



Market Efficiency Update

Transmission Expansion Advisory Committee

June 13, 2019

Nick Dumitriu, Market Simulation

2018/19 Market Efficiency Window

- Posted sensitivity cases
 - FSA Sensitivity Scenario
 - » includes units categorized as Facility Study Agreement (FSA) status
 - High and Low Load Sensitivity Scenarios
 - » +/- 2% Load Forecast increase/decrease from the base case
 - High and Low Gas Price Forecast Sensitivity Scenarios
 - » +/- 20% Henry Hub increase/decrease from the base case
- Posted FSA sensitivity congestion results

- Data validation for all projects (completed)
- Preliminary N-1 contingency analysis for all proposals (completed)
- PROMOD modeling of proposals (in-progress)
 - Completed PROMOD models for all interregional proposals
 - Currently finalizing PROMOD models for Hunterstown-Lincoln proposals
- PROMOD simulations for the interregional proposals (completed)
 - Simulated years 2019, 2023, 2026, 2029
 - Both Base Case and FSA sensitivity
- Calculated PJM benefits and determined B/C ratios for interregional proposals

Preliminary Results for Interregional Proposals



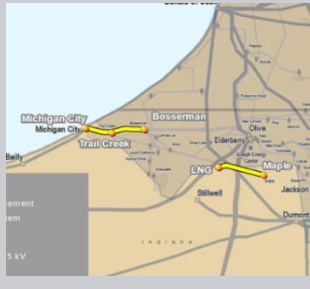

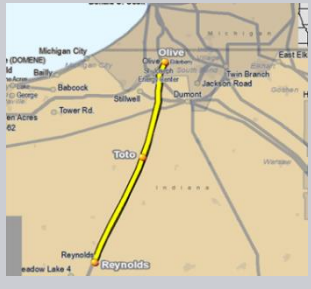


Interregional Proposals Summary

Congestion Driver	Transmission Zone	Greenfield Proposals Count	Upgrade Proposals Count	Total Proposals Count	Cost Range
Bosserman - Trail Creek 138 kV	AEP-MISOE	4	1	5	\$14M - \$266M
Marblehead XFMR	MISOC	1	1	2	\$36M
Monroe 1&2 - Wayne 345 kV	MISOE	-	3	3	\$0.1M - \$0.5M

- Completed preliminary N-1 contingency analysis for all interregional proposals to determine flowgates to monitor
- Completed the PROMOD runs for the 10 interregional proposals received from 9 entities (including 1 joint proposal)
 - Projects were modeled using the submitted assumptions
 - Modeled Base Case and FSA sensitivity
- Calculated PJM benefits and determined preliminary B/C ratios for the interregional proposals
 - B/C ratios were computed using the submitted in-service cost of components (assumed full cost assigned to PJM)
 - MISO benefits were not included in B/C ratios
- Descriptions of submitted proposals included in Appendix A



Bosserman-Trail Creek Proposals Preliminary Results

Proposal ID	BT_481	BT_398	BT_436	BT_129	BT_249
Proposal Description	Rebuild Michigan City-Trail Creek-Bosserman 138 kV (10.7mi) and reconductor Maple-LNG 138 kV (7.8 mi)	New Meadow Lake-Pike Creek 345kV line (63.4mi)	New Toto 345kV station	New Kuchar station and new Kutchar-Luchtman 138kV line (10.5mi)	50 MW 4-hour battery at Trail Creek 138 kV station
Project Type	Upgrade	Greenfield	Greenfield	Greenfield	Greenfield
B/C Ratio Metric	Lower Voltage	Lower Voltage	Lower Voltage	Lower Voltage	Lower Voltage
In-Service Cost (\$MM)*	\$35.60	\$266.44	\$19.31	\$27.62	\$42.96
Cost Containment	No	No	Yes	Yes	Yes
In-Service Year	2023	2023	2023	2023	2023
% Cong Driver Mitigated	100%	52%	40%	100%	67%
2023 Shifted Cong (\$MM)	-	-	\$0.08	\$0.52	\$1.63
Base Case B/C Ratio*	1.80	0.37	2.09	1.79	0.19
FSA Sens. B/C Ratio*	3.55	0.53	4.01	4.00	1.56
Map					

* Note: Costs under review by PJM



Marblehead Transformer Proposals Preliminary Results

Proposal ID	MH_322	MH_506
Proposal Description	Rebuild Palmyra-Marblehead 161 kV and Marblehead-Herleman 138 kV lines (12mi). New 345 kV ring bus at the Palmyra substation.	Rebuild Palmyra-Marblehead 161 kV and Marblehead-Herleman 138 kV lines. New Maywood-Palmyra 345 kV line (15mi).
Project Type	Upgrade	Greenfield
B/C Ratio Metric	Lower Voltage	Lower Voltage
In-Service Cost (\$M)*	\$35.95	\$36.02
Cost Containment	No	No
In-Service Year	2023	2023
% Cong Driver Mitigated	100%	100%
2023 Shifted Cong (\$MM)	\$0.42	\$0.45
Base Case B/C Ratio*	1.32	1.85
FSA Sens. B/C Ratio*	0.12	0.22
Map		

* Note: Costs under review by PJM

Monroe-Wayne Proposals Preliminary Results

Proposal ID	MW_782	MW_078	MW_775
Proposal Description	Upgrade Monroe-Wayne 345 kV line rating by replacing switches at the 345kV Wayne station.	Modify the Monroe-Wayne 345 kV line impedance to significantly reduce line flows.	Reconfigure the Monroe-Coventry 345 kV line that runs adjacent to the Monroe-Wayne line on common structures.
Project Type	Upgrade	Upgrade	Upgrade
B/C Ratio Metric	Lower Voltage	Lower Voltage	Lower Voltage
In-Service Cost (\$M)	\$0.46	\$0.10	\$0.10
Cost Containment	No	No	No
In-Service Year	2023	2023	2023
% Cong Driver Mitigated*	100%*	100%*	100%*
2023 Shifted Cong (\$MM)*	All congestion shifted to parallel line	All congestion shifted to parallel line	All congestion shifted to parallel line
Base Case B/C Ratio	81.39	0	0
FSA Sens. B/C Ratio	36.38	147.63	15.98
Map			

* 100% Congestion shifts from Monroe-Wayne 345 kV to Monroe-Brownstone 345 kV

- All three proposals shifted congestion from Monroe – Wayne 345 kV to parallel Monroe - Brownstone 345 kV constraint
- Because of the congestion shift, none of the proposals received significantly decreased the total congestion around the Monroe bus.
- Table below shows congestion around the Monroe bus (base case and each proposal, simulated year 2023).

Constraint	Base	MW_775	MW_078	MW_782
B:26461219MON12 26469219WAYNE 1 FLO E:21 19MON12 345-19BNSTNS 345 (DECO) [1]	\$ (1,667,690)			
B:26461219MON12 26470719BNSTNS 1 FLO E:40 L/O 19MON12 to 19WAYNE	\$ (2,497,653)	\$ (4,105,035)	\$ (4,154,729)	\$ (4,021,034)
Total	\$ (4,165,342)	\$ (4,105,035)	\$ (4,154,729)	\$ (4,021,034)

- Interregional Analysis
 - Coordination with MISO on interregional proposal B/C ratios
 - B/C ratios including both PJM and MISO benefits will be presented at the next IPSAC meeting
 - Complete Load and Gas Price sensitivities for interregional proposals
 - Reliability Analysis for interregional proposals
 - RPM Check for Bosserman – Trail-Creek projects
 - Cost Constructability Analysis for interregional proposals
- Start analysis of Hunterstown-Lincoln proposals

Appendix A

2018/19 Long Term Window

Individual Proposal Descriptions

Project ID: 201819_BT_129

Proposed Solution:

Establish a new 138 kV Kuchar station cutting into the Bosserman-Liquid Carbonics 138 kV line. Build a new Kuchar - Luchtman 138kV line (8.5mi). Establish The Bosserman-Liquid Carbonics 138 kV cut in (Kuchar 138 kV Extension Line (2mi). Upgrade Luchtman 138 kV station.

kV Level: 138 kV

In-Service Cost (\$M): \$27.62

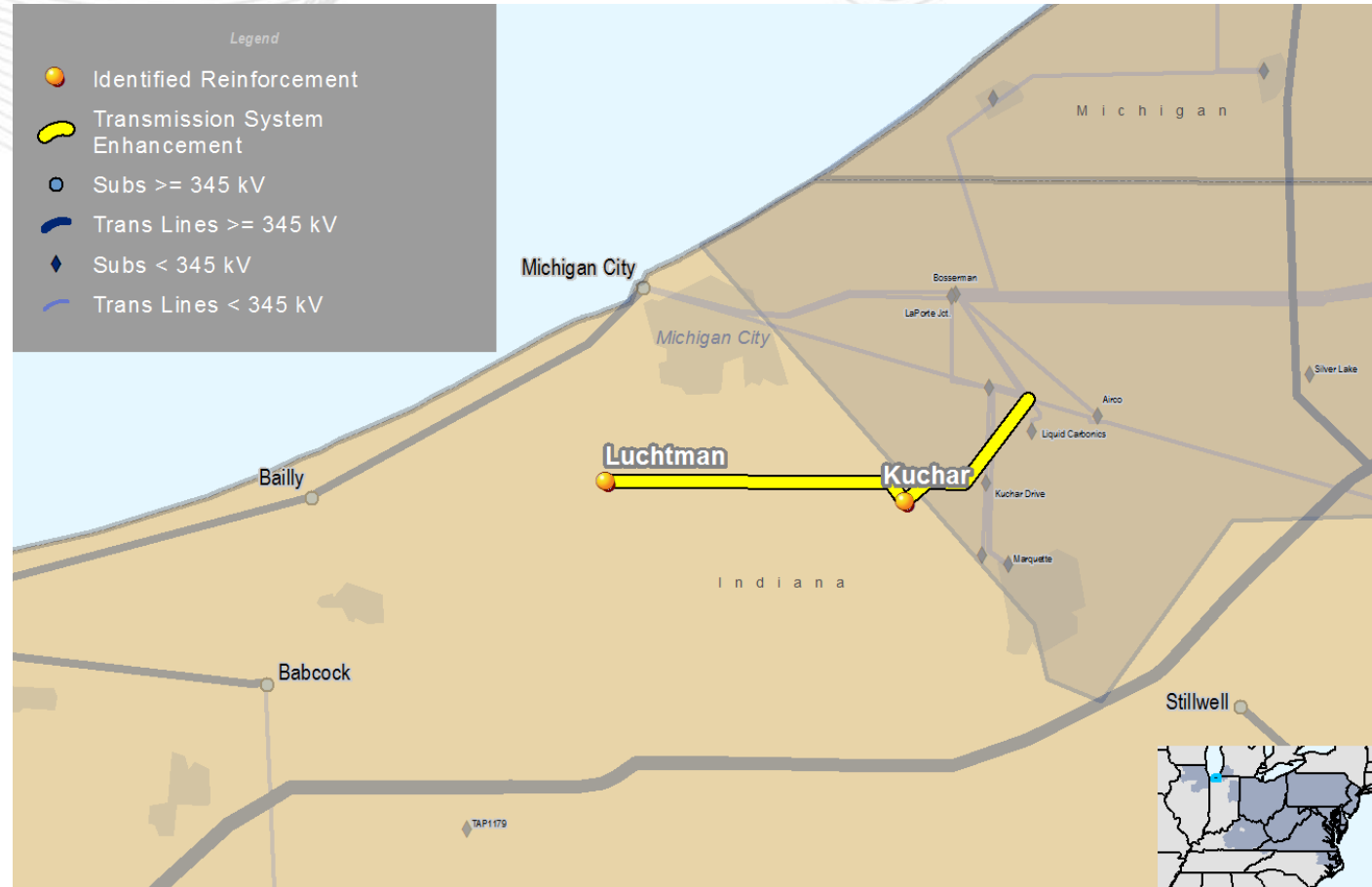
In-Service Year: 2023

Target Zone: AEP/MISOE

ME Constraints:

Bosserman - Trail Creek 138kV

Notes:



Project ID: 201819_BT_249

Proposed Solution:

Build a 50 MW 4-hour Warnke Battery Energy Storage System (BESS) to be connected to Trail Creek 138 kV station. Upgrade Trail Creek 138 kV station (less than 1mi).

kV Level: 138 kV

In-Service Cost (\$M): \$45.40

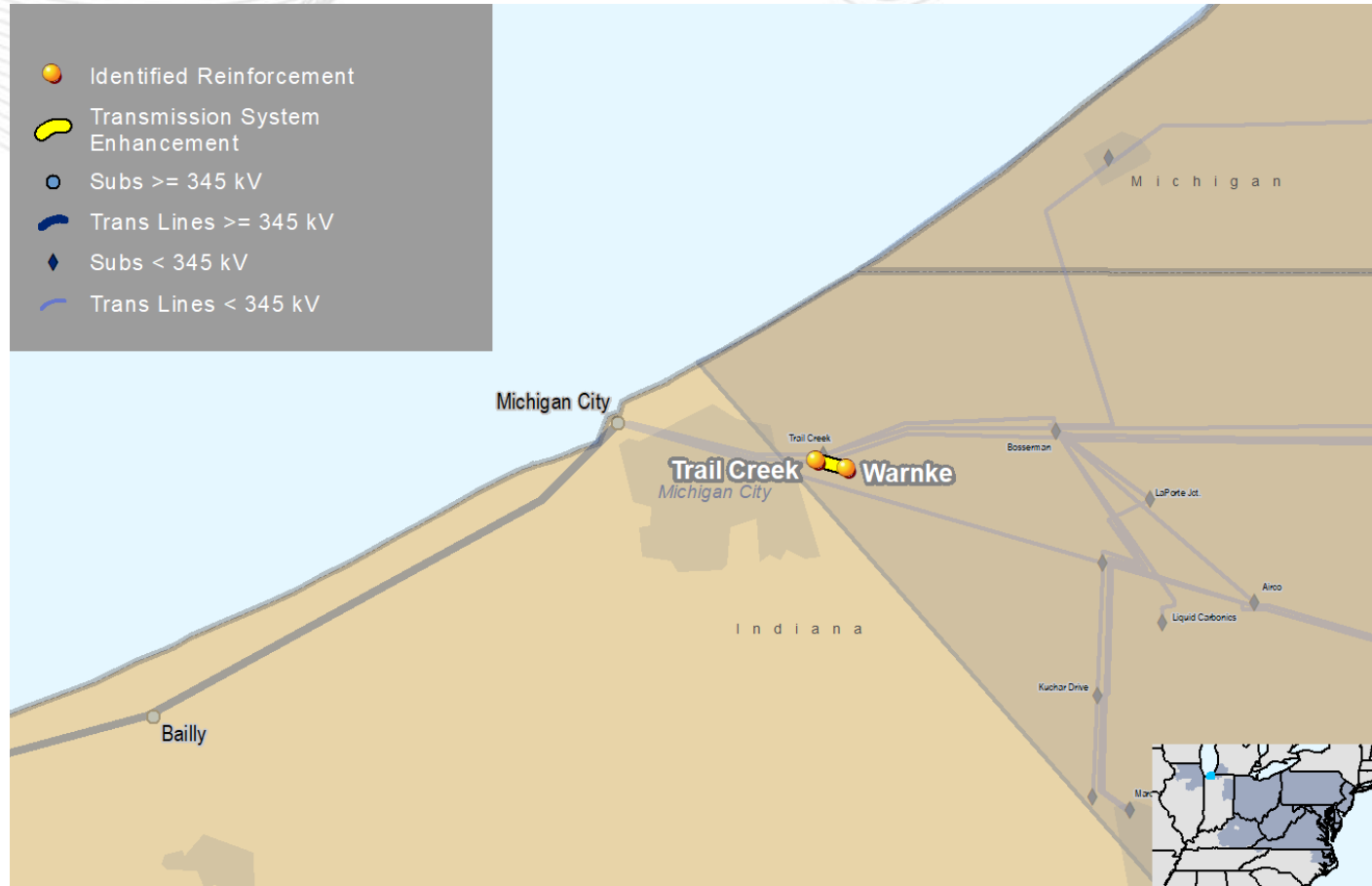
In-Service Year: 2022

Target Zone: AEP/MISOE

ME Constraints:

Bosserman - Trail Creek 138kV

Notes:



Project ID: 201819_BT_398

Proposed Solution:

Establish a new 345 kV Pike Creek station near the intersection of the 345 kV Bloom-Davis Creek and the 345 kV Burnham-Davis Creek lines. Build a new Meadow Lake-Pike Creek 345kV line (63.4mi). Upgrade Meadow Lake 345 kV station.

kV Level: 345 kV

In-Service Cost (\$M): \$266.44

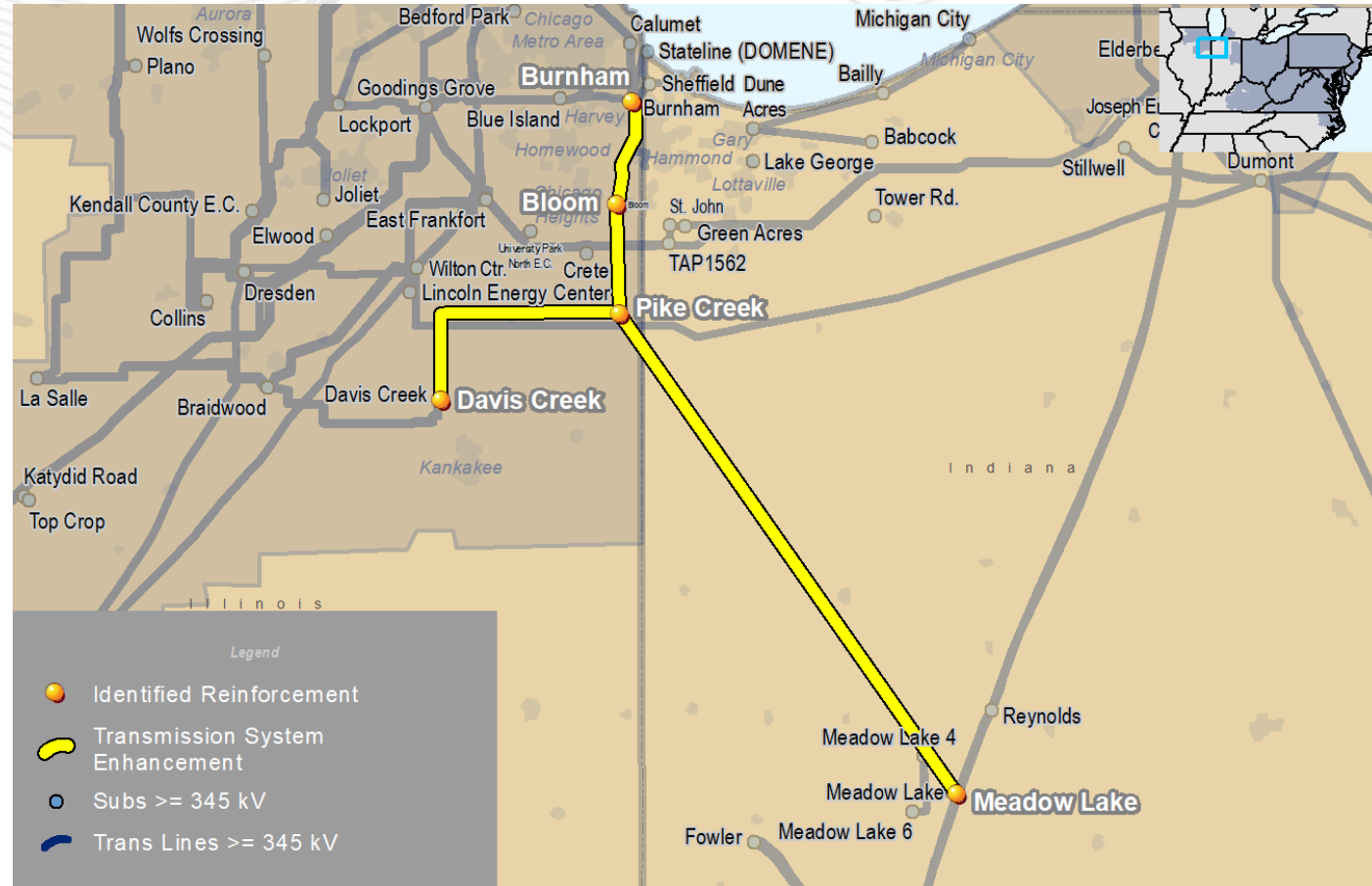
In-Service Year: 2023

Target Zone: AEP/MISOE

ME Constraints:

Bosserman - Trail Creek 138kV

Notes:



Project ID: 201819_BT_436

Proposed Solution:

Build a new Toto 345kV station, interconnecting the existing Olive-Reynolds #1, Olive-Reynolds #2, and Schafer-Burr Oak 345kV transmission lines with a new 345kV switching station (less than 1mi).

kV Level: 345 kV

In-Service Cost (\$M): \$19.31

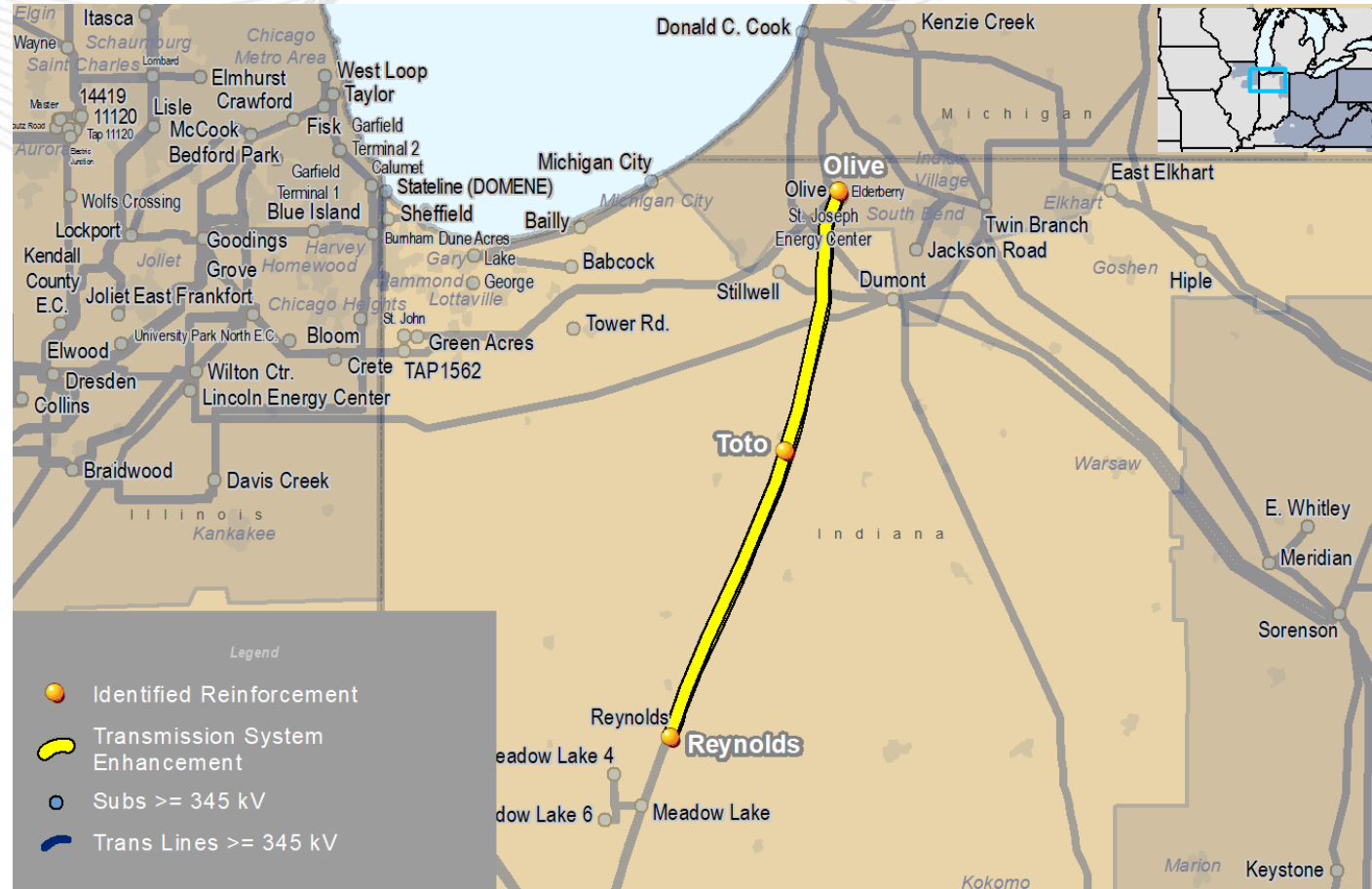
In-Service Year: 2023

Target Zone: AEP/MISOE

ME Constraints:

Bosserman - Trail Creek 138kV

Notes:



Project ID: 201819_BT_481

Proposed Solution:
 Rebuild Michigan City-Trail Creek-Bosserman 138 kV circuits (10.7mi). Reconductor Maple-LNG 138 kV circuit (7.8mi). Upgrade Michigan City, Trail Creek, Maple and LNG terminals.

kV Level: 138 kV

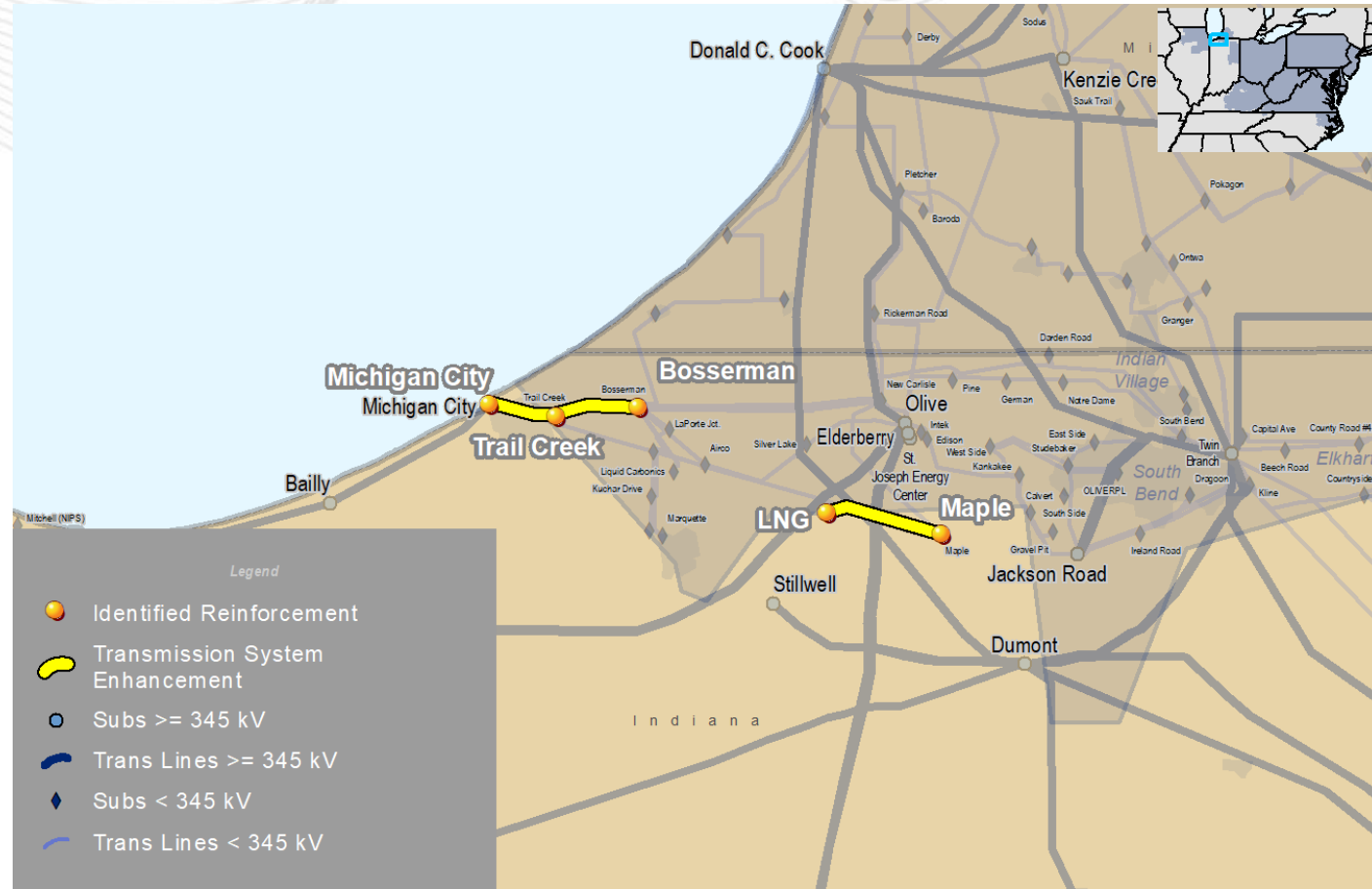
In-Service Cost (\$M): \$35.60

In-Service Year: 2023

Target Zone: AEP/MISOE

ME Constraints:
 Bosserman - Trail Creek 138kV

Notes:



Project ID: 201819_MH_322

Proposed Solution:

Rebuild Palmyra-Marblehead 161 kV as a 345 kV/161 kV double circuit line, and Marblehead-Herleman 138 kV as a 345 kV/138 kV double circuit line (12mi). Upgrade Herleman substation. Construct a 345 kV ring bus at the Palmyra substation.

kV Level: 345 kV

In-Service Cost (\$M): \$35.95

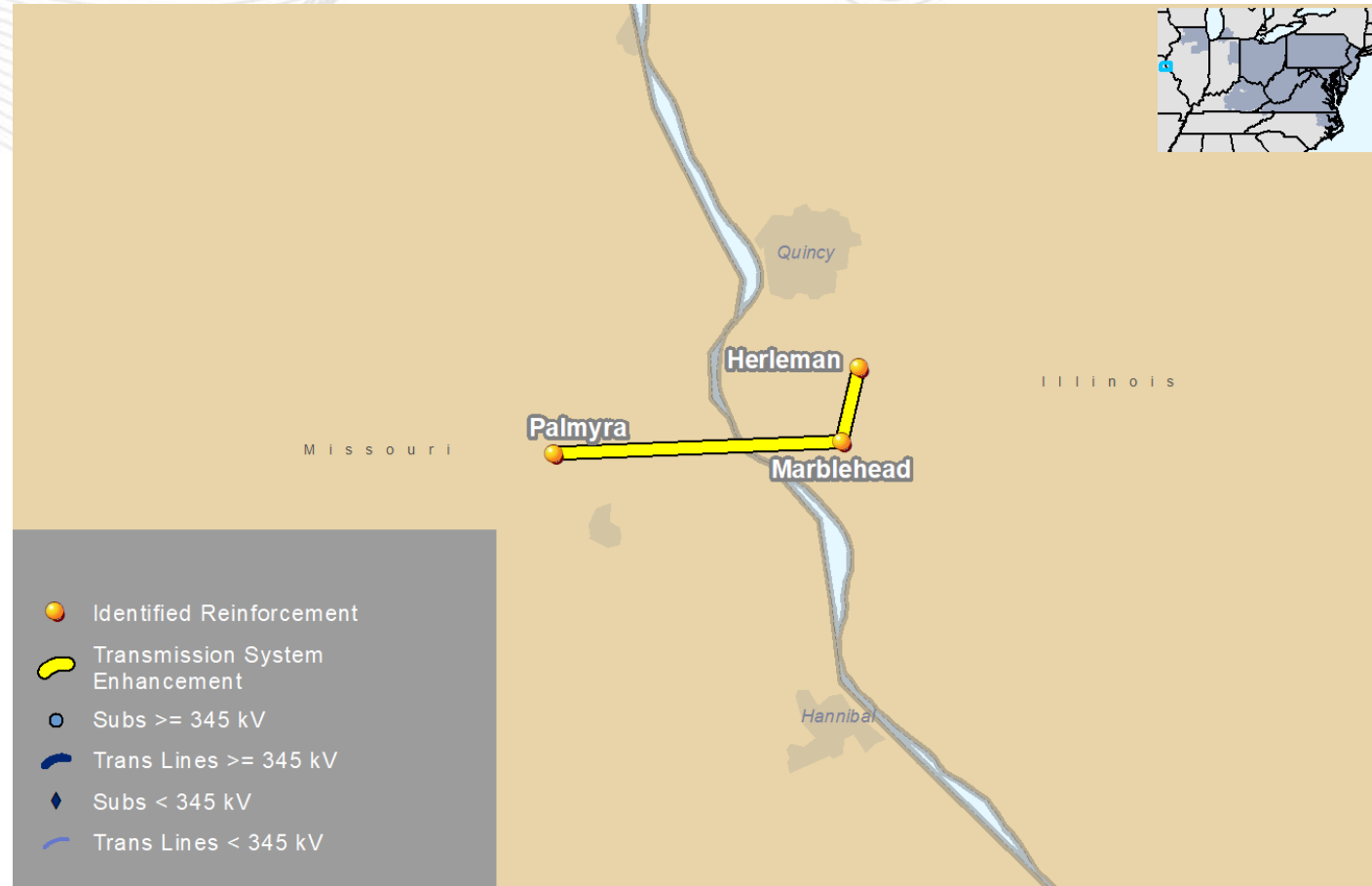
In-Service Year: 2023

Target Zone: MISOC

ME Constraints:

Marblehead Transformer

Notes:



Project ID: 201819_MH_506

Proposed Solution:

Rebuild Palmyra-Marblehead 161 kV as a 345 kV/161 kV double circuit line, and Marblehead-Herleman 138 kV as a 345 kV/138 kV double circuit line (15mi). Construct Maywood-Palmyra 345 kV line. Upgrade Herleman and Maywood substations.

kV Level: 345 kV

In-Service Cost (\$M): \$36.02

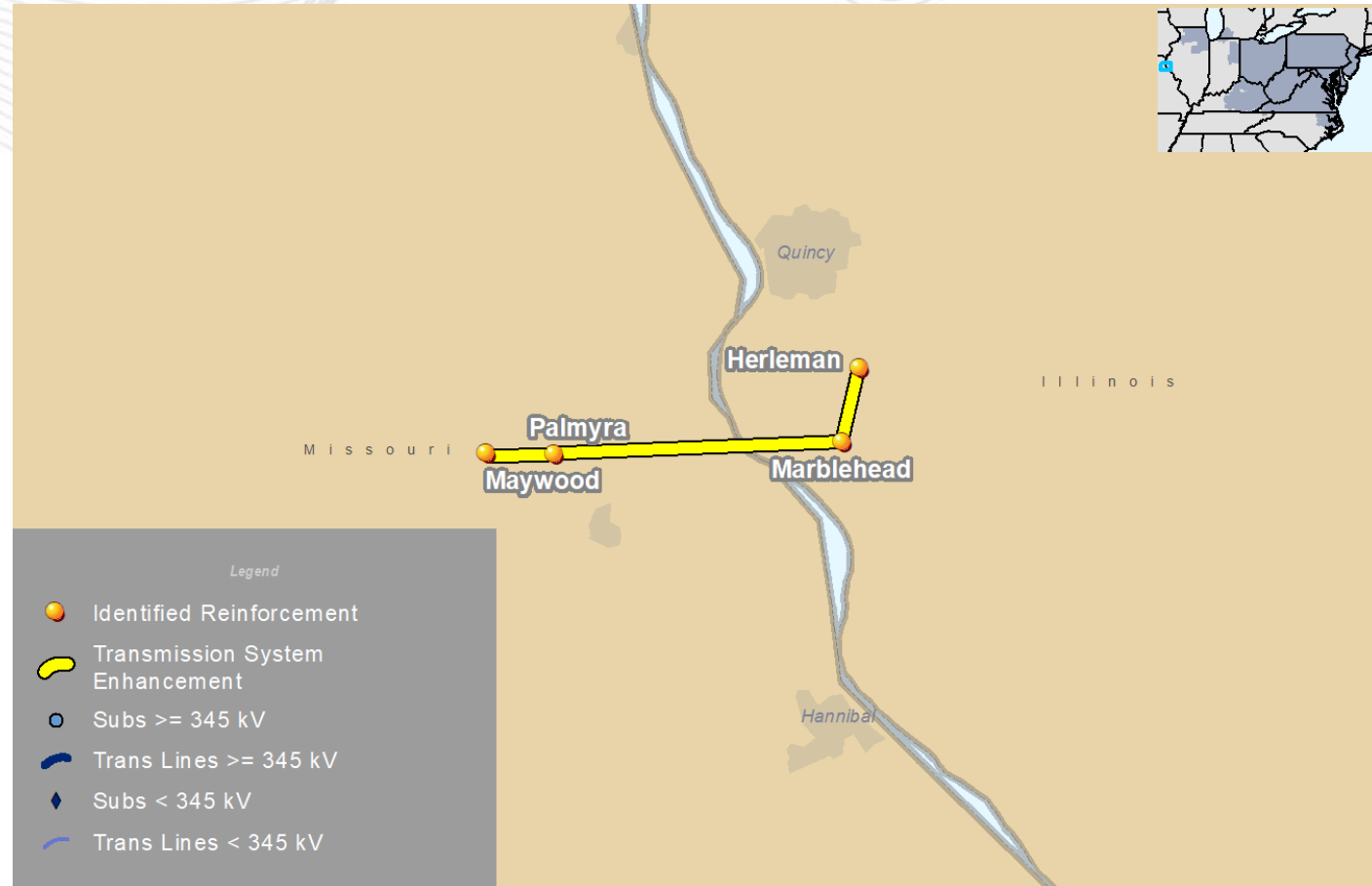
In-Service Year: 2023

Target Zone: MISOC

ME Constraints:

Marblehead Transformer

Notes:



Project ID: 201819_MW_078

Proposed Solution:
 Modify the Monroe-Wayne 345 kV line impedance to significantly reduce line flows.

kV Level: 345 kV

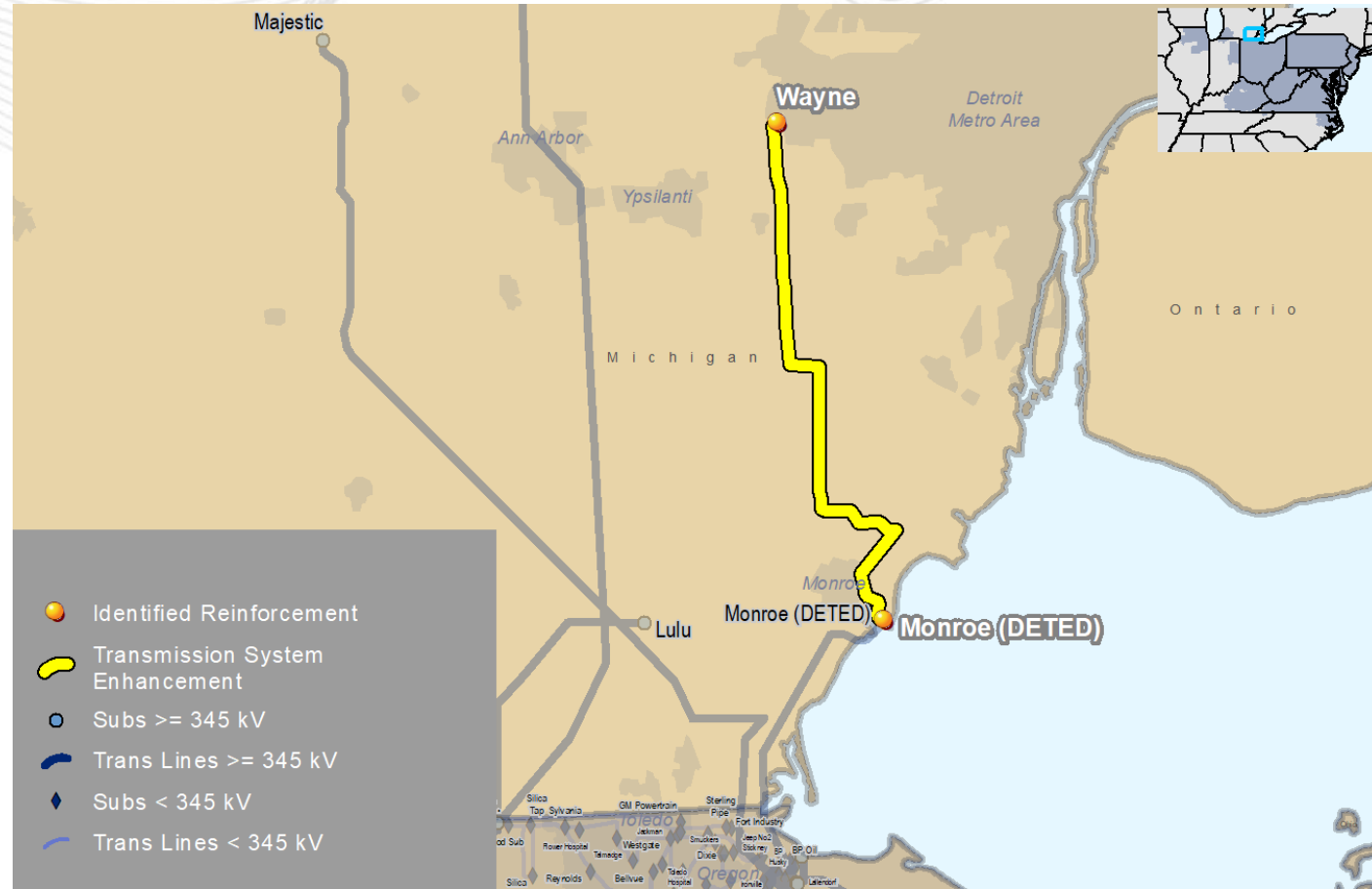
In-Service Cost (\$M): \$0.10

In-Service Year: 2023

Target Zone: MISOE

ME Constraints:
 Monroe 1&2 - Wayne 345 kV

Notes:



Project ID: 201819_MW_775

Proposed Solution:
 Reconfigure the Monroe-Coventry 345 kV line that runs adjacent to the Monroe-Wayne line on common structures.

kV Level: 345 kV

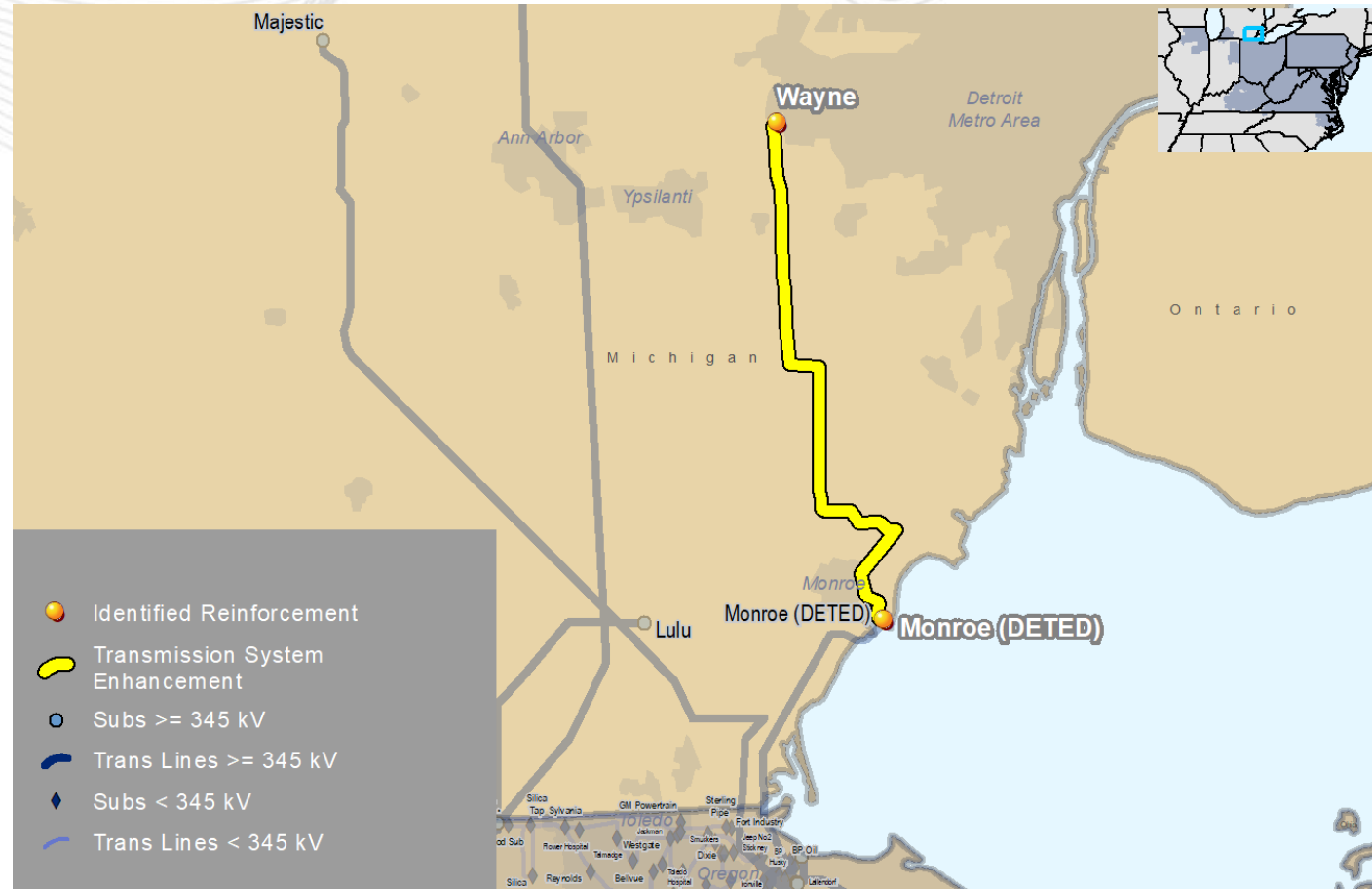
In-Service Cost (\$M): \$0.10

In-Service Year: 2023

Target Zone: MISOE

ME Constraints:
 Monroe 1&2 - Wayne 345 kV

Notes:



Project ID: 201819_MW_782

Proposed Solution:
 Upgrade Monroe-Wayne 345 kV line rating by replacing switches at the 345kV Wayne station.

kV Level: 345 kV

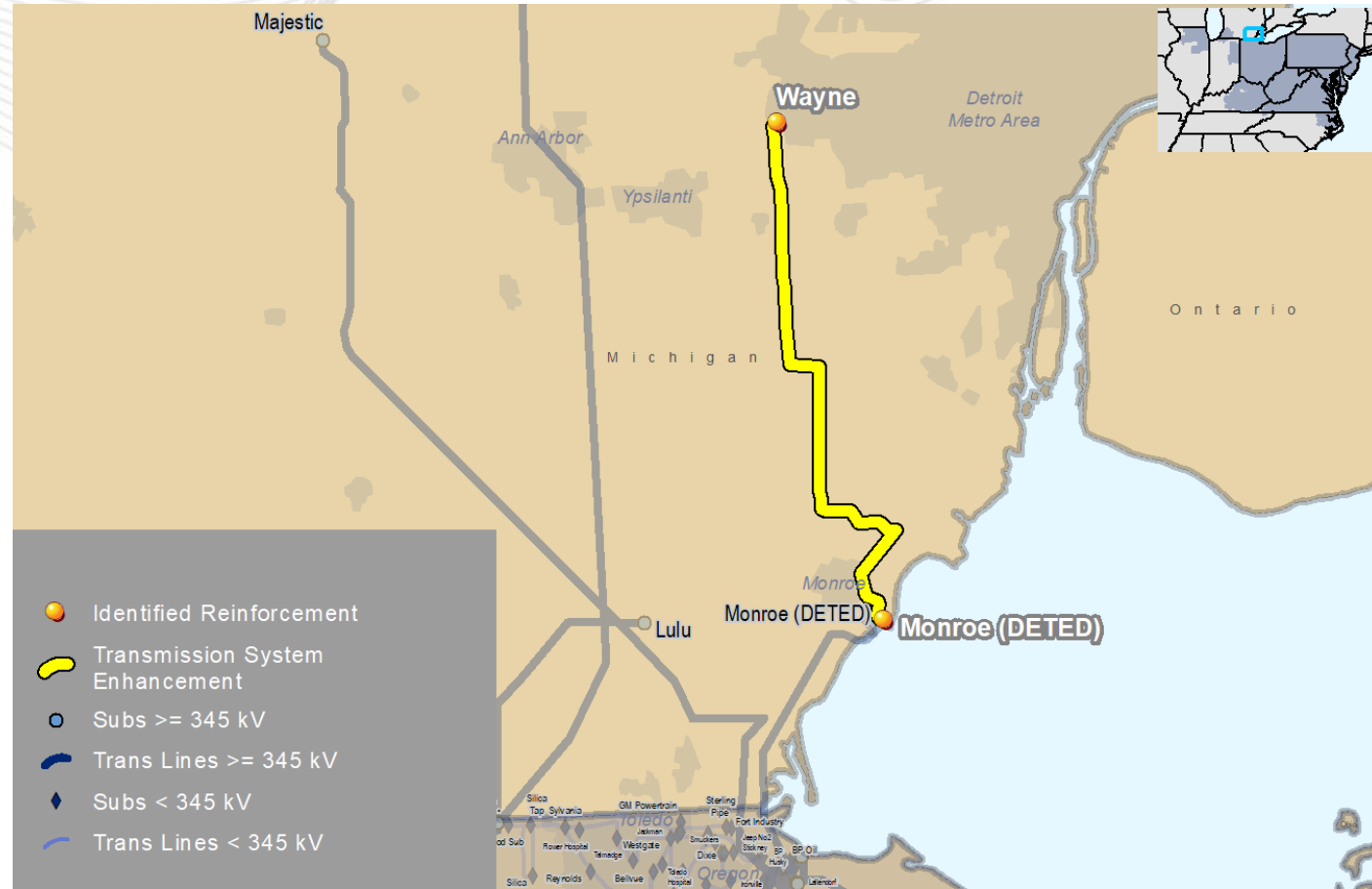
In-Service Cost (\$M): \$0.46

In-Service Year: 2023

Target Zone: MISOE

ME Constraints:
 Monroe 1&2 - Wayne 345 kV

Notes:



Revision History

6/10/2019 – V1 – Original version posted to pjm.com

6/12/2019 – V2 – Added Cost Containment information to slides 8, 9 and 10.
Corrected the cost of BT_129 on slide 8.