
Cable System	**FY16**	**FY17**	**FY18**	**FY19**	**FY20-25**	**Total**
Primary	1.0	1.5	2.5	3.5	21.0	29.5
Subtransmission	0.5	0.5	1.0	1.5	9.0	12.5
Secondary	1.0	1.5	2.5	3.0	18.0	26.0
Total	**2.5**	**3.5**	**6.0**	**8.0**	**48.0**	**68.0**

5.0 Implementation

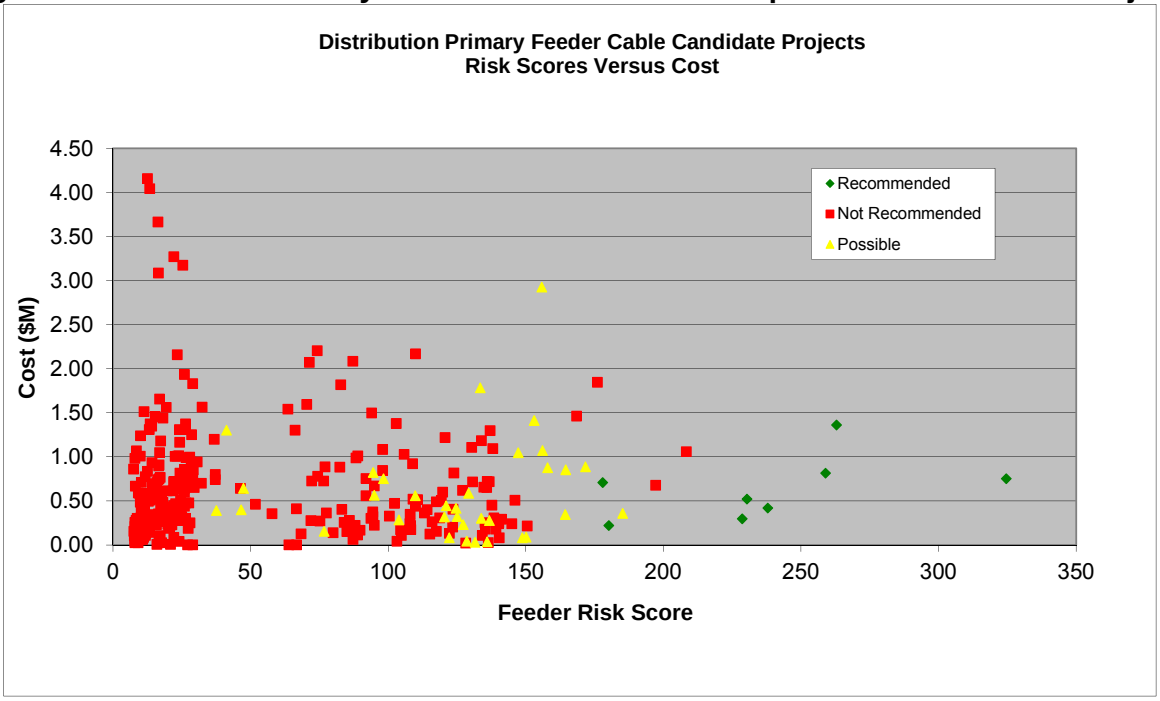
Pursuing projects simply by their cost/benefit rank as detailed in Figures 2 and 4 would tend to focus activities on the shortest and therefore least costly circuits to replace, leaving some of the poorest performing but more costly projects in service for longer periods of time. As such, the sub-transmission and distribution primary cable replacement candidate project list was reviewed in detail by a cross functional team of Company representatives having local knowledge and experience with the Rhode Island distribution system infrastructure. Functions represented included:

- Network Strategy engineers
- Operations
- Community and Customer Management
- Resource Planning

This review evaluated data used in the CSM and considered historical outage experience, active area projects, plans documented in the "Providence Area – Long Term Supply and Distribution Study" dated May, 2014, etc.

The review produced the 8 recommended (green) distribution primary cable replacement projects (to be complete or underway in FY16-18) illustrated in Figure 7. The 8 projects have a total estimated cost of $5.5M and represent approximately 9.1 miles of cable replacement. Also illustrated (yellow) are candidate projects to commence in FY19 and beyond. These projects are subject to change and require further review before specific projects are advanced. However, they are used for purposes of long range budget and resource planning. The list of the 8 cable projects is further detailed in Appendix 4.

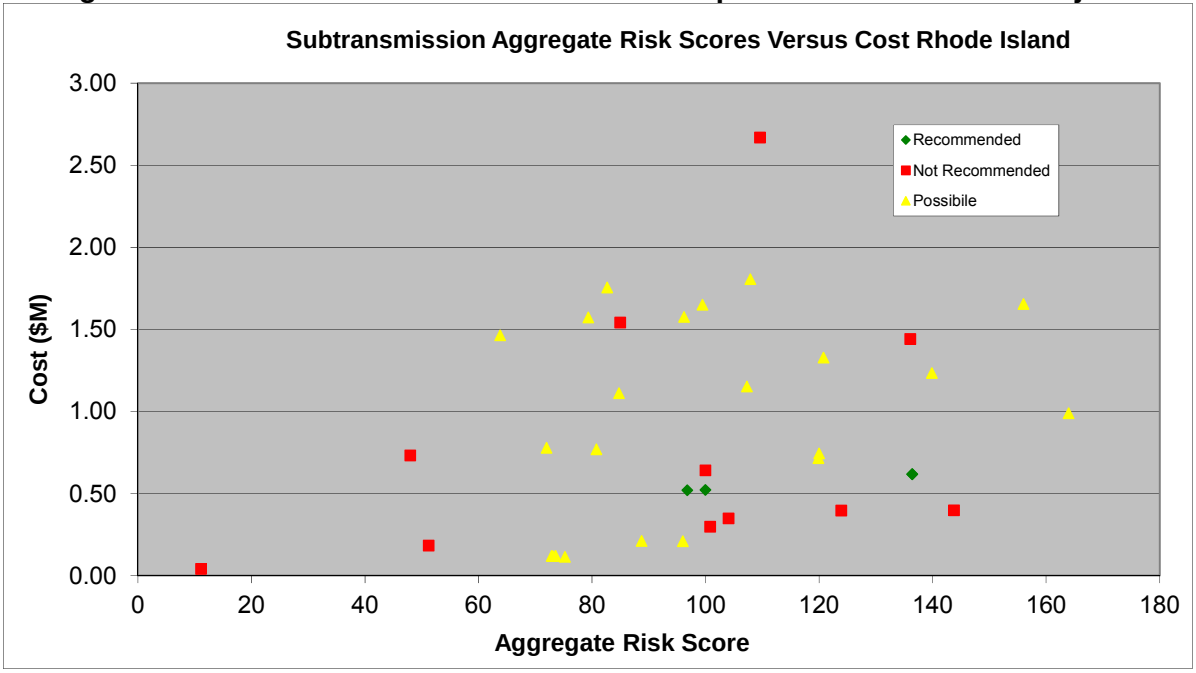
Figure 7 Distribution Primary Feeder Evaluated Cable Replacement Candidate Projects



The review also produced the 4 recommended (green) sub-transmission cable replacement projects (to be complete or underway in FY16-18) illustrated in Figure 8. The 4 projects have a total estimated cost of $2.3M and represent approximately 4.7 miles of cable replacement. Also illustrated (yellow)

are candidate projects to commence in FY19 and beyond. These projects are subject to change and require further review before specific projects are advanced. However, they are used for purposes of long range budget and resource planning. The list of the 4 cable projects is further detailed in Appendix 5.

Figure 8 Sub-transmission Evaluated Cable Replacement Candidate Projects



Each project will be approved individually with a separate scope, schedule, and cash flow. Field Engineering will perform an engineering review and initiate the individual projects. Individual projects will be managed by Program Management or Project Management depending on project complexity. Program Management will track replacement mileage. The overall program will be evaluated annually by Distribution Planning and Asset Management.

Network Strategy Engineers have consulted with Operations, Customer Community Management, and Resource Planning to develop a prioritized list of geographical areas for secondary cable replacement in the City of Providence, Rhode Island. These areas are prioritized as follows:

1. Jewelry District
2. College Hill
3. Wayland
4. Olneyville

Secondary cable replacement activities within each area will be directed by comprehensive asset inspections conducted in advance of project execution. Inspection results and subsequent project designs will be used to populate GIS with secondary system information. Availability of this data should enhance future operations and engineering design activities within the area. Consistent with a review entitled “Assessment of ventilated Manhole Covers”, dated March 31, 2014, the company has also made a decision to pilot the application of vented manhole covers and will implement this pilot in conjunction with the secondary replacement program activities recommended and documented in this study report. Figure 9 depicts the geographical area of the Jewelry District and Figure 10 provides a picture of a vented manhole cover.

Figure 9 Jewelry District

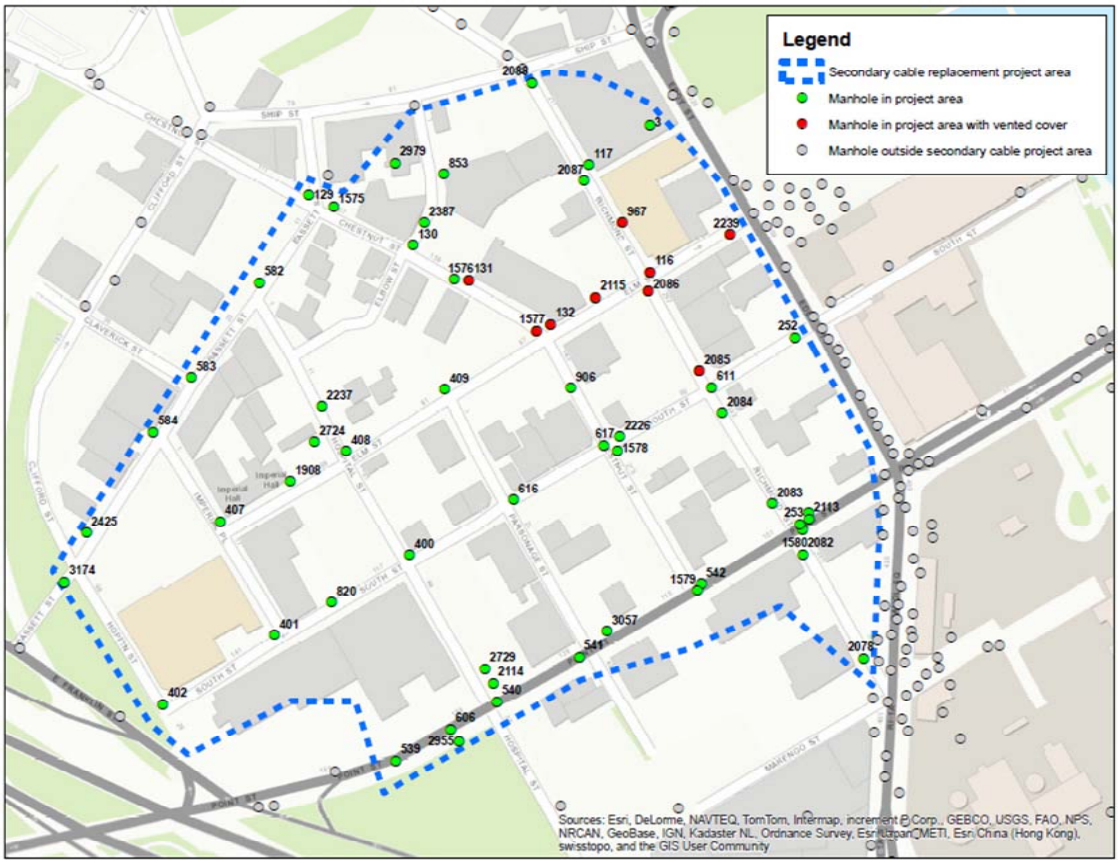


Figure 10 Vented Manhole Cover

The secondary replacement program will define the circuit miles to be replaced in jurisdictions each fiscal year. The estimated system-wide replacement goal will be 2.3 miles per year. Field Engineering will define geographic areas for secondary cable replacement. Operations will perform the necessary field inspections, replace the cable and document replacements through designed work against program funding projects approved annually by Distribution Planning and Asset Management. Program Management will track the program and limit the scope to keep within approved spending levels and goals.

6.0 Project Execution Considerations

In general, risks to cable removal efforts will be mitigated by applying lessons learned from earlier projects to subsequent projects.

6.1 Safety & Environmental

Individual project costs can be impacted by local environmental issues affecting any needed civil construction. Program costs do not assume significant environmental mitigation.

6.2 Reliability

Construction related outages, especially on sub-transmission cable projects, will increase load and customer reliability risks on parallel circuits. Construction related outage risks can be partially mitigated by having all materials on hand prior to starting replacement construction, and analyzing outage requirements as part of preliminary engineering.

6.3 Customer/Regulatory

Some projects will require additional manhole and ductbank construction. There is a risk that local jurisdictions will refuse to issue licensing and permitting for the proposed work, or that process delays will impact project schedule. Community outreach in major urban areas should be performed prior to secondary cable replacement program kickoff, and for each individually scoped and approved distribution and sub-transmission cable replacement project.

There is a risk that licensing will be delayed where roads have recently been repaved and will increase cost. This risk can be partially mitigated with a community outreach to obtain proposed paving schedules for urban communities. The information should be geographically mapped against identified feeder and circuit replacement projects so that the information is available during engineering review.

Some projects may require customer easements to locate equipment above ground as required by current standards. For example, sectionalizing riser poles currently used for backyard construction may require an easement to locate a padmounted switch on private property.

6.4 Resources

The volume of cable replacement proposed in this program represents an increase in underground work. Additional resources for engineering, program management and data management as well as civil and cable craft workers are expected to be necessary.

7.0 Data Requirements

The Excel-based tool used for this program will be stored on a shared drive. This report identifies how scoring was applied to available information, and makes recommendations for improvements.

8.0 Facts Influencing Future Study

Long range study presently underway will affect the timing of replacing some of the cables this program may identify. Future year candidates will be evaluated after creation of implementation plans associated with the Providence Long Range Supply and Distribution Study.

The intent of the scoring methodology is to take advantage of existing information to identify cable replacement opportunities, and to leverage new information as it becomes available. When that information becomes available, the scoring matrices will be reevaluated. Subsequent engineering review may result in deferral or elimination of candidate projects. In addition to annually reviewing funding levels, program weighting will be evaluated every two years based on lessons learned and as data quality improves.

9.0 Conclusion

The proactive replacement of underground cables on the Sub-Transmission, Distribution Primary, and Distribution Secondary systems in the Rhode Island service territory is recommended to minimize faults and the occurrence of manhole events. It is recommended that over the next ten years National Grid spend $29.5M replacing approximately 49.2 miles of distribution primary cable, $12.5M replacing approximately 25 miles of Sub-Transmission cables, and $26M replacing approximately 20 miles of distribution secondary cable. The total spend over the 10 year horizon is $68M replacing approximately 94.2 miles of cable in the Rhode Island service territory.

Appendix 1 Criticality Scoring Model - Input Data Weighting

Prioritization - Input Data Weighting

- Safety Impact: 20%
  The risk of potential injury in the case of an event.
- Customer Impact: 20%
  Assessment of how customers (and how many) are impacted by an event.
- Asset Condition (current/predictive): 40%
  Assessment of the current state of the asset and the likelihood/rate for continued deterioration
- Reliability (historic/predictive): 20%
  Assessment of asset performance and the likelihood/rate for continued performance degradation.

Appendix 2 Feeder Scoring Matrix for Identifying Distribution Cable Replacement

The most significant drivers are shown in green shading. Red lettering indicates weighting that can be changed within the scoring tool to evaluate the effect of different weighting factors. A similar matrix was used to score sub-transmission circuits.

Rhode Island Feeder Scoring

Category	Weight	Level 1 1	Level 2 20	Level 3 100	Level 4 400	Level 5 1000
Safety	**20%**					
Previous Manhole Events	12%	na	na	na	1	2
OR .. Public Accessibility: Percent of Feeder Passing Through High Pedestrian Traffic Area	8%	na	na	25%	50%	75%
Customer	**20%**					
Number of Customers Served	16%	25%	50%	75%	na	na
Feeder Loading	4%	25%	50%	75%	na	na
Asset Condition	**40%**					
Age	16%	na	na	26 to 49 Years	50+ Years	na
Weighted Average Insulation Type	16%	Use the weighted average scored for insulation type				
Crowding in Manholes Feeder Passes Through	2%	na	25%	50%	75%	na
Direct Buried Percentage	2%	na	25%	50%	75%	na
Reliability	**20%**					
Network Supply Feeder	1%	na	na	na	Yes	na
Splice Log	16%	80%	90%	95%	na	97%
RI Jurisdictional Reliability Score	1%	na	0	2	3	na
Feeder CKSAIFI	1%	na	25%	50%	75%	na
Degree of Redundancy	1%	Automatic Transfer	Manual Transfer 100%	Limited Transfer Capability	Can Not Transfer Any Load	na

Appendix 3 Cable Insulation Type Weighting

INSULATION CODES IN GIS	Assumed Code Definition	Point Weight
AER	Aerial	0
AWP	Aluminum Weatherproofing (Overhead)	0
B	Bare (Overhead)	0
CRR & L	Ozone Resistant Rubber and Lead	100
EPR	EPR	0
K & L	Kerite and Lead	100
KDPS Lead	Kerite Double Permashield Lead Covered	100
KER	Kerite	0
LC	Lead Covered	100
N/A	Not Available	0
NP	Neoprene overjacket, no shield	1000
P & L	Paper and Lead	100
PE combined with Age over 26 years	Polyethelene	400
PE combined with Age under 25 years	Tree Retardant Cross Linked Polyethylene	0
PILC	Paper Insulated Lead Covered	100
PW	Pilot Wire	0
R	Rubber	20
R & L	Rubber Covered Lead	100
SDC	Stranded Conductor (Overhead)	0
SLD	Solid (Overhead)	0
SS	Self Supporting Aerial Cable	0
SUBL	Submarine Cable Lead	100
SUBR	Submarine Cable Rubber	20
TW	Treewire (Overhead)	0
VC	Varnished Cambric	1000
VC & L	Varnished Cambric and Lead	1000
WP	Weatherproofing (Overhead)	0
XLPE combined with Age over 26 years	Cross Linked Polyethylene	400
XLPE combined with Age under 25 years	Tree Retardant Cross Linked Polyethylene	0
SAC	Unknown	0
Unknown Insulation	Unknown	0
Blank	Unknown	0

Appendix 4 Distribution Primary Feeder Cable Replacement Candidate Projects

Master CDF	Division	District	Risk Score	Miles	REPLACEMENT COST ($M)	Risk/$M	Safety Score	Customer Score	Asset Score	Reliability Score
49_53_1111	New England South	Capital	325	1.35	0.81	402 25	160	0	85	80
49_53_79F1	New England South	Capital	263	2.44	1.46	179.56	160	4	95	4
49_53_2J8	New England South	Capital	259	1.46	0.88	295 23	160	0	85	13
49_53_1107	New England South	Capital	238	0.75	0.45	530.76	64	0	94	80
49_53_1105	New England South	Capital	230	0.93	0.56	413 22	64	0	85	81
49_53_1127	New England South	Capital	229	0.53	0.32	715.12	64	0	85	80
49_53_13F1	New England South	Capital	180	0.40	0.24	760 28	160	0	16	4
49_53_1113	New England South	Capital	178	1.27	0.76	234.11	0	0	88	90

Appendix 5 Sub-transmission Cable Replacement Candidate Projects

Master CDF	Division	District	Risk Score	Miles	REPLACEMENT COST ($M)	Risk/$M	Safety Score	Customer Score	Asset Score	Reliability Score
49_56_54K21	New England South	Coastal	136	1.28	0.62	221.27	64	0	72	0
49_56_54K23	New England South	Coastal	136	1.28	0.62	220.78	64	0	72	0
49_53_1144	New England South	Capital	100	1.08	0.52	191.68	0	4	96	0
49_53_1142	New England South	Capital	97	1.08	0.52	186.23	0	1	96	0

Resanction Request

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Title:	RI UG Secondary Cable Replacement - FY17 Program	**Sanction Paper #:**	USSC-17-149
Project #:	C055392	**Sanction Type:**	Resanction
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	03/21/2017
Author:	John P. Richard, Jr.	**Sponsor:**	Carol Sedewitz, VP of Electric Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	John P. Richard, Jr.

1 *Executive Summary*

This paper requests sanction of the Program Project C055392 in the amount $1.279M with a tolerance of +/- 10% for the purposes of of Engineering, Procurement and full construction including underground cable replacement.

This sanction amount is $1.279M broken down into:

$1.038M Capex
$0.102M Opex
$0.139M Removal

Note the originally requested sanction amount of $0.900M

2 *Resanction Details*

2.1 Project Summary

The Company is proactively replacing underground cables in Rhode Island as documented in the report titled "Rhode Island Underground Cable Replacement Program - Study Report" dated August 15, 2014. This program includes a multi-year project for proactive replacement of underground secondary cable, targeting specific geographic areas for replacement.

2.2 Summary of Projects

Project Number	Project Type (Elect only)	Project Title	Estimate Amount ($M)
C055392	D-Line	RI UG Secondary Cable Replacement - FY17 Program	1.279
		Total	1.279

Resanction Request

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2.3 Prior Sanctioning History

Date	Governance Body	Sanctioned Amount	Potential Project Investment	Paper Title	Sanction Type	Paper Reference Number	Tolerance
5/12/16	Power Plant	$0.900M	$0.900M	NA	Sanction	NA	+/-25%
5/05/15	Power Plant	$0.500M	$0.500M	NA	Sanction	NA	+/-25%

Over / Under Expenditure Analysis

Summary Analysis ($M)	Capex	Opex	Removal	Total
Resanction Amount	1.038	0.102	0.139	1.279
Latest Approval	0.423	0.162	0.315	0.900
Change*	0.615	-0.060	-0.186	0.379

Change = (Re-sanction -- Amount Latest Approval)

2.4 Cost Summary Table

Project Number	Project Title	Project Estimate Level (%)	Spend ($M)	Prior Yrs	Current Planning Horizon Yr. 1 2016/17	Yr. 2 2017/18	Yr. 3 2018/19	Yr. 4 2019/20	Yr. 5 2020/21	Yr. 6 + 2021/22	Total
C055392	RI UG Secondary Cable Replacement - FY17 Program	Est Lvl (e.g. +/- 10%)	CapEx	0.000	1.038	0.000	0.000	0.000	0.000	0.000	1.038
			OpEx	0.000	0.102	0.000	0.000	0.000	0.000	0.000	0.102
			Removal	0.000	0.139	0.000	0.000	0.000	0.000	0.000	0.139
			Total	0.000	1.279	0.000	0.000	0.000	0.000	0.000	1.279
Total Project Sanction			CapEx	0.000	1.038	0.000	0.000	0.000	0.000	0.000	1.038
			OpEx	0.000	0.102	0.000	0.000	0.000	0.000	0.000	0.102
			Removal	0.000	0.139	0.000	0.000	0.000	0.000	0.000	0.139
			Total	0.000	1.279	0.000	0.000	0.000	0.000	0.000	1.279

2.5 Business Plan

Business Plan Name & Period	Project included in approved Business Plan?	Over / Under Business Plan	Project Cost relative to approved Business Plan ($)
FY17-21 NE Distribution Business plan	◉ Yes ○ No	○ Over ○ Under ◉ N/A	$0

2.6 Drivers

2.6.1 Detailed Analysis Table

The following table indicates the major key variations that account for the difference between the original sanction amount and the requested resanction amount.

Detail Analysis (M's)	Over/Under Expenditure?	Amount
Design Cost and Acceleration	☒ Over ☐ Under	$0.220
Construction Acceleration	☒ Over ☐ Under	$0.159

2.6.2 Explanation of Key Variations

Design Cost and Acceleration
In FY17, this project replaced UG Secondary cables in targeted geographic areas within Providence, specifically at George and Waterman Streets, as well as 3 sub sections of the College Hill area (Canal, Charles, Randall & North Benefit Streets). In addition to these sections, designs were completed for 6 additional sub sections of the College Hill area encompassing the following streets; S Benefit, S Water, S Main, Power, Planet, Benevolent, William and N Main.
Due to the age and complexities of the UG Secondary Systems, the designs for the completed sections took longer to complete than originally expected. Therefore, it was decided the design work for the future year's construction should start sooner than the past. Additionally, designing these projects required more field surveys than originally expected and because these UG secondary system are not currently shown in GIS, which required a full GIS rebuild.

Construction Acceleration
Operations requested the acceleration of a secondary project that was not originally planned for FY17 in order to maintain desired resourcing levels. Resource Planning evaluated the request with input from Operations and Engineering; it was determined the request could be granted without negatively impacting the program.

2.7 If cost > approved Business Plan how will this be funded?

Reallocation of funds within the Underground Cable Replacement Program portfolio has been managed by Resource Planning to meet jurisdictional, budgetary, statutory and regulatory requirements.

2.8 Key Milestones

Milestone	Target Date: (Month/Year)
Sanction	May 2016
Re-Sanction for FY17	March 2017
Construction Finish	March 2017
FY17 Closure Paper	June 2017

2.9 Next Planned Sanction Review

Date (Month/Year)	Purpose of Sanction Review
June 2017	FY17 Closure Paper

3 *Statements of Support*

3.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Department	Individual	Responsibilities
Investment Planning	Glen Diconza	Endorses relative to distribution 5-year plan or emergent work
Resource Planning	Anne Wyman	Endorses Resources, cost estimate, schedule, and Portfolio Alignment
Distribution Asset Management	Alan Labarre	Endorses scope, design, conformance with design standards

3.2 Reviewers

The reviewers have provided feedback on the content/language of the paper

Function	Individual
Finance	Patricia Easterly
Regulatory	Peter Zschokke
Jurisdictional	Sonny Anand
Procurement	Art Curran
Control Center	Mike Gallagher

Resanction Request

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4 *Decisions*

I:

(a) APPROVE this paper and the investment of $1.279M and a tolerance of +/- 10%

(b) NOTE that John Richard is the Project Manager and has the approved financial delegation.

(c) NOTE: In the event that the Program projects are not approved prior to the start of the FY18 fiscal year, the FY17 approval limits will remain in effect until such time as the FY18 Program projects are approved by USSC and/or other appropriate authority for approval.

Signature.....Date....3/27/17.

Executive Sponsor – Christopher Kelly, SVP of Electric Process and Engineering

Resanction Request

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5 *Appendices*

NA

Short Form Sanction Paper

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Title:	RI UG Secondary Cable Replacement FY18 Program	**Sanction Paper #:**	USSC-17-150
Project #:	C055392	**Sanction Type:**	Sanction
Operating Company:	The Narragansett Electric Co.	**Date of Request:**	03/21/2017
Author:	Roger Cox	**Sponsor:**	Carol Sedewitz, VP Electric Asset Management
Utility Service:	Electricity T&D	**Project Manager:**	John Richard

1 Executive Summary

1.1 Sanctioning Summary

This paper requests sanction of the program project C055392 in the amount $1.820M with a tolerance of +/- 10% for the purposes of Engineering, Design and Full implementation.

This sanction amount is $1.820M broken down into:
$1.468M Capex
$0.176M Opex
$0.176M Removal

1.2 Project Summary

The Company is proactively replacing underground cables in Rhode Island as documented in the report titled "Rhode Island Underground Cable Replacement Program - Study Report" dated August 15, 2014. This program includes a multi-year project for proactive replacement of underground secondary cable, targeting specific geographic areas for replacement, projecting spending through the year 2025.

2 Project Detail

2.1 Background

National Grid's Cable Replacement Strategy documented a program to proactively replace underground cable on sub-transmission, distribution primary, and distribution secondary cable systems. This strategy considered the age of the Company's underground infrastructure and acknowledged similarities in the physical characteristics (insulation materials) of cable assets that are more prone to failure.

This program focuses on the conventional underground systems generally found in more urban areas of the service territory. The cables are predominantly installed in manhole and duct systems, yet some may be direct-buried. Underground secondary cables, not including residential developments, are included in this RI UG Cable Replacement Program.

Cables utilized in the residential neighborhoods (Underground Residential Developments (URDs)) and Underground Commercial Developments (UCDs) are not in scope and are included under a separate program with a different strategey.

2.2 Drivers

This project is driven by asset condition of the underground secondary cable system, which impacts the reliability of the distribution system. In addition, underground asset failures can (and have) resulted in manhole cover dislodgements and/or a manhole fire. Such events are often visible to the public and raise understandable concern with regulators, businesses, and public safety officials. Although such events and possible outcomes can not be completely eliminated, it is the Company's opinion that the frequency with which such events occur can be reduced with programmatic cable replacements.

2.3 Project Description

In FY18, this project proposes replacement of approximately 22,000 circuit feet of underground secondary cable. Targeted geographic areas are in Providence and are portions of the neighborhoods of Fox Point, College Hill, Wayland Square, Olneyville, and western end of Federal Hill.

2.4 Benefits

Proactive replacement of underground secondary cable will reduce the risk of in-service failures and the potential for unplanned customer outages. This planned approach will provide an efficient replacement process compared to replacing the cables on an emergency basis when in-service failures occur.

2.5 Business & Customer Issues

2.6 Alternatives

Alternative 1: Defer

Deferring this project leaves the area at risk for increased outages.

2.7 Investment Recovery

2.7.1 Customer Impact

This project results in an indicative first full year revenue requirement when the asset is placed in service equal to approximately $0.174M. This is indicative only. The actual revenue requirement will differ, depending upon the timing of the next rate case and/or the timing of the next filing in which the project is included in rate base.

3 Related Projects, Scoring, Budgets

3.1 Summary of Projects

Project Number	Project Type (Elec only)	Project Title	Estimate Amount ($M)
C055392	D-Line	RI UG Secondary Cable Replacement	1.820
		Total	1.820

3.2 Associated Projects

NA

3.3 Prior Sanctioning History

The Secondary Cable Replacement Program Funding Project is sanctioned annually for annual spending. Cost estimates are based on past history and available resources.

Short Form Sanction Paper

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3.4 Category

Category	Reference to Mandate, Policy, NPV, or Other
○ Mandatory	Rode Island Underground Cable Replacement Program
◉ Policy- Driven	
○ Justified NPV	
○ Other	

3.5 Asset Management Risk Score

Asset Management Risk Score: 36

Primary Risk Score Driver: (Policy Driven Projects Only)

◉ Reliability ○ Environment ○ Health & Safety ○ Not Policy Driven

3.6 Complexity Level

○ High Complexity ○ Medium Complexity ◉ Low Complexity ○ N/A

Complexity Score: 15

3.7 Next Planned Sanction Review

Date (Month/Year)	Purpose of Sanction Review
June 2018	Closure Paper

Short Form Sanction Paper

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4 Financial

4.1 Business Plan

Business Plan Name & Period	Project included in approved Business Plan?	Over / Under Business Plan	Project Cost relative to approved Business Plan ($)
FY18-22 NE Distribution Business plan	⊙ Yes ○ No	○ Over ○ Under ⊙ NA	$0M

4.1.1 If cost > approved Business Plan how will this be funded?

NA

4.2 CIAC / Reimbursement

NA

4.3 Cost Summary Table

Project Number	Project Title	Project Estimate Level (%)	Spend	Prior Yrs	Current Planning Horizon ($M) Yr. 1 2017/18	Yr. 2 2018/19	Yr. 3 2019/20	Yr. 4 2020/21	Yr. 5 2021/22	Yr. 6 + 2022/23	Total
C055392	RI UG Secondary Cable Replacement	Est Lvl (e.g. +/- 10%)	CapEx	-	1.468	-	-	-	-	-	1.468
			OpEx	-	0.176	-	-	-	-	-	0.176
			Removal	-	0.176	-	-	-	-	-	0.176
			Total	-	1.820	-	-	-	-	-	1.820
Total Project Sanction			CapEx	-	1.468	-	-	-	-	-	1.468
			OpEx	-	0.176	-	-	-	-	-	0.176
			Removal	-	0.176	-	-	-	-	-	0.176
			Total	-	1.820	-	-	-	-	-	1.820

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4.4 Project Budget Summary Table

Project Costs per Business Plan

$M	Prior Yrs (Actual)	Current Planning Horizon ($M) Yr. 1 2017/18	Yr. 2 2018/19	Yr. 3 2019/20	Yr. 4 2020/21	Yr. 5 2021/22	Yr. 6 + 2022/23	Total
CapEx	0.000	1.468	0.000	0.000	0.000	0.000	0.000	1.468
OpEx	0.000	0.176	0.000	0.000	0.000	0.000	0.000	0.176
Removal	0.000	0.176	0.000	0.000	0.000	0.000	0.000	0.176
Total Cost in Bus. Plan	0.000	1.820	0.000	0.000	0.000	0.000	0.000	1.820

Variance (Business Plan-Project Estimate)

$M	Prior Yrs (Actual)	Current Planning Horizon ($M) Yr. 1 2017/18	Yr. 2 2018/19	Yr. 3 2019/20	Yr. 4 2020/21	Yr. 5 2021/22	Yr. 6 + 2022/23	Total
CapEx	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OpEx	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Removal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Cost in Bus. Plan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

5 Key Milestones

Milestone	Target Date: (Month/Year)
Sanction	March 2017
Preliminary Engineering	Various
Procurement	Various
Final Engineering	Various
Delivery	Various
Construction Start	Various
Construction Finish	Various
As Builts	Various
Annual Program Closure	June 2018

6 Statements of Support

6.1.1 Supporters

The supporters listed have aligned their part of the business to support the project.

Role	Individual	Responsibilities
Investment Planning	DiConza, Glen	Endorses relative to 5-year business plan or emergent work
Resource Planning	Wyman, Anne	Endorses construction resources, cost estimate, schedule, and portfolio alignment
Asset Management / Planning	Labarre, Alan T.	Endorses scope, estimate, and schedule with the company's goals, strategies, and objectives
Project Management	Schneller, Andrew	Endorses resources, cost estimate, schedule
Electric Project Estimation	Marceau, Daniel	Endorses Cost Estimate

6.1.2 Reviewers

The reviewers have provided feedback on the content/language of the paper.

Reviewer List	Individual
Finance	Patricia Easterly
Regulatory	Peter Zschokke
Jurisdictional Delegate(s)	Sonny Anand
Procurement	Art Curran
Control Centers (CC)	Michael Gallagher

6.1.3 List References

NA

Short Form Sanction Paper

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7 *Decisions*

I:

(a) APPROVE this paper and the investment of $1.820M and a tolerance of +/-10%

(b) NOTE that John Richard is the Project Manager and has the approved financial delegation.

(c) NOTE: In the event that any Blanket projects are not approved prior to the start of the FY19 fiscal year, the FY18 approval limits will remain in effect until such time as the FY19 blanket projects are approved by USSC and/or other appropriate authority for approval.

Signature.....Date...3/20/17.

Executive Sponsor – Christopher Kelly, SVP of Electric Process and Engineering

8 *Other Appendices*

Short Form Sanction Paper

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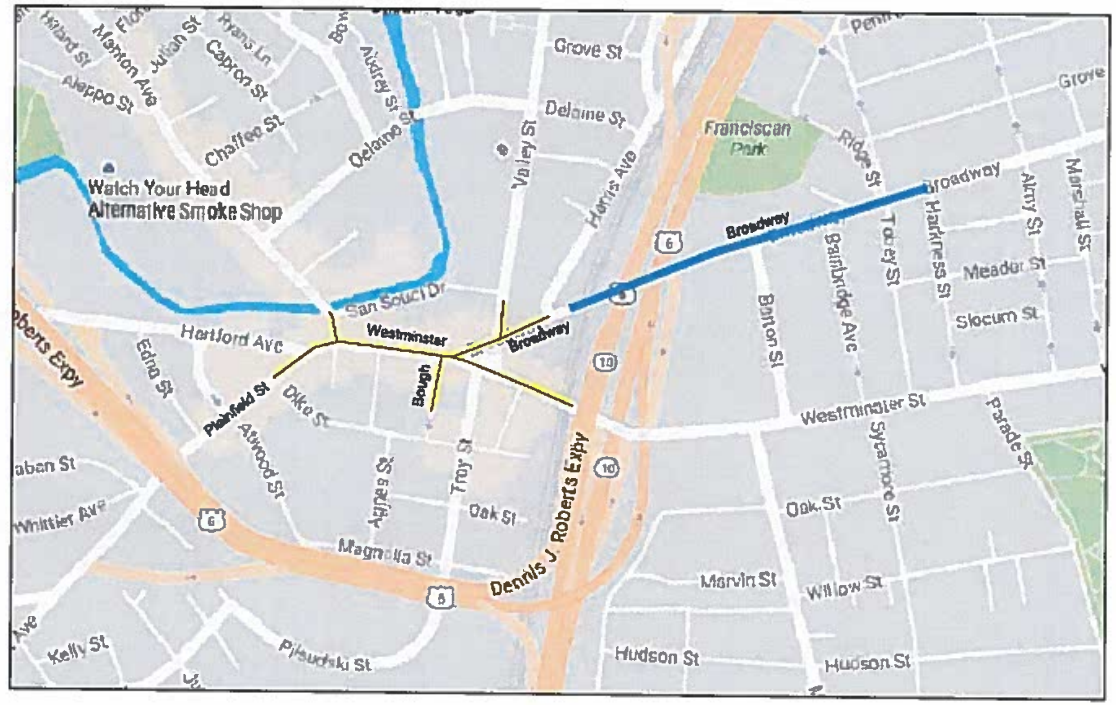


LEGEND
WORK AREA I
WORK AREA II

NOTE
WORK AREAS ARE APPROXIMATE AND ARE BASED ON HISTORIC RECORDS. ADJUST WORK AREAS AS NEEDED TO ADDRESS ALL SECONDARY CABLE IN GENERAL GEOGRAPHIC AREA OR CRIB.

RI UNDERGROUND SEC'Y CABLE REPLACEMENT PROGRAM
PROJ. C0S5395

FY18 AREAS
PG 2 OF 2 - OLNEYVILLE & BROADWAY, PROVIDENCE

CL - 6/22/18

C059663

Cutout Mounted Recloser Program_RI

5360-Narragansett Electric and Gas
Project Revision Detail Report

Fund Project Number:	C059663	**USSC #:**	FY17 Program
Revision:	3	**Budget Version:**	Default
Project Title:	Cutout Mnted Recloser Program RI		
Project Description:	This annual program is based on a strategy that recommends the installation of single phase cutout mounted reclosers at targeted locations on primary overhead lines across the TNECo distribution network		

Project Status:	open		
Responsible Person:	CURLEY, JOSEPH	**Initiator:**	Williams, John W
Spending Rationale:	System Capacity & Performance	**Funding Type:**	P Electric Distribution Line RI
Budget Class:	Reliability		
Capital by Category:			
Program Code:			
Project Risk Score:	34	**Project Complexity Score:**	18

Project Schedule / Expenditures

Revision Status:	Approved		
Est Start Date:	11/12/2014	**Est Complete Date:**	3/31/2020
Est In-Service Date:	3/31/2020		
TTD Actuals:	$340,098	**As Of:**	10/10/2017

Cost Breakdown	Capital	Expense	Removal	Total	Credits
	$110,000	$20,000	$10,000	$140,000	$0

Justification / Risk Identification:

This strategy recommends the installation of single phase cutout mounted reclosers at targeted locations on primary OH lines in TNECo Distribution Network. This work will benefit National Grid customers by improving reliability and operational efficiency. The devices reclosing feature will a clear temporary fault before the circuit is interrupted, reducing the number of adhoc repairs and customers interruptions on the network.

Project Scope:

Install 80 CMRs on the RI Distribution Network over the 5yr program at a capital cost of $360,000.

Project Alternatives Considered:

Single phase oil filled reclosers

Additional Notes:

Potential location have been identified.

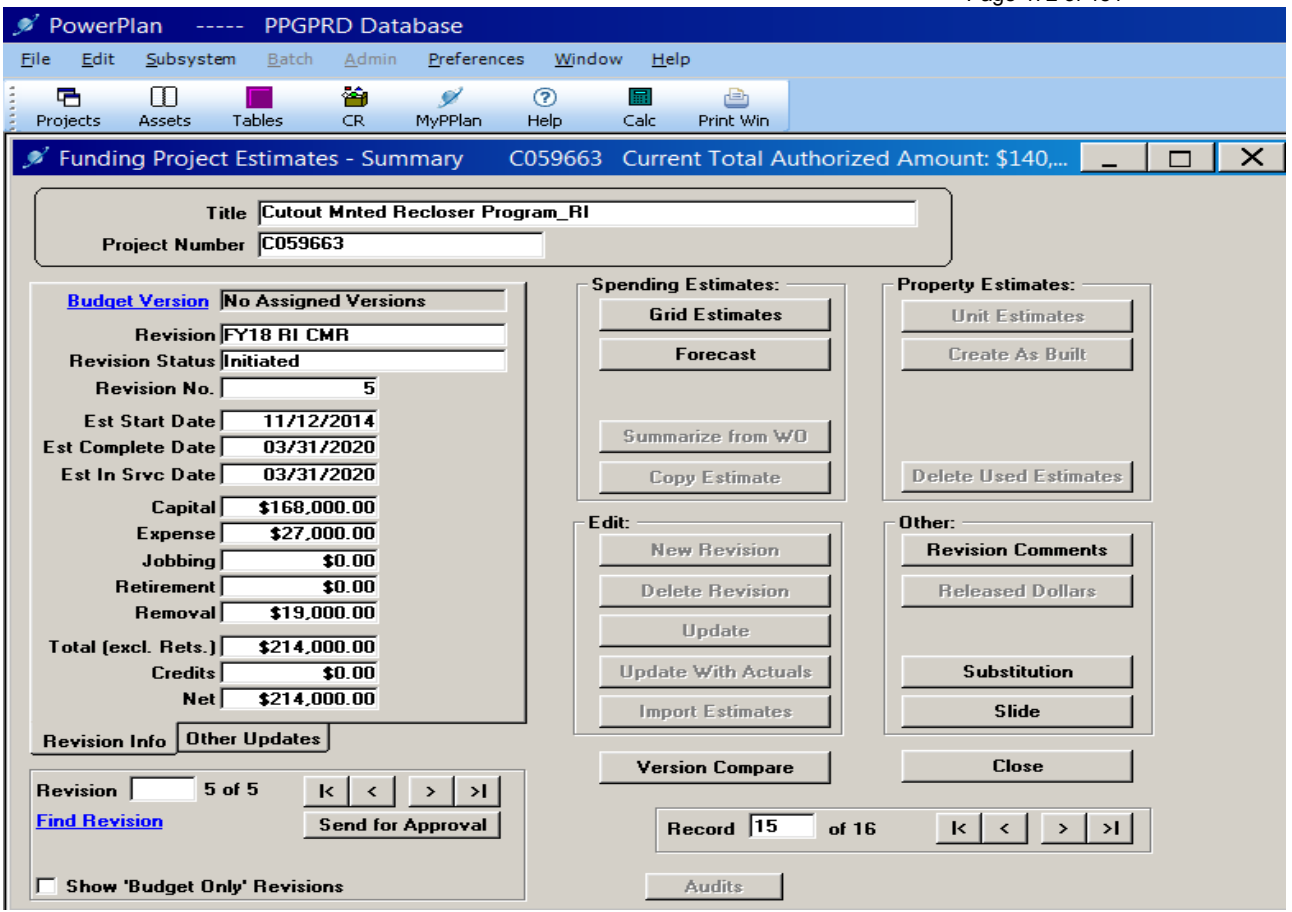
Related Projects:

Project Number:	Project Name:

Approvals

Line 1:	**Date**	4/25/2016 11:33:15	**Approver**	curljo	DOA - Distribution Lev
Line 2:	**Date**	4/26/2016 15:01:43	**Approver**	Diconza, Glen L	DOA - Distribution Lev
Line 3:	**Date**	5/4/2016 15:32:18	**Approver**	Constable, Ryan	DOA - Distribution Lev
Line 4:	**Date**	5/4/2016 15:54:58	**Approver**	Cox, Roger D	DOA - Distribution Lev
Line 5:	**Date**		**Approver**		

*****Project Authorization is for Approved Revision Total Estimated Cost +10%*****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Funding Project Estimates - Summary C059663 Current Total Authorized Amount: $140,...
Title Cutout Mnted Recloser Program_RI
Project Number C059663
Budget Version No Assigned Versions
Revision FY18 RI CMR
Revision Status Initiated
Revision No. 5
Est Start Date 11/12/2014
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $168,000.00
Expense $27,000.00
Jobbing $0.00
Retirement $0.00
Removal $19,000.00
Total (excl. Rets.) $214,000.00
Credits $0.00
Net $214,000.00
Revision Info
Other Updates
Revision 5 of 5
Find Revision
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Spending Estimates:
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Property Estimates:
Unit Estimates
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Edit:
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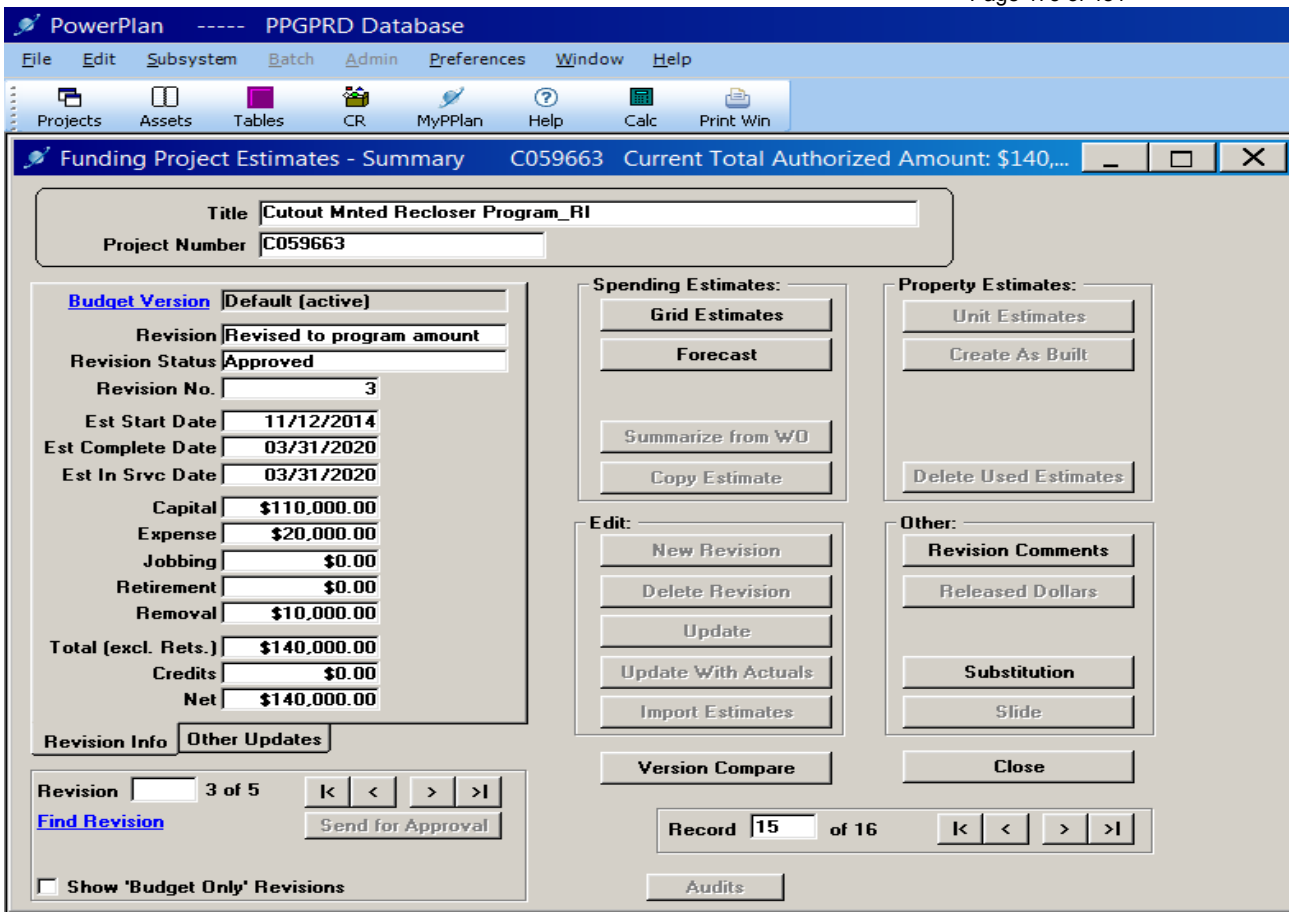
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Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C059663 Current Total Authorized Amount: $140,...
Title Cutout Mnted Recloser Program_RI
Project Number C059663
Budget Version Default (active)
Revision Revised to program amount
Revision Status Approved
Revision No. 3
Est Start Date 11/12/2014
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $110,000.00
Expense $20,000.00
Jobbing $0.00
Retirement $0.00
Removal $10,000.00
Total (excl. Rets.) $140,000.00
Credits $0.00
Net $140,000.00
Revision Info
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Revision 3 of 5
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
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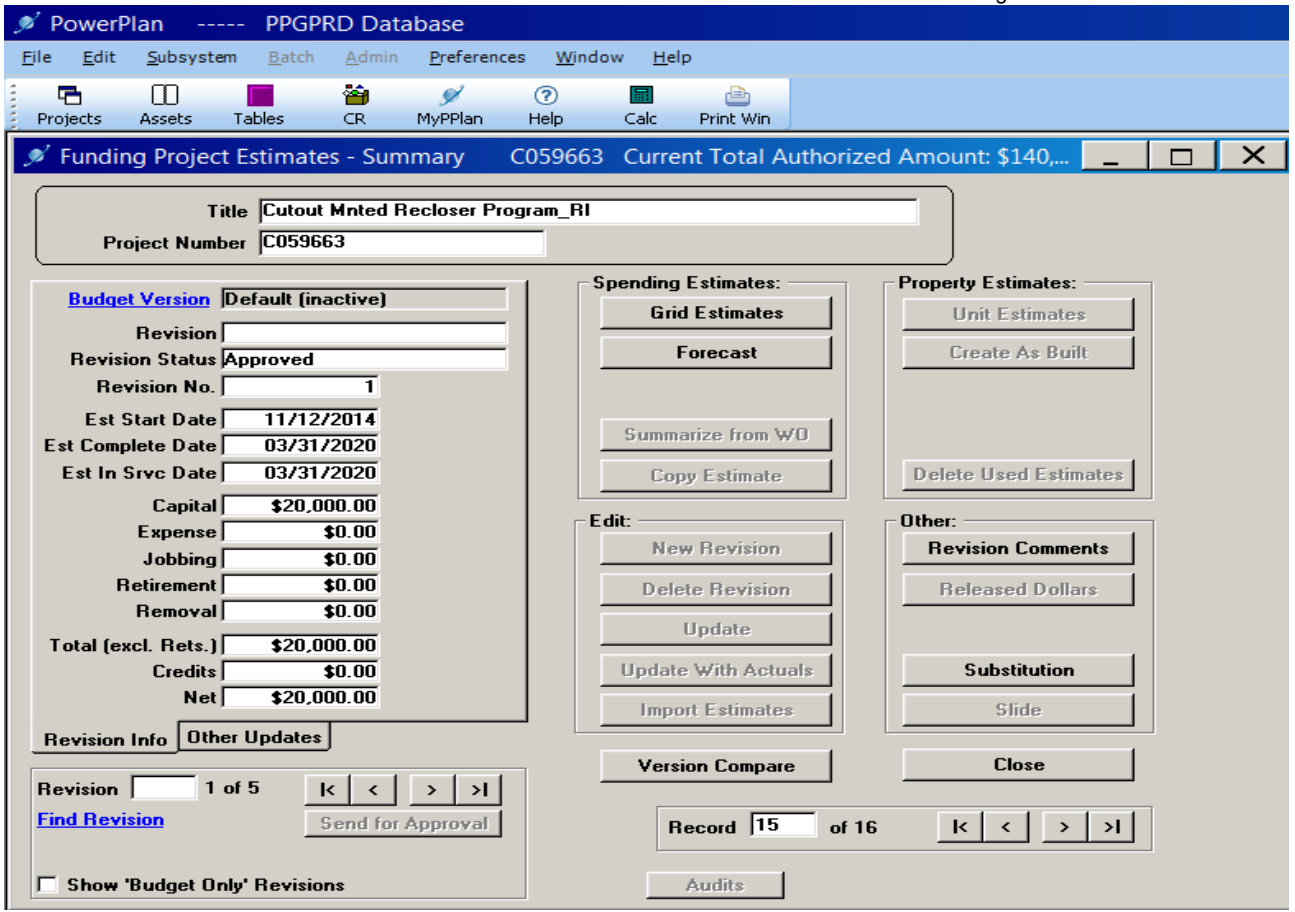
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Projects Assets Tables CR MyPPlan Help Calc Print Win
Funding Project Estimates - Summary C059663 Current Total Authorized Amount: $140,...
Title Cutout Mnted Recloser Program_RI
Project Number C059663
Budget Version Default (inactive)
Revision
Revision Status Approved
Revision No. 1
Est Start Date 11/12/2014
Est Complete Date 03/31/2020
Est In Srvc Date 03/31/2020
Capital $20,000.00
Expense $0.00
Jobbing $0.00
Retirement $0.00
Removal $0.00
Total (excl. Rets.) $20,000.00
Credits $0.00
Net $20,000.00
Revision Info
Other Updates
Revision 1 of 5
Find Revision
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Spending Estimates:
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CD01257

Distribution Secondary Network Arc

5360-Narragansett Electric and Gas
Project Revision Detail Report

Fund Project Number:	CD01257	**USSC #:**	FY17 Program
Revision:	10	**Budget Version:**	Default
Project Title:	Distribution Secondary Network Arc		
Project Description:	Install recommended engineering controls to decrease calculated incident energy levels in 480 volt spot network systems.		

Project Status:	open		
Responsible Person:	NEARY, ALEXANDER	**Initiator:**	PowerBatch,
Spending Rationale:	Asset Condition	**Funding Type:**	P Electric Distribution Line RI
Budget Class:	Safety		
Capital by Category:			
Program Code:			
Project Risk Score:	46	**Project Complexity Score:**	18

Project Schedule / Expenditures

Revision Status:	Approved		
Est Start Date:	4/1/2017	**Est Complete Date:**	3/31/2018
Est In-Service Date:	3/31/2018		
TTD Actuals:	$1,964,313	**As Of:**	10/10/2017

Cost Breakdown	Capital	Expense	Removal	Total	Credits
	$417,000	$42,000	$42,000	$501,000	$0

Justification / Risk Identification:

<Enter data here>

Project Scope:

Install recommended engineering controls to decrease calculated incident energy levels in 480 volt spot network systems, for reference see "Distribution Secondary Network Arc Flash Study" issued in February 2012 by Daniel J. Mungovan.

Project Alternatives Considered:

<Enter data here>

Additional Notes:

Changed estimate for only October 2012 through March 2013 period.

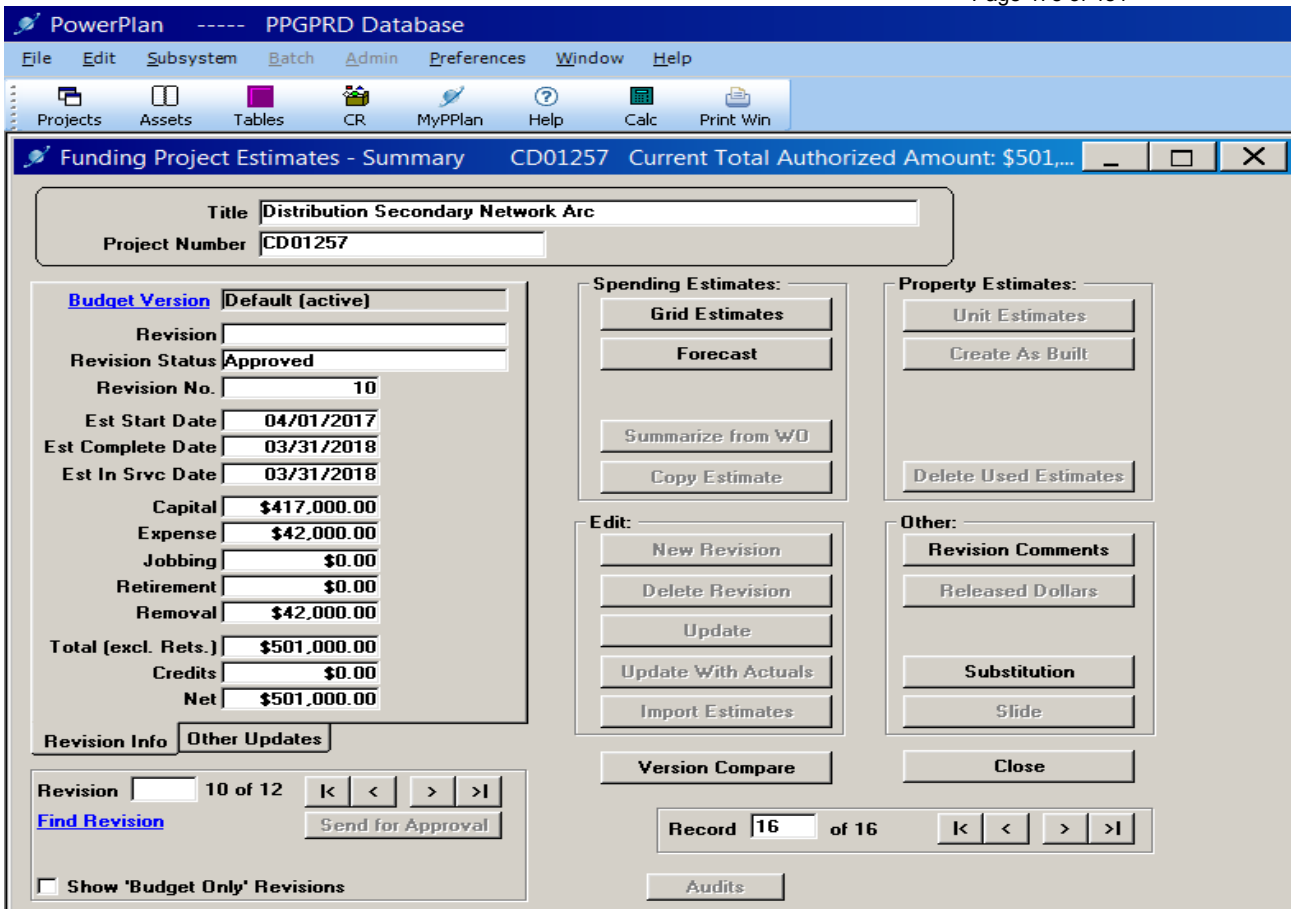
Related Projects:

Project Number: **Project Name:**

Approvals

Line 1:	**Date**	4/12/2017 13:04:30	**Approver**	labara	Approver 1
Line 2:	**Date**		**Approver**		
Line 3:	**Date**		**Approver**		
Line 4:	**Date**		**Approver**		
Line 5:	**Date**		**Approver**		

*****Project Authorization is for Approved Revision Total Estimated Cost +10%*****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Funding Project Estimates - Summary CD01257 Current Total Authorized Amount: $501,...
Title Distribution Secondary Network Arc
Project Number CD01257
Budget Version Default (active)
Revision
Revision Status Approved
Revision No. 10
Est Start Date 04/01/2017
Est Complete Date 03/31/2018
Est In Srvc Date 03/31/2018
Capital $417,000.00
Expense $42,000.00
Jobbing $0.00
Retirement $0.00
Removal $42,000.00
Total (excl. Rets.) $501,000.00
Credits $0.00
Net $501,000.00
Revision Info
Other Updates
Revision 10 of 12
Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
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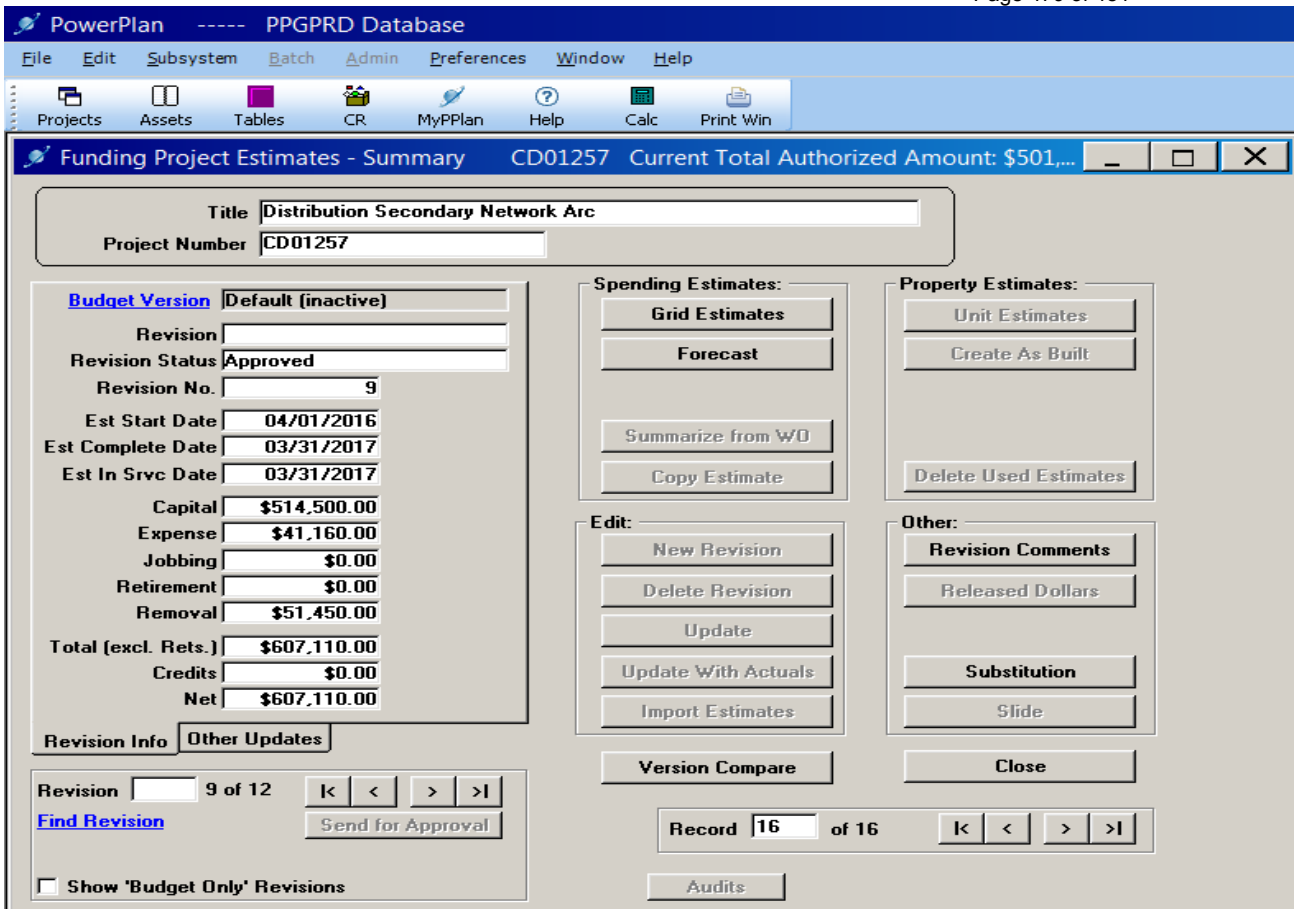
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Funding Project Estimates - Summary CD01257 Current Total Authorized Amount: $501,...
Title Distribution Secondary Network Arc
Project Number CD01257
Budget Version Default (inactive)
Revision
Revision Status Approved
Revision No. 9
Est Start Date 04/01/2016
Est Complete Date 03/31/2017
Est In Srvc Date 03/31/2017
Capital $514,500.00
Expense $41,160.00
Jobbing $0.00
Retirement $0.00
Removal $51,450.00
Total (excl. Rets.) $607,110.00
Credits $0.00
Net $607,110.00
Revision Info
Other Updates
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Find Revision
Send for Approval
Show 'Budget Only' Revisions
Spending Estimates:
Grid Estimates
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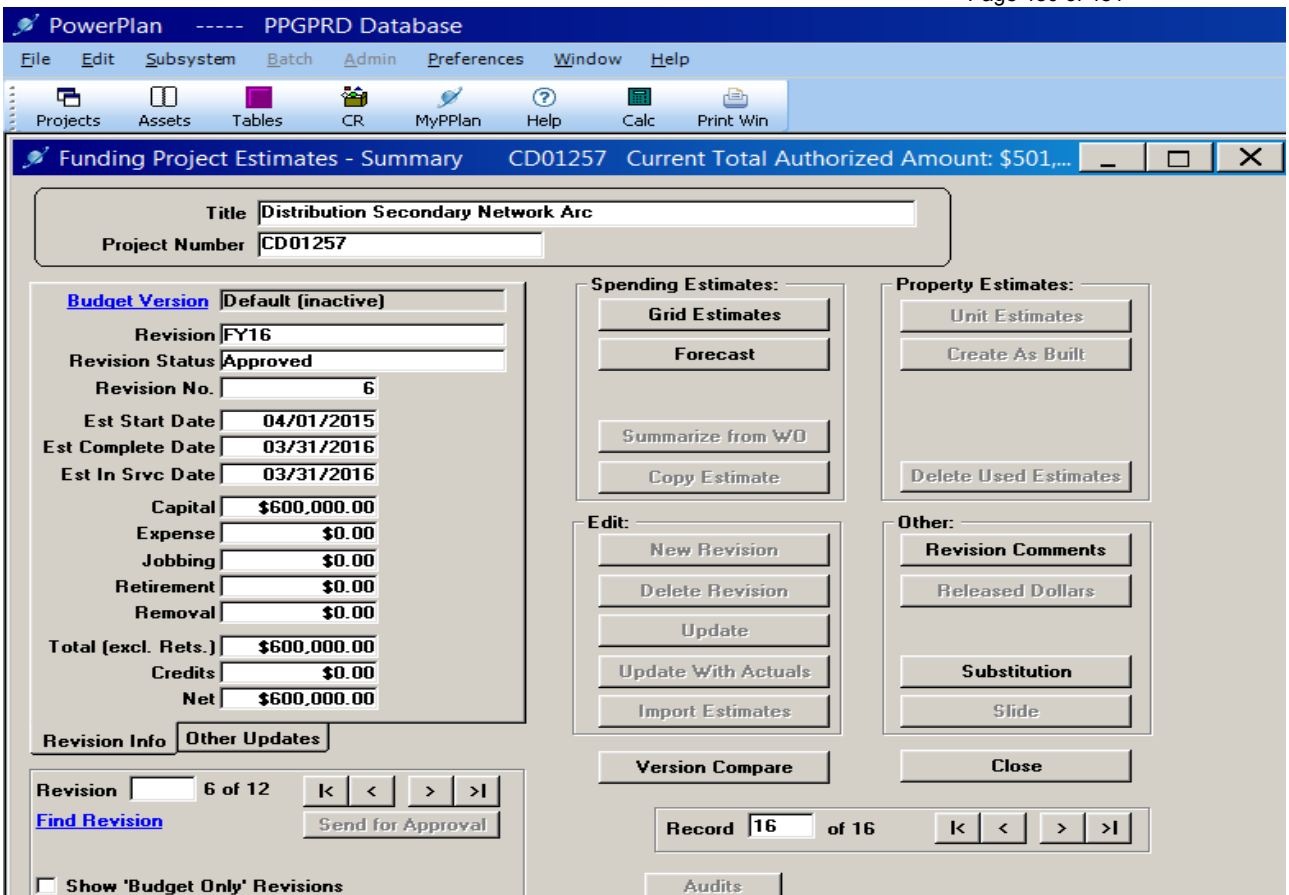
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Funding Project Estimates - Summary CD01257 Current Total Authorized Amount: $501,...
Title Distribution Secondary Network Arc
Project Number CD01257
Budget Version Default (inactive)
Revision FY16
Revision Status Approved
Revision No. 6
Est Start Date 04/01/2015
Est Complete Date 03/31/2016
Est In Srvc Date 03/31/2016
Capital $600,000.00
Expense $0.00
Jobbing $0.00
Retirement $0.00
Removal $0.00
Total (excl. Rets.) $600,000.00
Credits $0.00
Net $600,000.00
Revision Info
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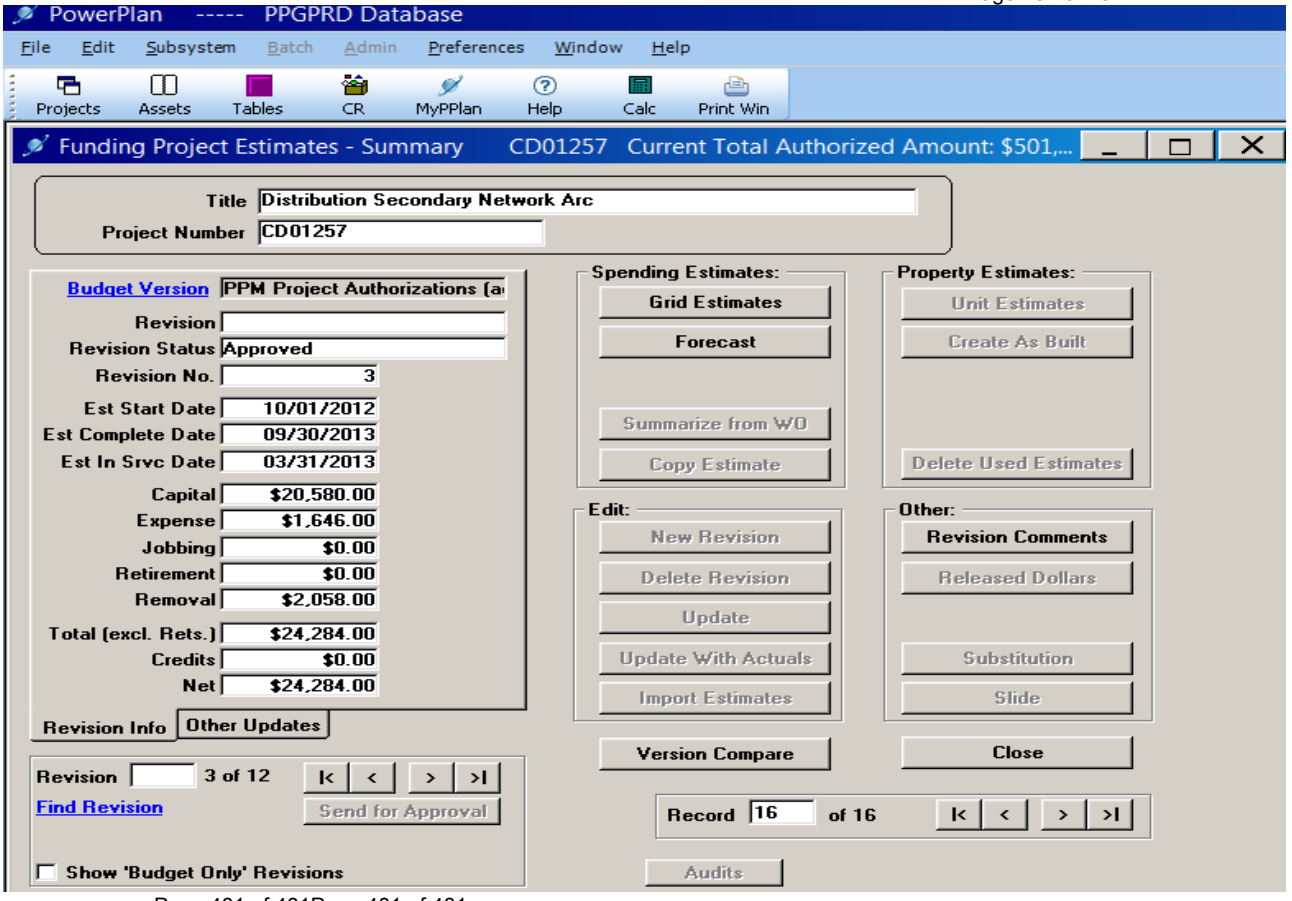
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Title Distribution Secondary Network Arc
Project Number CD01257
Budget Version PPM Project Authorizations (a
Revision
Revision Status Approved
Revision No. 3
Est Start Date 10/01/2012
Est Complete Date 09/30/2013
Est In Srvc Date 03/31/2013
Capital $20,580.00
Expense $1,646.00
Jobbing $0.00
Retirement $0.00
Removal $2,058.00
Total (excl. Rets.) $24,284.00
Credits $0.00
Net $24,284.00
Revision Info
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Revision 3 of 12
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Send for Approval
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