Subregional RTEP Committee – Western
FirstEnergy Supplemental Projects

November 20, 2020

Needs

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

ATSI Transmission Zone M-3 Process
Lincoln Park 138 kV

Need Number: ATSI-2020-039

Process Stage: Need Meeting – 11/20/2020

Supplemental Project Driver(s):

Equipment Material Condition, Performance, and Risk

Infrastructure Resilience

Specific Assumption Reference(s):

Global Factors

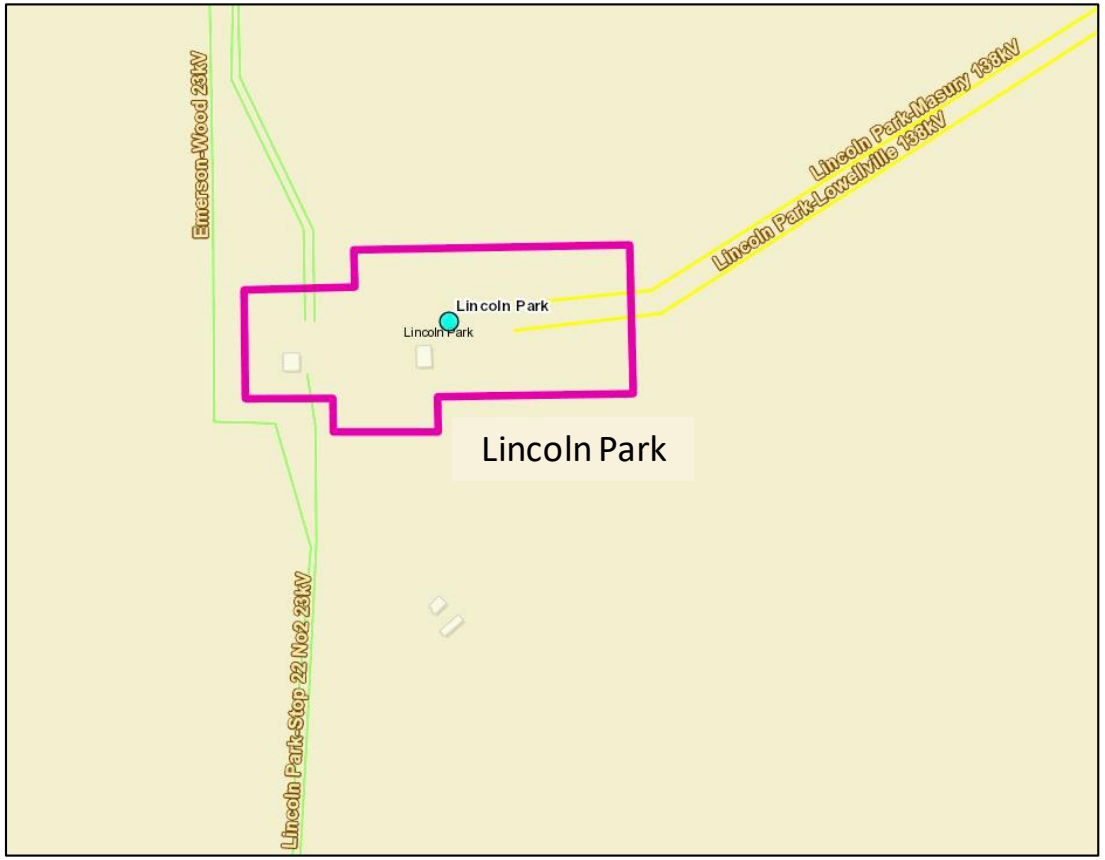
- Increasing negative trend in maintenance findings and/or costs
- Failure risk, to the extent caused by asset design characteristics, or historical industry/ company performance data, or application design error

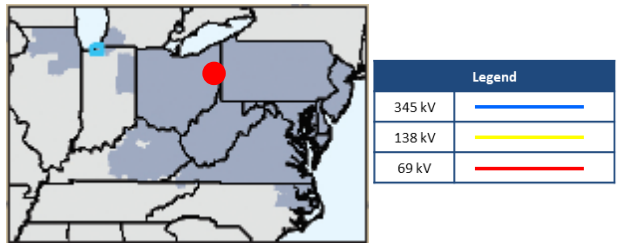
Substation Condition Rebuild/Replacement

- Circuit breakers and other fault interrupting devices
- Switches

Problem Statement

- McGraw Edison oil circuit breakers B-67, B-68, and associated disconnect switches at Lincoln Park are experiencing increasing maintenance concerns; hydraulic fluid issues, deteriorated operating mechanisms and increasing maintenance trends.
  - Breakers B-67 and B-68 are 48 years old
  - Associated terminal equipment line arrestors and substation conductor





ATSI Transmission Zone M-3 Process
Henrietta-Johnson 69 kV Line

Need Number: ATSI-2020-044

Process Stage: Need Meeting – 11/20/2020

Supplemental Project Driver(s):
Equipment Material Condition, Performance, and Risk

Specific Assumption Reference(s)

Line Condition Rebuild / Replacement

- Aged or deteriorated transmission line structures
- Negatively impact customer outage frequency and/or durations
- Demonstrate an increasing trend in maintenance findings and/or costs
- Transmission line ratings are limited by terminal equipment.

Problem Statement:

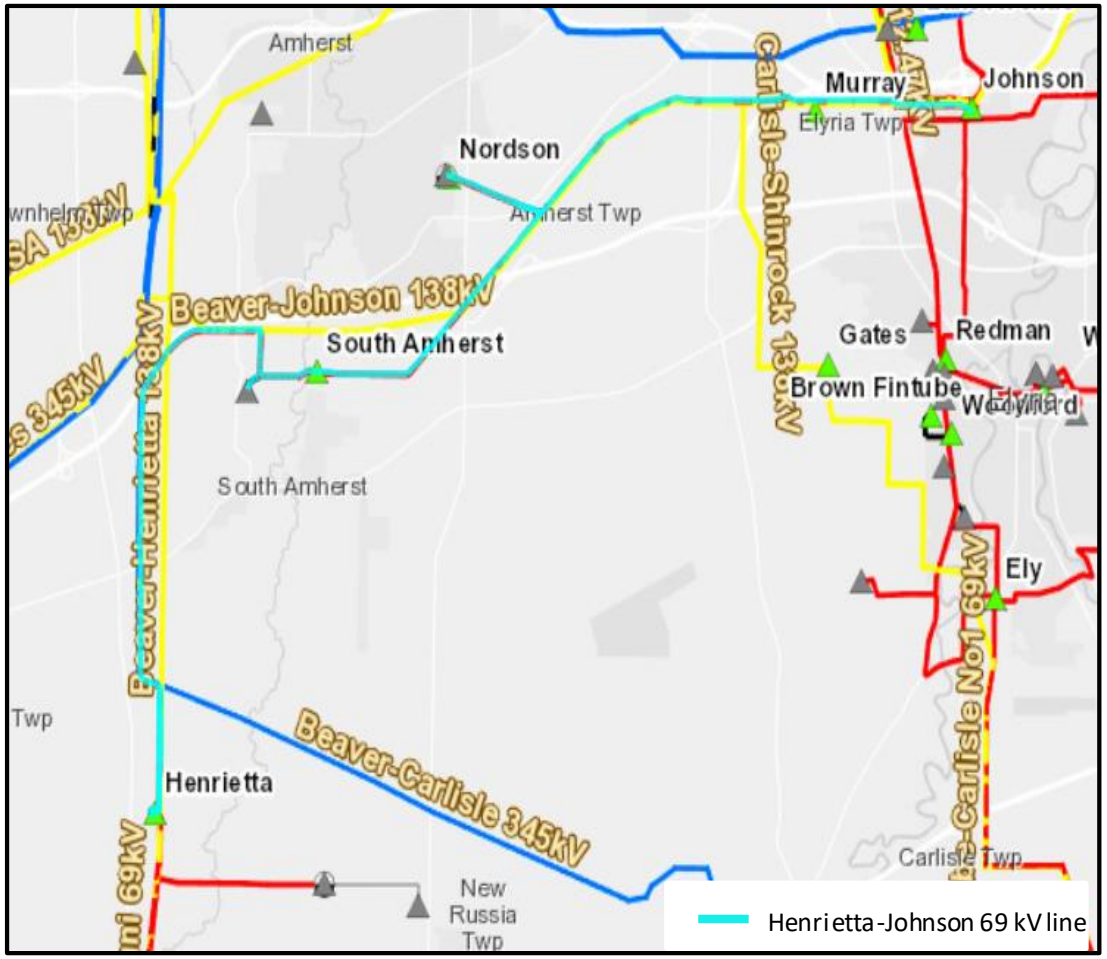
Henrietta-Johnson 69 kV Transmission Line is approximately 16 miles in length.

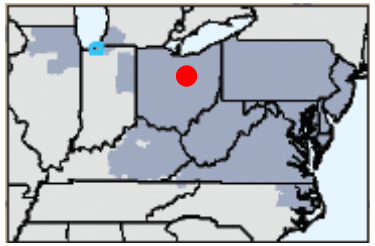
Line survey in 2020 showed a structure reject rate of 43% (93 of 218). The primary reasons for reject were wood pole deterioration, woodpecker holes, ground system damage, and decay damage.

Worst performing transmission circuit in ATSI.

Growing trend in unscheduled interruptions with 20 equipment failure caused outages in the past 5 years which have historically impacted approximately 9,200 customers. The majority of outage causes are related to Failed AC Circuit Equipment (conductor, crossarm, static wire, insulator, etc.).

Transmission line switches are obsolete and limiting the transmission line rating.





Legend	
345 kV	
138 kV	
69 kV	

ATSI Transmission Zone M-3 Process
Sharon 69 kV Substation

Need Number: ATSI-2020-045
Process Stage: Need Meeting – 11/20/2020

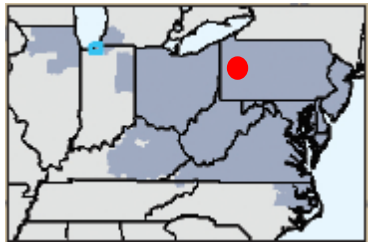
Supplemental Project Driver(s):
Equipment Material Condition, Performance, and Risk
Infrastructure Resilience

Specific Assumption Reference(s):
Global Factors

- Level of criticality to system performance and operations
- Customer outage frequency and/or durations
- Increasing negative trend in maintenance findings and/or costs
- Failure risk, to the extent caused by asset design characteristics, or historical industry/ company performance data, or application design error

Problem Statement

- The 69 kV lines at the Sharon 69 kV substation have a single set of relays providing protection.
- The Sharon 69 kV bus has a single bus protection scheme.
- There is no breaker failure presently installed on the Sharon 69 kV exposing this sub and its lines to risk of a larger outage if one of these schemes were to fail to operate.
- In June 2018, an uncleared fault on Y-300 line to McDowell led to a widespread outage of all the 69 kV lines from Sharon.



Legend	
345 kV	
138 kV	
69 kV	

Solutions

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Need Number: ATSI-2020-Mutiple (See next slide)

Process Stage: Solution Meeting – 11/20/2020

Previously Presented: Need Meeting – 08/14/2020

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption References:

Global Factors

- System reliability and performance
- Substation / line equipment limits

Upgrade Relay Schemes

- Relay schemes that have a history of misoperation
- Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
- Communication technology upgrades
- Bus protection schemes

Problem Statement:

- FirstEnergy has identified protection schemes using a certain vintage of relays and communication equipment that have a history of misoperation.
- Proper operation of the protection scheme requires all the separate components perform adequately during a fault
- In many cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.
- Transmission line ratings are limited by terminal equipment.

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Map Not Shown
Multiple Locations

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

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ATSI-2020	Transmission Line / Substation Locations	Existing Line/Terminal Equipment MVA Rating (SN / SE)	Existing Conductor/Transformer MVA Rating (SN / SE)	Limiting Terminal Equipment
-014	Galion 138/69 kV Transformer #1	112 / 132 143 (WN) / 143 (WE)	126 / 132 151 (WN) / 157 (WE)	Substation conductor and relay at 69 kV
-015	Masury – Maysville 138 kV Line	124 / 124 124 (WN) / 124 (WE)	273 / 332 309 (WN) / 393 (WE)	Metering and substation conductor
-016	Babb Substation 1. Valley Terminal Upgrade	200 / 223 223 (WN) / 223 (WE)	200 / 242 226 (WN) / 286 (WE)	Relay
-017	Highland – Mahoningside 138 kV Line	200 / 223 223 (WN) / 223 (WE)	200 / 242 226 (WN) / 286 (WE)	Relay
-018	Highland – GM Lordstown 138 kV Line 1. Highland-Tod 2. GM Lordstown-Tod	1. 329 / 413 430 (WN) / 430 (WE) 2. 267 / 352 387 (WN) / 430 (WE)	1. 376 / 465 430 (WN) / 520 (WE) 2. 430 / 494 430 (WN) / 520 (WE)	1. Disconnect switch and relay 2. Substation conductor and relay
-019	Dale – West Canton 138 kV Line (AEP)	233 / 282 263 (WN) / 287 (WE)	233 / 282 263 (WN) / 333 (WE)	Relay
-020	Dale – South Akron 138 kV Line 1. Dale-Moore 138 kV section 2. Moore-South Akron 138 kV section	1. 233 / 282 263 (WN) / 284 (WE) 2. 225 / 282 263 (WN) / 306 (WE)	1. 233 / 282 263 (WN) / 333 (WE) 2. 233 / 282 263 (WN) / 333 (WE)	Substation conductor and relay

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ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

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ATSI-2020	Transmission Line / Substation Locations	Existing Line/Terminal Equipment MVA Rating (SN / SE)	Existing Conductor/Transformer MVA Rating (SN / SE)	Limiting Terminal Equipment
-021	Avery – Shinrock 138 kV Line	233 / 282 263 (WN) / 287 (WE)	233 / 282 263 (WN) / 333 (WE)	Relay
-022	Central – Packard 138 kV Line	157 / 196 198 (WN) / 210 (WE)	157 / 196 198 (WN) / 255 (WE)	Relay
-023	Wauseon – Delta 138 kV Line 1. Wauseon – Lear 2. Delta-Nature Fresh Farms	1. 327 (WN) / 396 (WE) 2. 327 (WN) / 396 (WE)	1. 327 (WN) / 420 (WE) 2. 327 (WN) / 420 (WE)	Substation conductor and relay
-024	Eastlake – Lloyd Q13 138 kV Line 1. Eastlake – Marble	278 / 287 287 (WN) / 287 (WE)	278 / 339 315 (WN) / 401 (WE)	Relay
-025	Cardington (Galion) 138 kV Line	145 / 145 145 (WN) 145 (WE)	233 / 282 263 (WN) 333 (WE)	Substation conductor and relay
-026	Brookside – Longview East 138 kV Line	153 / 192 180 (WN) 210 (WE)	160 / 192 180 (WN) 228 (WE)	Substation conductor and relay
-027	Hanna – West Ravenna No1 138 kV Line	295 / 369 367 (WE) / 373 (WE)	376 / 432 376 (WE) / 455 (WE)	Substation conductor, disconnect switch, line drop and relay
-034	Masury – Maysville 138 kV Line	124 / 124 124 (WN) / 124 (WE)	273 / 332 309 (WN) / 393 (WE)	Metering, substation conductor, relays, and CTs

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Proposed Solution:

ATSI-2020	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-014	Galion 138/69 kV Transformer #1	126/132 MVA	Replace existing electromechanical relaying for Galion 138/69 kV TR#1 using SEL-351A for 51G tertiary relay. Also, replace limiting 750 CU substation conductors between TR & bus-side DS with 954 kcmil SAC.	1.2	12/1/2021
-015	Masury – Maysville 138 kV Line	273 / 332 MVA 309 / 393 MVA (WN/WE)	Masury: Replace (2) 138 kV 1200 A disconnect switches (D133 & D132) with 2000 A switches. Replace one (1) 138 kV 3000 A SF6 breaker (B85). Replace (1) 138 kV CVT. Replace (1) 138 kV wave trap with a 2000 A unit. Replace substation conductor. Upgrade Masury - Maysville 138 kV line relaying.	0.8	06/01/2021
-016	Babb –Valley 138 kV Substation Terminal Upgrade	200 / 242 MVA 226 / 286 MVA (WN/WE)	Babb: Replace (2) 138 kV disconnect switches (D8 & D10). Replace (1) 138 kV air-break switch (A11). Replace (3) 138 kV CVTs (CC12, CC13, & CC14). Replace line drops to breaker. Replace (3) rod gaps with (3) 108 kV, 84 kV MCOV, surge arresters. Valley: Replace (1) 138 kV circuit breaker (B1). Replace (1) 138 kV line side disconnect switch (D4) with a 2000 A disconnect switch. Replace (3) 138 kV CVTs (CC14, CC15, & CC16). Replace (3) rod gaps with (3) 108 kV, 84 kV MCOV, surge arresters.	1.3	12/31/2021

Alternatives Considered: Maintain existing condition

Project Status: Conceptual

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Proposed Solution:

ATSI-2020	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-017	Highland – Mahoningside 138 kV Line	200 / 242 MVA 226 / 286 MVA (WN/WE)	Highland: Replace (1) 138 kV breaker (B158). Replace (1) 138 kV disconnect switch (D159). Replace (3) CCVTs. Replace Highland-Mahoningside 138 kV line relaying. Mahoningside: Replace (1) 138 kV breaker (B67). Replace (1) 138 kV disconnect switch (D68). Replace (3) CCVTs. Replace Highland-Mahoningside 138 kV line relaying.	1.4	06/01/2022
-018	Highland – GM Lordstown 138 kV Line 1. Highland-Tod 2. GM Lordstown-Tod	1. 376 / 465 MVA 430 / 520 MVA (WN/WE) 2. 430 / 494 MVA 430/ 520 MVA (WN/WE)	Highland: Replace (1) 138 kV breaker (B2). Replace substation conductor. Replace (1) 138 kV disconnect switch (D3). Replace (3) CCVTs. Replace Highland-GM Lordstown 138 kV line relaying. Tod: Replace 1200 A line switches (A7 & A9) with 2000 A switches. GM Lordstown: Replace (1) 138 kV disconnect switch (D68). Replace (1) 138 kV transfer bus disconnect switch (A16) Replace (3) CCVTs. Replace substation conductor. Replace Highland-GM Lordstown 138 kV Line relaying.	1.2	06/01/2022

Alternatives Considered: Maintain existing condition

Project Status: Conceptual

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Proposed Solution:

ATSI-2020	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-019	Dale – West Canton 138 kV Line (AEP)	233 / 282 MVA 263 / 333 MVA (WN/WE)	Dale: On the Dale - West Canton 138 kV line exit, install AMETEK Smartgap. Replace Dale - West Canton 138 kV line primary and backup line relays with FE standard dual SEL-421 protection schemes. Install Power Comm PCM 5350.	0.42	03/31/2022
-020	Dale – South Akron 138 kV Line 1. Dale-Moore 138 kV section 2. Moore-South Akron 138 kV section	1. 233 / 282 MVA 263 / 333 MVA (WN/WE) 2. 233 / 282 MVA 263 / 333 MVA (WN/WE)	Dale: Replace spark gap arresters with surge arresters. Replace three (3) 138 kV CVTs . Replace line relaying and control with standard relay panel for the Dale – South Akron 138 kV line, include breaker failure relaying for breaker B29. South Akron: Replace (1) 138 kV line-side disconnect switch (D320). Replace limiting 750 Cuconductor between bus and disconnect switch. Replace (3) 138 kV CVTs. Replace line relaying and control with standard relay panel for the Dale – South Akron 138 kV line, include breaker failure relaying for breaker B2. Replace existing spark sap arresters with surge arresters. Replace 138 kV insulators.	1.0	12/30/2021

Alternatives Considered: Maintain existing condition

Project Status: Conceptual

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Proposed Solution:

ATSI-2020	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-021	Avery – Shinrock 138 kV Line	233 / 282 MVA 263 / 333 MVA (WN/WE)	Avery: Replace three (3) 138 kV CVTs . Replace three (3) spark gap arresters with new surge arresters. Install AMETEK Smartgap. Replace disconnect switches (D35 & D63). Replace line relaying with dual SEL-421 with DCB over PLC. Install new SEL-501 BFT scheme for 138 kV breaker (B36). Install PowerComm PCM5350. Shinrock: Install AMETEK Smartgap. Install PowerComm PCM5350.	0.6	03/31/2022
-022	Central – Packard 138 kV Line	157 / 196 MVA 198 / 255 MVA (WN/WE)	Niles Central Muni: Replace (1) 138 kV line trap and tuner. Replace (3) CCVTs. Replace Central - Packard 138 kV line relaying. Packard: Replace (1) 138 kV breaker (B13) and associated disconnect switches (D12 & D14). Replace (1) 138 kV line trap and tuner. Replace (3) CCVTs. Replace Central - Packard 138 kV line relaying.	1.4	03/31/2022
-023	Wauseon – Delta 138 kV Line 1. Wauseon – Lear 2. Delta-Nature Fresh Farms	1. 278 / 343 MVA 327 / 420 MVA (WN/WE) 2. 278 / 343 MVA 327/ 420 MVA (WN/WE)	Delta: Replace (1) 138 kV breaker (B13430). Replace 138 kV Wauseon line CCVT. Upgrade (1) 138 kV wave trap and line tuner. Upgrade substation conductor. Replace Delta-Wauseon 138 kV line relaying. Wauseon: Replace (1) 138 kV line trap. Replace 138 kV line CCVT. Upgrade substation conductor. Replace Delta line disconnect switch. Replace Delta-Wauseon 138 kV line relaying.	1.4	06/01/2022

Alternatives Considered: Maintain existing condition

Project Status: Conceptual

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Proposed Solution:

ATSI-2020	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-024	Eastlake – Lloyd Q13 138 kV Line 1. Eastlake – Marble	TBD	TBD	TBD	TBD
-025	Cardington (Galion) 138 kV Line	233 / 282 MVA	Cardington: Replace Cardington (Galion) 138 kV line relaying. Galion: Upgrade substation conductor.	1.1	12/1/2022
-026	Brookside – Longview East 138 kV Line	160 / 192 MVA	Brookside: Upgrade relay package. Upgrade the CCVTs, Wavetrap, tuner, co-ax cables, and carrier set. Upgrade 400 CU substation conductor, disconnect switches (D76 & D77). Longview: Upgrade relay package. Upgrade the CCVTs, Wavetrap, tuner, co-ax cables, and carrier set. Upgrade relay packages at Brookside and Longview Terminals, the CCVTs, Wavetrap, tuner, co-ax cables and carrier set. Include Smartgap and PCM 5350.	1.5	12/20/2022

Alternatives Considered: Maintain existing condition

Project Status: Conceptual

Model: 2020 RTEP model for 2025 Summer (50/50)

ATSI Transmission Zone M-3 Process
Multiple Relay Misoperation

Proposed Solution:

ATSI-2020	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
-027	Hanna – West Ravenna No1 138 kV Line	376 MVA / 432 MVA (SN/SE) 376 / 455 MVA (WN/WE)	Hanna: Replace 138 kV breaker (B7) foundation and conduit. Upgrade (2) 138 kV disconnect switches (D84 & D85) to 138 kV, 2000 A DSWs. Replace (1) 138 kV circuit breaker (B7). Replace line relaying and control consisting of dual SEL-421 over DCB and SEL-501 (BF/B7) for the Hanna - West Ravenna No1 138 kV line with a new prewired standard line relaying panel. West Ravenna: Upgrade (2) 138 kV disconnect switches (D60 & D59) to 138 kV, 2000 A DSWs. Replace line relaying and control consisting of dual SEL-421 over DCB and SEL-501 (BF/B21) for the Hanna - West Ravenna No1 138 kV line, using a prewired standard line relaying panel. Upgrade (1) 138 kV Transfer Bus Switch (A61) to 138 kV, 2000 A DSW due to condition. Upgrade limiting conductors between the dead end and the disconnect switches.	1.5	04/06/2021
-034	Masury – Maysville 138 kV Line	273 / 332 MVA (SN/SE) 309 / 393 MVA (WN/WE)	Maysville: Replace (2) 138 kV 1200 A disconnect switches (A1 & D3) with 2000 A switches. Replace (1) 138 kV wave trap with a 2000 A unit. Replace (1) 138 kV CVT. Replace substation conductor. Upgrade Masury-Maysville 138 kV line relaying.	1.0	06/01/2021

Alternatives Considered: Maintain existing condition

Project Status: Conceptual

Model: 2020 RTEP model for 2025 Summer (50/50)

Re-Present Solutions

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation

Previously Presented : 10/26/2018 SRRTEP

Need Number: ATSI-2018-008 (s1795)
Process Stage: Solutions Meeting
Solutions Meeting: 10/26/2018, 11/20/2020
Needs Meeting: 09/28/2018

Supplemental Project Driver(s):
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference(s)
Add/Expand Bus Configuration

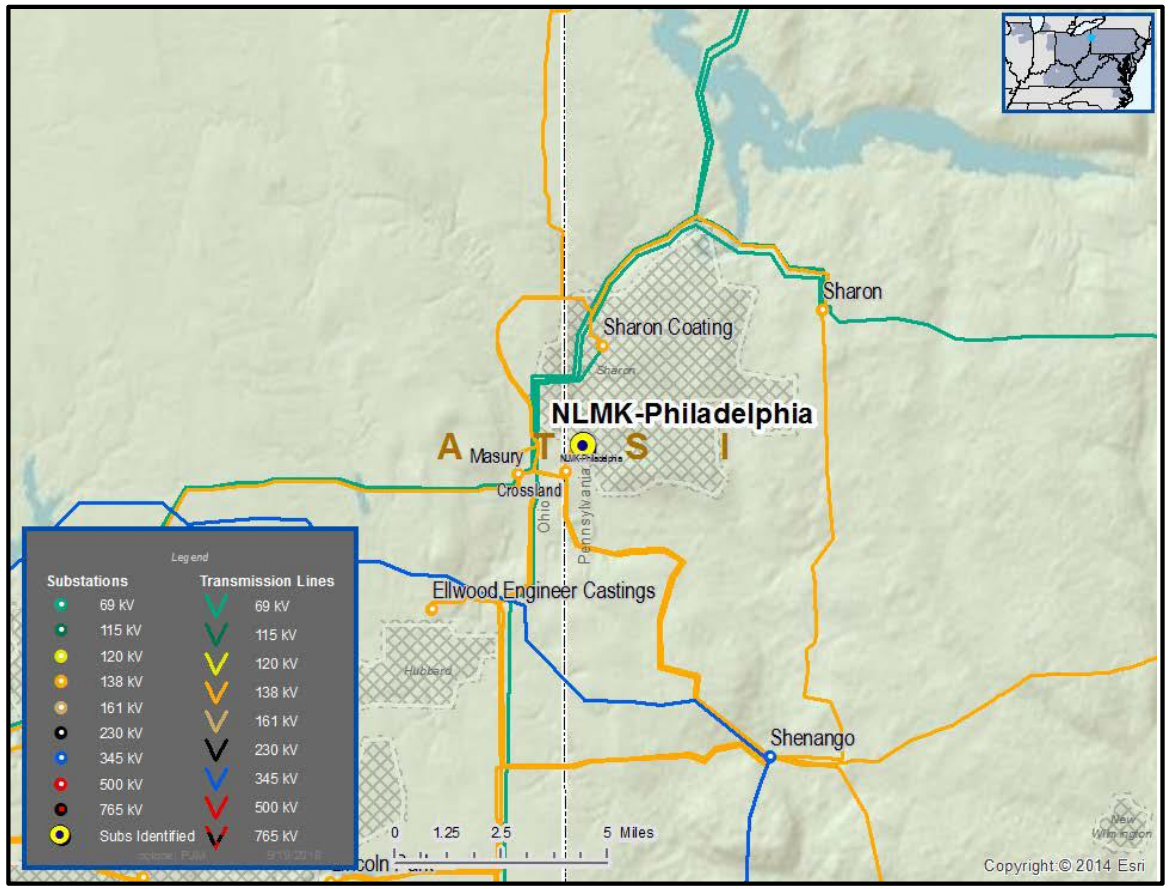
- Loss of substation bus adversely impacts transmission system performance
- Eliminate simultaneous outages to multiple networked elements under N-1 analysis

Substation Condition Rebuild/Replacement

- Power Transformers and Load Tap Changers (LTC)
- Circuit Breaker and Other Fault Interrupting Devices

Line Condition Rebuild/Replacement

- Assessment of existing transmission lines for equipment characteristics that are at, or beyond their existing service life, or contain components that are obsolete.



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ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation

Previously Presented : 10/26/2018 SRRTEP

Need Number: ATSI-2018-008 (s1795)
Process Stage: Solutions Meeting
Solutions Meeting: 10/26/2018, 11/20/2020
Needs Meeting: 09/28/2018

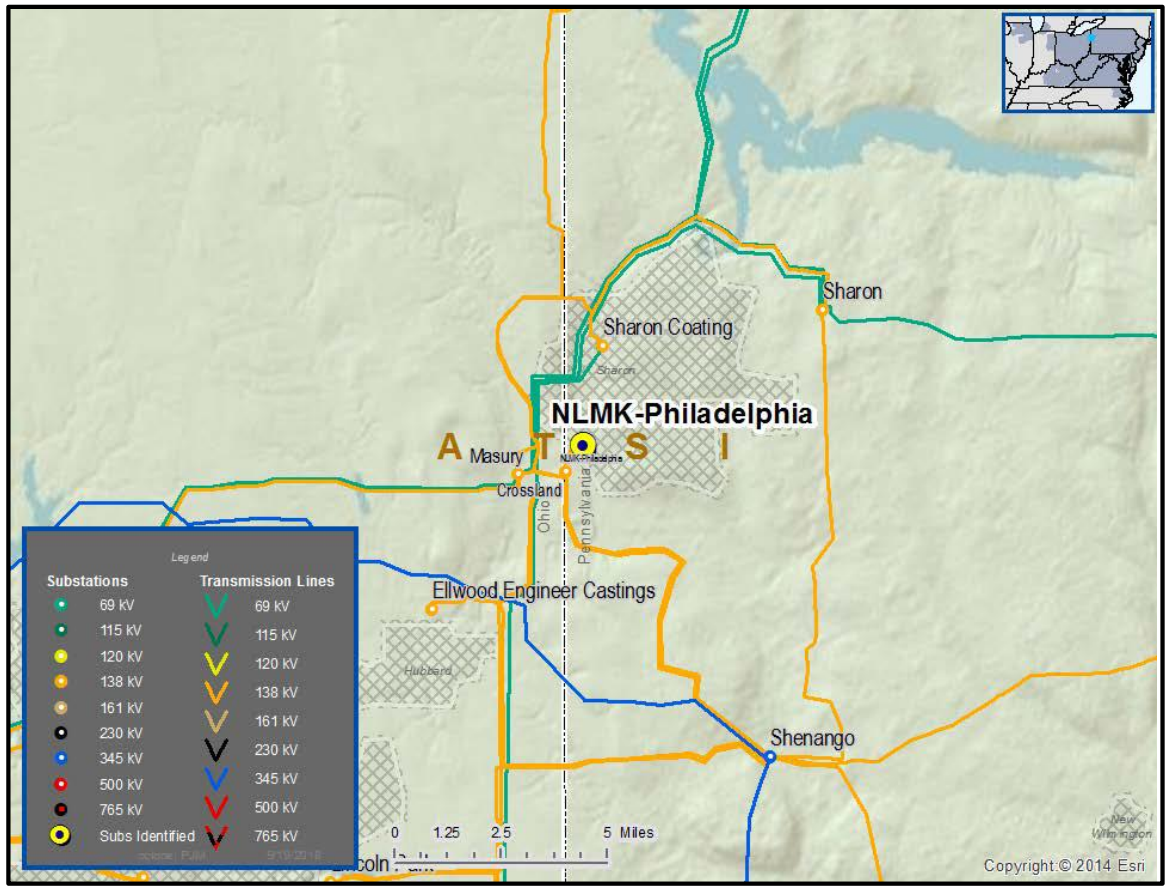
Problem Statement

NLMK Load at Risk

- Reduce the amount of local load loss under contingency conditions
  - Loss of Crossland-NLMK 138 kV line
  - Results in loss of approximately 58 MWs of load.

  Or
  - Masury 69 kV bus fault
  - Results in potential local voltage collapse of the Masury 69 kV area

- Equipment Material Condition, Performance and Risk
  - NLMK 69 kV system cable trenches are deteriorated and in need of replacement
  - 69 kV breakers in need of replacement (bus-tie breaker has already failed)
  - NLMK 138/69 kV transformer # 6 and # 12 are aged (> 50 years) and not standard design.
  - Transformer #6 has elevated gas levels.
  - Existing 69 kV transmission line conductor around NLMK is corroded and deteriorated with multiple splice locations.
  - Need to upgrade to current standards



ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation

PREVIOUS SOLUTION

Previously Presented : 10/26/2018 SRRTEP

Need Number: ATSI-2018-008 (s1795)
Process Stage: Solutions Meeting
Solutions Meeting: 10/26/2018, 11/20/2020
Needs Meeting: 09/28/2018

Proposed Solution:

NLMK 138/69 kV Substation Rebuild Project

- Retire existing NLMK 1M and 2M substations and network the existing NLMK 69 kV system with the Masury-Sharon 69 kV line
- Install a loop structure at the Masury tap and rebuild the segment of line from the tap to the 2M substation as double circuit 336 ACSR (0.8 miles)
- Replace existing NLMK 138/69 kV 1M substation with new a 138/69 kV substation
  - 3-138 kV breakers in a straight bus configuration (1-Line and 2-transformer breakers)
  - 2-138/69 kV transformers (134 MVA)
  - Six (6) breaker 69 kV ring bus
  - New control building
- Re-configure existing 69 kV lines around NLMK
  - Masury-NLMK 69 kV Line: 57 MVA SN / 73 MVA SE
  - Sharon-NLMK 69 kV Line: 57 MVA SN / 73 MVA SE
- Install revenue metering
- Add a 138 kV breaker at Crossland for the Crossland-NLMK 138 kV Line
- Upgrade 69 kV relays at Masury and Sharon substations

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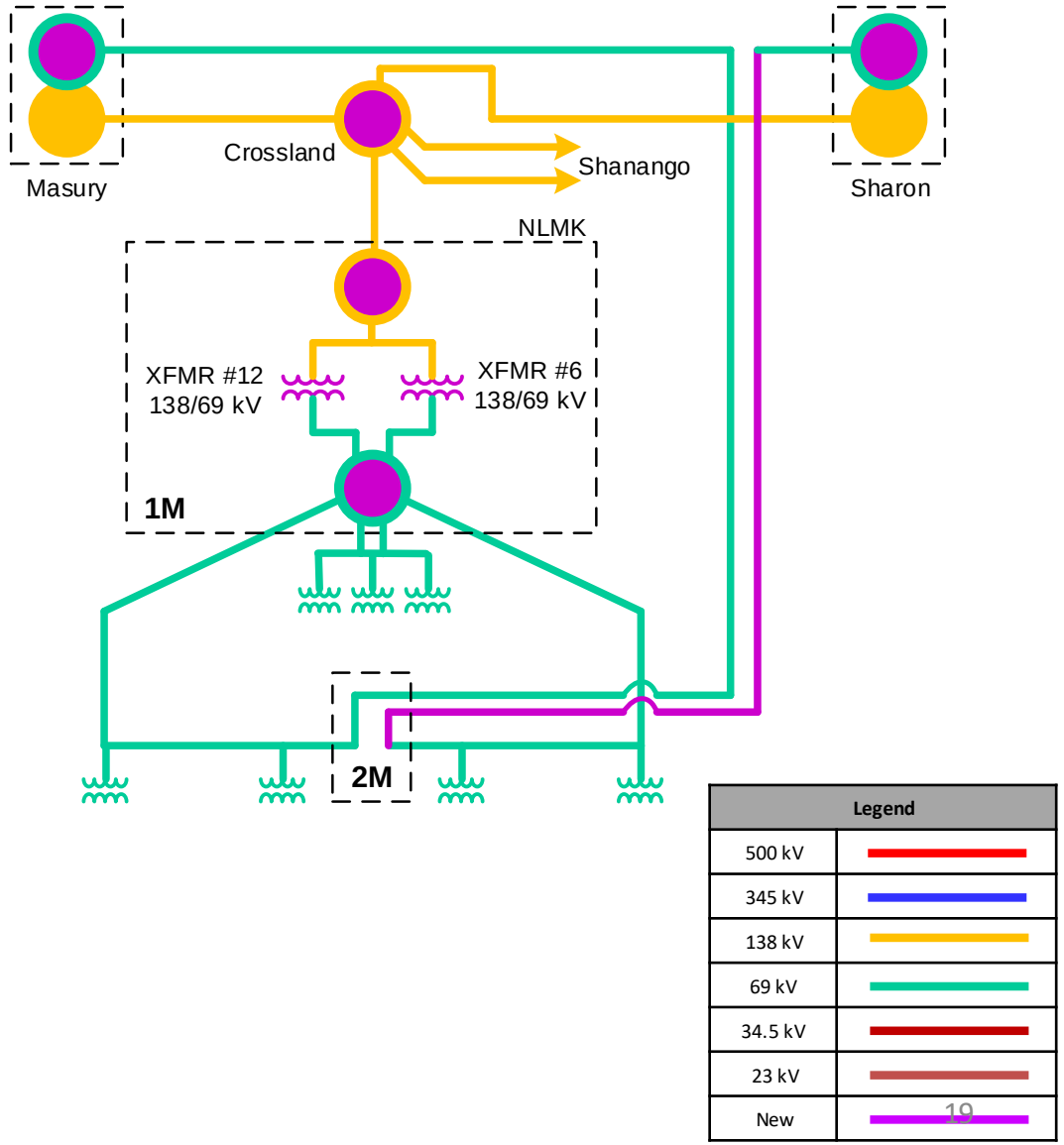


ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation

PREVIOUS SOLUTION

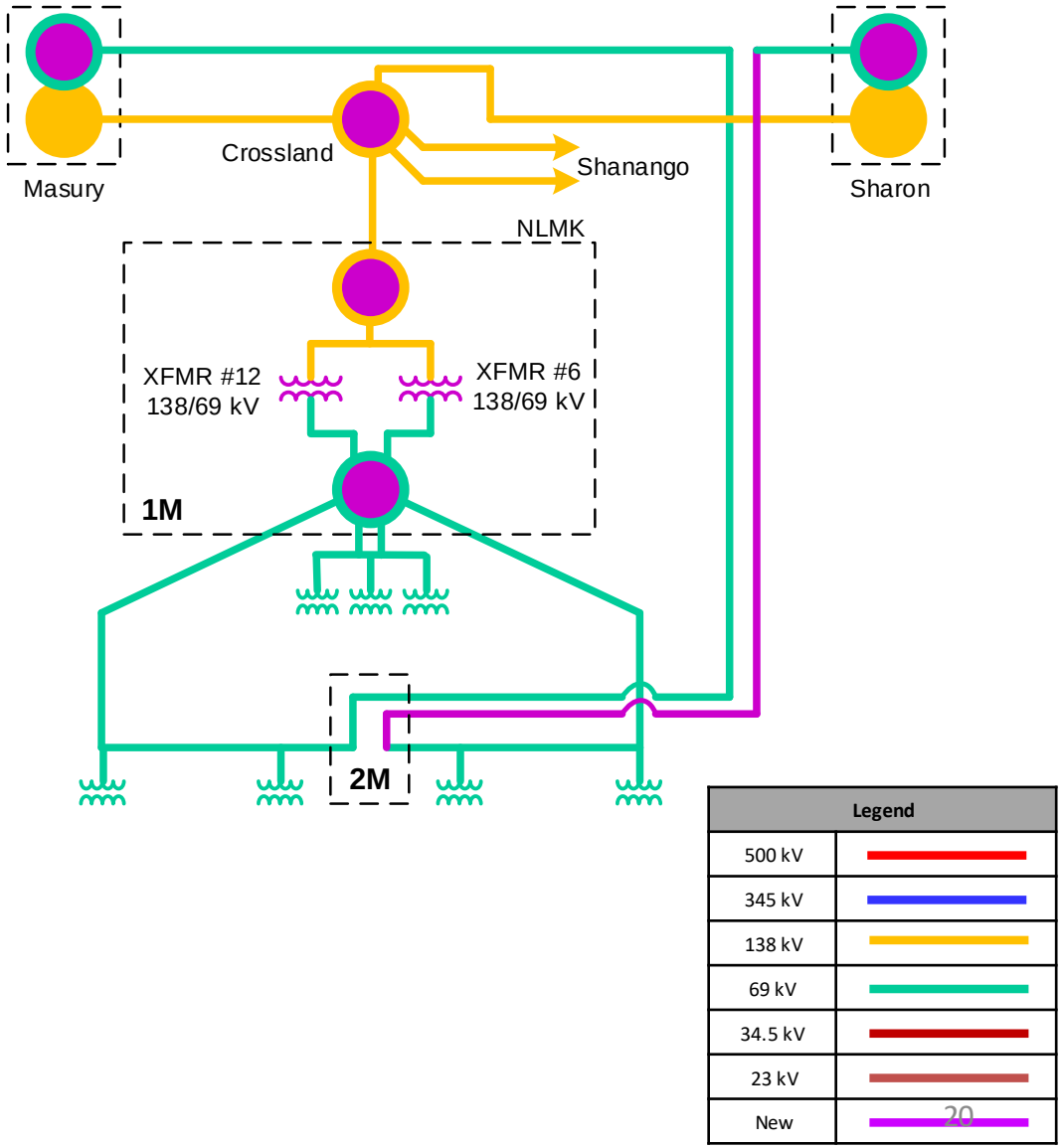
Previously Presented : 10/26/2018 SRRTEP

Need Number: ATSI-2018-008 (s1795)
Process Stage: Solutions Meeting
Solutions Meeting: 10/26/2018, 11/20/2020
Needs Meeting: 09/28/2018

Alternatives Considered:

Convert Masury 69 kV into breaker-and-a-half configuration and replace two (2) 138/69 kV transformers, seven (7) 69 kV breakers at NLMK 1M substation, and all substation control cable at NLMK 1M substation

Estimated Project Cost: $30.0M
Projected IS Date: 12/31/2021
Status: Conceptual



ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation

NEW SOLUTION

Need Number: ATSI-2018-008 (s1795)
Process Stage: Solutions Meeting
Solutions Meeting: 10/26/2018, 11/20/2020
Needs Meeting: 09/28/2018

Proposed Solution:

The scope change is driven by the condition of the existing NLMK 1M substation and challenges with keeping NLMK energized throughout the duration of construction.

Riverbank 138/69 kV Substation

- Replace existing NLMK 138/69 kV 1M substation with new a 138/69 kV substation (Riverbank)
  - — Install a 138 kV 3-breaker ring bus
  - — 2-138/69 kV transformers (134 MVA)
  - — Six (6) breaker 69 kV ring bus
  - — New control building
  - — Install two revenue metering packages
- Re-configure existing 69 kV lines around NLMK
  - — Masury-Riverbank 69 kV Line: 76 MVA SN / 92 MVA SE
  - — Sharon-NLMK 69 kV Line: 80 MVA SN / 96 MVA SE
  - — Crossland-Riverbank 138 kV Line: 96 MVA SN / 105 MVA SE
  - — NLMK 1S (Riverbank) 69 kV Line: 80 MVA SN / 96 MVA SE
  - — NLMK 3S (Riverbank) 69 kV Line: 80 MVA SN / 96 MVA SE
- Add a 138 kV breaker at Crossland for the Crossland-NLMK 138 kV Line
- Install transfer bus and breaker at Crossland 138 kV
- Upgrade 69 kV relays at Masury and Sharon substations
- Install line switches for each NLMK tap (SCADA at 13S, 2S, and 10A)
- Build 0.8 miles of 795 ACSR 69 kV line to loop into the Riverbank substation
- Rebuild the NLMK loop using 795 ACSR (~1.3 miles) reconfiguring lines as required
- Remove/retire NLMK 1M and 2M substations

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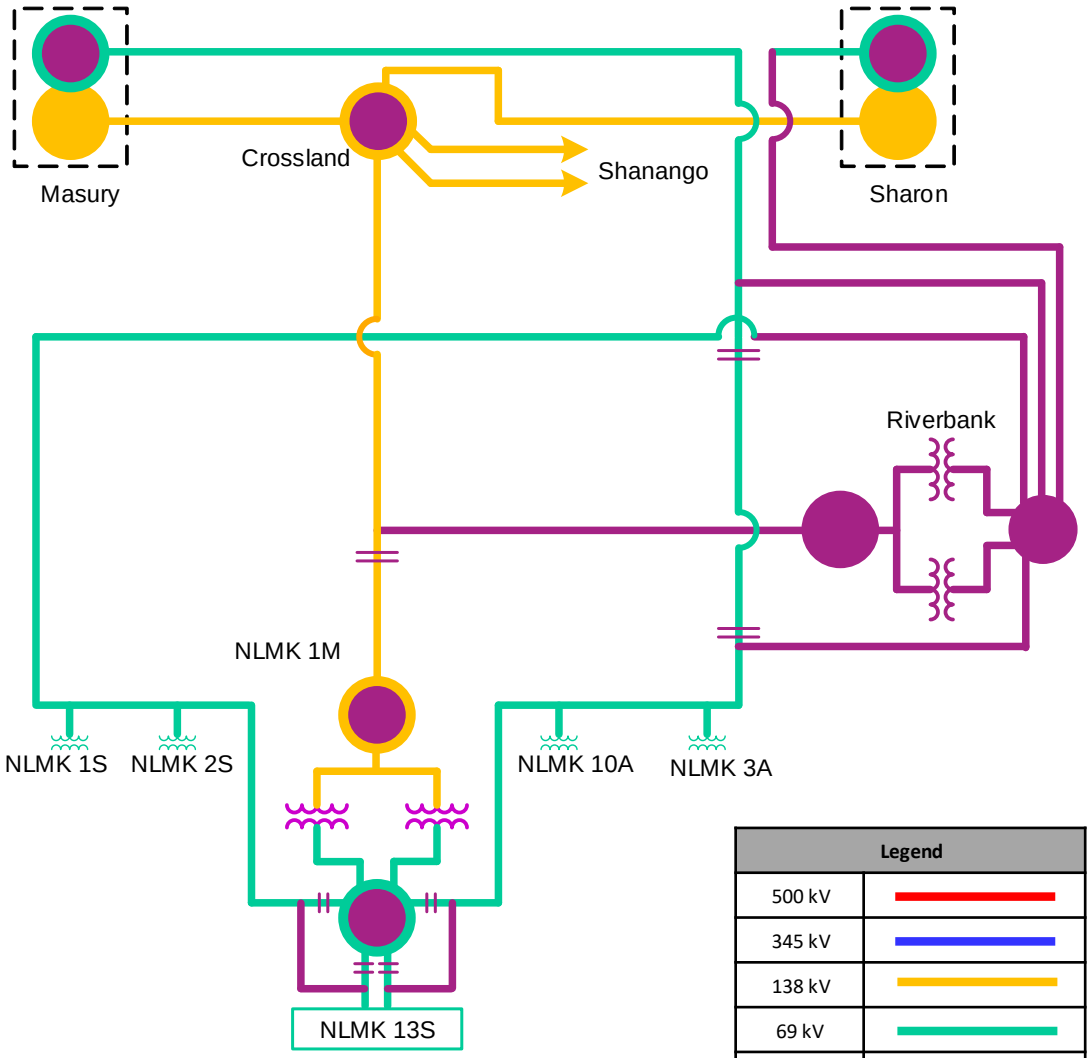


Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

ATSI Transmission Zone M-3 Process
NLMK 138/69 kV Substation

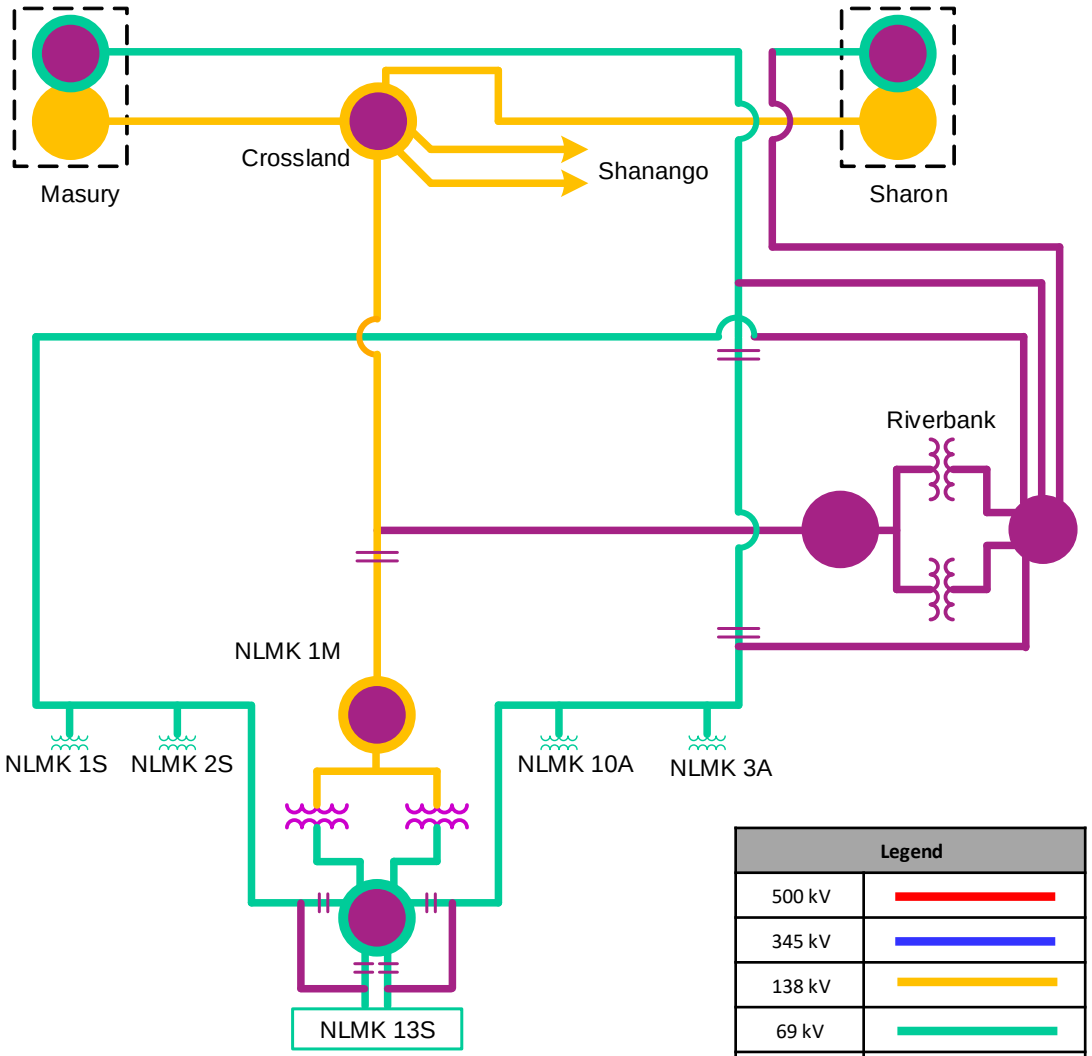
NEW SOLUTION

Need Number: ATSI-2018-008 (s1795)
Process Stage: Solutions Meeting
Solutions Meeting: 10/26/2018, 11/20/2020
Needs Meeting: 09/28/2018

Alternatives Considered:

- Convert Masury 69 kV into breaker-and-a-half configuration and replace two (2) 138/69 kV transformers, seven (7) 69 kV breakers at NLMK 1M substation, and all substation control cable at NLMK 1M substation
- Rebuild the NLMK 1M substation

Estimated Project Cost: $40 M
Projected IS Date: 12/31/2022
Status: Conceptual



ATSI Transmission Zone M-3 Process
Ayersville Weston Network and 69 kV Conversion Project

Previously Presented : 3/28/2019 SRRTEP

Need Number: ATSI-2019-009 (s1953)
Process Stage: Solutions Meeting
Solutions Meeting: 03/28/2019, 11/20/2020
Needs Meeting: 01/14/2019

Project Driver(s):
Operational Flexibility and Efficiency
Infrastructure Resilience

Specific Assumption Reference(s)

Global Considerations

- System reliability and performance
- Substation / Line equipment limits
- Reliability of Non-Bulk Electric System (Non-BES) facilities
- Load and risk in planning and operational scenarios
- Load and/or customers at risk on single transmission lines

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ATSI Transmission Zone M-3 Process
Ayersville Weston Network and 69 kV Conversion Project

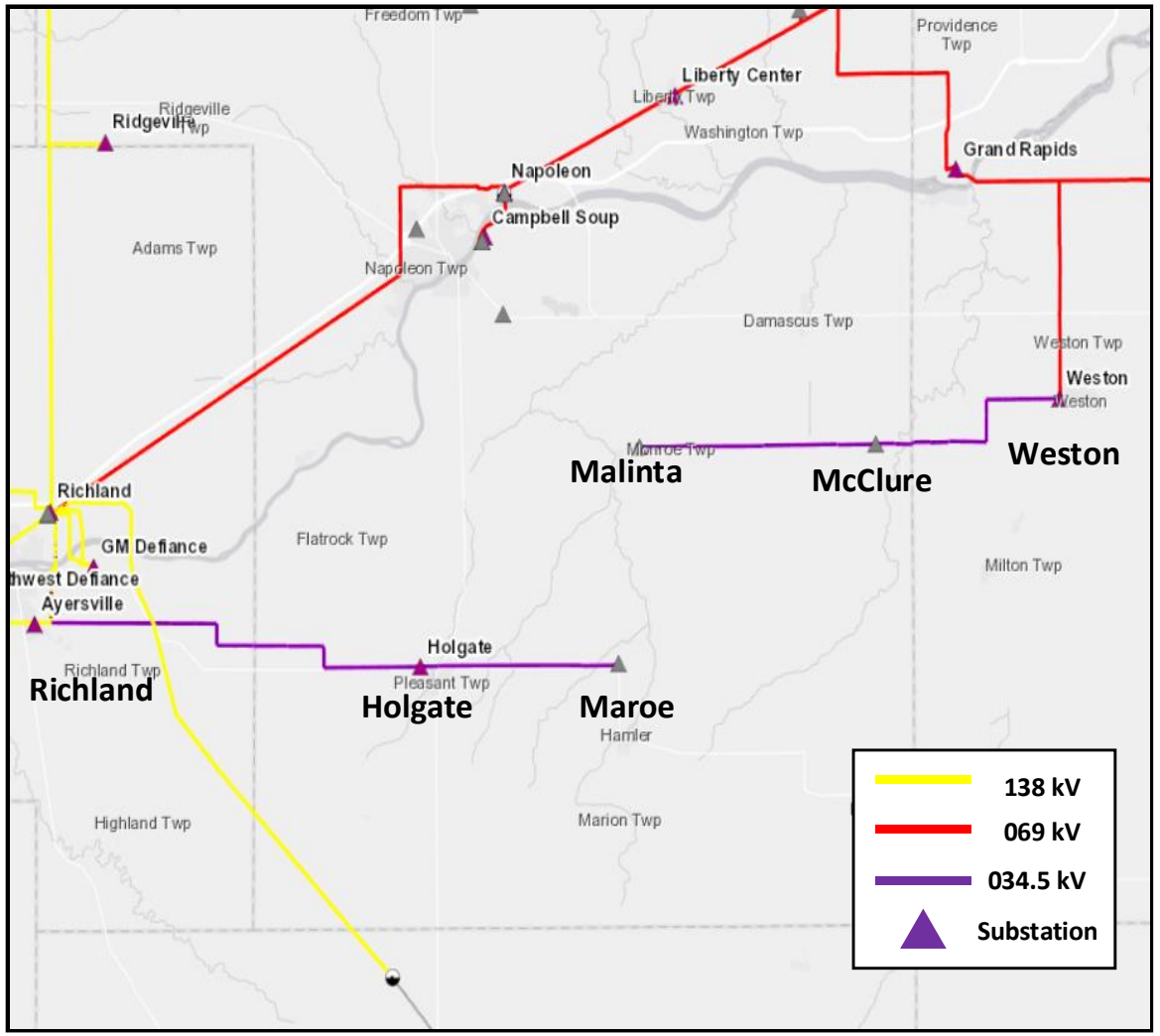
Previously Presented : 3/28/2019 SRRTEP

Need Number: ATSI-2019-009 (s1953)
Process Stage: Solutions Meeting
Solutions Meeting: 03/28/2019, 11/20/2020
Needs Meeting: 01/14/2019

Problem Statement

Maroe-Malinta 34.5 kV Area

- *The existing Richland-Maroe 34.5kV line is a radial line with limited capability of transferring load onto different circuits for emergency restoration and scheduling of routine maintenance.*
- *The loss of the Richland-Maroe 34.5 kV radial line results in the loss of approximately 8 MW and 2,550 customers at two (2) sub-transmission service points.*
- *The existing Weston-Malinta 34.5 kV line is a radial line with limited capability of transferring load onto a different circuits for emergency restoration and scheduling of routine maintenance.*
- *The loss of the Weston-Malinta 34.5 kV radial line results in the of approximately 6 MW and 1,000 customers at two (2) sub-transmission service points.*
- *The 138 / 34.5 kV transformer #1 at Richland substation is greater than 70 years old and is showing signs of end of life; including oil leaks, failing components, and increasing maintenance.*
- *The 69 / 34.5 kV transformer #3 at Westin substation is greater than 74 years old and is showing signs of end of life; including oil leaks and deteriorating components.*
- *Customers taking sub-transmission service on these two radial lines have requested additional reliability and operational flexibility.*
  - *The 34.5kV radial lines cannot be networked due to insufficient short circuit current.*
  - *The Westin 69 / 34.5 kV transformer #3 (end of life) does not have the capacity to carry the entire load on a networked 34.5 kV system for a path end outage at Richland substation.*



ATSI Transmission Zone M-3 Process
Ayersville Weston Network and 69 kV Conversion Project

Previously Presented : 3/28/2019 SRRTEP

Need Number: ATSI-2019-009 (s1953)

Process Stage: Solution Meeting

Solutions Meeting: 03/28/2019, 11/20/2020

Needs Meeting: 01/14/2019

Proposed Solution:

The scope change is driven by the challenges discovered for the constructability of the 69 kV line across the Maumee River to Richland substation. Additionally the scope of work to prevent a three-terminal line at the Weston Tap on the Bowling Green No2-Midway 69 kV line was not originally included.

~~*Richland-Weston*~~ ***Ayersville-Weston 69 kV Line - Conversion from 34.5 kV***

- ~~**Richland Substation:** Install one (1) new 69 kV breaker and reconfigure the 69 kV yard to a three (3) breaker ring bus with a new 69 kV line exit to Weston substation. Remove all 34.5 kV equipment post conversion (ex: Richland 138/34/5 kV transformer #1, circuit breakers, …etc).~~
- **Ayersville Substation**: Install one (1) new 69 kV breaker. Install one (1) new 138 – 69 kV transformer. Install four (4) new 138 kV breakers and reconfigure the 138 kV yard to a four (4) breaker ring bus with a new 69 kV line exit to Weston substation. Close in the N.O. switch A13404 at Ayersville to network Ayersville 138 kV substation to Richland 138 kV K Bus. Remove all 34.5 kV equipment post conversion (ex: Richland 138 - 34.5 kV transformer #1 and circuit breakers).
- **Weston Substation:** Expand Weston substation to a four (4) breaker, future six (6) breaker ring bus with 69 kV line exits for the new ~~Richland~~ Ayersville line, and the Midway and Tontogany 69 kV lines. Remove all 34.5 kV equipment post conversion (ex: Weston 69/34.5 kV transformer #3, circuit breakers, …etc).
- **Bowling Green No2-Midway 69 kV Line:**
  - Rebuild 5.0 miles of 69 kV transmission line from Weston substation to the Weston tap on the Bowling Green No2-Midway 69 kV line as double circuit to eliminate the three-terminal line from Weston, Midway and Bowling Green No2

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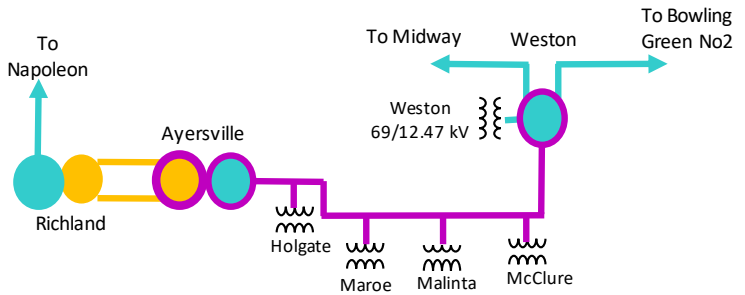


Convert existing 34.5 kV line and delivery points to 69 kV
Remove 34.5 kV Equipment.

Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

ATSI Transmission Zone M-3 Process
Ayersville Weston Network and 69 kV Conversion Project

Previously Presented : 3/28/2019 SRRTEP

Need Number: ATSI-2019-009 (s1953)
Process Stage: Solutions Meeting
Solutions Meeting: 03/28/2019, 11/20/2020
Needs Meeting: 01/14/2019

Proposed Solution:

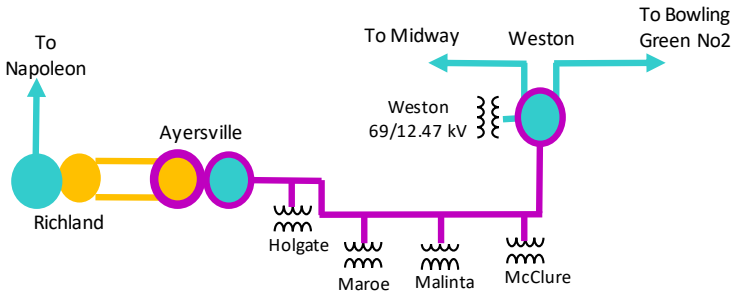
- **New ~~Richland~~ Ayersville-Weston 69 kV Line:**
  - Build new 5.6 miles 69 kV line to network ~~Richland~~ Ayersville-Maroe and Weston-Malinta radial lines.
  - Rebuild 0.5 miles of 138 kV transmission line as double circuit 138 kV and 69 kV to network the Maroe radial line to Ayersville substation; de-energize and retire the 34.5 kV line section from to Richland.
  - Convert the existing Richland-Maroe 34.5 kV line to 69 kV (Approximately ~~19~~ 17 miles) and re-terminate line from Maroe to Ayersville; customers to upgrade existing substation equipment at Holgate and Maroe to 69 kV.
  - Convert the existing Weston-Malinta 34.5 kV line to 69 kV (Approximately 13 miles) ; customers to upgrade existing substation equipment at Weston, McClure, and Malinta substations.
  - Remove all 34.5 kV equipment post conversion.
  - Install eight (8) SCADA and MOAB controlled switches on the new Ayersville-Weston 69 kV line.

Transmission Line Ratings:

- ~~Richland~~ Ayersville-Weston 69 kV Line
  - After Proposed Solution: ~~80~~ 111 MVA SN / ~~96~~ 134 MVA SE
  - After Proposed Solution: 125 MVA WN / 159 MVA WE

Alternatives Considered:

- Replace existing 138/34.5 kV and 69/34.5 kV transformers; rehab the existing 34.5 kV lines and maintain radial configuration; limits restoration, maintenance, and future economic growth.



Convert existing 34.5 kV line and delivery points to 69 kV
Remove 34.5 kV Equipment.

Legend	
500 kV	
345 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Estimated Project Cost: $103 M
Projected IS Date: 6/1/2025
Status: Engineering

Revision History

11/10/2020 – V1 – Original version posted to pjm.com

11/12/2020 – V2 – Additional detail added for 2018-008 and 2019-009

11/20/2020– V3 – Added page numbers where missing, corrected SN/SE to WN/WE on slide #26