

PUC 1-1

Spare Transformers and Mobile Substations

Request:

- 1-1. Mr. Booth states several times that the need for a certain quantity of the replacement transformers may be driven by the loss of synergies resulting from the PPL acquisition of The Narragansett Electric Company. "The Commission may want to evaluate whether some of the spare transformer synergy lost due to the acquisition should be a transition cost absorbed by the Company and not imposed on the ratepayer." (Booth Test. at 11 of 22 and Report at page 33 of 112).
- a. Please elaborate on all of the reasons the Commission should conduct such an evaluation.
 - b. The Division supported the proposed expenditures of \$736,000 in the Substation Breakers & Reclosers Substation (spare transformers) which the Division supported for FY 2025. Please confirm that the Division has concluded that these spare transformers are not transition costs and explain why.
 - c. Which future transformer purchases has the Division questioned as being improperly categorized (ISR versus transition costs)?

Response:

- a. My reasons to evaluate whether some of the cost of the spare transformers should be borne by the Company and not the ratepayer include:
 - 1) The loss of Synergies with National Grid. Narragansett Electric had the benefit of utilization of a spare transformer fleet from other National Grid jurisdictions without ratepayer cost until a spare was called upon. This synergy was lost as a result of the acquisition.
 - 2) Narragansett Electric and the National Grid ISR Plans and Area Studies were not projecting the large number of spare transformer purchases now being projected by RIE, This may have been partly due to Narragansett Electric benefiting from the on-going synergies with the other National Grid jurisdictions.
 - 3) While the Division supports the FY 2025 ISR Plan purchase of certain spare transformers as needed for safety and reliability, the Division believes that it is appropriate to evaluate whether any cost sharing between the ratepayers and the Company is appropriate based on the expectation and requirements of the transaction Commitments made by the Company in Docket D-21-09.

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- b. The Division does support the expenditure of \$736,000 in FY 2025, of which \$540,000 is proposed by the Company to apply towards spare transformer down payment, in order to begin the process of purchasing spare transformers for safety and reliability reasons. That said, the Division has **not** concluded whether these spare transformers are or are not transition costs; the Division has not made a determination if some or all of these capital expenditures should be part of the transition cost or otherwise borne by the Company. The ISR Plan need was established and concurred with by the Division from a purely safety and reliability perspective.
- c. The Division has not completed its review process of the Long-Range Plan and the Company's proposed and projected total spare transformer purchases. The Division does find the Company's methodology to establish the quantity of needed spares throughout the Long-Range Plan may result in an excessive quantity of spare transformers. At issue is whether any of the cost of spare transformers should be considered a transition cost that should not be recovered from ratepayers, or alternatively, whether with the acquisition completed, these spare transformers are simply a cost that naturally flows through the ISR Plan because of the need. Ultimately, the Company bears the burden of demonstrating that the need for transformers (or portions thereof) does not directly derive from PPL's acquisition of Narragansett Electric from National Grid. The Company must stand by its commitment to hold ratepayers harmless.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-2

Spare Transformers and Mobile Substations

Request:

- 1.2. Mr. Booth states, "Similar to spare transformers, the Company had access to multiple mobile substations under National Grid ownership. The Company lost the ability to leverage a significant level of compatible spare inventory after the PPL acquisition. RIE now relies on a mobile lease agreement with National Grid.... For the current FY 2025 ISR Plan, however, the Division concurred with the proposed \$1.3 budget to proceed with mobile substation purchases. The Division will also review whether some of the cost of spare equipment should be considered transition costs borne by PPL.
- a. The Division supported the proposed \$1.3 million budget for the mobile substation purchases in FY 2025. Please confirm that the Division has concluded that these mobile substations are not transition costs and explain why.
 - b. When will the Division conduct the review into whether some of the cost of spare equipment should be considered transition costs borne by PPL?

Response:

- a. The Division has not determined if the mobile substation capital cost would be borne in whole or in part by the Company as a transition cost. Similar to the spare transformer issue, the mobile substation is needed for reliability and safety, but may not have been required under National Grid ownership in the FY 2025 ISR Plan.
- b. The Division's review of the Company's FY 2025 planning and budget, presently underway in this and parallel dockets, are all important steps in helping inform the ultimate determination of what expenses must be borne by the Company as part of its Commitments during the transaction.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-3

Spare Transformers and Mobile Substations

Request:

- 1.3. Is it Mr. Booth's position that under National Grid ownership, The Narragansett Electric Company strategy was a "portfolio" approach (spare transformers, mobile substations, affiliate agreements, etc.)? Please explain.

Response:

It is Mr. Booth's position that under National Grid, Narragansett Electric Company's strategy was a "portfolio" approach. This means that all of the jurisdictions of National Grid required spare transformers and mobiles and, as such, Narragansett Electric Company enjoyed significant benefits of the synergies through lower capital costs in spare transformers and mobile substations while having those from the other jurisdictions available in an emergency. The Company also benefited by the proximity of other National Grid jurisdictions and the fact that operating voltages were comparable, so that a portfolio of spare transformers and mobile substations could be efficiently leveraged across all service territories. Under PPL ownership, the Company notes that "there are voltage differences between the operating companies which makes it difficult to adopt a common spare transformer strategy" and that an initial review "did not indicate much commonality between the transformer assets located in either operating company." (DIV 2-3) The Company also confirms that a reason for mobile substation purchases are "logistical challenges with using mobiles stored in Pennsylvania and Kentucky, and the reduction in compatible mobile substations throughout the PPL operating system." (DIV 2-35) These are clear indicators that the PPL acquisition eliminated Narragansett Electric Company's access to a portfolio of spare equipment and that the Company's proposal to replace that inventory, in part or in whole, would not have been required under National Grid ownership.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-4

Spare Transformers and Mobile Substations

Request:

- 1.4. Please provide a schedule that includes a line for each spare transformer the company proposes to purchase through FY 2031. Please also identify the amount of capital spending by fiscal year through FY 2031 for each transformer. The total of all the capital spending in the schedule should equal the approximate \$40 million total proposed transformer spending in the long-range plan (see Bates 149 of Book 1). If the totals don't match, please reconcile. Please include totals, row numbers and column letters where appropriate.

Response:

The PUC withdrew this question to the Division because it was intended for the Company.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-5

Reclosers (CEMI-4; ERR; DARP)

Request:

- 1.5. Mr. Booth also raises concerns about the CEMI-4 program target and goal. Specifically, he states that “RI Energy’s methodology drives higher annual spend to meet an arbitrary target” resulting in potential unnecessary investment for trying to achieve “blue-sky” results for “dark-sky” conditions. (Booth Report at 68).
- a. What benefits has the Company demonstrated under the 2024 CEMI-4 program to justify doubling it in year 2?
 - b. Mr. Booth states that refinement of targets and goals “will be an iterative and evolutionary process which will be evaluated and adjusted as the program matures.” Was there an iterative and evolutionary process that took place during year one? If so, please describe?

Response:

- a. The Company has expended \$1.1 million on 2024 CEMI-4 program work and plans to spend to the budget of \$1.2 million (FY 2024 ISR Plan Q3 report, page 6). Once the work is complete, the Company should be reporting on reliability performance in the first year following implementation and continue from that point forward. This allows some reasonable amount of time to progress in order to assess program benefits. Therefore, the FY 2024 CEMI-4 program results were not relied upon to justify the FY 2025 program, but continuation was premised on the reasonableness of addressing extremely poor performing sections of the system where customers experience multiple outages each year. Concurrence was reached on the FY 2025 CEMI-4 budget of \$2.6 million and this proposed spend includes nearly \$900,000 for mainline reclosers which is a significant driver of the overall increase. The FY 2025 budget was reduced by nearly \$2.6 million for additional Advanced Reclosers (FLISR) initially proposed by the Company.
- b. The statement is intended to describe the future process once projects have been completed and some reasonable amount of time has elapsed in order to assess reliability improvements and ultimately determine program cost-effectiveness. Another consideration is the point of diminishing benefits as future circuit level performance improves across the system thereby reducing the need for improvements. The evaluation is expected to consider optimizing and streamlining all programs that address poorly performing feeders including CEMI-4, ERR and DARP.

PUC 1-6

Reclosers (CEMI-4; ERR; DARP)

Request:

- 1.6. Mr. Booth explained that “ERR is essentially an enhancement of select feeder reliability work previously performed under the discretionary Distribution Blanket.” (Booth report at 72 of 112)
- a. What is the reason for removing it from the blanket and creating a new program line item?
 - b. Were any reductions made to the Distribution Blanket as a result of the new budget item? If so, what were they? If not, why not?

Response:

- a. The Company did not provide a specific reason but has articulated a new focus on programmatic approaches to address poorly performing areas of the system.
- b. During discussions with the Company, the Division did observe that reductions to the Distribution Blanket to account for budget dollars moving to the ERR program would be a reasonable area for adjustment, but the Company did not propose any reductions to the Distribution Blanket. The Division accepted the Company's proposed Distribution Blanket budget based on the understanding it is for small projects (typically \$100,000 or less) which unexpectedly arise during the year. Additionally, with the ERR program it is expected the fiscal year spending in this category will be under budget. The Division and Company will continue the quarterly updates on the ISR Plan progress, and this category will be monitored.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-7

Reclosers (CEMI-4; ERR; DARP)

Request:

- 1.7. The Division and Commission both issued several data requests to understand the need for a CEMI-4 program and an ERR program. What is the Division's position as to why there needs to be two separate programs?

Response:

While the programs have similar objectives for targeted reliability improvements, the CEMI-4 program has a discrete goal to drive performance to EEI first quartile level while ERR is an ongoing effort to address the top 5% worst performing feeders. The programs rely on differing criteria for circuit selection. The Division has accepted the Company's approach for two separate programs in this initial phase due to the varying objectives and selection criteria. However, given the Company's recent CEMI results and as indicated in Mr. Booth's report (page 72), the CEMI-4 performance can very well be addressed as needed under the ERR program under a single program. The Division's future evaluation is expected to consider optimizing and streamlining all programs that address poorly performing feeders including CEMI-4, ERR and DARP. The Division expects the expansion of feeder engineering analysis and associated memorandum detailing the needs and most cost-effective solutions including sectionalizing equipment application. This expansion of the analysis and documentation process should allow for future consolidation of the protective coordination and system sectionalizing programs intended to achieve enhanced feeder reliability.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-8

Reclosers (CEMI-4; ERR; DARP)

Request:

- 1.8. In the DARP, CEMI-4, and ERR programs, Mr. Booth raises a lot of the same concerns he raised during the FY 2024 review. However, he says that the compromise that the Division will support funding of the programs if there is a 60-day preconstruction report will satisfy his concerns.
- a. Please review RI Energy's response to PUC 3-31. Does Mr. Booth agree completely with their answer? If not, please explain.
 - b. Please provide a copy of the February 1, 2024 report discussed in RI Energy's response to PUC 3-31 (or any such report received to date).
 - c. If there has been a 60-day report, please describe the Division's review process to date.
 - d. The Company has indicated in PUC 3-31 that "this memo includes information such as mainline interruption history, existing and proposed circuit configurations with one-lines, recloser placements, consideration of lowest cost solution development and forecasted reliability improvements." How is this information going to address Mr. Booth's stated concern that the Company "fail[s] to account for circuit characteristics, outage causes, and other initiatives to improve reliability." (Booth Report at 82).

Response:

- a. Mr. Booth and the Division do not agree with all aspects of the RIE answer to PUC 3-31. There are still negotiations taking place to reach an agreement on the memorandum contents. The Company has provided an updated memorandum, and the Division has provided comments back to the Company requesting additional information be included. The Division and Company conferenced again on March 1, 2024 and the Company has put forth one additional enhanced memorandum. RIE's response to PUC 3-31 suggests that all the Company needs to do is deliver the memorandum to advance its improvements and, in particular, add reclosers with FLISR schemes on the circuits with a CKAIFI of 2.0 or greater with no further approval process envisioned. This is not Mr. Booth's or the Division's understanding. Initially, it is expected that RIE will deliver a circuit improvement and recloser justification memorandum with a level of detail that is satisfactory to the Division. The first four memoranda produced by RIE

PUC 1-8, Page 2

have not met that expectation and discussions with the Company are ongoing. Some areas of focus include the absence of supporting reliability data, variations in the criteria used to identify targeted circuits compared to criteria used to derive solutions and estimate benefits, and the failure to comprehensively outline and consider alternatives. Once agreement is reached on structure and contents, the Division expects that future memorandum will be reviewed and discussed with RIE, and that the Division’s concurrence with RIE’s proposed circuit improvements and recloser additions will be reached prior to RIE progressing work. To reinforce the need for this process, the Division observes that of the four memoranda presented by the Company to date (provided in 1.8.c), three circuits have solutions that deviate from what was initially proposed in the FY 2025 ISR Plan (summarized below).

Summary of RIE Recloser Justification Memos (received as of 2-27-24)

Memo Date	Circuit		CKAIFI	Initial Proposed Recloser by Type		Initial Total Proposed Reclosers	Memo Proposed Reclosers by Type		Memo Total Proposed Reclosers
				Mainline	Tie (FLISR)		Mainline	Tie (FLISR)	
2/6/2024	53-126W50	WASHINGTON	4.2	0	3	3	3	2	5
2/12/2024	53-127W41	NASONVILLE	3.2	1	1	2	1	1	2
2/14/2024	56-155F2	CHASE HILL	2.9	3	0	3	3	1	4
2/9/2024	53-21F1	WEST CRANSTON*	1.7	3	0	3	0	3	3
Total Proposed Redosers				7	4	11	7	7	14

* Proposal is outside of conditions agreed upon by Division and RIE

Two of the memoranda address poor performing circuits (known as ERR circuits) but include no improvements beyond recloser additions which does not appear to be a comprehensive assessment. In addition, RIE put forth proposed Advanced Reclosers with FLISR on a circuit with reliability that is well below the agreed upon threshold (West Cranston with a CKAIFI of 1.65 which is below the 2.0 threshold) which would be unacceptable under the Division’s conditions. The Division believes the final step requiring Division concurrence with the Company’s recommended improvements and recloser additions are necessary to maintain the integrity of the agreement between the Division and RIE, and specifically adhere to the limitation placed on additional Advanced Reclosers with FLSIR schemes. The process and details have certainly not yet been resolved between the Division and RIE.

- b. Attached are proposed memorandum received to date (please see Attachment 1-8-1). In addition, attached is a section of the ISR Plan Attachment A which is marked to show the circuits and estimated 88 reclosers to be installed (please see Attachment 1-8-2).

PUC 1-8, Page 3

- c. Mr. Booth and the Division have communicated to the Company the additional information desired in the memorandums for each feeder. This additional information will further address the concerns. Additionally, the future performance of these feeders after enhancements will assist in guiding future work and the analysis of the true reliability benefits resulting from the addition of circuit reclosers and FLISR schemes. Mr. Booth and the Division are comfortable that these worst performing circuits will see a positive benefit and that the RIE specific reliability performance on these circuits will replace the current speculation of benefits. These statistics on the actual level of benefit will better guide the future applications and expected benefits and should result in more accurate benefit cost analysis.
- d. The Division and the Company have held multiple conferences so as to establish individual feeder analysis details to be delivered to the Division 60 days prior to advancement of recloser solutions. The last conference was on March 1, 2024. Subsequent to that conference, the Company delivered an enhancement to the memorandum based on the conference. The Division and Company have also agreed on further reliability documentation that will be provided 60 days in advance of project work. In addition, the Company and Division have agreed on working to develop a comprehensive post implementation assessment in order to measure the benefits of the recloser additions including blue sky and storm reliability improvements. Mr. Booth finds this added documentation will address his existing concerns and establish a benchmark moving forward for a continued enhancement to the recloser addition process.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-9

Reclosers (CEMI-4; ERR; DARP)

Request:

- 1.9. Discussing Coventry Circuit 56-54F1, Mr. Booth notes it is scheduled for DARP recloser investment, presumably to incorporate a FLISR scheme, but that it was also in the CEMI-4 program in FY 2024. He concludes, "The Company has made investments to improve reliability but has not considered the outcome before planning additional recloser investments. There are seven existing mainline reclosers on that circuit with 336 customers per line section which is well below RI Energy's target."
- a. Please explain what protocols are currently in place to effectively address this concern.
 - b. Does the Division believe the 60-day reviews are sufficient to avoid such alleged overinvestment? Please explain.

Response:

- a. The Company and Division have agreed on an analysis process and protocol and delivery of a memorandum to summarize the Company's analysis which we find an acceptable manner to address our concerns at this time. The detailed circuit analysis paired with an overall annual budget cap on Advanced Reclosers (FLISR) are designed to resolve the Division's concerns. The tracking of the reliability performance enhancements achieved versus those projected to be achieved will further assist in future assessments and circuit recloser additions for system reliability improvement.

The process of careful analysis of each circuit for needed reliability improvements and the delivery of a comprehensive memorandum documenting that analysis and the projected future benefits is an excellent way to mitigate future overinvestments. There is no perfect way to mitigate potential overinvestment since the engineering and benefit analysis is based on historical data, best engineering judgment and prediction of the future. We are confident that this is a more than satisfactory way to avoid future overinvestment while capturing needed statistics to enhance future decision making. This is not the system-wide protective coordination study Mr. Booth prefers, however, it is a very close approximation for a portion of the system currently being addressed. Furthermore, since the circuits selected are some of the poorest performing circuits, the reliability improvements and benefits are reasonably expected to be the best selections to outweigh the cost.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-10

Reclosers (CEMI-4; ERR; DARP)

Request:

1.10. What was the reason the Division agreed to a specific number of reclosers instead of an overall budget?

Response:

The overarching principle for ISR Plans and Area Studies is to develop a plan to meet specific needs which then results in a budget balanced against affordability. It has never been considered appropriate to develop a budget and then fit a plan to the budget since that can most often result in overspending and capital investment not driven by a specific need and benefit. The Division agreed that the Company could pursue recloser installations on worst performing circuits, which then dictated the estimated number of reclosers and the associated budget. Specifically, the Division and RIE mutually agreed that reclosers with FLISR schemes could be considered on circuits with CKAIFI of 2.0 or greater. This would ensure that the Company targeted worst performing feeders rather than providing an overall budget that, under the Company's sole discretion, could potentially lead to recloser installations on reasonably or well performing circuits. The Company's *Attachment A – Preliminary Prioritization List – Circuits with Frequency > 1.05* (Bates page 138 of Book 1) was used to identify the circuits which are the top 23 worst performing circuits. The far right column was relied upon to determine the number of proposed reclosers, or 88 reclosers. This list has been provided in the Division's response to PUC 1-8 (see Att 1-8 No. 2-88 Reclosers). Of these, the Company confirmed that 15 reclosers were designated for mainline installations and the remaining 73 reclosers were proposed for FLISR scheme installations under DARP. At a budget of \$81,600 per recloser, the total budget of \$5.957 million was derived.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-11

Reclosers (CEMI-4; ERR; DARP)

Request:

1.11. Is the budget cap intended to drive the number of reclosers/candidate circuits or is the number of reclosures/candidate circuits driving the budget cap? Please explain.

Response:

The number of candidate circuits drives the number of estimated recloser additions and thus the budget. See also DIV 1-10 response.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-12

Electromechanical Relay Upgrades

Request:

- 1.12. In his Report on page 49 of 112, Mr. Booth stated “In FY 2024, RIE introduced this work as foundational grid modernization infrastructure which was not approved in the ISR Plan. At that time, I observed that this infrastructure is customarily installed as part of a utility’s normal course of business and not considered grid modernization. Digital relays are simply the next iteration of technology available to electric utilities for power line fault detection and protection. The Company has been systematically replacing relays on its system and this initiative continues those efforts. I fully support relay upgrades and the Company’s FY 2025 budget of \$1.2 million for work at four substations.”
- a. What need did Mr. Booth identify to justify the creation of a new programmatic line item for something that was previously done in the normal course of business?
 - b. Why shouldn’t this replacement be in asset condition rather than separately funded?

Response:

- a. The Division wants the Company to track its progress of electromechanical relay replacements, particularly since the historical progress was not as significant as anticipated. The newer solid-state relays provide significant protective coordination flexibility which can enhance reliability and power line protection. Due to its advanced functionality, there are some cases that a solid-state relay may be able to avoid the installation of additional line equipment such as reclosers. The Division supports a separate program to explicitly monitor the progress and ensure that functionality is optimized.
- b. The electromechanical relays are being tested and maintained in proper working condition therefore they are not equipment with a condition subject to near term failure. The relay replacement is an upgrade and natural progression of technology and not necessarily driven by condition. For example, prior to the South Street Substation replacement, it contained electromechanical relays which were fifty to eighty years old or older that were operating satisfactorily and were still being tested and maintained in a satisfactory manner.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-13

Reliability

Request:

- 1.13. Does the Division consider customer satisfaction surveys to be a reliable and objective measure of system safety and reliability? Please explain.

Response:

The Division does not find customer satisfaction surveys to be a meaningful measure of system reliability. These surveys and the associated answers are both subjective and can be driven in a particular direction by the question itself. Reliability statistics are the appropriate measure of reliability. These factual statistics can then be compared to various known acceptable statistics to reach a conclusion on satisfactory reliability. Different utilities may have much different reliability and yet both be considered good or excellent by the customers. There are many items which drive customer satisfaction, not the least of which is the level of customer response. If the preponderance of customers responding to a survey are those which are dissatisfied for some reason, the survey becomes distorted and does not necessarily reflect the real system performance satisfaction level to all customers. Additionally, making capital investments based on a survey without a clear definition of the level of increased rate a customer is willing to pay for improvement leaves out an important measurement.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-14

Misc.

Request:

1.14. Referencing footnote 8 in Mr. Booth's report (page 17 of 112), at what point does a program become a "legacy" program?

Response:

For the purposes of the ISR Plan evaluation, a program would generally be considered a "legacy" program if it were previously introduced in the ISR Plan and adequately justified to continue on an annual basis. That point depends on when the Division is satisfied that a system need exists and that the program is fully justified which may require more than one year of implementation in order to collect actual data. As the legacy program is proposed in future years, the need for the program would not require re-evaluation on an annual basis but the planned work within that program would be assessed. This assessment considers, among other items, how the work aligns with the program objective, project prioritization, and proposed budget levels.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-15

Misc.

Request:

- 1.15. Where RI Energy has multi-year spend in most programs, how does the Division determine if a program that is approved in FY 2025 becomes a recurring program or is subject to a year over year review as if it is a new proposal?

Response:

Every program in an ISR Plan is subject to year over year review. As described in response to PUC 1-14, the evaluation will be more comprehensive for new and recently introduced programs as opposed to mature programs that have been implemented over many Plan years.

Prepared by or under the supervision of: Gregory L. Booth, PE

PUC 1-16

Misc.

Request:

1.16. What does Mr. Booth mean by the term “regional projects” “regional work” (Booth Report at 9 of 112; 16 of 112; 22 of 112; 24 of 112, etc).

Response:

The term “regional projects” or “regional work” refers to projects within the distinct geographical and electrical boundaries the Company created to study its system, which resulted in eleven regional studies, or Area Studies.

Prepared by or under the supervision of: Gregory L. Booth, PE



Memorandum

To: Eric Wiesner / Ryan Constable
From: Mark Fraser
Date: February 9, 2024
Subject: Recloser Justification – West Cranston Substation, Circuit 21F1

EXECUTIVE SUMMARY

This memo documents the placements of three tie reclosers on the West Cranston substation circuit 21F1 under the FY25 Engineering Reliability Review program (ERR). The circuit was included in the program because of its poor five-year reliability performance.

Reliability improvements are estimated on the circuit's five-year main line interruption history and includes major storm events. Placements of reclosers are expected to reduce circuit frequency (CKAIFI) by 1.074 and circuit duration (CKAIDI) by 111.7 minutes. The estimated cost of the recommendations is \$249,000.

RECLOSER PROIRITY SCORE

Table One Illustrates physical configuration and reliability statistics used to prioritize recloser placements: Table Information includes: Circuit Length, Sectionalization, Reliability History, Distributed Generation Penetration, Existing Reclosers and Priority Score.

District	Region	Study Area	Brkr Tax District Name	Substation Name	Fdr	Construction Class	Voltage	Total OH 3ph Miles	Line Exposure Rank	Cs	# of Customers / Line Section
53	Capital	NC	Cranston	WEST CRANSTON	53-21F1	OH	12.47 kV	9.4	261	2,609	522

5 yr Average CKAIFI	5 yr Average CKAIDI (Min)*	Circuit CKAIDI Rank	# yrs on CEMI 4 list	ERR Program Fiscal Year	DG Totals (KW)	Priority Score	Proposed Open Reclosers	Proposed Mainline Reclosers	Total Proposed Reclosers
1.65	139	304	5	FY25	15,174	252	2	1	3

* Note: Through detailed analysis of the circuit, three tie reclosers were more appropriate. No additional mainline reclosers were necessary.

PENDING WORK

There are no capital investments planned for this circuit in the FY25 Budget

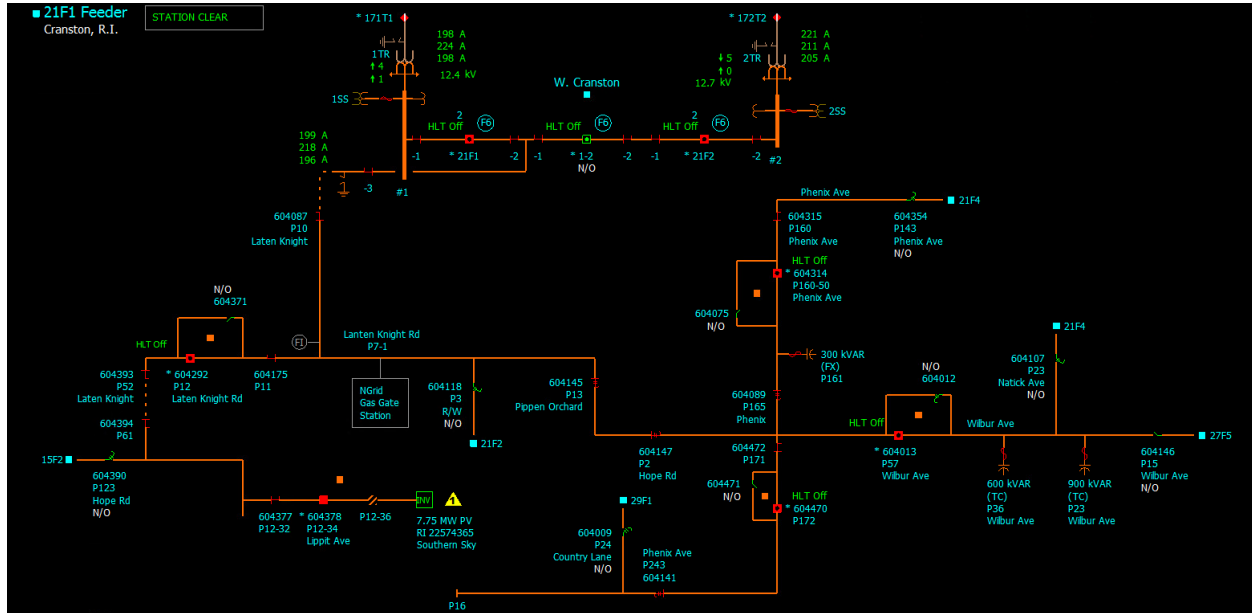
MAIN LINE OUTAGE HISTORY

Main Line interruptions on the 21F1 circuit from October of 2018 through September of 2023 were reviewed to determine recloser placements. These dates were chosen to be consistent with the ERR Program analysis. The circuit's annual CKAIFI for these main line events was 1.55 during the study period.

Five Year Main Line IDS Event History, Including Major Storms						
Events	Customer Served	Estimated CI Customers Interrupted	Estimated CMI	Annual CKAIFI	Annual CKAIDI min	CAIDI min
8	2,609	20,203	5,125,619	1.55	393	254

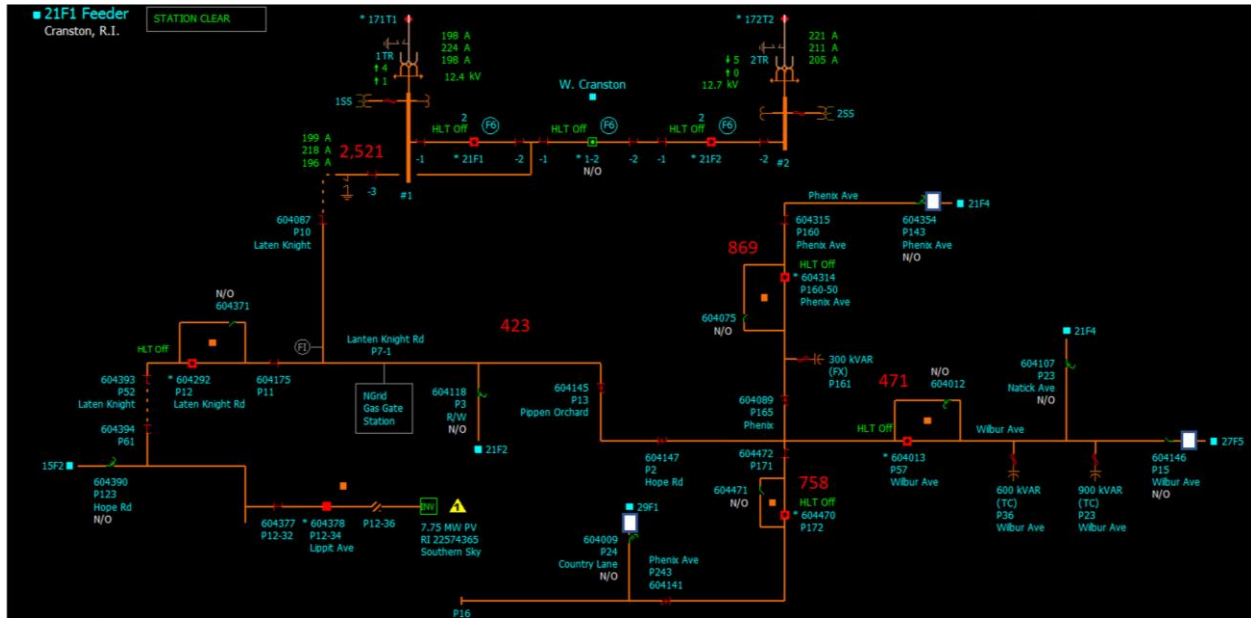
Event ID	Date	Cause	Class	Protective Device Type	Event Total Customers Interrupted	Event Total Customer Minutes Interrupted	Estimate Event CAIDI (Minutes)	Comment
8201234	10/23/2018	Construction by Company	Main Line	Station breaker	2,459	159,835	65	Cable fault during riser construction along main line.
8202482	11/2/2018	Tree Fell	Main Line	Station breaker	2,461	63,986	26	Manually open breaker to remove tree from line.
8271546	12/18/2019	Equipment	Main Line	Station breaker	2,480	129,310	52	21F1 feeder locked out at West Cranston Sub due to failed getaway cable terminator'
8319183	6/22/2020	Unknown	Main Line	Station breaker	2,532	186,984	74	Trip and reclose of breaker. Found line down near P14 Phippen St. Manually opened breaker.
8332140	8/4/2020	Major Storm - Tree	Main Line	Station breaker	2,532	3,402,962	1,344	21F1 feeder lockout at West Cranston Sub. Multiple tree and wire down issues.
8343901	9/30/2020	Major Storm - Tree	Main Line	Station breaker	2,541	982,612	387	21F1 feeder lockout at West Cranston Sub. Tree on primaries P10 Hope Rd.
8396502	7/28/2021	Tree - Broken Limb	Main Line	Station breaker	2,574	79,794	31	Opened breaker for emergency repairs. Large tree limb on primary between P10 and P9 Hope Rd
8659714	7/10/2023	Vehicle	Main Line	Station breaker	2,624	120,136	46	West Cranston 21F1 Lockout. MVA P12 Phippen Orchard Rd, Cranston.

EXISTING EMS ONE-LINE



Line Segment	From Node	To Node	Segment Main Line Length	Segment Customer Count	Customers Interrupted per Event	Outages	Total CI	Cause
A	Substation	to P172 Phenix Ave.	1.6 miles	423	2,609	8	20,872	2 Major Storm
		to P57 Wilbur Ave.						2 Tree
		to P160-50 Phenix Ave.						1 Construction
B	P172 Phenix Ave.	to P24 County Lane	1.7 miles	758	758			1 Unknown
C	P57 Wilbur Ave.	to P15 Wilbur Ave.	.9 miles	471	471			1 Equipment
D	P160-50 Phenix Ave.	to P143 Phenix Ave.	1.4 miles	869	869			1 Vehicle

PROPOSED EMS ONE-LINE



Recloser #	Location	Function	Notes
1	P24 County Lane, Cranston	Tie Switch	Tie has adequate capacity. No additional construction will be required. Location reviewed with Operations.
2	P15 Wilbur Ave., Cranston	Tie Switch	Tie has adequate capacity. No additional construction will be required. Location reviewed with Operations.
3	P143 Phenix Ave., Cranston	Tie Switch	Tie has adequate capacity. No additional construction will be required. Location reviewed with Operations.

PROPOSED CIRCUIT CONFIGURATION

The table below identifies the number of customers that would have seen an outage from October of 2018 through September of 2023 if the proposed mainline and tie reclosers were installed. It is assumed that all mainline reclosers operate successfully and the tie reclosers close within 5 minutes of the initial outage.

West Cranston 21F1 Existing Line Segments.									
Line Segment	From Node		To Node	Segment Main Line Length	Segment Customer Count	Customers Interrupted per Event	Outages	Total CI	Cause
A	Substation	to	P172 Phenix Ave.	1.6 miles	423	423	8	3,384	2 Major Storm 2 Tree 1 Construction 1 Unknown 1 Equipment 1 Vehicle
		to	P57 Wilbur Ave						
		to	P160-50 Phenix Ave.						
B	P172 Phenix Ave.	to	P24 County Lane	1.7 miles	758	758			
C	P57 Wilbur Ave.	to	P15 Wilbur Ave.	.9 miles	471	471			
D	P160-50 Phenix Ave	to	P143 Phenix Ave.	1.4 miles	869	869			

RELIABILITY IMPROVEMENT

The estimated reliability improvement was determined by recalculating the CI and CMI of the 8 main line events as if the proposed configuration was in place. For purposes of estimating the reliability benefits, IDS mainline events were adjusted in the following ways:

- Customer interruption totals were adjusted to reflect the customer served number when the event interrupted more than one circuit.
- Line sections with tie reclosers were assumed to be restored within five minutes of the initial outage.
- Unhealthy line sections were assigned a restoration time equal to the event CAIDI.
- The CI counts for Major Storm Interruptions were reduced by 50 % of the original events. This is done to recognize that some automated switching schemes may not be available during a TMED day when 10 % to 20 % of the RIE's customer base is without service.

The following chart illustrates the annual CKAIFI and CKAIDI over the previous five years of main line events, the estimated reliability if the proposed reclosers were in place and the estimated savings.

Annual Reliability Statistics - Main Line Interruptions including Major Storms			
Matrix	Actual Results	Estimated Results w/ Reclosers	Estimated Savings
CKAIFI	1.55	.476	1.074
CKAIDI (Min)	393	271.3	111.7

CIRCUIT MODIFICATIONS

There are no reconductoring projects planned to support the circuit's tie reclosers. The main line ties have adequate capacity to serve load from their assigned line sections.

OTHER CONSIDERATIONS

Another consideration to improving the circuit reliability is to construct 1.6 miles of spacer cable in place of the existing bare wire on crossarm construction in section A. The benefit of these tie reclosers is directly related to outages in line segment A. These faults all resulted in the 21F1 circuit breaker opening dropping all the customers on the feeder. The location of the tie switches will allow for line segments B, C, and D to be restored quickly from the control center.

There were eight outages in segment A. They were the result of major storms (2), tree contact (2), a fault during construction, an unknown cause, a motor vehicle accident, and an equipment failure. There is no one alternative solution to address all the outage causes. Upgrading the 1.6 miles of primary to spacer cable would likely have reduced the number of outages by as much as 50%.

High Level Estimated Cost: \$1.8 M.



Memorandum

To: Eric Wiesner / Ryan Constable
From: Mark Fraser
Date: February 6, 2024
Subject: Recloser Justification – Washington Substation, Circuit 126W50

EXECUTIVE SUMMARY

This memo documents the placements of three main line reclosers and two tie reclosers on Washington Substation circuit 126W50 under the FY25 Distribution Automation Recloser program (DARP). The circuit was included in the program because its five-year regulatory circuit Frequency Index (CKAIFI) was greater than 2.0.

Reliability improvements are estimated on the circuit's five-year main line interruption history and includes major storm events. Placements of reclosers are expected to reduce circuit frequency (CKAIFI) by 3.417 and circuit duration (CKAIDI) by 488.4 minutes. The estimated cost of the recommendations is \$ 415,000.

RECLOSER PROIRITY SCORE

The following table illustrates the circuit's length, reliability history, and amount of distributed generation that made up the circuit's recloser priority score. This information was used to determine which circuits would be included in the FY25 DARP program and was previously presented by RIE in Attachment A of the Proposed FY25 ISR filing.

District	Region	Study Area	Brkr Tax District Name	Substation Name	Fdr	Construction Class	Voltage	Total OH 3ph Miles	Line Exposure Rank	Cs	# of Customers / Line Section
53	Capital	BSVS	Lincoln	WASHINGTON	53-126W50	Mixed	13.8 kV	11.0	289	1608	402

5 yr Average CKAIFI	5 yr Average CKAIDI (Min)*	Circuit CKAIDI Rank	# yrs on CEMI 4 list	ERR Program Fiscal Year	DG Totals (KW)	Priority Score	Proposed Open Reclosers	Proposed Mainline Reclosers	Total Proposed Reclosers
4.15	248	330	5		749	259	3	0	3

*Detailed circuit analysis revealed the opportunity for two additional tie reclosers.

PENDING WORK

There are no capital investments planned for this circuit in the FY25 Budget.

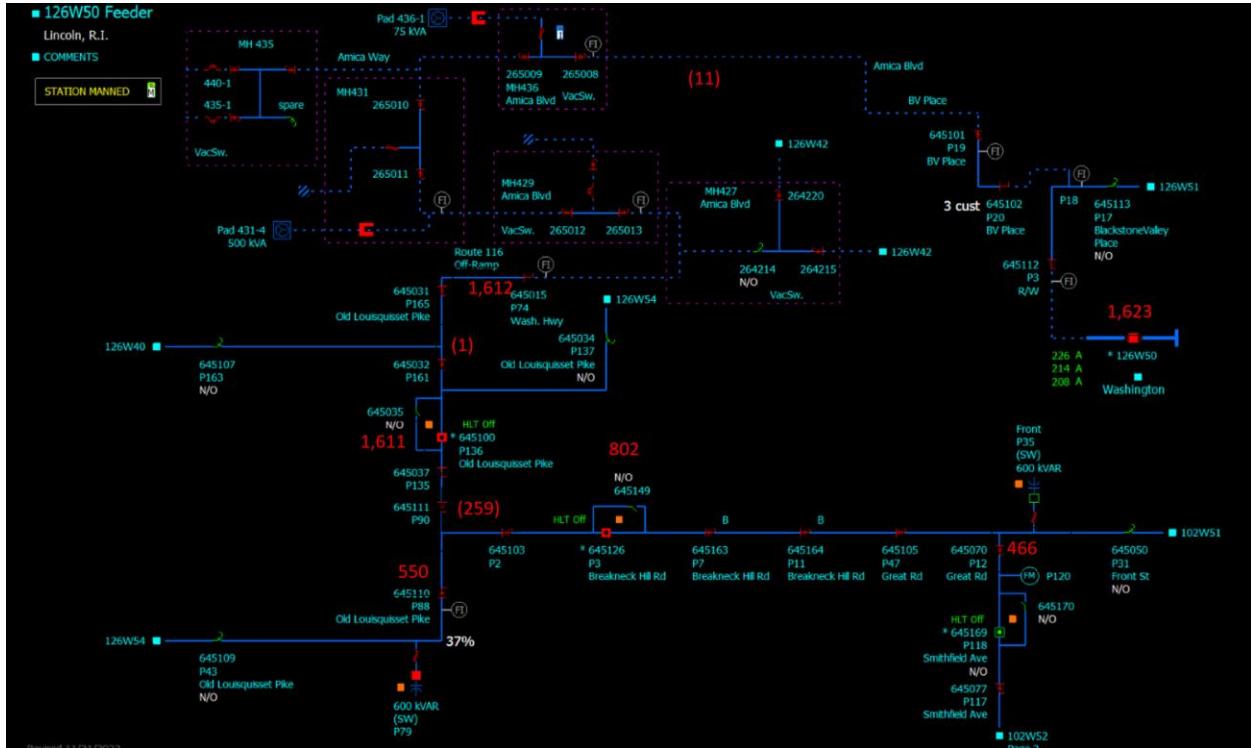
MAIN LINE OUTAGE HISTORY

Main Line interruptions on the 126W50 circuit from 2018 through 2022 were reviewed to determine recloser placements. The circuit's annual CKAIFI for these main line events was 4.38 during the study period.

Five Year Main Line IDS Event History, Including Major Storms						
Events	Customer Served	Estimated CI Customers Interrupted	Estimated CMI	Annual CKAIFI	Annual CKAIDI min	CAIDI min
28	1,623	35,506	7,153,605	4.38	882	201

Event ID	Date	Cause	Class	Protective Device Type	Event Total Customers Interrupted	Event Total Customer Minutes Interrupted	Estimated Event CAIDI (Minutes)	Comment
8251976	10/11/2019	Tree - Broken Limb	Main Line	Recloser	1,609	41,834	26	PTR P136 Louisquisset Pike - branch P139 Smithfield Ave
8262515	11/1/2019	Major Storm - Limb	Main Line	Recloser	1,610	677,810	421	PTR P136 Old Louisquisset Pike - Limb on Old Louisquisset Pike.
8222080	4/24/2019	Non-Company Activities	Main Line	Recloser	1,600	33,610	21	PTR P136 Old Louisquisset Pike branch at P114 Old Louisquisset Pike
8224449	5/24/2019	Tree Growth	Main Line	Recloser	1,610	235,878	147	PTR P136 Old Louisquisset Pike -Phase off pin at P83 Old Louisquisset Pike/ limb at P33 Great Rd.
8249361	9/8/2019	Unknown	Main Line	Recloser	1,540	106,260	69	PTR P136 Old Louisquisset Pike on 126W50.
8306909	5/9/2020	Tree - Broken Limb	Main Line	Recloser	1,607	187,124	116	PTR P136 Old Louisquisset Pike. Tree limb at pole 121 Old Louisquisset Pike.
8154162	3/2/2018	Major Storm - Tree	Main Line	Recloser	806	944,661	1,172	PTR P2 Breakneck Hill Rd - Tree P18 Great Rd.
8223302	5/13/2019	Tree Fell	Main Line	Recloser	806	36,407	45	PTR P2 Breakneck Hill Rd tree at P23 P24 Great Rd
8391607	6/30/2021	Tree Fell	Main Line	Recloser	803	36,327	45	PTR P3 Breakneck Hill Rd - tree at P6 Great Rd.
8305374	4/26/2020	Tree - Broken Limb	Main Line	Recloser	805	27,370	34	PTR P3 Breakneck Hill Rd- branch on line at P137 Smithfield Rd.
8380160	3/16/2021	Tree - Broken Limb	Main Line	Recloser	807	807	1	PTR P3 Breakneck Hill Rd for emergency repair - remove limb P32 Breakneck Hill Rd.
8333816	8/4/2020	Major Storm - Tree	Main Line	Recloser	806	1,605,066	1,991	PTR P3 Breakneck Hill Rd. Cause was multiple trees & wires down
8346429	10/7/2020	Major Storm - Lightning	Main Line	Recloser	805	442,750	550	PTR P3 Breakneck Hill Rd. Lightning.
8354906	10/30/2020	Tree Fell	Main Line	Recloser	804	43,590	54	PTR P3 Breakneck Hill Rd. Tree fell / broken pole at P138 Smithfield Ave.
8343698	9/30/2020	Major Storm - Limb	Main Line	Recloser	805	34,615	43	PTR P3 Breakneck Hill Rd. Limb at pole 137 Smithfield Ave.
8533447	5/22/2022	Vehicle	Main Line	Recloser	806	59,123	73	PTR P3 Breakneck -MVA / broken pole at P27 Breakneck Hill Rd.
8384527	5/8/2021	Vehicle	Main Line	Recloser	807	15,481	19	PTR P3 Breakneck Rd. -MVA /broken pole at P32 Breakneck Hill Rd.
8398035	8/12/2021	Tree Fell	Main Line	Station breaker	1,618	50,448	31	126W50 feeder locked out at Washington Sub - tree / broken crossarm at P139 Smithfield Rd.
8371193	2/3/2021	Device Failed	Main Line	Station breaker	1,620	46,025	28	126W50 feeder locked out at Washington Sub. C phase tap burnt off at P191 Old Louisquisset Pike.
8224951	5/15/2019	Unknown	Main Line	Station breaker	1,623	1,623	1	126W50 feeder lockout - patrolled nothing found - no reclosing
8270065	12/2/2019	Unknown	Main Line	Station breaker	1,550	49,600	32	126W50 feeder lockout - patrolled nothing found - no reclosing
8355125	11/1/2020	Unknown	Main Line	Station breaker	1,619	50,189	31	126W50 feeder lockout - patrolled nothing found - no reclosing
8383874	4/30/2021	Tree Fell	Main Line	Station breaker	1,552	61,848	40	126W50 feeder lockout at Washington Sub. Cause was tree fell at P142 Old Louisquisset Pike.
8194332	8/13/2018	Device Failed	Main Line	Station breaker	1,623	40,575	25	126W50 feeder lockout at Washington Sub. U/G cable fault in getaway from substation
8275472	1/17/2020	Tree Fell	Substation	Station breaker	1,623	136,332	84	Loss of source
8284400	2/7/2020	Major Storm - Limb	Substation	Station breaker	1,623	602,133	371	Loss of source
8394770	7/17/2021	Tree - Broken Limb	Main Line	Station breaker	1,559	159,402	102	PTR tripped at P136 Old Louisquisset Pike, 126W50 feeder lockout. Tree limb fell P92 Old Louisquisset Pike
8153345	3/2/2018	Major Storm - Tree	Main Line	Station breaker	1,060	1,426,717	1,346	Tree at P5 Jenckes Hill Rd and took phase down

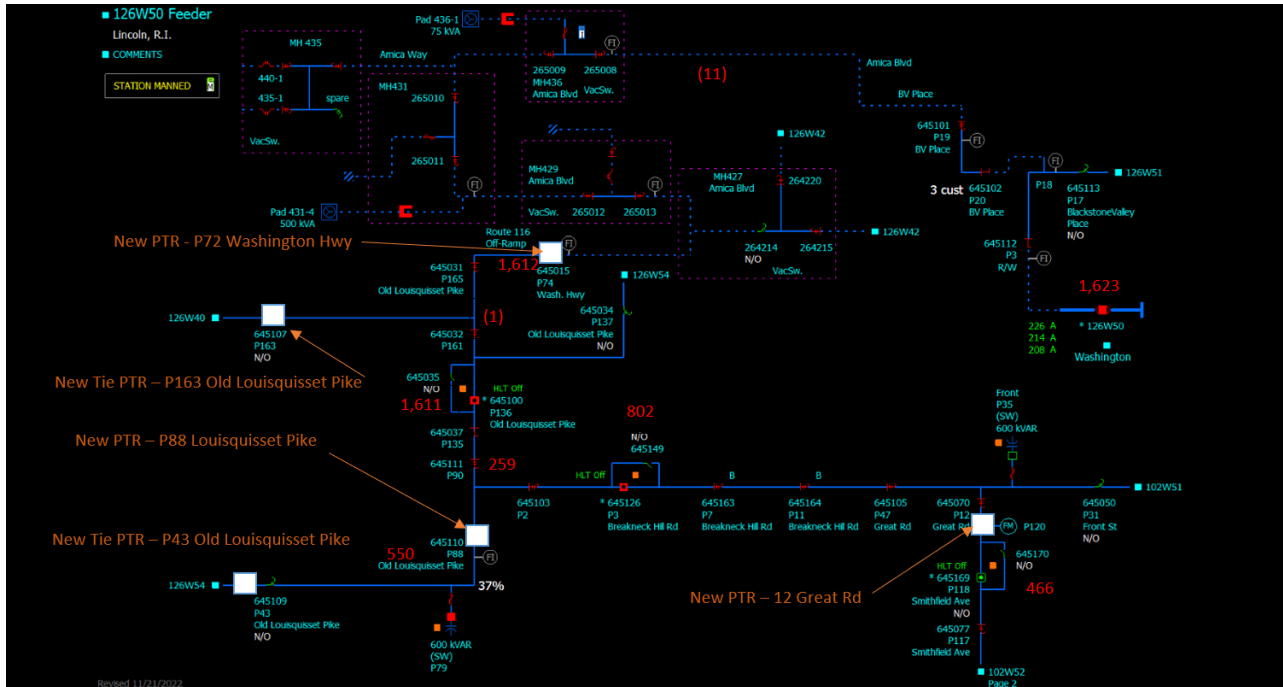
EXISTING EMS ONE-LINE



EXISTING CIRCUIT CONFIGURATION

Washington 126W50 Existing Line Segments.								
Line Segment	From Node	To Node	Segment Main Line Length	Segment Customer Count	Customers Interrupted per Event	Outages	Total CI	Cause
A	Substation	to P136 Old Louisquesset Pike	2.4 miles	12	1,623	11	17,853	4 tree 2 limb 3 unknown 2 equipment
B	P136 Old Louisquesset Pike	to P43 Old Louisquesset Pike	2.1 miles	809	1,611	6	9,666	1 tree 3 limb 1 unknown 1 action by others
C	P2 Breakneck Hill Road	to P118 Smithfield Ave.	3.0 miles	802	802	11	8,822	6 tree 2 limb 2 MVA 1 lightning

PROPOSED EMS ONE-LINE



PROPOSED RECLOSER PLACEMENTS

Recloser #	Location	Function	Notes
1	P74 Washington Highway - Lincoln	Mainline	This is a main line recloser with no loading concerns or additional construction requirements. Needed for reclosing as the breaker is one shot to lockout due to large underground at the beginning of the circuit.
2	P12 Great Road - Lincoln	Mainline	This is a main line recloser with no loading concerns or additional construction requirements.
3	P43 Old Louisquisset Pike	Tie	This is a tie recloser with no loading concerns or additional construction requirements.
4	P88 Old Louisquisset Pike	Mainline	This is a main line recloser with no loading concerns or additional construction requirements.
5	P163 Old Louisquisset Pike	Tie	This is a tie recloser with no loading concerns or additional construction requirements. This tie was chosen because the 126W40 is fed from a different bus. There were two bus outages during the outage review period.

PROPOSED CIRCUIT CONFIGURATION

The table below identifies the number of customers that would have seen an outage from 2018 through 2022 if the proposed mainline and tie reclosers were installed. It is assumed that all mainline reclosers operate successfully and the tie reclosers close within 5 minutes of the initial outage.

Washington 126W50 Existing Line Segments.									
Line Segment	From Node		To Node	Segment Main Line Length	Segment Customer Count	Customers Interrupted per Event	Outages	Total CI	Cause
A	Substation	to	P74 Washington Hwy	1.0 miles	11	11	3	33	1 tree 1 limb 1 equipment
A1	P74 Washington Hwy	to	P136 Old Louisquesset Pike	1.4 miles	1	1	8	8	3 tree 1 limb 3 unknown 1 equipment
B	P136 Old Louisquesset Pike	to	P88 Old Louisquesset Pike	1.1 miles	259	259	3	777	1 tree 1 limb 1 action by others
B1	P188 Old Louisquesset Pike	to	P43 Old Louisquesset Pike	1 miles	505	505	3	1,515	1 tree 1 limb 1 unknown
C	P2 Breakneck Hill Road	to	P31 Front Street	2.0 miles	336	336	7	2,352	4 tree 2 MVA 1 lightning
D	P12 Great Road	to	EOL	1 miles	466	466	4	1,864	2 tree 2 limb

RELIABILITY IMPROVEMENT

The estimated reliability improvement was determined by recalculating the CI and CMI of the 28 main line events as if the proposed configuration was in place. For purposes of estimating the reliability benefits, IDS mainline events were adjusted in the following ways:

- Customer interruption totals were adjusted to reflect the customer served number when the event interrupted more than one circuit.
- Line sections with tie reclosers were assumed to be restored within five minutes of the initial outage.
- The unhealthy line section was assigned a restoration time equal to the event CAIDI.
- The CI counts for Major Storm Interruptions were reduced by 50 % of the original events. This is done to recognize that some automated switching schemes may not be available during a TMED day when 10 % to 20 % of the RIE's customer base is without service.

The following chart illustrates the annual CKAIFI and CKAIDI over the previous five years of main line events, the estimated reliability if the proposed reclosers were in place and the estimated savings.

Annual Reliability Statistics - Main Line Interruptions including Major Storms			
Matrix	Actual Results	Estimated Results w/ Reclosers	Estimated Savings
CKAIFI	4.38	.96	3.42
CKAIDI (Min)	882	393.6	488.4

CIRCUIT MODIFICATIONS

There are no reconductoring projects planned to support the circuit's tie reclosers. The main line ties have adequate capacity to serve load from their assigned line sections.

OTHER CONSIDERATIONS

The first recloser addition at P74 Washington Highway is important for reliability and operational reasons. From Washington Substation to the location, there is a mile of underground distribution running through the Amica property before it rises at P74 to feed most of the circuit. Because of this configuration, the 126W50 breaker is set to non-reclosing to avoid the possibility of closing back into an underground cable fault. There were three temporary faults during our review period that could have been avoided with a standard recloser with typical settings located just beyond the underground.

Other system upgrades in lieu of installing a recloser would be reconductoring 1.2 miles of conductor from open wire on crossarms to spacer cable. This line is double circuited which would make upgrading to spacer cable costly. The nine outages beyond this device were varied with three related to trees and one limb. This upgrade would not fully eliminate outages in this section.

Beyond the P136 Old Louisquisset Pike recloser, there were 18 outages over the 5.1 miles of mainline. Tree trimming was specified in the Area Study for 2023. There were no mainline tree related outages in 2022 or 2023. Due to the length of the feeder and the improvements in tree related outages, no reconductoring is recommended. The tie recloser and mainline recloser proposed through the study are important to fast restoration of the circuit for events occurring upstream. To restore end of line customers, the ability to tie to adjacent circuits is essential.

The estimated line upgrade cost is \$1.33M.



Memorandum

To: Eric Wiesner / Ryan Constable
From: Mark Fraser
Date: February 12, 2024
Subject: Recloser Justification – Nasonville Substation, Circuit 127W41

EXECUTIVE SUMMARY

This memo documents the placements of one main line reclosers and one tie recloser on the Nasonville Substation circuit 127W41 under the FY25 Distribution Automation Recloser program (DARP). The circuit was included in the program because its five-year regulatory circuit Frequency Index (CKAIFI) was greater than 2.0.

Reliability improvements are estimated on the circuit's five-year main line interruption history and includes major storm events. Placements of reclosers are expected to reduce circuit frequency (CKAIFI) by 0.493 and circuit duration (CKAIDI) by 27.5 minutes. The estimated cost of the recommendations is \$ 166,000.

RECLOSER PROIRITY SCORE

The following table illustrates the circuit's length, reliability history, and amount of distributed generation that made up the circuit's recloser priority score. This information was used to determine which circuits would be included in the FY25 DARP program and was previously presented by RIE in Attachment A of the Proposed FY25 ISR filing.

District	Region	Study Area	Brkr Tax District Name	Substation Name	Feeder	Construction Class	Voltage	Total OH 3ph Miles	Customers	# of Customers / Line Section	Line Exposure Rank
53	Capital	BSVN	Burrillville	NASONVILLE	53-127W41	OH	13.8 kV	7.8	661	661	226

5 yr Average CKAIFI	Circuit CKAIFI Rank	5 yr Average CKAIDI (Min)*	Circuit CKAIDI Rank	# yrs on CEMI 4 list	DG Totals (KW)	Overall Circuit Priority Score	Proposed Open Reclosers	Proposed Mainline Reclosers	Total Proposed Reclosers
3.23	335	346.6	335	5	882	266	1	1	2

PENDING WORK

There are no capital investments planned for this circuit in the FY25 Budget.

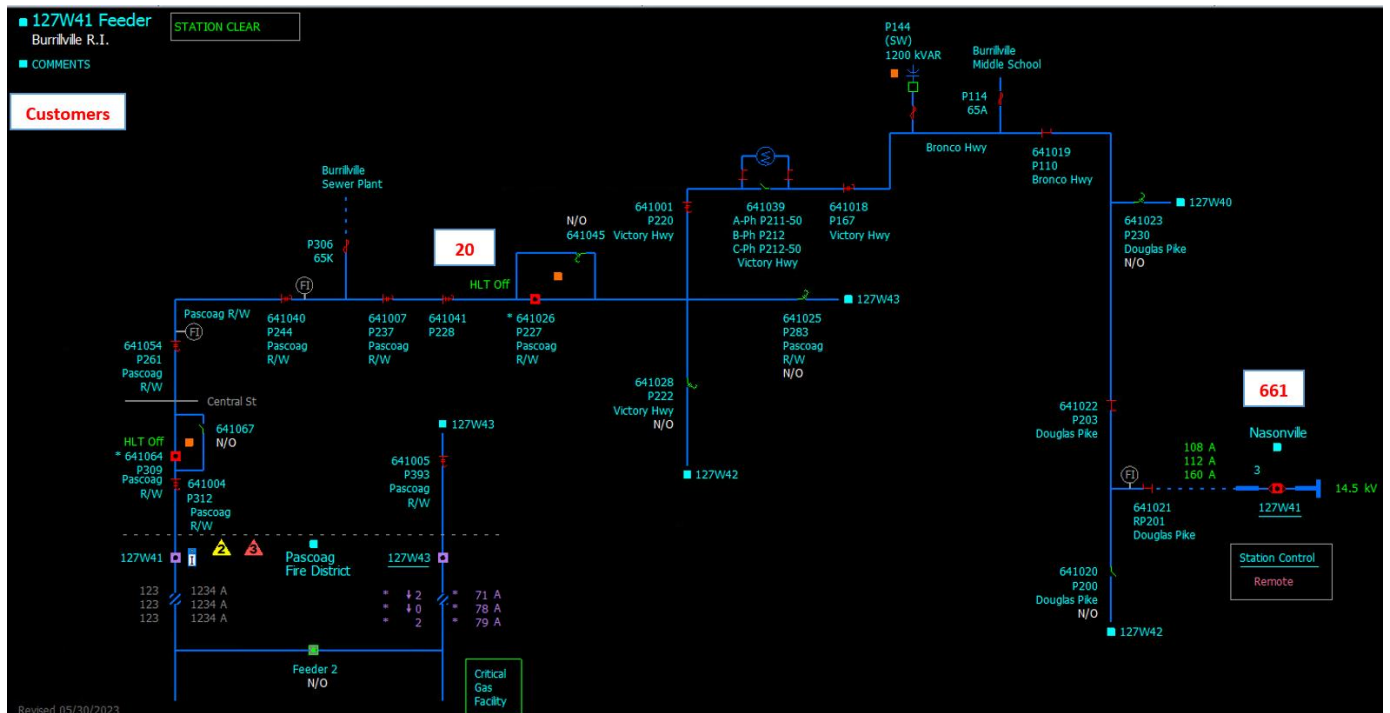
MAIN LINE OUTAGE HISTORY

Main Line interruptions on the 127W41 circuit from 2019 through 2023 were reviewed to determine recloser placements. The circuit's annual CKAIFI for these main line events was 1.91 during the study period.

Five Year Main Line IDS Event History, Including Major Storms						
Events	Customer Served	Estimated CI Customers Interrupted	Estimated CMI	Annual CKAIFI	Annual CKAIDI min	CAIDI min
13	661	6,317	1,345,486	1.91	407	213

Event ID	Date	Device Type	Classification	Cause	Event CI	Event CMI	Min	Day Type	Comments
8650039	3/31/2023	Station breaker	Main Line	Vehicle	323	55,658	172	Blue Sky	Broken pole P209 Douglas Pike Burrilville MVA.
8210868	1/24/2019	Station breaker	Main Line	Insulation failure	652	33,904	52	Blue Sky	Insulator failure P 216 Douglas Pike, burned through crossarm
8246265	8/19/2019	Station breaker	Main Line	Tree - Broken Limb	656	38,704	59	Blue Sky	Tree branch at P210 Douglas Pike. Thunderstorms
8540408	7/18/2022	Station breaker	Main Line	Device Fail	661	29,745	45	Major Storm	Phase down at P219. Opened 127W40 and 127W41 breakers
8368731	1/13/2021	Station breaker	Main Line	Animal	656	21,011	32	Blue Sky	Animal contact at P227 Pascoag R/W.
8230174	7/17/2019	Station breaker	Main Line	Tree - Broken Limb	657	55,188	84	Blue Sky	Tree limb at pole 183 Victory Hwy. T-storms.
8291585	4/13/2020	Station breaker	Main Line	Tree Fell	660	168,866	256	Major Storm	Tree fell at pole 153 Victory Hwy. Wind/rain storm.
8521833	3/31/2022	Recloser	Main Line	Tree Fell	20	1,300	65	Blue Sky	Tree at P310 Pascoag right of way.
8653827	5/25/2023	Recloser	Main Line	Animal	24	1,392	58	Blue Sky	Animal at P227 Pascoag R/W.
8679597	12/18/2023	Recloser	Main Line	Tree Fell	25	18,900	756	Major Storm	Tree @ P258 Pascoag right of way.
8512091	12/16/2021	Station breaker	T Supply	Unknown	661	42,163	64	Blue Sky	B23 line locked out at West Farnum Sub - loss of supply to Nasonville Sub.
8512411	12/18/2021	Station breaker	T Supply	Insulation failure - other	661	64,977	98	Blue Sky	B23 line locked out at West Farnum Sub - loss of supply to Nasonville Sub.
8545240	8/23/2022	Station breaker	Mainliine	Lightning	661	813,678	1,231	Blue Sky	Nasonville SS Failure

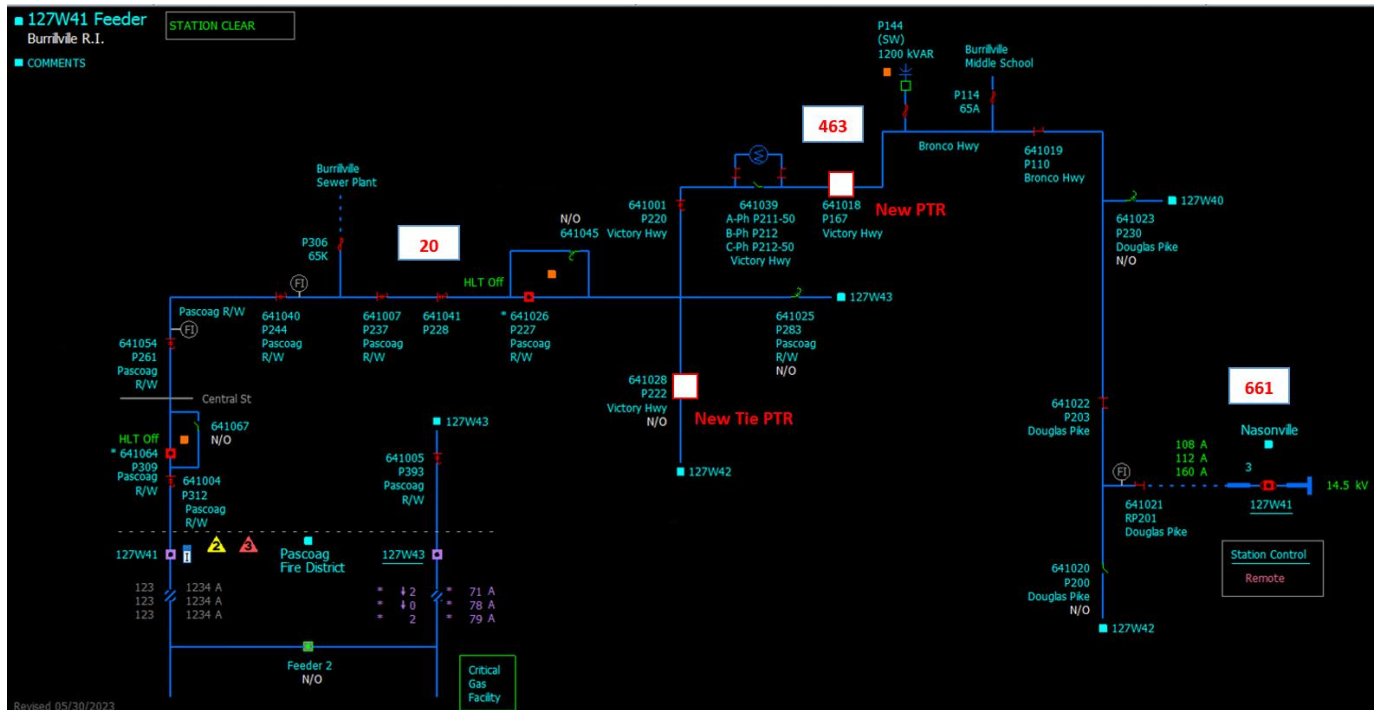
EXISTING EMS ONE-LINE



EXISTING CIRCUIT CONFIGURATION

Line Segment	To	Miles	Customers in Line Segment	Customers Interrupted During Event	Outages	Total CI	Causes	
A	Substation	P277 Pascoag ROW	2.7	641	661	7	4,627	1 MVA 2 Equipment 2 Limb 1 Tree 1 Animal
B	P277 Pascoag ROW	End of Line	2.9	20	20	3	60	2 Tree 1 Animal

PROPOSED EMS ONE-LINE



PROPOSED RECLOSER PLACEMENTS

Recloser	Location	Function	Notes
1	P167 Victory Hwy	Mainline	This is a main line recloser with no loading concerns or additional construction requirements.
2	P277 Pascoag ROW	Tie	This is a tie recloser no load concerns, however, this circuit does feed Pascoag Muple. Coordiation consideration will be required. There are no additional construction requirements

PROPOSED CIRCUIT CONFIGURATION

The table below identifies the number of customers that would have seen an outage from 2019 through 2023 if the proposed mainline and tie reclosers were installed. It is assumed that all mainline reclosers operate successfully and the tie reclosers close within 5 minutes of the initial outage.

Line Segment	From	To		Customers in Line Segment	Customers Interrupted During Event	Outages	Total CI	Causes
A	Substation	PTR P167 Victory Hwy	1.7	198	463	4	1,852	1 MVA 2 Equipment 1 Limb
A1	PTR P167 Victory Hwy	PTR P277 Pascoag ROW/ Tie PTR P222 Victory Hwy (N.O.)	1.0	443	198	3	594	1 Limb 1 Tree 1 Animal
B	PTR P277 Pascoag ROW	End of Line	2.9	20	20	3	60	2 Tree 1 Animal

RELIABILITY IMPROVEMENT

The estimated reliability improvement was determined by recalculating the CI and CMI of the 28 main line events as if the proposed configuration was in place. For purposes of estimating the reliability benefits, IDS mainline events were adjusted in the following ways:

- Customer interruption totals were adjusted to reflect the customer served number when the event interrupted more than one circuit.
- Line sections with tie reclosers were assumed to be restored within five minutes of the initial outage.
- The unhealthy line section was assigned a restoration time equal to the event CAIDI.
- The CI counts for Major Storm Interruptions were reduced by 50% of the original events. This is done to recognize that some automated switching schemes may not be available during a TMED day when 10 % to 20 % of the RIE’s customer base is without service.

The following chart illustrates the annual CKAIFI and CKAIDI over the previous five years of main line events, the estimated reliability if the proposed reclosers were in place and the estimated savings.

Annual Reliability Statistics - Main Line Interruptions including Major Storms			
Matrix	Actual Results	Estimated Results w/ Reclosers	Estimated Savings
CKAIFI	1.91	1.38	0.53
CKAIDI (Min)	407	373	34.0

CIRCUIT MODIFICATIONS

There are no reconductoring projects planned to support the circuit's tie reclosers. The main line ties have adequate capacity to serve load from their assigned line sections.

OTHER CONSIDERATIONS

In the past five years, there were three tree-related (two limb and one tree), two equipment outages, one vehicle accident, and one animal contact outages on the 2.7 mile circuit backbone. To upgrade this entire section to space cable would cost \$3.0 M and would be beneficial primarily for tree outages.

The largest concentration of outages was a result of faults on Douglas Pike where there was only one limb caused outage. Upgrading the 3,600 feet of primary along Douglas Pike to spacer cable would improve the system and reduce exposure. This is a double circuited pole route making this upgrade more challenging and costly. The estimated line upgrade cost is \$750,000.

With the proposed reclosers, there are only 198 customers between the substation and the proposed 167 Victory Highway location that would be impacted by faults in this section. The reclosers are a more cost-effective solution compared to space cable upgrade.



Memorandum

To: Eric Wiesner/ Ryan Constable
From: Frank Louis Carro
Date: 02/14/2024
Subject: Chase Hill 155F2 – DARP

EXECUTIVE SUMMARY

This memo documents the placements of four (4) line reclosers on the Chase Hill 155F2 feeder under the FY25 Distribution Automation Recloser Program (DARP). The circuit was included in the program because its five-year regulatory circuit Frequency Index (CKAIFI) was greater than 2.0.

Reliability improvements are estimated on the circuit's five-year main line interruption history and include major storm events. Placements of reclosers are expected to reduce circuit frequency (CKAIFI) by 1.06 and circuit duration (CKAIDI) by 342 minutes. The estimated cost of the recommendations is \$ 332,000.

RECLOSER PRIORITY SCORE

The following tables illustrate the circuit's length, reliability history, and amount of distributed generation that made up the circuit's recloser priority score. This information was used to determine which circuits would be included in the FY25 DARP program and was previously presented by RIE in Attachment A of the Proposed FY25 ISR.

District	Region	Study Area	Brkr Tax District Name	Substation Name	Fdr
56	Coastal	SCW	Hopkinton	CHASE HILL SUBSTATION	56-155F2

Construction Class	Voltage	Total OH 3ph Miles	Cs	# of Customers / Line Section	Line Exposure Rank
OH	12.47 kV	11.1	2054	1027	291

5 yr Average CKAIFI	Circuit CKAIFI Rank	5 yr Average CKAIDI (Min)*	Circuit CKAIDI Rank	# yrs on CEMI 4 list	DG Totals (KW)
2.99	331	223.4	328	5	7718

Overall Circuit Priority Score	Proposed Open Reclosers	Proposed Mainline Reclosers	Total Proposed Reclosers
284	0	3	3

PENDING WORK

There are no capital investments planned for this circuit in the FY25 Budget.

MAIN LINE OUTAGE HISTORY

The Main Line events on the 155F2 from 2019 through 2023 were reviewed to determine recloser placements. The circuit's annual CKAIFI for main line events was 2.06 (1.63*) during the study period.

Five Year Main Line IDS Event History, Including Major Storms						
Events	Customer Served	Estimated CI	Estimated CMI	Annual CKAIFI	Annual CKAIDI min	CAIDI min
13	2054	21,174	9,658,917	2.06	941	456
13	2054	(16,787*)	(6,747,482*)	(1.63*)	(657*)	(402*)

* - Event CI and CMI reported in 5-year main line IDS event history was adjusted to account for reliability benefits derived from the installation of the distribution line recloser at Pole 3 Ross Hill Road, Charlestown, RI in May 2022 (see table below).

The table below lists the 13 main line outages that make up the event history in the above table.

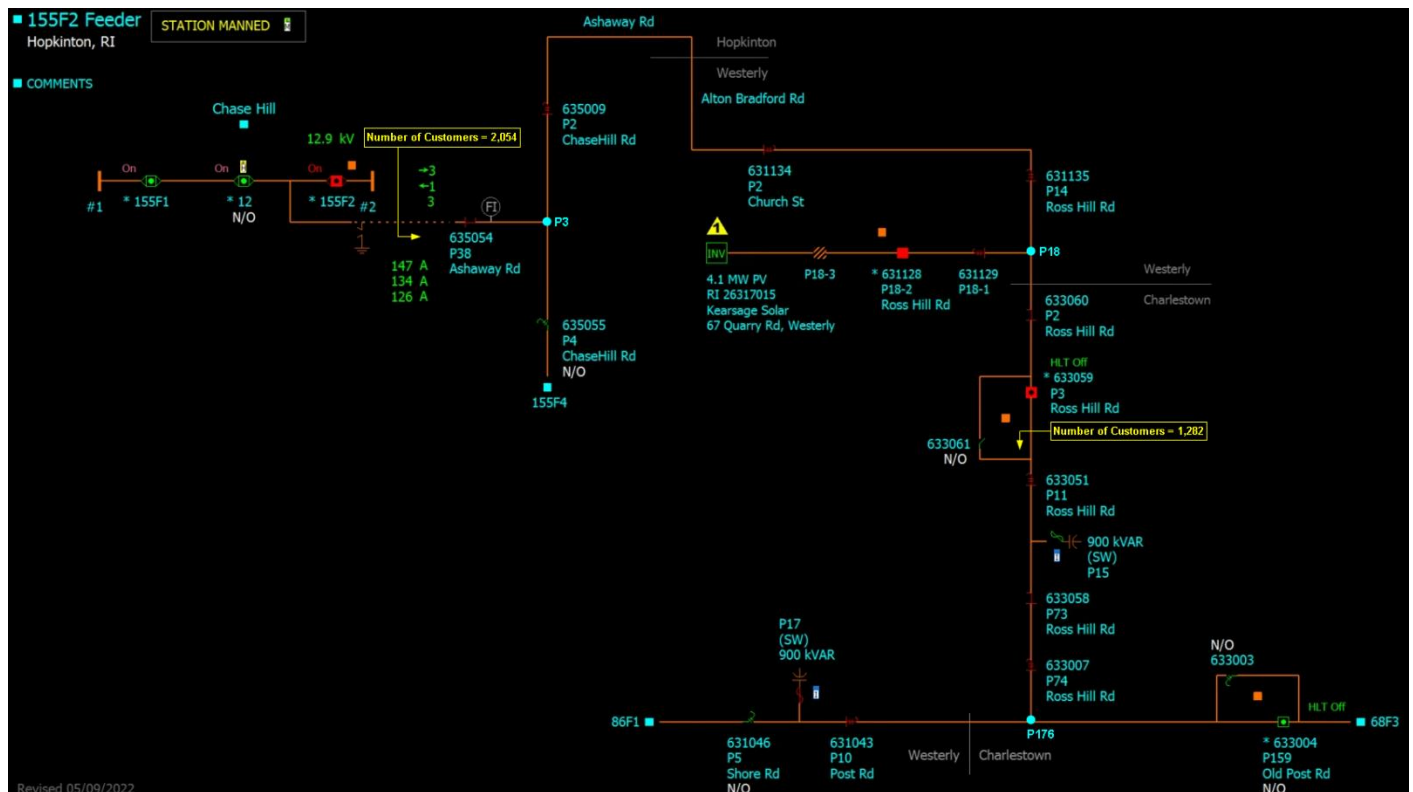
Event ID	Date	Device Type	Cause	Estimated CI	Estimated CMI	Day Type	Comments
8231848	7/23/2019	Solid disc - main	Insulation Failure	789	49977	Blue Sky	One phase burned down at pole 179 Old Post Road.
8254140	10/17/2019	Station breaker	Tree Fell	1803 (1282*)	3007258 (2138376*)	Major Storm	155F2 feeder lockout at Chase Hill Sub. Tree fell and took primary down and broke poles around pole 39 - 43 Ross Hill Rd.
8262519	11/1/2019	Station breaker	Tree - Broken Limb	1803	716780	Major Storm	155F2 circuit breaker locked out of Chase Hill Sub. Patrol found tree branch found on N/O tie load break switch at P4 Chase Hill Rd.
8289968	3/22/2020	Station breaker	Tree - Broken Limb	1867 (1282*)	78414 (53844*)	Blue Sky	155F2 feeder lockout at Chase Hill Sub. Cause was tree limb on primary at P189 Post Rd Warwick.
8306504	5/9/2020	Station breaker	Tree Growth	2277 (1282*)	312743 (175634*)	Blue Sky	155F2 feeder lockout at Chase Hill Sub. Cause: tree growth into primary between pole 23 + pole 24 Post Rd, phase off insulator.
8319209	6/29/2020	Solid disc - main	Deterioration	1012	36432	Blue Sky	Manually opened loadbreak at P74 Ross Hill Rd due to phases burning P184 Post Rd due to broken crossarm.
8387598	6/7/2021	Station breaker	Vehicle	2060	136861	Blue Sky	155F2 feeder tripped and reclosed several times at Chase Hill Sub. MVA/broken pole at pole 28 Church St.
8388129	6/12/2021	Station breaker	Vehicle	2144 (1282*)	133494 (79484*)	Blue Sky	155F2 circuit breaker locked out at Chase Hill Sub. Cause: MVA/broken pole at P17 Post Rd, Westerly.
8400478	8/22/2021	Station breaker	Tree - Broken Limb	2017 (1282*)	3467452 (2203758*)	Major Storm	155F2 feeder lockout at Chase Hill Sub. Multiple trees down on Ross Hill Rd, broken crossarms.
8402234	9/1/2021	Solid disc - main	Tree Fell	1222	55852	Blue Sky	155F2 feeder trip and reclose at Chase Hill Sub. Tree took phase down at P14 Ross Hill Rd. Manually open load break switch at P11 Ross Hill Road.
* - Adjusted to account for reliability benefits derived from installation of line recloser at Pole 3 Ross Hill Road, Charlestown, RI in May 2022.							

Individual Main Line Events Continued.

Event ID	Date	Device Type	Cause	Estimated CI	Estimated CMI	Day Type	Comments
8408237	10/27/2021	Station breaker	Tree Fell	1971 (1282*)	1611846 (1048676*)	Major Storm	155F2 circuit breaker locked out of Chase Hill Sub due to wires down at Pole 27 Post Rd.
8514485	1/17/2022	Solid disc - main	Tree Fell	130	9100	Blue Sky	Manually de-energized the section between P11 and P74 Ross Hill Rd to remove a large tree on the wires at P45 to P46 Ross Hill Rd.
8535177	6/9/2022	Station breaker	Tree Fell	2079	42708	Blue Sky	Chase Hill 155F2 Circuit Breaker locked out. Cause was tree down P53 Ashaway Rd.

* - Adjusted to account for reliability benefits derived from installation of line recloser at Pole 3 Ross Hill Road, Charlestown, RI in May 2022.

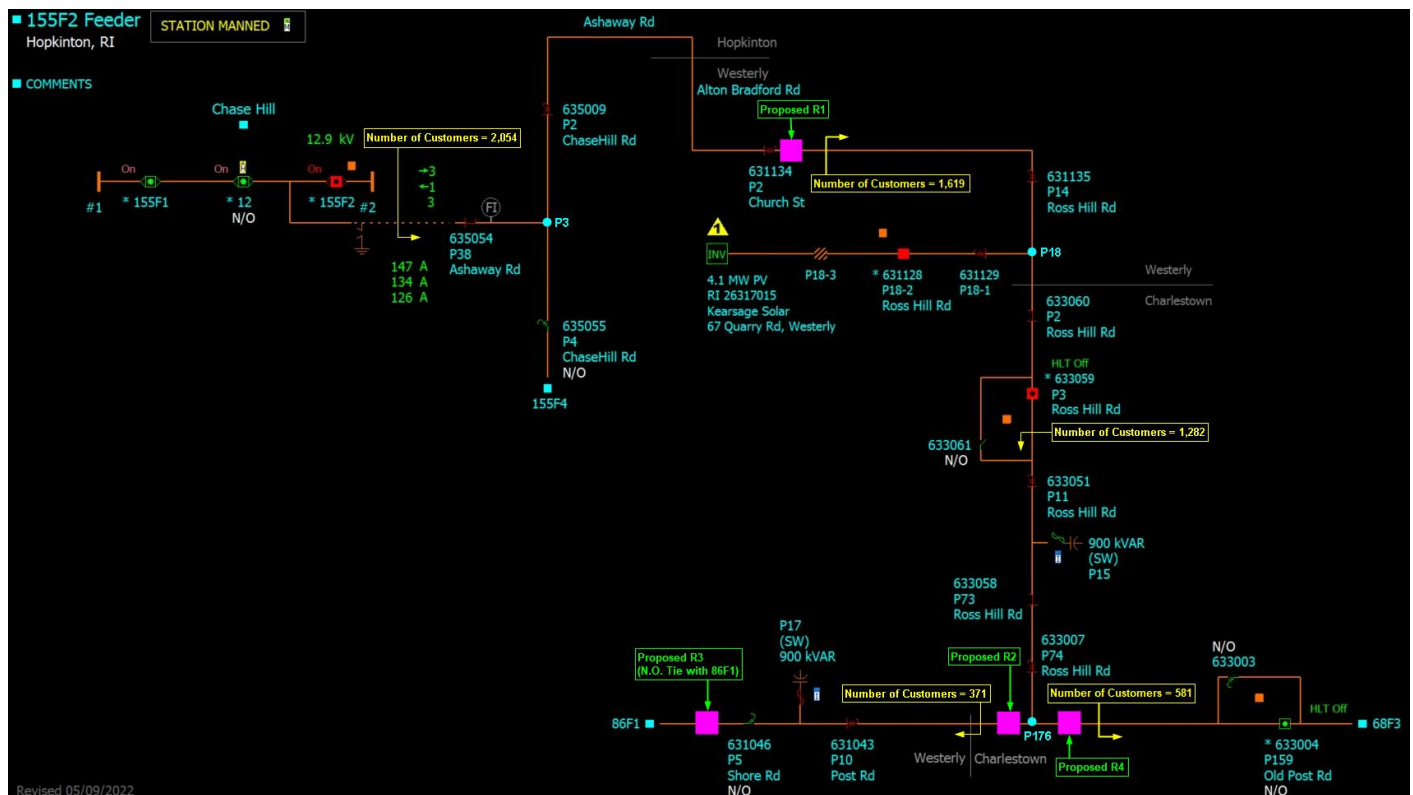
EXISTING EMS ONE LINE



EXISTING CIRCUIT CONFIGURATION

Chase Hill 155F2 - Existing Circuit Configuration									
Line Section	Line Section Description		Customers per Line Section	Main Line Miles per Line Section	Events per Line Section	Customers Interrupted per Event	Total CI	Cause	
A	Substation Breaker	to	P18-2 Ross Hill Rd	772	4.1	3	2,054	6,162	(1) - Tree
		to	P3 Ross Hill Rd						(1) - Tree Branch
B	P3 Ross Hill Rd	to	P5 Shore Road	1,282	4.4	10	1,282	12,820	(4) - Tree
		to	P159 Old Post Rd						(3) - Tree Branch
									(1) - Insulation Failure
									(1) - Deterioration
									(1) - MVA

PROPOSED EMS ONE-LINE



PROPOSED RECLOSERS

Two new recloser at the following locations are proposed to improve circuit performance.

Recl. #	Recloser Location	Function	Notes
R1	P2 Church St	Mainline	Reduces line exposure and customer count on line section A.
R2	P177 Old Post Rd	Mainline	Reduces line exposure and customer count on line section B.
R3	P5 Shore Rd	Tie	Automated N.O. Tie with 86F1 circuit.
R4	P175 Old Post Rd	Mainline	Reduces line exposure and customer count on line section B.

PROPOSED CIRCUIT CONFIGURATION

The table below identifies the number of customers that would have seen an outage in the 5-year period between 2019 and 2023 if the proposed mainline and tie reclosers were installed. Calculations assume that all mainline reclosers operate successfully and tie reclosers close within five (5) minutes of the initial outage.

Chase Hill 155F2 - Proposed Circuit Configuration									
Line Section	Line Section Description			Customers per Line Section	Main Line Miles per Line Section	Events per Line Segment	Customers Interrupted per Event	Total CI	Cause
A	Substation Breaker	to	P2 Church St	435	2.2	2	435	870	(1) - Tree (1) - Tree Branch
A1	P2 Church St	to	P18-2 Ross Hill Rd	337	1.9	1	337	337	(1) - MVA
		to	P3 Ross Hill Rd						
B	P3 Ross Hill Rd	to	P177 Old Post Rd	330	2.4	4	330	1320	(3) - Tree (1) - Tree Branch
		to	P175 Old Post Rd						
B1	P177 Old Post Rd	to	P5 Shore Rd	371	1.5	6	371	2226	(1) - Tree (2) - Tree Branch (1) - Insulation Failure (1) - Deterioration (1) - MVA
B2	P175 Old Post Rd	to	P159 Old Post Rd	581	0.5	0	N/A	N/A	N/A

RELIABILITY IMPROVEMENT

The estimated reliability improvement was determined by recalculating the CI and CMI of the 13 main line events as if the proposed configuration was in place. For purposes of estimating the reliability benefits, IDS mainline events were adjusted in the following ways:

- Customer interruption totals were adjusted to reflect the customer served number when the event interrupted more than one circuit.
- Line sections with tie reclosers were assumed to be restored within five minutes of the initial outage.
- Unhealthy line section was assigned a restoration time equal to the event CAIDI.
- The CI counts for Major Strom Interruptions were reduced by 50 % of the original events. This is done to recognize that some automated switching schemes may not be available during a TMED day when 10 % to 20 % of the RIE's customer base is without service.

Note: Event CI and CMI reported in 5-year main line IDS event history was adjusted to account for reliability benefits derived from the installation of the distribution line recloser at Pole 3 Ross Hill Road, Charlestown, RI in May 2022 prior to determining reliability improvement from proposed line reclosers.

The following chart illustrates the annual CKAIFI and CKAIDI over the previous five years of main line events, the estimate reliability of the proposed configuration had the reclosers been in place and the estimated savings.

Annual Reliability Statistics - Main Line Interruptions			
Matrix	Actual Results	Estimated Results w/ Reclosers	Estimated Savings
CKAIFI	1.63	0.58	1.06
CKAIDI (Min)	657	315	342

CIRCUIT MODIFICATIONS

There are no reconductoring projects planned to support the circuit's tie reclosers. The main line ties have adequate capacity to serve load from their assigned line sections.

OTHER CONSIDERATIONS

Reconductoring of 1.3 miles of bare conductor, crossarm construction to spacer cable could be performed in lieu of installing the proposed recloser at Pole 2 Church Street. The one (1) outage that occurred in this section was attributed to a motor vehicle accident (MVA). This upgrade would not have eliminated the outage which occurred in this section. The estimated cost of reconductoring is \$1,440,000.

Reconductoring of 1.5 miles of bare conductor, crossarm construction to spacer cable could be performed in lieu of installing the proposed recloser at Pole 177 Old Post Road. Of the six (6) outages that occurred between the mainline recloser and N.O. Tie recloser, only three were tree-related outages. This upgrade would not fully eliminate outages in this section. The estimated cost of reconductoring is \$1,660,000.

Reconductoring of 0.5 miles of bare conductor, crossarm construction to spacer cable could be performed in lieu of installing the proposed recloser at Pole 175 Old Post Road. The estimated cost of reconductoring is \$560,000.



Memorandum

To: Eric Wiesner / Ryan Constable
From: Mark Fraser
Date: March 4, 2024
Subject: Recloser Justification – Washington Substation, Circuit 126W50

EXECUTIVE SUMMARY

This memo documents the placements of three main line reclosers and two tie reclosers on Washington Substation circuit 126W50 under the FY25 Distribution Automation Recloser program (DARP). The circuit was included in the program because its five-year regulatory circuit Frequency Index (CKAIFI) was greater than 2.0.

Reliability improvements are estimated on the circuit's five-year main line interruption history and includes major storm events. Placements of reclosers are expected to reduce circuit frequency (CKAIFI) by 3.28 and circuit duration (CKAIDI) by 450 minutes. The estimated cost of the recommendations is \$ 415,000.

RECLOSER PROIRITY SCORE

The following table illustrates the circuit's length, reliability history, and amount of distributed generation that made up the circuit's recloser priority score. This information was used to determine which circuits would be included in the FY25 DARP program and was previously presented by RIE in Attachment A of the Proposed FY25 ISR filing.

District	Region	Study Area	Brkr Tax District Name	Substation Name	Fdr	Construction Class	Voltage	Total OH 3ph Miles	Line Exposure Rank	Cs	# of Customers / Line Section
53	Capital	BSVS	Lincoln	WASHINGTON	53-126W50	Mixed	13.8 kV	11.0	289	1608	402

5 yr Average CKAIFI	5 yr Average CKAIDI (Min)*	Circuit CKAIDI Rank	# yrs on CEMI 4 list	ERR Program Fiscal Year	DG Totals (KW)	Priority Score	Proposed Open Reclosers	Proposed Mainline Reclosers	Total Proposed Reclosers
4.15	248	330	5		749	259	3	0	3

*Detailed circuit analysis revealed the opportunity for two additional tie reclosers.

PROPOSED, RECENTLY COMPLETED, OR PENDING CIRCUIT WORK

Maintenance cycle tree trimming was completed on this circuit during the winter of 2022/23. The next planned trimming for this circuit is in 2027.

In the area study, a recloser was suggested for Twin River Road. This project did not progress. There was adequate fusing at this location and new trip savers have since been added down the line at Angel Road.

There are no other significant capital investments planned for this circuit in the FY25 Budget.

MAIN LINE OUTAGE HISTORY

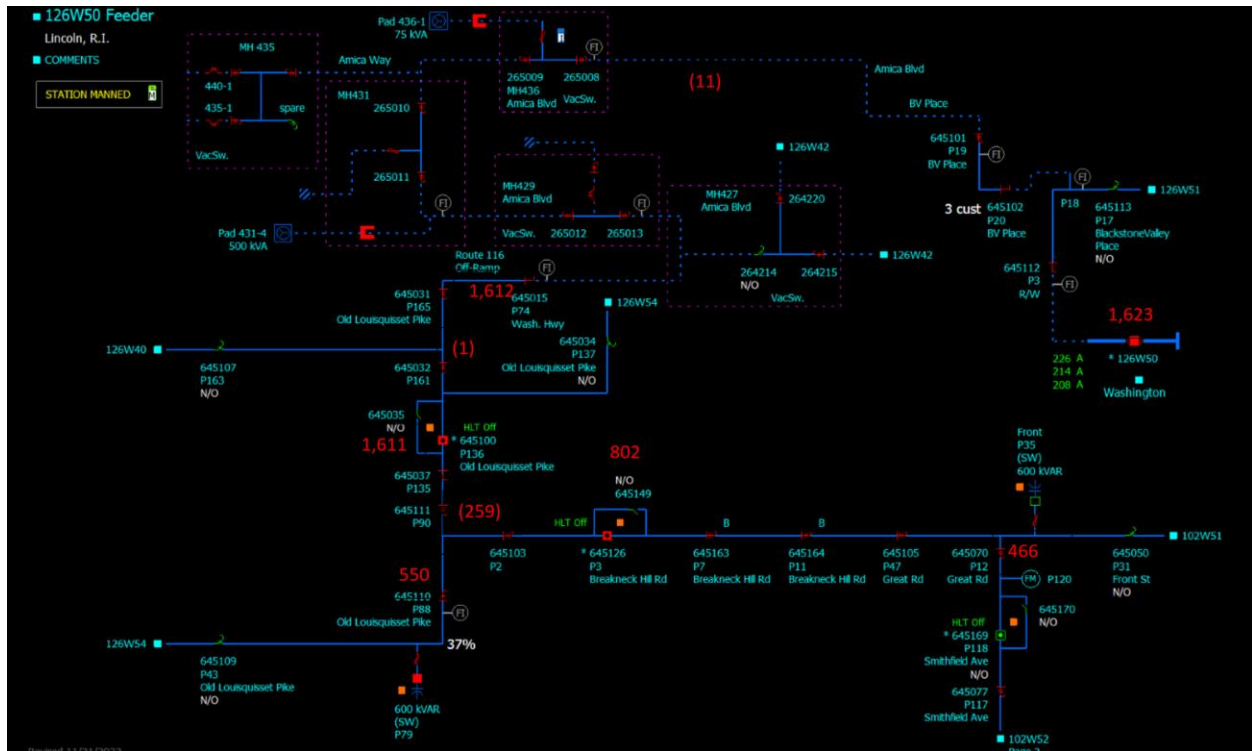
Main Line interruptions on the 126W50 circuit from 2018 through 2022 were reviewed to determine recloser placements. The circuit's annual CKAIFI for these main line events was 4.38 (with major storms) and 3.45 (without major storm) during the study period.

Five Year Main Line IDS Event History, Including Major Storms						
Events	Customer Served	Estimated CI Customers Interrupted	Estimated CMI	Annual CKAIFI	Annual CKAIDI min	CAIDI min
28	1,623	35,506	7,153,605	4.38	882	201

Five Year Main Line IDS Event History, Excluding Major Storms						
Events	Customer Served	Estimated CI Customers Interrupted	Estimated CMI	Annual CKAIFI	Annual CKAIDI min	CAIDI min
21	1,623	27,991	1,419,853	3.45	175	201

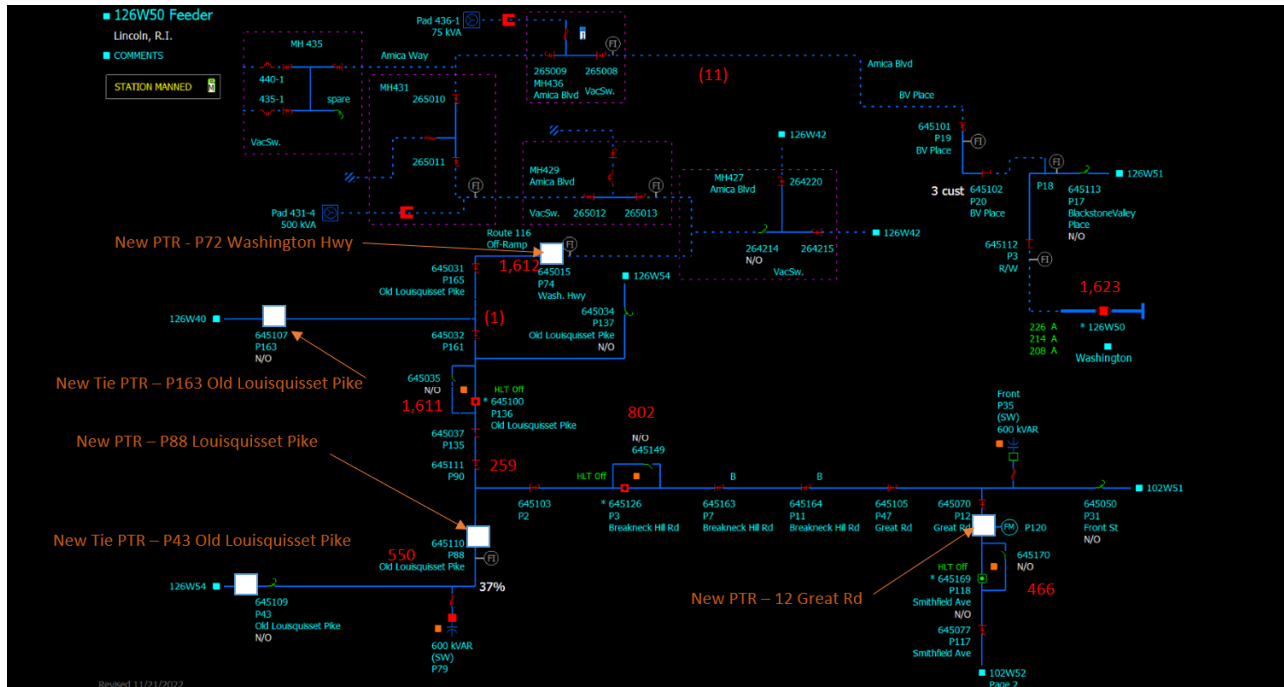
Event ID	Date	Cause	Class	Protective Device Type	Event Total Customers Interrupted	Event Total Customer Minutes Interrupted	Estimated Event CAIDI (Minutes)	Comment
8251976	10/11/2019	Tree - Broken Limb	Main Line	Recloser	1,609	41,834	26	PTR P136 Louisquisset Pike - branch P139 Smithfield Ave
8262515	11/1/2019	Major Storm - Limb	Main Line	Recloser	1,610	677,810	421	PTR P136 Old Louisquisset Pike - Limb on Old Louisquisset Pike.
8222080	4/24/2019	Non-Company Activities	Main Line	Recloser	1,600	33,610	21	PTR P136 Old Louisquisset Pike branch at P114 Old Louisquisset Pike
8224449	5/24/2019	Tree Growth	Main Line	Recloser	1,610	235,878	147	PTR P136 Old Louisquisset Pike -Phase off pin at P83 Old Louisquisset Pike/ limb at P33 Great Rd.
8249361	9/8/2019	Unknown	Main Line	Recloser	1,540	106,260	69	PTR P136 Old Louisquisset Pike on 126W50.
8306909	5/9/2020	Tree - Broken Limb	Main Line	Recloser	1,607	187,124	116	PTR P136 Old Louisquisset Pike. Tree limb at pole 121 Old Louisquisset Pike.
8154162	3/2/2018	Major Storm - Tree	Main Line	Recloser	806	944,661	1,172	PTR P2 Breakneck Hill Rd - Tree P18 Great Rd.
8223302	5/13/2019	Tree Fell	Main Line	Recloser	806	36,407	45	PTR P2 Breakneck Hill Rd tree at P23 P24 Great Rd
8391607	6/30/2021	Tree Fell	Main Line	Recloser	803	36,327	45	PTR P3 Breakneck Hill Rd - tree at P6 Great Rd.
8305374	4/26/2020	Tree - Broken Limb	Main Line	Recloser	805	27,370	34	PTR P3 Breakneck Hill Rd- branch on line at at P137 Smithfield Rd.
8380160	3/16/2021	Tree - Broken Limb	Main Line	Recloser	807	807	1	PTR P3 Breakneck Hill Rd for emergency repair - remove limb P32 Breakneck Hill Rd.
8333816	8/4/2020	Major Storm - Tree	Main Line	Recloser	806	1,605,066	1,991	PTR P3 Breakneck Hill Rd. Cause was multiple trees & wires down
8346429	10/7/2020	Major Storm - Lightning	Main Line	Recloser	805	442,750	550	PTR P3 Breakneck Hill Rd. Lightning.
8354906	10/30/2020	Tree Fell	Main Line	Recloser	804	43,590	54	PTR P3 Breakneck Hill Rd. Tree fell / broken pole at P138 Smithfield Ave.
8343698	9/30/2020	Major Storm - Limb	Main Line	Recloser	805	34,615	43	PTR P3 Breakneck Hill Rd. Limb at pole 137 Smithfield Ave.
8533447	5/22/2022	Vehicle	Main Line	Recloser	806	59,123	73	PTR P3 Breakneck -MVA / broken pole at P27 Breakneck Hill Rd.
8384527	5/8/2021	Vehicle	Main Line	Recloser	807	15,481	19	PTR P3 Breakneck Rd. -MVA /broken pole at P32 Breakneck Hill Rd.
8398035	8/12/2021	Tree Fell	Main Line	Station breaker	1,618	50,448	31	126W50 feeder locked out at Washington Sub - tree / broken crossarm at P139 Smithfield Rd.
8371193	2/3/2021	Device Failed	Main Line	Station breaker	1,620	46,025	28	126W50 feeder locked out at Washington Sub. C phase tap burnt off at P191 Old Louisquisset Pike.
8224951	5/15/2019	Unknown	Main Line	Station breaker	1,623	1,623	1	126W50 feeder lockout - patrolled nothing found - no reclosing
8270065	12/2/2019	Unknown	Main Line	Station breaker	1,550	49,600	32	126W50 feeder lockout - patrolled nothing found - no reclosing
8355125	11/1/2020	Unknown	Main Line	Station breaker	1,619	50,189	31	126W50 feeder lockout - patrolled nothing found - no reclosing
8383874	4/30/2021	Tree Fell	Main Line	Station breaker	1,552	61,848	40	126W50 feeder lockout at Washington Sub. Cause was tree fell at P142 Old Louisquisset Pike.
8194332	8/13/2018	Device Failed	Main Line	Station breaker	1,623	40,575	25	126W50 feeder lockout at Washington Sub. U/G cable fault in getaway from substation
8275472	1/17/2020	Tree Fell	Substation	Station breaker	1,623	136,332	84	Loss of source
8284400	2/7/2020	Major Storm - Limb	Substation	Station breaker	1,623	602,133	371	Loss of source
8394770	7/17/2021	Tree - Broken Limb	Main Line	Station breaker	1,559	159,402	102	PTR tripped at P136 Old Louisquisset Pike, 126W50 feeder lockout. Tree limb fell P92 Old Louisquisset Pike
8153345	3/2/2018	Major Storm - Tree	Main Line	Station breaker	1,060	1,426,717	1,346	Tree at P5 Jenckes Hill Rd and took phase down

EXISTING EMS ONE-LINE



Washington 126W50 Existing Line Segments.								
Line Segment	From Node	To Node	Segment Main Line Length	Segment Customer Count	Customers Interrupted per Event	Outages	Total CI	Cause
A	Substation	to P136 Old Louisquesset Pike	2.4 miles	12	1,623	11	17,853	4 tree 2 limb 3 unknown 2 equipment
B	P136 Old Louisquesset Pike	to P43 Old Louisquesset Pike	2.1 miles	809	1,611	6	9,666	1 tree 3 limb 1 unknown 1 action by others
C	P2 Breakneck Hill Road	to P118 Smithfield Ave.	3.0 miles	802	802	11	8,822	6 tree 2 limb 2 MVA 1 lightning

PROPOSED EMS ONE-LINE



PROPOSED RECLOSER PLACEMENTS

Recloser #	Location	Function	Notes
1	P74 Washington Highway - Lincoln	Mainline	This is a main line recloser with no loading concerns or additional construction requirements. Needed for reclosing as the breaker is one shot to lockout due to large underground at the beginning of the circuit.
2	P12 Great Road - Lincoln	Mainline	This is a main line recloser with no loading concerns or additional construction requirements.
3	P43 Old Louisquisset Pike	Tie	This is a tie recloser with no loading concerns or additional construction requirements.
4	P88 Old Louisquisset Pike	Mainline	This is a main line recloser with no loading concerns or additional construction requirements.
5	P163 Old Louisquisset Pike	Tie	This is a tie recloser with no loading concerns or additional construction requirements. This tie was chosen because the 126W40 is fed from a different bus. There were two bus outages during the outage review period.

PROPOSED CIRCUIT CONFIGURATION

The table below identifies the number of customers that would have seen an outage from 2018 through 2022 if the proposed mainline and tie reclosers were installed. It is assumed that all mainline reclosers operate successfully and the tie reclosers close within 5 minutes of the initial outage.

Washington 126W50 Existing Line Segments.									
Line Segment	From Node		To Node	Segment Main Line Length	Segment Customer Count	Customers Interrupted per Event	Outages	Total CI	Cause
A	Substation	to	P74 Washington Hwy	1.0 miles	11	11	3	33	1 tree 1 limb 1 equipment
A1	P74 Washington Hwy	to	P136 Old Louisquesset Pike	1.4 miles	1	1	8	8	3 tree 1 limb 3 unknown 1 equipment
B	P136 Old Louisquesset Pike	to	P88 Old Louisquesset Pike	1.1 miles	259	259	3	777	1 tree 1 limb 1 action by others
B1	P188 Old Louisquesset Pike	to	P43 Old Louisquesset Pike	1 miles	505	505	3	1,515	1 tree 1 limb 1 unknown
C	P2 Breakneck Hill Road	to	P31 Front Street	2.0 miles	336	336	7	2,352	4 tree 2 MVA 1 lightning
D	P12 Great Road	to	EOL	1 miles	466	466	4	1,864	2 tree 2 limb

RELIABILITY IMPROVEMENT

The estimated reliability improvement was determined by recalculating the CI and CMI of the 28 main line events as if the proposed configuration was in place. For purposes of estimating the reliability benefits, IDS mainline events were adjusted in the following ways:

- Customer interruption totals were adjusted to reflect the customer served number when the event interrupted more than one circuit.
- Line sections with tie reclosers were assumed to be restored within five minutes of the initial outage.
- The unhealthy line section was assigned a restoration time equal to the event CAIDI.
- The CI counts for Major Storm Interruptions were reduced by 50 % of the original events. This is done to recognize that some automated switching schemes may not be available during a TMED day when 10 % to 20 % of the RIE's customer base is without service.

The following chart illustrates the annual CKAIFI and CKAIDI over the previous five years of main line events, the estimated reliability if the proposed reclosers were in place and the estimated savings.

Annual Reliability Statistics - Main Line Interruptions including Major Storms			
Matrix	Actual Results	Estimated Results w/ Reclosers	Estimated Savings
CKAIFI	4.38	1.10	3.28
CKAIDI (Min)	882	432	450

Annual Reliability Statistics - Main Line Interruptions excluding Major Storms			
Matrix	Actual Results	Estimated Results w/ Reclosers	Estimated Savings
CKAIFI	3.45	.57	2.88
CKAIDI (Min)	175	32.5	142.5

SUBSTATION RELAYS

The 126W50 has a DFP100 digital relay. This station is categorized as a type 4 replacement since this station will be studied in the next round of area studies and the solution could include a station rebuild. Engineering is expected to start in FY28 with the completion date yet to be determined.

CIRCUIT MODIFICATIONS

There are no reconductoring projects planned to support the circuit's tie reclosers. The main line ties have adequate capacity to serve load from their assigned line sections.

OTHER CONSIDERATIONS

The first recloser addition at P74 Washington Highway is important for reliability and operational reasons. From Washington Substation to the location, there is a mile of underground distribution running through the Amica property before it rises at P74 to feed most of the circuit. Because of this configuration, the 126W50 breaker is set to non-reclosing to avoid the possibility of closing back into an underground cable fault. There were three temporary faults during our review period that could have been avoided with a standard recloser with typical settings located just beyond the underground.

Other system upgrades in lieu of installing a recloser would be reconductoring 1.2 miles of conductor from open wire on crossarms to spacer cable. This line is double circuited which would make upgrading to spacer cable costly. The nine outages beyond this device were varied with three related to trees and one limb. This upgrade would not fully eliminate outages in this section. The estimated line reconductoring cost is \$1.33M.

Beyond the P136 Old Louisquisset Pike recloser, there were 18 outages over the 5.1 miles of mainline. Tree trimming was specified in the Area Study for 2023. There were no mainline tree related outages in 2022 or 2023. Due to the length of the feeder and the improvements in tree related outages, no reconductoring is recommended. The tie recloser and mainline recloser proposed through the study are important to fast restoration of the circuit for events occurring upstream. To restore end of line customers, the ability to tie to adjacent circuits is essential.

The Narragansett Electric Company
d/b/a Rhode Island Energy
Proposed FY 2025 Electric Infrastructure, Safety, and Reliability Plan
Section 2: Electric Capital Plan
Attachment 6
Page 14 of 16

5. Attachment A – Preliminary Prioritization List – Circuits with Frequency > 1.05

Feeder	Substation Name	Cust. Served	ERR FY	CEMI FY	5 yr Average CKAIFI	5 yr Average CKAIDI	Sectionalize Rank	Line Exposure Rank	Circuit CKAIFI Rank	Circuit CKAIDI Rank	CEMI Rank	DG Rank	Construction Adjustment	Priority Score	Approx. Reclosers
53-126W50	WASHINGTON	1608			4.2	248	121	289	336	330	336	181		259	3
53-127W41	NASONVILLE	661			3.2	347	180	226	335	335	336	195		266	2
56-30F2	LAFAYETTE	1869			3.1	277	168	317	334	331	336	271	250	296	3
53-34F3	CHOPMIST	845	FY25		3.1	343	80	311	333	334	336	304		260	3
56-85T1	WOOD RIVER	2748		FY25	3.1	320	332	334	332	333	336	325		299	6
53-34F2	CHOPMIST	2631			3.0	221	177	327	330	327	336	263		270	3
56-155F2	CHASE HILL SUBSTATION	2054	FY25		3.0	223	263	291	331	328	336	300		284	3
53-112W44	STAPLES	2344			2.9	140	204	259	329	306	336	231		264	3
56-155F4	CHASE HILL SUBSTATION	1773	FY25		2.9	133	163	304	328	300	336	267		260	4
53-127W40	NASONVILLE	2946		FY24	2.6	176	162	326	327	318	336	298		267	2
56-155F8	CHASE HILL SUBSTATION	1955		FY24	2.6	225	99	331	326	329	336	299		260	5
56-86F1	LANGWORTHY CORNER	2735		FY25	2.4	142	150	297	325	308	336	234		257	3
56-54F1	COVENTRY	2685		FY24	2.4	193	108	333	324	321	336	280		258	5
53-45F2	WEST GREENVILLE	1924	FY25		2.4	161	172	263	323	314	336	329		264	6
53-126W41	WASHINGTON	2356		FY25	2.3	118	205	269	322	288	336	253		259	7
53-126W51	WASHINGTON	1748			2.3	132	126	214	320	299	336	248		246	5
56-33F4	TIVERTON	3095		FY25	2.3	141	202	330	321	307	336	301	250	294	8
56-146J14	HOSPITAL	567			2.2	53	158	24	319	193	201	94		194	3
56-63F6	HOPKINS HILL	2605		FY24	2.2	194	106	335	318	322	336	293		257	2
53-148J5	Pawtucket	361			2.1	159	113	60	317	312	134	75	250	235	3
56-16F1	WESTERLY	2027	FY25		2.1	67	122	293	316	226	0	223		222	1
53-127W42	NASONVILLE	1033			2.0	200	264	305	315	324	336	296		279	4
56-16F2	WESTERLY	1817			2.0	54	234	190	314	197	0	187		224	4
56-14F3	DRUMROCK	239			1.9	128	89	95	313	296	201	87		210	1
53-107W63	Pawtucket	3152			1.9	86	207	181	312	262	0	239	250	263	5
56-36W44	DEXTER	2083	FY25		1.8	140	109	298	310	305	134	320		230	4
56-36W42	DEXTER	1861			1.8	126	239	238	309	294	134	305		243	4

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