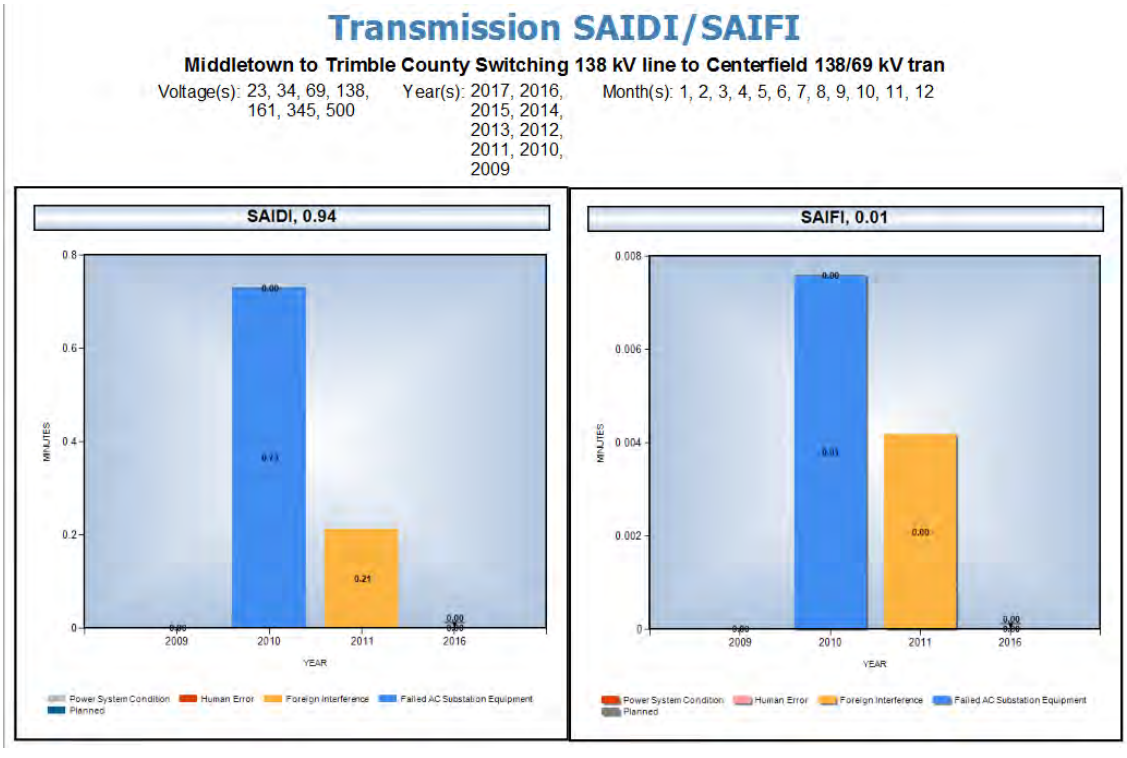
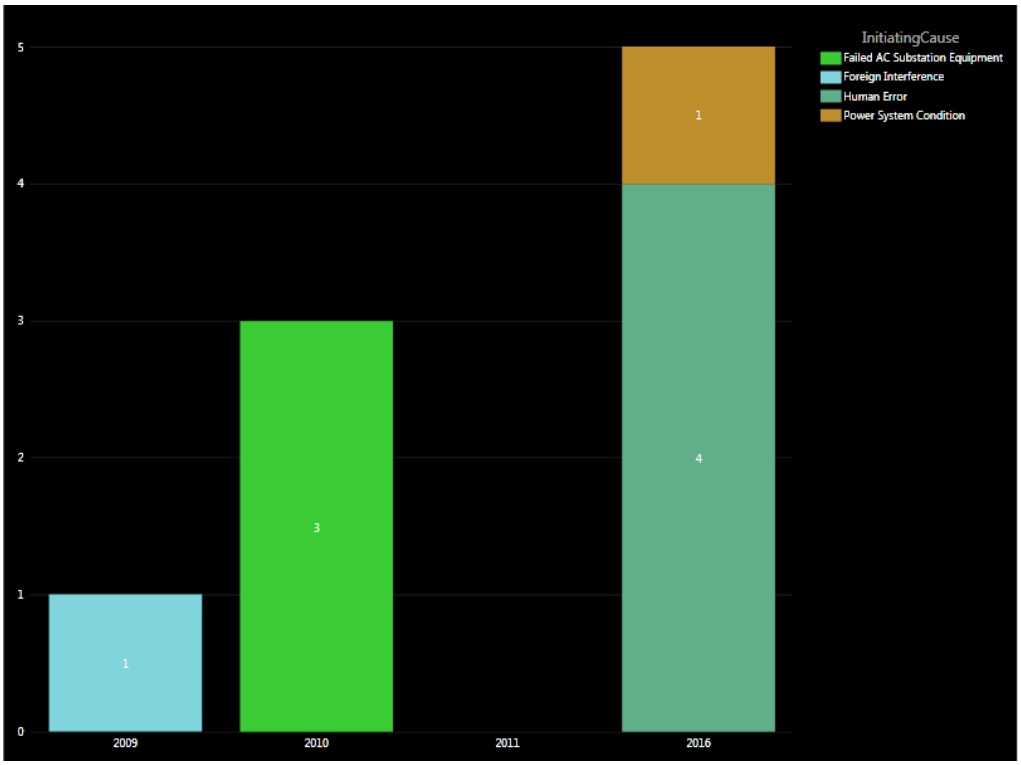
Background
Middletown to Trimble County Switching 138 kV line to Centerfield 138/69 kV tranline has been a consistent high contributor to Transmission's SAIDI metric. This breaker will reduce the mileage exposure by half for all of the customers served by this line Therefore, for a given fault, only half as many customers will go out in the case with the breaker, as compared to the case without the breaker. This will also speed up restoration in that the line requiring patrol will also be cut in half.

The chart below shows the historical SAIDI/SAIFI (including MED) for this line:



The following graph shows the number of relay events since 2009 and their associated cause codes on the line



- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,018k
     It is recommended that a breaker be installed on the Middletown to Trimble County Switching 138 kV line to Centerfield 138/69 kV tran to limit the exposure of customers on a line that has historically had SAIDI issues. This recommendation assists Transmission in achieving the SAIDI targets established as part of the Transmission Reliability Plan (TRP), as well as reduces the number of customers that would otherwise experience a power outage during an event. In addition, this recommendation provides additional relay data to aid in restoring service quickly that includes information to help determine the cause and location of the event.

  2. Alternative #1: NPVRR: ($000s) $1,835k
     The next best alternative is to add 2 breakers at Centerfield. This includes the recommended breaker and a second breaker on the line to Middletown. This would eliminate line outages from impacting the nearly 5,000 customers at Centerfield. This

second breaker could be added at a later date after the recommended breaker. This alternative would provide greater overall reliability to Centerfield but would most likely double the overall project cost. This option is not the lowest cost alternative and is not recommended at this time.

3. Do Nothing: NPVRR: N/A
   This option is not advisable as this circuit has siginificant MW-Mile (customer outage) exposure and the current state of the line puts Transmission at risk of not being able to accomplish SAIDI targets established as part of the Transmission Reliability Plan which assumed the completion of this project.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Approved for preliminary engineering	September, 2017
Materials Ordered	October, 2017
Materials Received	February - March, 2018
Project Approved for Full Funding	October, 2017
Below Grade Work Begins	March, 2018
Below Grade Work Completed	March, 2018
Above Grade Work Begins	March, 2018
Above Grade Work Completed	March, 2018
Project Complete	June, 2018

- **Project Cost**
  The total cost of this project is $906k with $149k in 2017 and $757k in 2018. The 2017 BP included $850k for this project. The budgeted amount was estimated based on similar projects that have been previously completed and has been updated based on the preliminary scope review and site visit. Of the proposed 2017 spending, $100k approved by the RAC in the 8+4 forecast and $49k is being funded by a reduction in 153370. The estimated total project figure includes a 10% contingency. This contingency is expected to cover uncertainty with the contract labor costs based upon variances that have been noticed on past similar projects, as well as unidentified risks that may come about during detailed engineering and with below grade construction.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	2019	Post 2019	Total
1. Capital Investment Proposed	149	744	-	-	893
2. Cost of Removal Proposed	-	13	-	-	13
3. Total Capital and Removal Proposed (1+2)	149	757	-	-	906
4. Capital Investment 2017 BP	-	850	-	-	850
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	850	-	-	850
7. Capital Investment variance to BP (4-1)	(149)	106	-	-	(43)
8. Cost of Removal variance to BP (5-2)	-	(13)	-	-	(13)
9. Total Capital and Removal variance to BP (6-3)	(149)	93	-	-	(56)

Financial Detail by Year - O&M ($000s)	2016	2017	2018	Post 2018	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate: 6.32%
Capital Breakdown:
- Labor: $63k
- Contract Labor: $385k
- Materials: $219k
- Other: $0k
- Local Engineering: $89k
- Burdens: $66k
- Contingency: $84k
- Net Capital Expenditure: $906k

Spend (000's)	Substation	P&C	Telecom	Total
Company Labor	$ 23	$ 25	$ 15	**$ 63**
Contract Labor	$ 181	$ 204	$ -	**$ 385**
Materials	$ 107	$ 112	$ -	**$ 219**
Contingency	$ 39	$ 43	$ 2	**$ 84**
Raw total	**$ 350**	**$ 384**	**$ 17**	**$ 751**
Burdens				$ 155
Project Total				**$ 906**

- **Assumptions**
  - Suppliers and contractors will meet reasonable and customary delivery dates for materials and services.
  - The testing and validation for the operation of the new breaker is completed in the time frame scheduled for the project and not delayed due to the availability of resources. Delays could require additional mobilization costs for construction removal and cut-over to the new system.
  - Telecommunications scope to be confirmed during detailed engineering. Approximately $20K included in the estimate based on previous project costs. Additional required funds to be covered by contingency or returned to contingency.
  - Construction costs are estimated and not based on bid pricing.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  - Completing the project involves risk related to construction work within an operating substation. This project involves installing new underground conduits and reconfiguring the existing system.
  - If the breaker is not added, Transmission will not achieve their targeted reduction in MW-Mile exposure as outlined in the Transmission Reliability Plan.

Conclusions and Recommendation
It is recommended that Management approve the Centerfield Breaker Addition project for $906k to enhance the reliability of the Transmission system.

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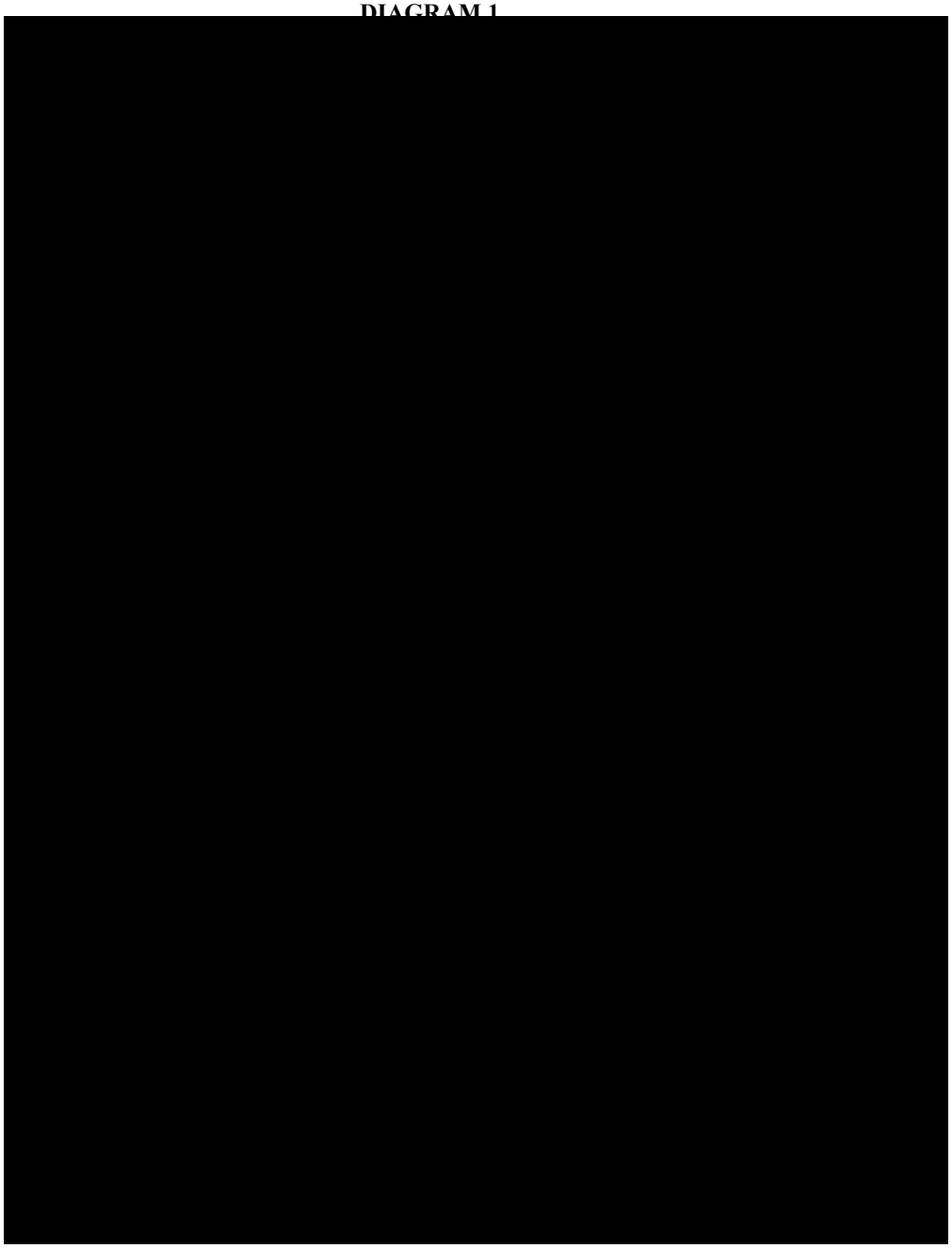
Appendix A

DIAGRAM 1



Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: REL-Smyrna 604 Brkr Add

Total Expenditures: $987k (Including $92k of Contingency)

Project Number(s): 152109

Business Unit/Line of Business: Transmission Reliability Performance & Standards

Prepared/Presented By: Keith Yocum – Manager Reliability Performance & Standards

Executive Summary

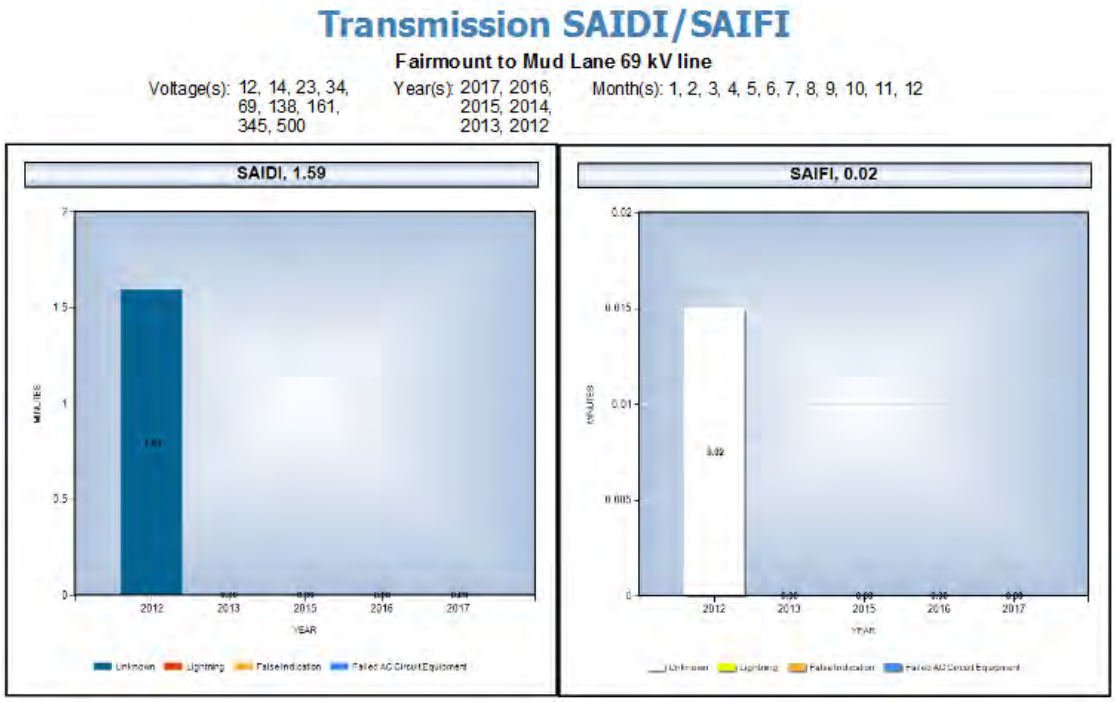
The Transmission Reliability Performance and Standards group identified the need for a breaker at the Smyrna substation to reduce the MegaWatt-Mile (MW-Mile is calculated by multiplying total miles of line exposure times the MWs served from the line) exposure on the Fairmount to Mud Lane 69 kV line.This line has significant MW-Mile exposure and has had 1.6 minutes of SAIDI_MED since 2012 for Transmission.

Fairmount to Mud Lane 69 kV line is 8.16 miles long and has 2 distribution transfomers tapped off of it which serve around 15,117 customers and 59.78 MW of load. A fault anywhere along this line will result in an outage on all Customers. The placement of a breaker at Smyrna will reduce MW-Mile exposure from 488to 226, a 54% reduction. Diagram 1 include in Appendix A depicts the configuration for Fairmount to Mud Lane 69 kV line.

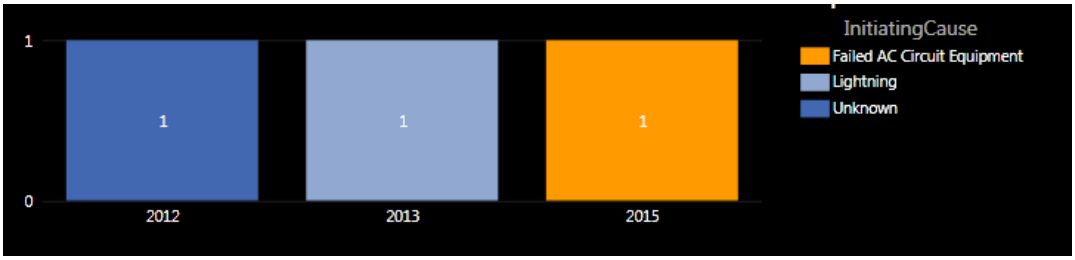
The total cost of this project is estimated at $987k with $34k in 2017 and $954k in 2018. The 2017 BP included $849K for this project in 2018. The 2017 portion was approved by the RAC in the 9+3 forecast. The 2018 portion was partially included in the 2018 BP ($793k) and the $161k remainder in 2018 will be funded by LTFFAIL18. The budgeted amount was estimated based on similar projects that have been previously completed and has been updated based on the preliminary engineering performed.

Background
Fairmount to Mud Lane 69 kV line has been a consistent high contributor to Transmission's SAIDI metric. This breaker will reduce the mileage exposure by half for all of the customers served by this line Therefore, for a given fault, only half as many customers will go out in the case with the breaker, as compared to the case without the breaker. This will also speed up restoration in that the line requiring patrol will also be cut in half.

The chart below shows the historical SAIDI/SAIFI (including MED) for this line:



The following graph shows the number of relay events since 2009 and their associated cause codes on the line:



- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,117k
     It is recommended that a breaker be installed on Fairmount to Mud Lane 69 kV line to limit the exposure of customers on a line that has historically had SAIDI issues. This recommendation assists Transmission in achieving the SAIDI targets established as part of the Transmission Reliability Plan (TRP), as well as reduces the number of customers that would otherwise experience a power outage during an event. In addition, this recommendation provides additional relay data to aid in restoring service quickly that includes information to help determine the cause and location of the event.

  2. Alternative #1: NPVRR: ($000s) $1,991k
     The next best alternative is to add 2 breakers, one at Smyrna and one at Fairmount. This includes the recommended breaker and a second breaker on the line at Fairmount. This alternative would provide limited reliability improvement but would most likely double the overall project cost. The additional breaker would be helpful to determine whether a fault is on the line or in the Fairmount substation. This option is not the lowest cost alternative and provides limited improvement and is not recommended at this time.

  3. Do Nothing: NPVRR: N/A
     This option is not advisable as this circuit has siginificant MW-Mile (customer outage) exposure and the current state of the line puts Transmission at risk of not being able to accomplish SAIDI targets established as part of the Transmission Reliability Plan which assumed the completion of this project.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Initially Approved for preliminary engineering	N/A
Materials Ordered	November 2017
Materials Received	April, July-Oct 2018
Project Approved for Full Funding	October 2017
Below Grade Work Begins	September 2018
Below Grade Work Completed	October 2018
Above Grade Work Begins	October 2018
Above Grade Work Completed	November 2018
Project Complete	December 2018

- **Project Cost**
  The total cost of this project is estimated at $987k with $34k in 2017 and $954k in 2018. The 2017 BP included $849K for this project in 2018. The 2017 portion was approved by the RAC in the 9+3 forecast. The 2018 portion was partially included in the 2018 BP ($793k) and the $161k remainder in 2018 will be funded by LTFFAIL18. The budgeted amount was estimated based on similar projects that have been previously completed, and the project cost has been updated based on the preliminary scope review and site visit. The estimated total project figure includes a 10% contingency. This contingency is expected to cover uncertainty with the contract labor costs based upon variances that have been noticed on past similar projects, as well as unidentified risks that may come about during detailed engineering and with below grade construction.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	Post 2018	Total
1. Capital Investment Proposed	34	949	-	983
2. Cost of Removal Proposed	-	5	-	5
3. Total Capital and Removal Proposed (1+2)	34	954	-	987
4. Capital Investment 2017 BP	-	849	-	849
5. Cost of Removal 2017 BP	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	849	-	849
7. Capital Investment variance to BP (4-1)	(34)	(100)	-	(134)
8. Cost of Removal variance to BP (5-2)	-	(5)	-	(5)
9. Total Capital and Removal variance to BP (6-3)	(34)	(105)	-	(138)

Financial Detail by Year - O&M ($000s)	2017	2018	Post 2018	Total
1. Project O&M Proposed	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.5%
Capital Breakdown:	
Labor:	$55k
Contract Labor:	$435k
Materials:	$249k
Other:	$0k
Local Engineering:	$97k
Burdens:	$59k
Contingency:	$92k
Net Capital Expenditure:	$987k

Spend (000's)	Construction	P&C	Telecom	Total
Company Labor	$ 21	$ 19	$ 15	**$ 55**
Contract Labor	$ 196	$ 239	$ -	**$ 435**
Materials	$ 156	$ 93	$ -	**$ 249**
Contingency	$ 46	$ 44	$ 2	**$ 92**
Raw Total	**$ 419**	**$ 395**	**$ 17**	**$ 831**
Burdens				**$ 156**
Total				**$ 987**

- **Assumptions**
  - Suppliers and contractors will meet reasonable and customary delivery dates for materials and services.
  - The testing and validation for the operation of the new breaker is completed in the time frame scheduled for the project and not delayed due to the availability of resources. Delays could require additional mobilization costs for construction removal and cut-over to the new system.
  - Telecommunications scope to be confirmed during detailed engineering. Approximately $20K included in the estimate based on previous project costs. Additional required funds to be covered by contingency or returned to contingency.
  - Construction costs are estimated and not based on bid pricing.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  - Completing the project involves risk related to construction work within an operating substation. This project involves installing new underground conduits and reconfiguring the existing system.
  - If the breaker is not added, Transmission will not achieve their targeted reduction in MW-Mile exposure as outlined in the Transmission Reliability Plan.

Conclusions and Recommendation

It is recommended that Management approve the Centerfield Breaker Addition project for $987k to enhance the reliability of the Transmission system.

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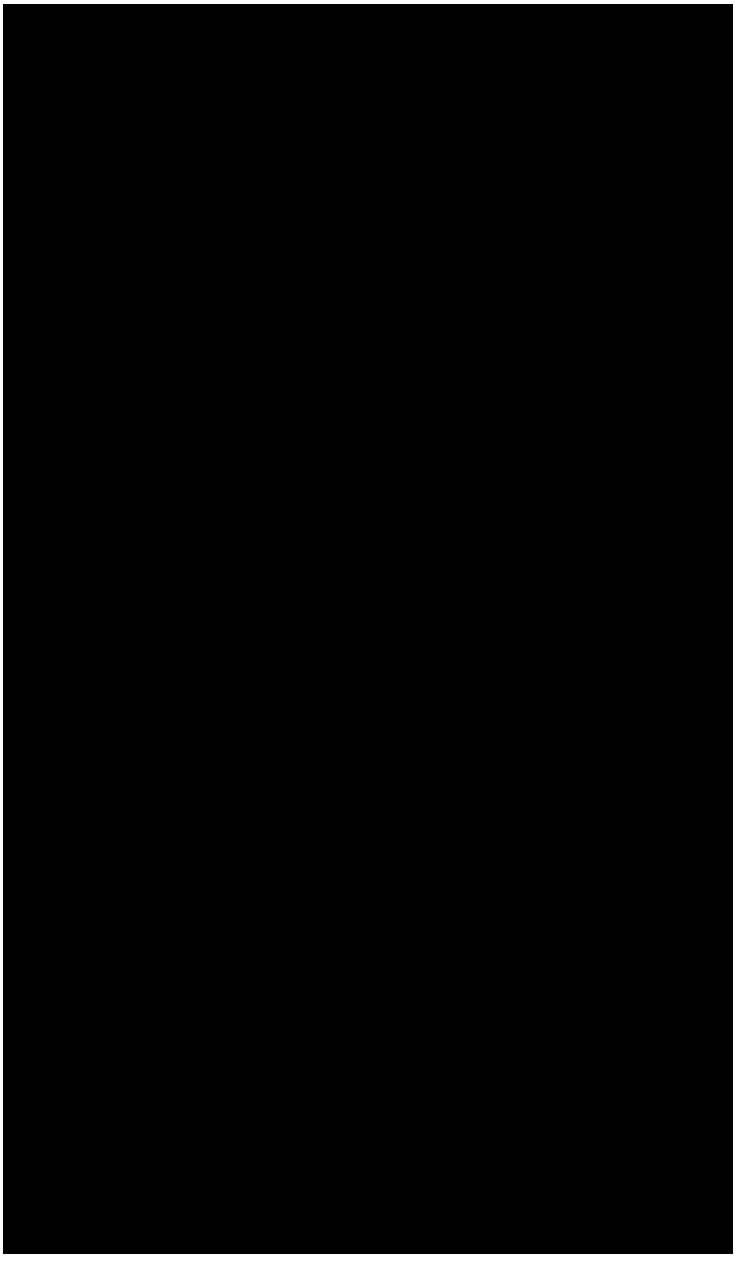
Appendix A



Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: January 25, 2017

Project Name: Mill Creek 2017 Breaker and Switch Replacements

Total Expenditures: $3,317k (Including $298k of Contingency)

Project Number(s): 152221

Business Unit/Line of Business: Transmission Substation Construction

Prepared/Presented By: Chris Talley – Manager Transmission Substation Construction

Executive Summary

The scope of this project includes the replacement of (2) 345kV and (4) 138kV circuit breakers along with (15) 138kV switches at the Mill Creek substation. The specific equipment that is being replaced is listed below in the "Background" section. All of the equipment being targeted for replacement under this project is part of the overall Transmission System Improvement Plan.

The overall 345kV breaker replacement program targets (12) effectively obsolete breakers across the system that have limited replacement parts, high SF6 leak rates, outdated operating specifications, and difficulties keeping in proper adjustment. Funding has been allocated to replace the remaining ten breakers prior to 2020. The design and construction of these specific breakers prevent them from reaching an average 60 years of useful life that is expected from the remaining in-service breakers.

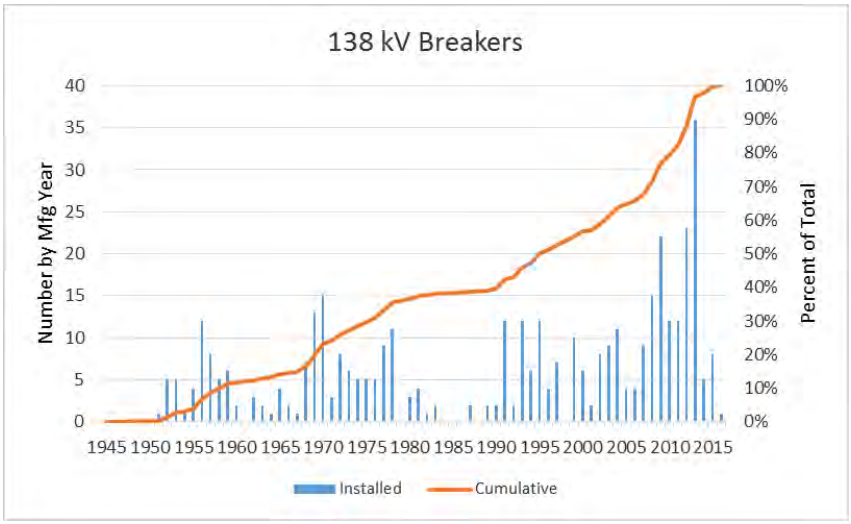
The (4) 138kV breakers being targeted for replacement at Mill Creek are part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The criteria driving the replacements of this equipment include maintenance history, insufficient continuous current capacity, insufficient interrupting current capability, repair vs. replace economics, and management of the age of the breaker fleet.

The (15) 138kV switches at Mill Creek being planned for replacement are associated switches with the (4) 138kV breakers and the remaining bus connected switches. These switches utilize cap and pin insulators, which have a historically high failure rate.

The project was opened for $453k during 2016 for preliminary engineering and materials with the understanding that the project would be presented for approval once detailed engineering was completed. The total cost of this project will be $3,317k, with $928k in 2016 and $2,389k in 2017. This project was included in the 2017 BP for $1,100k, with $453k in 2016 and $647k in 2017 which was for only (2) 345kV breaker replacements. Funding projects 151756 LG&E Breaker Replacements and 152621 LG&E Cap and Pin Replacements were included in the 2017 BP and will be reduced to cover the difference in 2017 and approved through the normal RAC process.

Background
LG&E/KU has seven vintage 1973-1982 dead tank two pressure ITE GA Sulfur Hexafluoride 345kV (SF6) gas breakers in-service. They employ complicated operating systems with two pressures blast valve systems for arc extinguishing, multi-breaker contacts, pre-insertion resistors and grading capacitors across the contacts which predisposes these types of breakers to many failure modes. These types of breakers hold up to 1,800 lbs. of gas compared to new style puffer breakers with around 340 lbs. and have infinitely more places to leak. These breakers have the highest gas leakage rates in our system. Since 2010 the combined leak total of these seven breakers is 1,088.6 pounds per year; the combined total of all remaining gas in our 107 newer style 345kV puffer breakers is 451.8 pounds per year. Currently, there are no regulatory implications as related to these gas leaks. These breakers ceased being manufactured in the late 1980's and are only marginally supported by the manufacturer at this point. There have been a combined 295 corrective maintenance orders since 2005. Parts for these breakers generally have to be made by third party machine shops. It is critical that the MC-4504-60 TIE breaker be replaced to improve the reliability of Mill Creek Unit 4 and reduce the risk of damage to the unit from a breaker failure.

Based on historical data, most circuit breakers reach the end of useful life at 60 years. The chart below outlines the age of the (417) 138kV breakers that are currently in service in the LKE system. Failure to fund this project and others that are similar will contribute to the ongoing concern of an aging infrastructure with equipment in service that has reached the end of its useful life and can no longer be properly maintained. The technology used for the construction of these breakers is antiquated and the high number of moving parts makes it challenging to keep all of the measurements within manufacturers specifications.



The switch replacements are driven by the need to remove cap and pin insulators, which have a history of mechanical failures. Insulators are used to isolate from ground and support energized conductors and substation equipment such as disconnect switches. The entire switch will be

replaced instead of only replacing the insulators and reusing the old switch assembly. Bus insulator failures can lead to an unplanned outage on the Mill Creek 138kV bus, which could impact the operation of the plant.

List of Equipment Being Replaced:

Breakers:
- MC-4532
- MC-4504-60 TIE
- MC-3834
- MC-138KVTR6
- MC-138KVTR5
- MC-138KVBUSTIE&TFR

Switches:
- MC-855 Bus
- MC-857 Bus
- MC-834 Line
- MC-834 Bus
- MC-138KV TR 6 TRANS
- MC-138KV TR 6 BUS
- MC-138KV TR 7 & 8 BUS
- MC-138KV BUS TIE & TFR SEC B
- 138kV BUS TIE
- MC-138KV BUS TIE & TFR SEC A
- MC-838 Bus
- MC-138KV TR 5 TRANS
- MC-138KV TR 5 BUS
- MC-866 BUS
- 138kV TR9 BUS

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $3,671k
     It is recommended to replace the various 345kV breakers, 138kV breakers, switches and arresters at the Mill Creek substation. Parts from the breakers that are retired will be used to support other similar breakers that are still in service on the system.

  2. Alternative #1: NPVRR: ($000s) $3,891k
     The next best alternative is to replace all of the identified equipment gradually over a period of several years instead of completing the numerous replacements in one time period. Taking a logical approach the (2) 345kV breakers, (4)138kV breaker and (15) 138kV switches would be split into three separate projects completed over the next three years. Intermittently completing the required work is not recommended as inherent risks will remain for extended durations. Additionally, this alternative will ensure higher forecasted costs as well.

3. Do Nothing: NPVRR: ($000s) $4,194k
   This option is not advisable as the breakers currently in-service at Mill Creek have a history of maintenance issues and the parts necessary to alleviate these issues are no longer available, which requires additional maintenance activities as well. Expertise to maintain assets in the field are lacking or are not currently available. Specifically to the 345kV, these breakers historical have high leak rates. SF6 is currently being monitored by the EPA, but there are no compliance risks as of today.

   It is assumed both 345kV breakers will fail within 10 years and four 138kV breakers will fail within a fifteen year period. These assumptions are based on a mechanical failure were a component within the breaker is defective and replacement parts are not available and therefore repairs will not be possible. The current ongoing maintenance costs of the breakers in-service is $3,500 a year. The new breakers will have $500 a year in maintenance costs. If one of these breakers fails at certain time of year, more serious consequences could occur within the system, including the loss of customers.

   The 138kV disconnects currently in-service at Mill Creek are comprised of cap & pin insulators. During operation of these disconnects forces are applied to failing glue joints. If the glue joints catastrophically fail live parts have the potential to shear loose of the insulator, this type of failure poses serious consequences to the operator on the ground. Subsequent outage will impact the system. No maintenance cost are associated with these disconnects. It is assumed that a switch will mechanically fail every 2 years due to operational uses or forces applied during faults.

Project Description

The equipment to be replaced has been highlighted on the single line included in Appendix A.

- **Project Scope and Timeline**

Description	Date
Project Pre-Approved	September, 2016
Breakers Ordered	October, 2016
Breakers Received	December, 2016
Remaining Materials Ordered	February, 2017
345kV MC-4532 Breaker Replacement Work Begins	February, 2017
345kV MC-4532 Breaker Replacement Work Completed	March, 2017
Remaining Materials Received	March, 2017
345kV MC-4504-60 TIE Breaker Replacement Work Begins	October, 2017
345kV MC-4504-60 TIE Breaker Replacement Work Completed	October, 2017
138kV Breaker, Switch Replacement Work Begins	March, 2017
138kV Breaker, Switch Work Completed	April, 2017
Project Complete	December, 2017

- **Project Cost**
  The total cost of this project will be $3,317k, with $928k in 2016 and $2,389k in 2017. This project was included in the 2017 BP for $1,100k, with $453k in 2016 and $647k in 2017. In addition, funding projects 151756 LG&E Breaker Replacements and 152621 LG&E Cap and Pin Replacements were included in the 2017 BP. Reductions in these funding projects will cover the difference in 2017. The estimated total project figure includes a 10% contingency. This contingency is reasonable based on the level of detailed engineering and is expected to cover uncertainty with the contract labor costs based upon variances that have been observed on past similar projects.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2016	2017	2018	Post 2018	Total
1. Capital Investment Proposed	928	2,220	-	-	3,148
2. Cost of Removal Proposed	-	169	-	-	169
3. Total Capital and Removal Proposed (1+2)	928	2,389	-	-	3,317
4. Capital Investment 2017 BP	453	647	-	-	1,100
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	453	647	-	-	1,100
7. Capital Investment variance to BP (4-1)	(475)	(1,573)	-	-	(2,048)
8. Cost of Removal variance to BP (5-2)	-	(169)	-	-	(169)
9. Total Capital and Removal variance to BP (6-3)	(475)	(1,742)	-	-	(2,217)

Financial Detail by Year - O&M ($000s)	2016	2017	2018	Post 2018	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.5%
Capital Breakdown:	
Labor:	$58k
Contract Labor:	$1,277k
Materials:	$1,204k
Other:	$0k
Local Engineering:	$387k
Burdens:	$93k
Contingency:	$298k
Reimbursements:	($0k)
Net Capital Expenditure:	$3,317k

- **Assumptions**
  - Suppliers and contractors will meet reasonable and customary delivery dates for materials and services.
  - Outages required can be obtained with normal working hours

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of the LKE Transmission system and introduces risks to the operation of the Mill Creek Generating Station.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Mill Creek 2017 Breaker and Switch Replacements project for $3,317k to enhance the reliability of the Transmission system.

Approval Confirmation for Capital Projects Greater Than or Equal to $1 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake.	Victor A. Staffieri
Chief Financial Officer	Chairman and CEO

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Appendix A

[redacted]

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: PR-Blue Lick (1) 345kV (1) 69kV BKR Project

Total Expenditures: $862k (Including $78k of Contingency)

Project Number(s): 152222

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Stephen Miranda

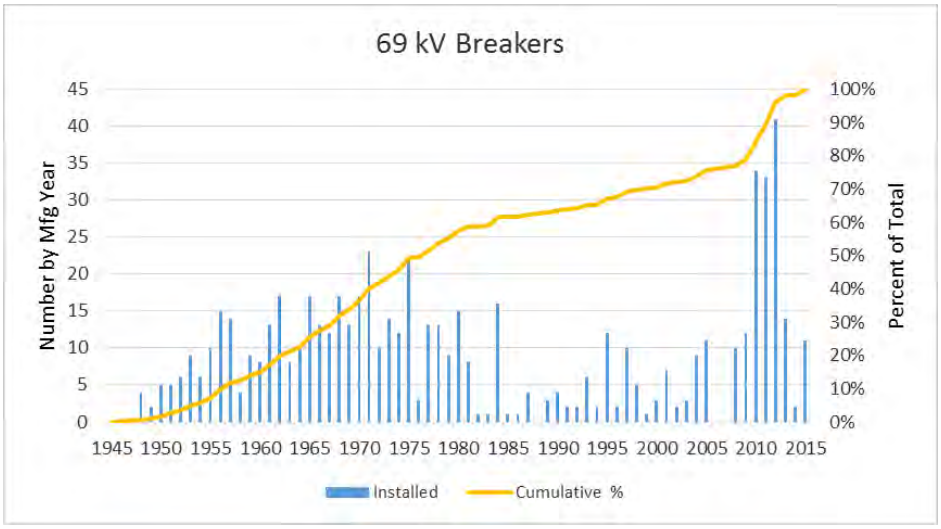
Executive Summary

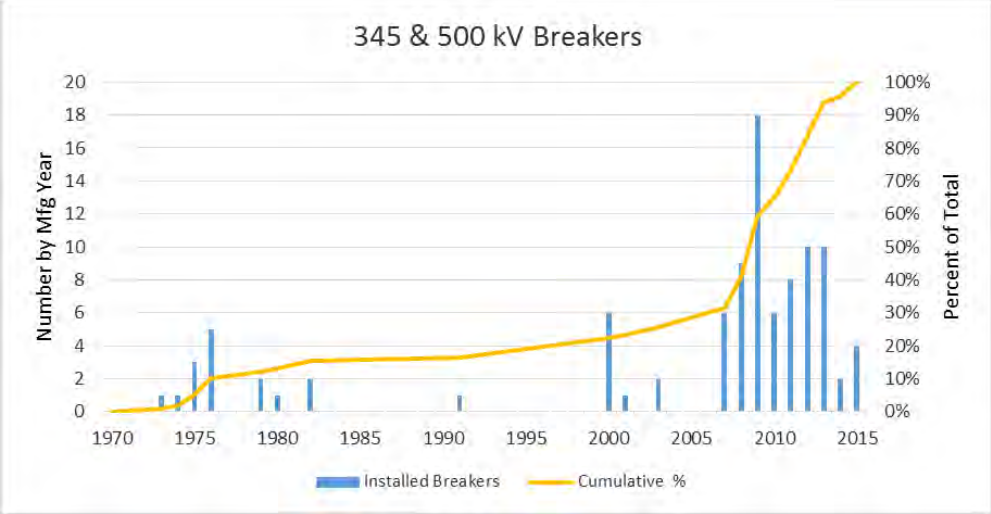
The scope of this project includes the replacement of (1) 345kV and (1) 69kV circuit breaker and associated equipment at the Blue Lick substation. The breakers that will be replaced are BL-4532-38 and BL-6676. This project proposes to proactively replace the cited equipment prior to failure, to ensure the integrity and reliability of the substation, and to prevent potential outages resulting from failure. The alternative of replacing the equipment upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

These breakers must be replaced due to a variety of drivers including age, reliability, and availability of replacement parts, known operational issues, and higher maintenance costs. The continued use of the breakers currently in-service is not prudent. The replacement of this equipment will lead to fewer unplanned outages and therefore increased reliability within the Transmission grid system.

This project was opened for preliminary engineering and materials during August 2016 and revised in March 2017 to increase the amount needed for engineering and materials. The project is being resubmitted now for the full amount of $862k based on detailed engineering with $256k in 2016 and $606k in 2017. The 2017 BP included $550k for this project with $200k in 2016 and $350k in 2017. The budgeted amount was estimated based on similar projects that have been previously completed and has been updated based on the preliminary engineering performed. The funding needed above the budgeted amount in 2016 was addressed by the RAC during 2016. The funding needed above the budget in 2017 ($256k) was partially funded by the RAC in the 3+9 forecast ($252k) and partially funded by a reduction in project KRTU-17 ($4k). The estimated total project figure includes a 10% contingency. This contingency is expected to cover uncertainty with the contract labor costs based upon variances that have been noticed on past similar projects.

Background
Based on historical data, most circuit breakers reach the end of useful life at 60 years. The chart below outlines the age of the breakers that are currently in service in the LKE system. Failure to fund this project and others that are similar will contribute to the ongoing concern of an aging infrastructure with equipment in-service that has reached the end of its useful life and can no longer be properly maintained. The technology used for the construction of these breakers is antiquated and the high number of moving parts makes it challenging to keep all of the measurements within manufacturers specifications.





The (1) 345kV circuit breakers, (1) 69kV circuit breaker are being targeted for replacement at Blue Lick are part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The criteria driving these replacements: Age and repair vs. replace economics, the 345kV circuit breaker is vintage 1950's and the 69kV breaker is vintage 1960's.

The associated breaker line arresters are being targeted for replacement at Blue Lick are part of a program to replace silicon carbide type arresters that provide little or no protection and failures typically result in high likelihood of collateral damage.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,003k
     It is recommended that (1) 345kV and (1) 69kV circuit breakers at (Blue Lick substation) and any associated equipment are replaced.

  2. Next Best Alternative: NPVRR: ($000s) $1,335k
     The next best alternative is to replace all of the identified equipment gradually over a period of several years instead of completing the numerous replacements in one time period. Intermittently completing the required work is not recommended as inherent risks will remain for extended durations. Additionally, this alternative will ensure higher forecasted costs as well.

  3. Do Nothing: NPVRR: ($000s) N/A
     This option is not advisable as the breakers currently in-service at Blue Lick substation have a significant history of maintenance issues and many of the parts necessary to alleviate their known issues are generally no longer available. The equipment in question also have higher maintenance costs as well. If any of this equipment were to fail, it could lead to an unplanned outage in the LKE Transmission system. Additionally, choosing this option puts the company at risk of not being able to accomplish the objectives of the Transmission System Improvement Plan.

Project Description

- **Project Scope and Timeline**

Scope:

- Remove (1) 69kV breaker and (1) 345kV breaker
- Install (1) new 69kV SF6 ABB breaker, 2000A, 40kA
- Install (1) new 345kV SF6 ABB breaker, 3000A, 63kA
- Install (9) new arresters on the 6676, 4532, and 4538 lines

Timeline:

Description	Date
Project Originally Approved	August, 2016

Materials Ordered	February 2017
Materials Received	July 2017
Below Grade Work Begins	August 2017
Below Grade Work Completed	September 2017
Above Grade Work Begins	August 2017
Above Grade Work Completed	September 2017
Project Complete	October 2017

- **Project Cost**
  The total cost of this project will be $862k and was approved by the RAC in the 2017 3+9 forecast for $858k. $4k was funded by a reduction in KRTU-17. The estimated total project figure includes a 10% contingency as the project is in its final stages of completion. This contingency is expected to cover uncertainty with the contract labor costs based upon variances that have been noticed on past similar projects.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2016	2017	2018	Post 2018	Total
1. Capital Investment Proposed	256	536	-	-	792
2. Cost of Removal Proposed	-	70	-	-	70
3. Total Capital and Removal Proposed (1+2)	256	606	-	-	862
4. Capital Investment 2017 BP	200	350	-	-	550
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	200	350	-	-	550
7. Capital Investment variance to BP (4-1)	(56)	(186)	-	-	(242)
8. Cost of Removal variance to BP (5-2)	-	(70)	-	-	(70)
9. Total Capital and Removal variance to BP (6-3)	(56)	(256)	-	-	(312)

Financial Detail by Year - O&M ($000s)	2016	2017	2018	Post 2018	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.5%
Capital Breakdown:	
Labor:	$44
Contract Labor:	$373
Materials:	$196
Other:	$5
Local Engineering:	$120
Burdens:	$46
Contingency:	$78
Reimbursements:	($0)
Net Capital Expenditure:	$862

- **Assumptions**
  - Existing foundations can be reused
  - Existing secondary cables for the 69kV breaker will be reused
  - Primary high side conductors will be replaced
  - TDI to scrap breakers
  - Can install arresters on existing steel
  - Required outages during normal working hours
  - Contract labor to complete equipment testing & relay commissioning
  - Equipment delivery to SSC or site
  - Construction crew to receive misc. equipment & material
  - Existing breakers are PCB free
  - No site/Civil work required
  - RTU points available for new spring discharge

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos. As a result, consulation with the Enviromental group has not been deemed necessary at this time.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. If action is not taken, there will continue to be challenges associated with keeping these breakers in good working order. There is also an increased probability of failure, reduction of system reliability through the occurrence of system outages and possible collateral damage in the event of a catastrophic failure.

Conclusions and Recommendation
It is recommended that Management approve the PR-Blue Lick (1) 345kV (1) 69kV BKR Project for $862k to enhance the reliability of the Transmission system.

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: PBR-Clifty Creek DL1/DL2 Breaker Replacement

Total Expenditures: $1,306k (Includes $119k (10%) Contingency)

Project Number(s): 152224

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Aaron Burns – Sargent & Lundy / Brent Birchell

Executive Summary

This project includes the replacements of (2) 345kV circuit breakers for Clifty Creek Substation.

The (2) 345kV breakers that are being targeted for replacement are part of a program to replace aging and obsolete transmission assets. The replacement of these breakers will reduce the risk of a potential failure and improve reliability of the Transmission system.

The total cost of this project will be $1,306k with $119k in 2018 and $1,187k in 2019. This project was included in the 2018 BP for $100k in 2018 and $1,100k in 2019. The higher 2018 spending has been approved by the RAC in the 7+5 forecast and the 2019 spending is included in the proposed 2019 BP. The proposed 2019 BP includes $111k in 2018 and $1,139k in 2019.

Background

The two (2) 345kV breakers are aging air blast type circuit breaker vintage 1975. In addition to age, these breakers have a history of maintenance issues. Asset Management has identified these two breakers as overdue for replacement. The replacement of these breakers will reduce risk of a potential failure and improve the reliability of the Transmission system.

The two (2) 345kV breakers are LG&E assets, however they are located in the Clifty Creek substation which is owned and operated by Indiana-Kentucky Electric Corporation (IKEC). IKEC is responsible for operation of the DL1 and DL2 circuit breakers, therefore it is recommend that IKEC standard Siemens SPS2-362-63 type circuit breakers are purchased for this project.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,426k
     It is recommended that the breakers be replaced to reduce the potential risk to the Transmission system.

  2. Alternative #1: NPVRR: ($000s) $1,519k
     The next best alternative is to replace all of the identified equipment gradually over a period of several years instead of completing the numerous replacements in one time period. Intermittently completing the required work is not recommended as inherent risks will remain for extended durations. Additionally, this alternative will result in a loss of efficiency that comes with packaging similar work at one location.

  3. Do Nothing: NPVRR: ($000s) $0k
     This option is not advisable as it puts Transmission at risk of not being able to accomplish targets established as part of the Transmission Reliability Plan.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Approved	August 2018
Materials Ordered	September 2018
Materials Received	February 2019
Construction Complete	April 2019
Project Complete	July 2019

Project Cost

The total cost of this project will be $1,306k with $1119k in 2018 and $1,187k in 2019. The estimated total project figure includes a 10% contingency. This contingency is expected to cover uncertainty with the cost of expediting materials and premium cost for construction due to this being a pull forward project.

Economic Analysis and Risks

- **Bid Summary**
  IKEC is responsible for operation of the DL1 and DL2 circuit breakers, therefore it is recommend that IKEC standard Siemens SPS2-362-63 type circuit breakers are purchased for this project. Siemens does not currently have a blanket contract in place with LG&E/KU supply chain, therefore a Sole Source Award (SSA) will be utilized for procurement of the new circuit breakers. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2018	2019	Total
1. Capital Investment Proposed	119	1,168	1,287
2. Cost of Removal Proposed	-	19	19
3. Total Capital and Removal Proposed (1+2)	119	1,187	1,306
4. Capital Investment 2018 BP	100	1,100	1,200
5. Cost of Removal 2018 BP	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	100	1,100	1,200
7. Capital Investment variance to BP (4-1)	(19)	(68)	(87)
8. Cost of Removal variance to BP (5-2)	-	(19)	(19)
9. Total Capital and Removal variance to BP (6-3)	(19)	(87)	(106)

Financial Detail by Year - O&M ($000s)	2018	2019	Total
1. Project O&M Proposed	-	-	-
2. Project O&M 2018 BP	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-

Financial Summary ($000s):
Discount Rate:
Capital Breakdown:

Labor:	$52k
Contract Labor:	$336k
Materials:	$516k
Other:	$0k
Local Engineering:	$174k
Burdens:	$109k
Contingency:	$119k
Net Capital Expenditure:	$1,306k

Assumptions
No major assumptions were included in the capital evaluation model. It is assumed material can be obtained in a timely manner. All assumptions were made prior to site visit.

- **Environmental**

This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Delaying this project exposes our system to the continuing risk of impacts from other potential transmission failures.

Conclusions and Recommendation
It is recommended that Management approve the Clifty Creek 345kV DL1 & DL2 breakers project for $1,306k to enhance the reliability of the Transmission system.

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: June 26, 2017

Project Name: PBR-Middletown (5) Breaker Replacement

Total Expenditures: $2,478k (Including $200k of Contingency)

Project Number(s): 152226

Business Unit/Line of Business: Transmission Substation Construction

Prepared By: Chris Talley – Director Transmission Construction

Executive Summary

The scope of this project includes the replacement of (5) 345kV circuit breakers at the Middletown 345kV substation. The specific equipment that is being replaced is listed below in the "Background" section. All of the equipment being targeted for replacement under this project is part of the LG&E and KU Energy LLC (LKE) overall Transmission System Improvement Plan.

The Middletown project is part of the transmission system improvement plan to address existing 345kV high pressure live tank breakers prone to issues and failure. The overall 345kV breaker replacement program targeted (12) effectively obsolete breakers across the LKE system that have limited replacement parts, high SF6 leak rates, outdated operating specifications, and difficulties keeping in proper adjustment. Four of these breakers have been replaced, five will be replaced at Middletown in this project and the three remaining breakers have been included in the 2017 BP for replacement in 2019.

LKE will utilize (4) retired ABB breakers from the proposed Trimble Co. Combustion Turbine "TCT" breaker replacement project during the execution of Middletown 345kVA fifth breaker used in this project will be a breaker from another Trimble substation breaker replacement project that is scheduled for completion in the spring of 2018. These breakers will be charged to this proposed project at the remaining net book value amount.This project is scheduled for 2018 in the current business plan. The total cost of this project will be $2,478k, including $287k to fund engineering that will be pulled forward into 2017 and was approved by the RAC in the 5+7 forecast.

Background

LKE has six vintage 1975-1976 GE Type ATB-7 high pressure air blast, live tank breakers still in service. These breakers ceased being manufactured in the late 1970's and the manufacturer no longer supports the product. The technology used for the construction of these breakers is antiquated and the high number of moving parts makes it challenging to keep all of the

measurements within manufacturer's specifications. Parts are not readily available and must be manufactured when needed.

With limited internal expertise to maintain these breakers, LKE must rely on a single third party source for service. Maintenance with this style of breaker is intensive, requiring longer outage time extending up to two weeks versus days for new breaker types. The older style breakers also require additional equipment including cranes and lifts in order to work on the components. These breakers are susceptible to leaks and require consistent attention to ensure correct breaker operation. Since 2005 ATB-7's average 5 corrective maintenance work orders per year versus 1.5 work orders against the entire LKE breaker fleet.

The five breakers to be installed at Middletown 345kV will be ABB 362PMI63-20 breakers retired from the two current projects, Trimble Co. TCT (4) breaker replacement & Trimble Co. 4511 breaker replacement. While the ABB breakers are not suitable for use at Trimble County due to the increased dielectric stress introduced by synchronizing a generator, these breakers are rated for the operating environment at Middletown.

List of Equipment Being Replaced:

Proposed breakers slotted for replacement:

- MT-345kV TR 5
- MT-4531
- MT-4531-43 TIE
- MT-4538
- MT-4543

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,775
     It is recommended to replace the (5) 345kV ATB breakers at the Middletown 345kV substation.

  2. Alternative #1: NPVRR: ($000s) $3,620
     The next best alternative is to replace the (5) 345kV breakers over a period of several years. This project could be divided into (3) projects. Intermittently completing the required work is not recommended as inherent risks will remain for extended durations. Additionally, this alternative will ensure higher overall cost due to inefficiencies with engineering and construction management.

  3. Do Nothing: NPVRR: ($000s) $3,007
     It is assumed that (5) 345kV breakers will fail within 20 years. These assumptions are based on a mechanical failure, where a component within the breaker is defective and replacement parts are not available and or catastrophic failure during fault clearing. This option is not advisable as the breakers currently in-service at Middletown 345kV have a history of maintenance issues.

The current ongoing maintenance costs of the high pressure breakers in-service is $4,000 a year per breaker. Each new breaker will have annual maintenance costs of $500.

Project Description

The equipment to be replaced has been highlighted on the single line included in Appendix A.

- **Project Scope and Timeline**

Description	Date
Project Approved	June, 2017
Breakers Ordered	N/A
Engineering Complete	November, 2017
Breakers Received	Retired from 2 Trimble Co. Projects
Remaining Materials Delivered	March, 2018
345kV MT-4531, 4543, 4531-4543 TIE Work Begins	April, 2018
345kV MT-4531, 4543, 4531-4543 TIE Work Completed	May, 2018
345kV MC-4538, TR7 Breaker Replacement Work Begins	November, 2018
345kV MC-4538, TR7 Breaker Replacement Work Completed	December, 2018
Project Complete	December, 2018

- **Project Cost**

  This project is scheduled for 2018 in the current business plan. The total cost of this project will be $2,478k. 2017 includes $287k to fund engineering and was approved by the RAC in the 5+7 Forecast. Contingency of $200k (9%) is included in this project to account for uncertainties during construction.

Economic Analysis and Risks

- **Bid Summary**

  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out after project design completed.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2016	2017	2018	Post 2018	Total
1. Capital Investment Proposed		287	2,028		2,315
2. Cost of Removal Proposed			163		163
3. Total Capital and Removal Proposed (1+2)		287	2,191		2,478
4. Capital Investment 2017 BP			2,750		2,750
5. Cost of Removal 2017 BP					-
6. Total Capital and Removal 2017 BP (4+5)		-	2,750		2,750
7. Capital Investment variance to BP (4-1)		(287)	722		435
8. Cost of Removal variance to BP (5-2)		-	(163)		(163)
9. Total Capital and Removal variance to BP (6-3)		(287)	559		272

Financial Detail by Year - O&M ($000s)	2016	2017	2018	Post 2018	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.5%
Labor:	$160
Contract Labor:	$1,092
Materials:	$680
Other:	
Local Engineering:	$193
Burdens:	$153
Contingency:	$200
Reimbursements:	
Net Capital Expenditure:	$2,478

- **Assumptions**
  - Suppliers and contractors will meet reasonable and customary delivery dates for materials and services.
  - Outages required can be obtained with normal working hours.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

  This project involves the removal and installation of sulfur hexafluoride (SF6). There are no current environmental regulatory implications related to SF6 gas.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work.

  Not completing the project decreases the reliability of the LKE Transmission system and introduces risks to the operation of the Middletown 345kV Generating Station.

  Breaker replacements are tied to the removal of Trimble Co. unit breakers, delays with the Trimble Co. replacements can impart delays on the Middletown replacements.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Middletown 345kV 2018 Breaker Replacements project for $2,478k to enhance the reliability of the Transmission system.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Paul W. Thompson
President and Chief Operating Officer

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: Green River Plant Switch/Insulator/Arrester Replacements

Total Expenditures: $862k (Including $80k of Contingency)

Project Number(s): 152401

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Victor Payne – Electrical Engineer

Executive Summary

This project will include the replacement of cap and pin style insulators that supports the 138kV bus and switches and replacement of surge arresters at the Green River Plant substation. Additionally, equipment no longer in use at the substation including breakers, switches, feeders, and various bus work will be removed. This project is necessary to reduce risk of outages caused by failure of unused or deteriorating equipment. The execution of this project is vital to enhancing the reliability of the Transmission system in the area and was included in the Transmission Reliability Plan (TRP).

This project was initially approved for preliminary engineering during May 2017. Based on detailed engineering, the total cost of this project will be $862k and was approved by the RAC in the 5+7 forecast. $890k of funding was included in the 2017 BP for this project, with $270k in 2016 and $620k in 2017. The estimated total project figure includes a 10% contingency.

Background
There is equipment no longer being used at the substation due to configuration changes related to the retirement of the generating units at the Green River Power Plant (GRPP). Such equipment left in place poses a reliability risk to other equipment at the substation that is still in use. Of the equipment no longer in use, reusable equipment will be transferred to a storage area and out of the substation and Unusable equipment will be scrapped.

Additionally, equipment that will continue to be used will be replaced and/or relocated. (9) 138kV surge arresters will be replaced due to outdated technology being used. (15) 69kV surge arresters will be relocated to meet National Electric Safety Code Specifications (NESC) safety clearances. The new arresters will provide better protection to the equipment in the substation and reduce risk of potential equipment failures. 138kV cap and pin insulators in 7 bays will be replaced with station post insulators. Lastly, (8) 138kV switches and operators will be replaced with cap and pin insulators.

Installations:
- Replace (9) 138kV line arresters in positions 794, 744, 724.
- Replace and relocate (15) 69kV arresters in line positions 604, 614, 634, 644, and 654.
- Replace the (8) 138kV switches and operators with cap and pin insulators for 758T, 758B, 768T, 768B, 778T, 778B, 788T, and 788B.
- Replace the 138kV cap and pin insulators with station post insulators in (7) bays.

Removals:
- Relocate the 009-736 switch to the Earlington Operation Center to utilize as a future spare.
- Scrap 138kV breaker 009-746, 009-626, and TB541 breakers. TB514 is sitting on wood timbers in the 69kV substation.
- Remove 69kV switch and operator for 626G and bus work to the transformer.
- Remove 69kV switch 626B and operator but leave base and top (3) insulators supporting the 69kV bus.
- Remove (1) 138kV bus potential transformer disconnect switch and operator with cap and pin insulators.
- Remove the (4) 138kV breaker disconnect switches and operators 746B, 746G, 736G and 736B and associated tube bus connecting to the main 138kV bus.
- Remove the (7) 138kV transfer bus switches and operators 749, 727, 739 747, 769, 779 and 797.
- Remove transfer bus including (54) steel support structures and foundations, (81) cap and pin insulators and all associated HV bus work.
- Remove feeders between station take-off point position 746 and vertical angle pole in the line to the unit 4 GSU.
- Remove conductor between station take-off point position 736 and the unit 3 generator step-up unit (GSU) transformer take-off structure.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,001k
     It is recommended that the various switches, insulators, and arresters be replaced and any unnecessary abandoned equipment be retired from the Green River Plant

substation. This option will increase the reliability of the station and eliminate safety hazards.

2. Alternative #1: NPVRR: ($000s) $1,077k
   The next best alternate is to delay the work until additional signs of damage are present using visual inspections or hot spot identification methods. This is not recommended due to sudden failures of equipment that could cause unplanned outages or safety concerns. This option may be able to prevent some unplanned outages, but the increased costs of repairing damage during a failure and increase labor rates during emergency restoration will increase costs in the long term. This option also does not address any immediate safety concerns.

3. Do Nothing: NPVRR: ($000s) N/A
   This option is not advisable due to the risk of equipment failures that can cause unplanned outages and safety hazards. In addition, not doing the project will prevent us from meeting the goals of the TRP.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Originally Approved	May 2017
Materials Ordered	July 2017
Materials Received	October, 2017
Above Grade Work Begins	October, 2017
Above Grade Work Completed	December, 2017
Project Complete	December, 2017

- **Project Cost**
  This project was initially approved for preliminary engineering during May 2017. Based on detailed engineering, the total cost of this project will be $862k and was approved by the RAC in the 5+7 forecast. $890k of funding was included in the 2017 BP for this project, with $270k in 2016 and $620k in 2017. The estimated total project figure includes a 10% contingency.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	2019	Post 2019	Total
1. Capital Investment Proposed	713	-	-	-	713
2. Cost of Removal Proposed	149	-	-	-	149
3. Total Capital and Removal Proposed (1+2)	862	-	-	-	862
4. Capital Investment 2017 BP	206	437	-	-	643
5. Cost of Removal 2017 BP	64	183	-	-	247
6. Total Capital and Removal 2017 BP (4+5)	270	620	-	-	890
7. Capital Investment variance to BP (4-1)	(507)	437	-	-	(70)
8. Cost of Removal variance to BP (5-2)	(85)	183	-	-	98
9. Total Capital and Removal variance to BP (6-3)	(592)	620	-	-	28

Financial Detail by Year - O&M ($000s)	2016	2017	2018	Post 2018	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.5%
Capital Breakdown:	
Labor:	$71k
Contract Labor:	$453k
Materials:	$137k
Other:	$0k
Local Engineering:	$55k
Burdens:	$66k
Contingency:	$80k
Reimbursements:	($0k)
Net Capital Expenditure:	$862k

- **Assumptions**
  - The requested outages for construction will be granted. The labor estimate assumes 4 day/week, 10 hour/day work week, with no special construction considerations to minimize the required outage window.
  - Suppliers and contractors will meet reasonable and expected delivery dates for materials and services

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  If the project is not completed there is increased risk of equipment failures that can cause unplanned outages and safety hazards. If the project is delayed those increased risks will remain. Also, due to the outages required to compete the work there is a risk that overtime rates or extra mobilizations could increase costs.

Conclusions and Recommendation
It is recommended that Management approve the Green River Plant Switch/Insulator/Arrester Replacements project for $862k to enhance the reliability of the Transmission system.

Investment Proposal Project 153346 Brown CT-Bardstown Pole Replacement

Investment Proposal for Investment Committee Meeting on: November 29, 2016

Project Name: Brown CT-Bardstown Pole Replacement

Total Expenditures: $5,221k
Total Contingency: $475k (10%)

Project Number(s): 153346

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Ashley Burns/Adam Smith

Executive Summary

The proposed project is to replace eighty-six (86) wood structures on the Brown CT-Bardstown 138kV line with steel based on the results of a routine line inspection. The recommendation is to replace the structures energized due to the difficulty in obtaining an extended outage. If the opportunity to complete the project de-energized would occur, we would pursue this option and it would reduce the cost by $1,016k As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

This project is not included in the 2016 Business Plan, however is included in the proposed 2017 Business Plan under the K9-2017 Priority Pole Replacement Blanket. All spending will occur in 2017.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. During a routine climbing inspection of the Brown CT-Bardstown 138kV line, eighty-six (86) structures were identified as priority poles and found to be in need of replacement. All eighty-six (86) structures need to be replaced in order to ensure the integrity and reliability of this line. There are 271 total structures along this 39.19 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $6,549k
     The recommendation is to replace the structures energized due to the difficulty in obtaining an extended outage. If the opportunity to complete the project de-energized would occur, we would pursue this option and it would reduce the cost by $1,016k and the NVPRR by $1,274k.
  2. Alternative #1: NPVRR: ($000s) $10,211k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $8,120k
     The next best alternative would be to replace the eighty-six (86) structures with wood. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing sixty-one (61) standard steel H-frames, twenty-one (21) custom steel H-frames, three (3) custom three-pole steel dead end structures, one (1) custom three-pole steel running corner, and associated hardware and material, and the removal of eighty-six (86) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B, Elliot, Groves, and Pike are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in February of 2017 and be completed in August of 2017.

  The construction milestones for this project are provided below:

Construction Milestones	
November 2016	Engineering and Design
December 2016	Steel Poles Ordered
February 2017	Steel Poles Received

February 2017	Line Construction Begins
August 2017	Line Construction Completed

A facility map of the Brown CT-Bardstown 138kV line is shown below:
Line length: 39.19 miles

- **Project Cost**
  The total project cost is $5,221k and was not included in the 2016 Business Plan, however is included in the proposed 2017 Business Plan under the K9-2017 Priority Pole Replacement blanket. All spending will occur in 2017. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material package for construction of this project to be $1,788k. This project will utilize standard and custom steel structures. The steel structures will be purchased through our steel pole alliance partner, Trinity Meyer. Hardware will be purchased through Brownstown Electric Supply. The line construction will be based on continuing contracts with our line contractors. Davis H. Elliot,

Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,689k
Hardware	$99k
Total	$1,788k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	4,802	-	-	-	4,802
2. Cost of Removal Proposed	419	-	-	-	419
3. Total Capital and Removal Proposed (1+2)	5,221	-	-	-	5,221
4. Capital Investment 2016 BP	-	-	-	-	-
5. Cost of Removal 2016 BP	-	-	-	-	-
6. Total Capital and Removal 2016 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(4,802)	-	-	-	(4,802)
8. Cost of Removal variance to BP (5-2)	(419)	-	-	-	(419)
9. Total Capital and Removal variance to BP (6-3)	(5,221)	-	-	-	(5,221)

Financial Detail by Year - O&M ($000s)	**2016**	**2017**	**2018**	**Post 2018**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2016 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project was not included in the 2016 BP, however is included in the proposed 2017 BP under the K9-2017 Priority Pole Replacement Blanket. All spending will occur in 2017.

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$120k
Contract Labor:	$2,351k
Materials:	$1,788k
Local Engineering:	$331k
Burdens:	$156k
Contingency:	$475k
Reimbursements:	($0k)
Net Capital Expenditure:	$5,221k

Financial Analysis - Project Summary ($000)	2017	2018	2019	2020	2021	Life of Project
Project Net Income	$ 111	$ 210	$ 202	$ 195	$ 188	$ 4,656
Project ROE	5.1%	7.5%	10.0%	10.0%	10.0%	9.8%

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available and the structure replacements will need to be completed with the 138kV line energized.

  Do nothing alternative – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize the construction crews. These poles would fail and require replacement within the next four years.

  Next best alternative - The cost of this alternative assumes the cost of the wood poles is 42% of the cost of the steel poles, and that the wood poles would be replaced again in 30 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead, asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Brown CT-Bardstown 138kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Brown CT-Bardstown 138kV project for $5,221k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $1 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Chief Financial Officer	Victor A. Staffieri Chairman, CEO and President

Investment Proposal 153347 Clinton-South Paducah Pole Replacement

Investment Proposal for Investment Committee Meeting on: October 26, 2016

Project Name: Clinton-South Paducah Pole Replacement

Total Expenditures: $4,080k
Total Contingency: $375k (10%)

Project Number(s): 153347

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Ronnie Bradford/Adam Smith

Executive Summary

The proposed project is to replace ninety-five (95) wood structures on the Clinton-South Paducah 69kV line with steel, during a routine outage, based on the results of a routine line inspection. To ensure construction of the project will begin in January of 2017, the project is being submitted for approval so material can be ordered in November of 2016 and received in January of 2017.

This proposal it to proactively replace the structures over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures. The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

The total project cost is $4,080k and is included in both the 2016 Business Plan and the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. All spending will occur during 2017. The project was included in the 2016 BP under the K9-2017 priority pole replacement blanket.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Clinton-South Paducah 69kV line was completed in 2014, and ninety-five (95) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. There are 274 total structures along this 36.58 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $5,552k
     The recommendation is to replace all ninety-five (95) structures during a scheduled outage.
  2. Alternative #1-Do Nothing: NPVRR: ($000s) $7,999k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2-Next Best Alternative: NPVRR: ($000s) $5,583k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of 4% which is in line with market cost increases over the last 15 years.

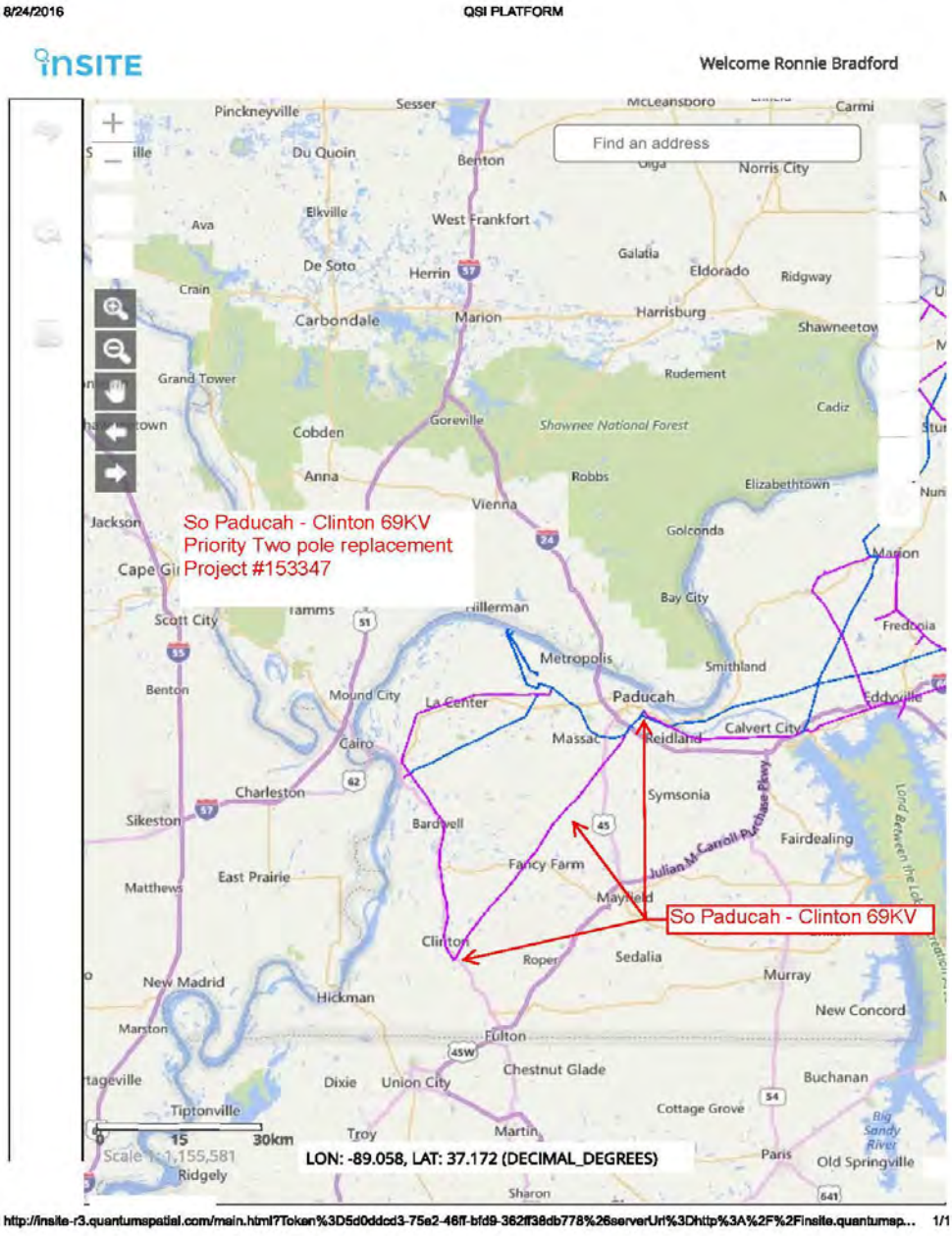
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing ninety-two (92) standard steel H-frame structures, two (2) steel 3-pole running corners, one (1) steel 1-pole horizontal post structure, and associated hardware and material, and the removal of ninety-five (95) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B, Elliot, Groves and Pike are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in January of 2017 and be completed in April of 2017.

  The construction milestones for this project are provided below:

Construction Milestones	
October 2016	Engineering and Design
November 2016	Steel Poles Ordered
January 2017	Steel Poles Received
January 2017	Line Construction Begins
April 2017	Line Construction Completed

A facility map of the Clinton-South Paducah 69kV line is shown below:
Line length: 36.58 miles



- **Project Cost**
  The total project cost is $4,080k and is included in both the 2016 Business Plan and the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions. This level of contingency is consistent with similar projects completed in recent years.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $1,964k. This project will utilize standard steel structures. The steel structures will be purchased through our steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with our line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,792k
Hardware	$172k
Total	$1,964k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	3,889	-	-	-	3,889
2. Cost of Removal Proposed	191	-	-	-	191
3. Total Capital and Removal Proposed (1+2)	4,080	-	-	-	4,080
4. Capital Investment 2016 BP	3,889	-	-	-	3,889
5. Cost of Removal 2016 BP	191	-	-	-	191
6. Total Capital and Removal 2016 BP (4+5)	4,080	-	-	-	4,080
7. Capital Investment variance to BP (4-1)	0	-	-	-	0
8. Cost of Removal variance to BP (5-2)	-	-	-	-	-
9. Total Capital and Removal variance to BP (6-3)	0	-	-	-	0

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2016 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project was included in both the 2016 BP and 2017 BP under K9-2017.

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$61k
Contract Labor:	$1,295k
Materials:	$1,964k
Local Engineering:	$261k
Burdens:	$124k
Contingency:	$375k
Reimbursements:	($0)
Net Capital Expenditure:	$4,080k

Financial Analysis - Project Summary ($000)	2017	2018	2019	2020	2021	Life of Project
Project Net Income	$63	$200	$190	$181	$173	$3,926
Project ROE	6.0%	8.0%	10.0%	10.0%	10.0%	9.8%

- **Assumptions**

  Recommendation – This alternative assumes that the line outage will be available and that all ninety-five (95) structures will be replaced during this timeframe.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 36% the cost of the steel poles, and that the wood poles would be replaced again in 30 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Clinton-South Paducah 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather, which affects site access and working conditions, could increase the project cost and cause schedule delays. Schedule delays may also occur if the requested outage is not obtained to complete the scheduled work.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Clinton-South Paducah Pole Replacement project for $4,080k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $1 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Victor A. Staffieri
Chairman, CEO and President

Investment Proposal Project 153348 Crittenden County Tap Pole Replacement

Investment Proposal for Investment Committee Meeting on: December 19, 2016

Project Name: Crittenden County Tap Pole Replacement

Total Expenditures: $2,347k
Total Contingency: $215k (10%)

Project Number(s): 153348

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Ronnie Bradford/Adam Smith

Executive Summary

The proposed project is to replace sixty-eight (68) wood structures on the Crittenden County Tap 69kV line with steel based on the results of a routine line inspection. The recommendation is to replace the structures energized due to the difficulty in obtaining an extended outage. If the opportunity to complete the project de-energized would occur, we would pursue this option and it would reduce the cost by $405k. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures. This project also includes installation of a new switch at the Dycusburg Tap point, which will facilitate construction through enhanced switching capabilities and limit customer impacts during project execution. A transmission reliability improvement project to install a switch at Dycusburg was included in the 2016 Business Plan for 2018 under project 147492. Accelerating the switch to align with the pole replacement project will limit customer impacts from this project and provide future reliability benefits.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

The total project cost is $2,347k. The proposed pole replacement was not included in the 2016 BP, however is included in the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. The portion of the project related to the switch installation ($21k) was also not included in the 2016 BP under this project, however, as noted, was included in the Dycusburg Switch installation project (147492) for $351k in 2018. All spending will occur during 2017.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Crittenden County Tap 69kV line was completed in 2014, and sixty-eight (68) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. There are 299 total structures along this 24.60 mile line. This project also includes installation of a new switch at the Dycusburg Tap point, which will facilitate construction through enhanced switching capabilities and limit customer impacts during project execution. Accelerating the switch to align with the pole replacement project will limit customer impacts from this project and provide future reliability benefits.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,944
     The recommendation is to replace the structures, and complete the switch installation energized due to the difficulty in obtaining an extended outage. If the opportunity to complete the project de-energized would occur, we would pursue this option and it would reduce the cost by $405k and the NVPRR by $508k.
  2. Alternative #1: NPVRR: ($000s) $4,509k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $3,472k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing eighteen (18) standard and custom steel H-frame structures, one (1) custom steel switch structure, two (2) custom steel vertical dead end structures, forty-seven (47) steel davit arm structures, and associated hardware and material, and the removal of sixty-eight (68) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B, Elliot, Groves and Pike are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in March of 2017 and be completed in June of 2017.

Construction Milestones	
December 2016	Engineering and Design
December 2016	Steel Poles Ordered
February 2017	Steel Poles Received
March 2017	Line Construction Begins
June 2017	Line Construction Completed

A facility map of the Crittenden County Tap 69kV line is shown below:
Line length: 24.6 miles

- **Project Cost**
  The total project cost is $2,347k. The proposed pole replacement was not included in the 2016 BP, however is included in the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. The portion of the project related to the switch installation ($21k) was also not included in the 2016 BP under this project, however, as noted, was included in the Dycusburg Switch installation project (147492) for $351k in 2018. All spending will occur during 2017. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and

potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $789k. This project will utilize standard and custom steel structures. The steel structures will be purchased through our steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with our line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$721k
Hardware	$68k
Total	$789k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	2,217	-	-	-	2,217
2. Cost of Removal Proposed	130	-	-	-	130
3. Total Capital and Removal Proposed (1+2)	2,347	-	-	-	2,347
4. Capital Investment 2016 BP	-	-	-	-	-
5. Cost of Removal 2016 BP	-	-	-	-	-
6. Total Capital and Removal 2016 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(2,217)	-	-	-	(2,217)
8. Cost of Removal variance to BP (5-2)	(130)	-	-	-	(130)
9. Total Capital and Removal variance to BP (6-3)	(2,347)	-	-	-	(2,347)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2016 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

The proposed pole replacement was not included in the 2016 BP, however is included in the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. The portion of the project related to the switch installation ($21k) was also not included in the 2016 BP under

this project, however, as noted, was included in the Dycusburg Switch installation project (147492) for $351k in 2018. All spending will occur during 2017.

Financial Summary ($000s):	
Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$65k
Contract Labor:	$1,044k
Materials:	$789k
Local Engineering:	$147k
Burdens:	$87k
Contingency:	$215k
Reimbursements:	($0k)
Net Capital Expenditure:	$2,347k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available and the structure replacements and switch installation will need to be completed with the 69kV line energized.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 34% the cost of the steel poles, and that the wood poles would be replaced again in 30 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Crittenden County Tap 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays. Schedule delays may also occur if the requested outage is not obtained to complete the scheduled work.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Crittenden County Tap Pole Replacement project for $2,347k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $1 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Chief Financial Officer	Victor A. Staffieri Chairman, CEO and President

Investment Proposal Project 153349 Leitchfield-Stephensburg Pole Replacement

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: Leitchfield-Stephensburg Pole Replacement

Total Expenditures: $936k
Total Contingency: $85k (10%)

Project Number(s): 153349

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: John Doll/Adam Smith

Executive Summary
The proposed project is to replace twenty-eight (28) wood structures on the Leithcfield-Stephensburg 69kV line with steel based on the results of a routine line inspection. To ensure construction of the project will begin in January of 2017, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2017.

This proposal it to proactively replace the structures over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures. The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

The total project cost is $936k and is not included in the 2016 Business Plan for 2017. This project is included in the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. All spending will occur in 2017.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Leithfield-Stephensburg 69kV line was completed in 2014, and twenty-eight (28) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. There are 354 total structures along this 23.74 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,174k
     The recommendation is to replace all twenty-eight (28) structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $1,829k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $1,387k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of 4% which is in line with market cost increases over the last 15 years.

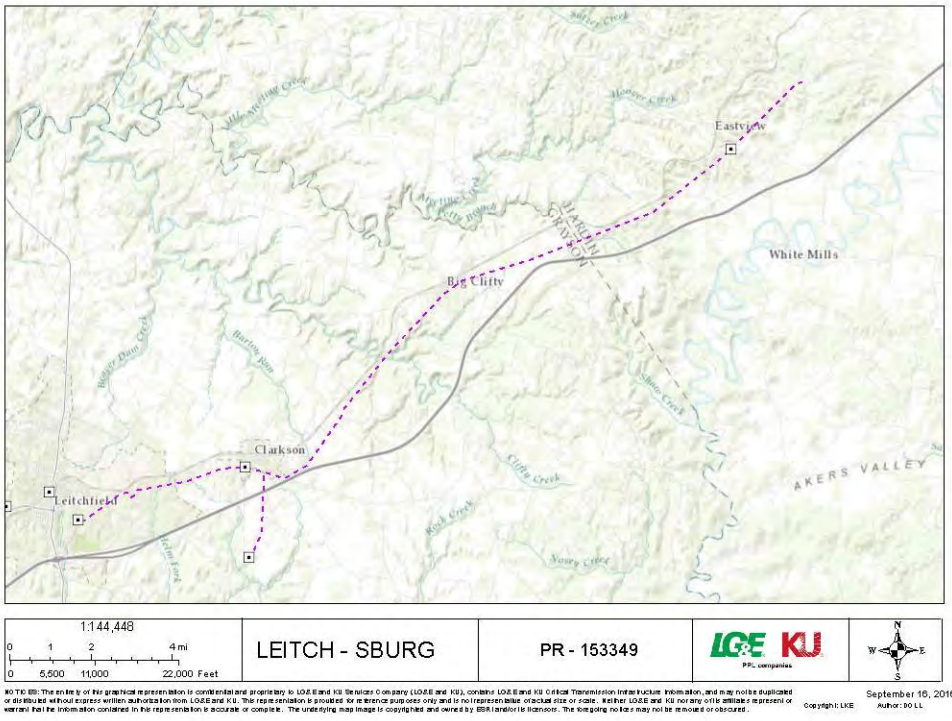
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing twenty (20) single pole steel structures, eight (8) standard steel H-frame structures, and associated hardware and material, and the removal of twenty-eight (28) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B, Elliot, Groves and Pike are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in January of 2017 and be completed in March of 2017.

  The construction milestones for this project are provided below:

Construction Milestones	
November 2016	Engineering and Design
January 2017	Steel Poles Charged
January 2017	Line Construction Begins
March 2017	Line Construction Completed

A facility map of the Leitchfield-Stephensburg 69kV line is shown below:
Line length: 23.74 miles



- **Project Cost**
  The total project cost is $936k and is included in the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $293k. This project will utilize standard steel structures. The line construction will be based on continuing contracts with our line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$285k
Hardware	$8k
Total	$293k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2016**	**2017**	**2018**	**Post 2018**	**Total**
1. Capital Investment Proposed	-	843	-	-	843
2. Cost of Removal Proposed	-	93	-	-	93
3. Total Capital and Removal Proposed (1+2)	-	936	-	-	936
4. Capital Investment 2016 BP	-	-	-	-	-
5. Cost of Removal 2016 BP	-	-	-	-	-
6. Total Capital and Removal 2016 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	-	(843)	-	-	(843)
8. Cost of Removal variance to BP (5-2)	-	(93)	-	-	(93)
9. Total Capital and Removal variance to BP (6-3)	-	(936)	-	-	(936)

Financial Detail by Year - O&M ($000s)	**2016**	**2017**	**2018**	**Post 2018**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2016 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project was not included in the 2016 BP, however is included in the proposed 2017 BP under the K9-2017 Priority Pole Replacement Blanket. All spending will occur in 2017.

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$9k
Contract Labor:	$421k
Materials:	$293k
Local Engineering:	$57k
Burdens:	$71k
Contingency:	$85k
Reimbursements:	($0k)
Net Capital Expenditure:	$936k

Financial Analysis - Project Summary ($000)	2017	2018	2019	2020	2021	Life of Project
Project Net Income	$ 20	$ 38	$ 36	$ 35	$ 34	$ 834
Project ROE	5.1%	7.5%	10.0%	10.0%	10.0%	9.8%

- **Assumptions**

  Recommendation – This alternative assumes that the line outage will be available and that all twenty-eight (28) structures will be replaced during this timeframe.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 39% the cost of the steel poles, and that the wood poles would be replaced again in 30 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Leitchfield-Stephensburg 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays. Schedule delays may also occur if the requested outage is not obtained to complete the scheduled work.

Conclusions and Recommendation
It is recommended that Management approve the Leitchfield-Stephensburg Pole Replacement project for $936k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project 153350 Cloverport-Tip Top Pole Replacement

Investment Proposal for Investment Committee Meeting on: December 19, 2016

Project Name: Cloverport-Tip Top Pole Replacement

Total Expenditures: $1,276k
Total Contingency: $118k (10%)

Project Number(s): 153350

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Johnny Doll/Adam Smith

Executive Summary

The proposed project is to replace thirty-five (35) wood structures on the Cloverport-Tip Top 138kV line with steel, during a routine outage, based on the results of a routine line inspection. To ensure construction of the project will begin in February of 2017, the project is being submitted for approval so material can be ordered in January of 2017 and received in February of 2017.

This proposal it to proactively replace the structures over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures. The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

The total project cost is $1,276k and is included in the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. All spending will occur during 2017.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Cloverport-Tip Top 138kV line was completed in 2015, and thirty-five (35) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. There are 238 total structures along this 35.34 mile line.

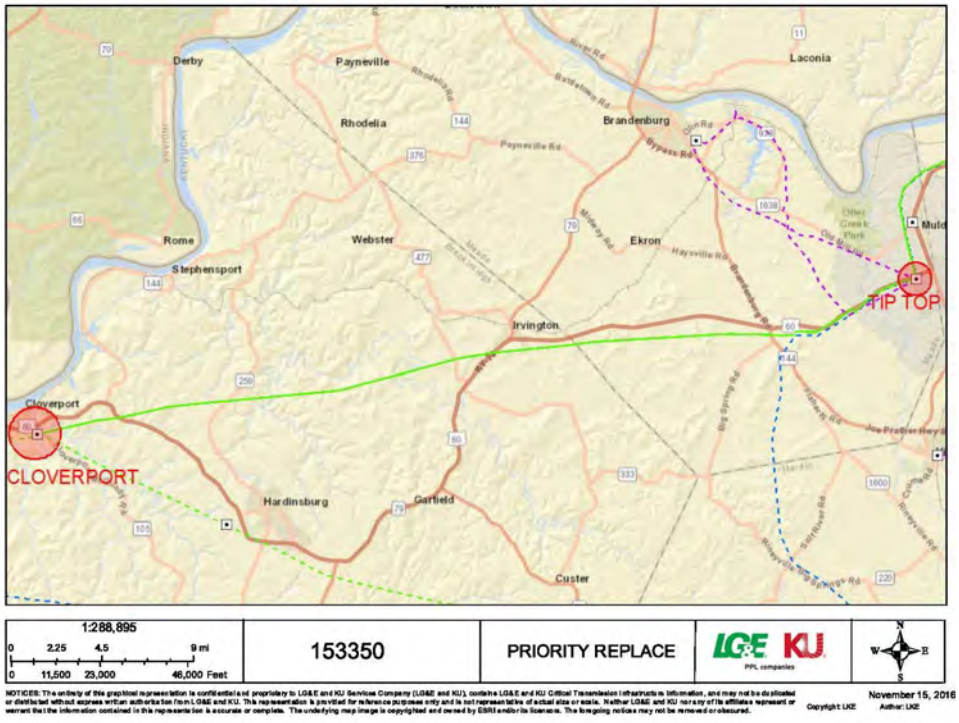
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,597k
     The recommendation is to replace all thirty-five (35) structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $2,615k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $1,639k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty-five (35) standard steel H-frame structures, and associated hardware and material, and the removal of thirty-five (35) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B, Elliot, Groves and Pike are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in February of 2017 and be completed in May of 2017.

Construction Milestones	
November 2016	Engineering and Design
January 2017	Steel Poles Ordered
February 2017	Steel Poles Received
February 2017	Line Construction Begins
May 2017	Line Construction Completed

A facility map of the Cloverport-Tip Top 138kV line is shown below:
Line length: 35.34 miles



- **Project Cost**
  The total project cost is $1,276k and is included in the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $654k. This project will utilize standard steel structures. The structures will be purchased through our steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with our line contractors. Davis H.

Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$636k
Hardware	$18k
Total	$654k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	1,199	-	-	-	1,199
2. Cost of Removal Proposed	77	-	-	-	77
3. Total Capital and Removal Proposed (1+2)	1,276	-	-	-	1,276
4. Capital Investment 2016 BP	-	-	-	-	-
5. Cost of Removal 2016 BP	-	-	-	-	-
6. Total Capital and Removal 2016 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(1,199)	-	-	-	(1,199)
8. Cost of Removal variance to BP (5-2)	(77)	-	-	-	(77)
9. Total Capital and Removal variance to BP (6-3)	(1,276)	-	-	-	(1,276)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2016 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project was not included in the 2016 BP, however is included in the proposed 2017 BP under the K9-2017 Priority Pole Replacement Blanket. All spending will occur in 2017.

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$6k
Contract Labor:	$368k
Materials:	$654k
Local Engineering:	$102k
Burdens:	$28k
Contingency:	$118k
Reimbursements:	($0k)
Net Capital Expenditure:	$1,276k

- **Assumptions**

  Recommendation – This alternative assumes that the line outage will be available and that all thirty-five (35) structures will be replaced during this timeframe.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 43% the cost of the steel poles, and that the wood poles would be replaced again in 30 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Cloverport-Tip Top 138kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays. Schedule delays may also occur if the requested outage is not obtained to complete the scheduled work.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Cloverport-Tip Top pole replacement project for $1,276k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $1 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Chief Financial Officer	Victor A. Staffieri Chairman, CEO and President

Investment Proposal Project 153351 Adams-Millersburg Pole Replacement

Investment Proposal for Investment Committee Meeting on: November 29, 2016

Project Name: Adams-Millersburg Pole Replacement

Total Expenditures: $4,528k
Total Contingency: $412k (10%)

Project Number(s): 153351

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Joe Mina/Adam Smith

Executive Summary

The proposed project is to replace seventy-five (75) existing wood structures with seventy-five (75) steel structures, and one (1) existing steel switching station with one (1) steel single pole structure on the Adams-Millersburg 69kV line based on the results of a routine line inspection. The recommendation is to replace the structures energized due to the difficulty in obtaining an extended outage. If the opportunity to complete the project de-energized would occur, we would pursue this option and it would reduce the cost by $965k As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

This project is not included in the 2016 Business Plan, however is included in the proposed 2017 Business Plan under the K9-2017 Priority Pole Replacement Blanket. All spending will occur in 2017.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. During a routine climbing inspection of the Adams-Millersburg 69kV line, seventy-six (76) structures were identified as priority poles and found to be in need of replacement. All seventy-six (76) structures need to be replaced in order to ensure the integrity and reliability of this line. There are 510 total structures along this 35.37 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $5,680k
     The recommendation is to replace the structures energized due to the difficulty in obtaining an extended outage. If the opportunity to complete the project de-energized would occur, we would pursue this option and it would reduce the cost by $965k and the NVPRR by $1,210k.
  2. Alternative #1 (Do Nothing): NPVRR: ($000s) $8,855k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2 (Next Best Alternative): NPVRR: ($000s) $7,357k
     The next best alternative would be to replace the seventy-five (75) of the proposed seventy-six (76) structures with wood. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

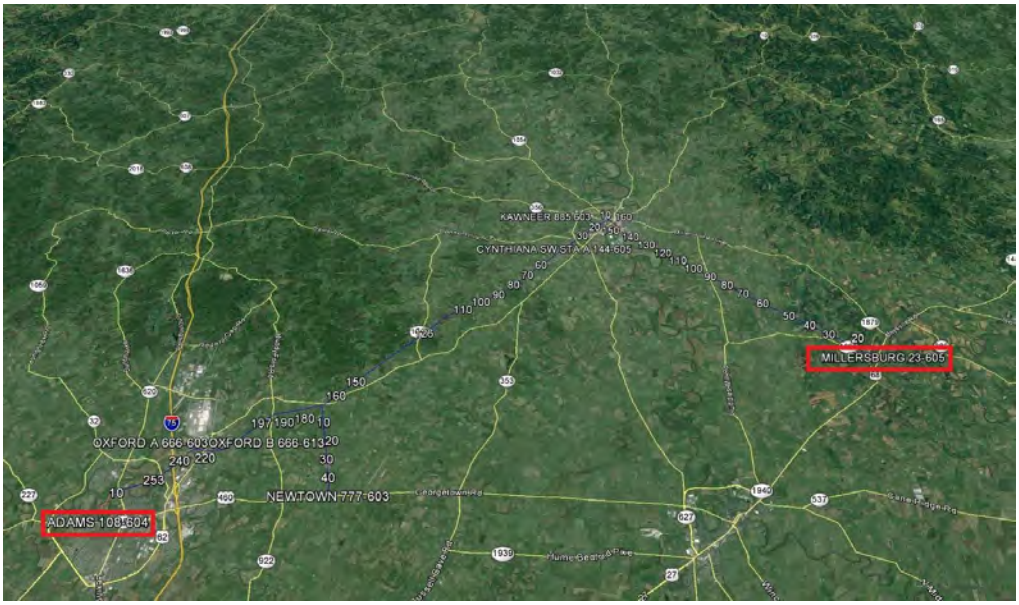
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing twenty-three (23) standard steel H-frame structures, forty-nine (49) standard single pole structures, one (1) custom steel single pole switch structure, one (1) steel lattice tower, one (1) steel 3-pole running corner, one (1) steel single pole running corner, and associated hardware and material, and the removal of seventy-five (75) wood structures, one (1) steel switching station, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B, Elliot, Groves and Pike are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in January of 2017 and be completed in April of 2017.

The construction milestones for this project are provided below:

Construction Milestones	
November 2016	Engineering and Design
December 2016	Steel Poles Ordered
January 2017	Steel Poles Received
January 2017	Line Construction Begins
April 2017	Line Construction Completed

A facility map of the Adams-Millersburg 69kV line is shown below:
Line length: 35.37 miles



- **Project Cost**
  The total project cost is $4,528k and was not included in the 2016 Business Plan, however is included in the proposed 2017 Business Plan under the K9-2017 Priority Pole Replacement blanket. All spending will occur in 2017. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**

Based on preliminary engineering, Transmission Lines has estimated the material package for construction of this project to be $1,119k. This project will utilize standard and custom steel structures. The steel structures will be purchased through our steel pole alliance partner, Trinity Meyer. Hardware will be purchased through Brownstown Electric Supply. The line construction will be based on continuing contracts with our line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,043k
Hardware	$76k
Total	$1,119k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	3,593	-	-	-	3,593
2. Cost of Removal Proposed	935	-	-	-	935
3. Total Capital and Removal Proposed (1+2)	4,528	-	-	-	4,528
4. Capital Investment 2016 BP	-	-	-	-	-
5. Cost of Removal 2016 BP	-	-	-	-	-
6. Total Capital and Removal 2016 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(3,593)	-	-	-	(3,593)
8. Cost of Removal variance to BP (5-2)	(935)	-	-	-	(935)
9. Total Capital and Removal variance to BP (6-3)	(4,528)	-	-	-	(4,528)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2016 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

The 2017 spending is included in the proposed 2017 Business Plan under the K9-2017 Priority Pole Replacement Blanket.

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$176k
Contract Labor:	$2,322k
Materials:	$1,119k
Local Engineering:	$275k
Burdens:	$224k
Contingency:	$412k
Reimbursements:	($0)
Net Capital Expenditure:	$4,528k

Financial Analysis - Project Summary ($000)	2017	2018	2019	2020	2021	Life of Project
Project Net Income	$ 96	$ 182	$ 176	$ 169	$ 163	$ 4,038
Project ROE	5.1%	7.5%	10.0%	10.0%	10.0%	9.8%

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available and the structure replacements will need to be completed with the 69kV line energized.

  Do nothing alternative – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize the construction crews. These poles would fail and require replacement within the next four years.

  Next best alternative - The cost of this alternative assumes the cost of the wood poles is 28% of the cost of the steel poles, and that the wood poles would be replaced again in 30 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead, asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Adams-Millersburg 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Adams-Millersburg Pole Replacement project for $4,528k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $1 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Victor A. Staffieri
Chairman, CEO and President

Investment Proposal Project 153595 West Frankfort-Shelbyville Pole Replacement

Investment Proposal for Investment Committee Meeting on: December 19, 2016

Project Name: West Frankfort-Shelbyville Pole Replacement

Total Expenditures: $1,652k
Total Contingency: $148k (10%)

Project Number(s): 153595

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Chris Wheeldon/Adam Smith

Executive Summary

The proposed project is to replace forty-four (44) wood structures on the West Frankfort-Shelbyville 69kV line with steel. The majority of structures (31) were identified as needing to be replaced based on the results of a routine line inspection. In addition to the thirty-one (31) structures, thirteen (13) additional structures will be replaced, and six (6) structures will be re-framed to accommodate the Transmission Expansion Plan (TEP) West Frankfort-Clay Village project (139742) scheduled for 2018. Installation of the 13 additional poles now will ensure all 44 poles (31 defective and 13 for grade in) can be used as part of the TEP West Frankfort-Shelbyville project.

The additional poles were added to increase transmission to distribution clearances and accommodate a future conductor required for the TEP project.

This proposal it to proactively replace the structures over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures. The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

The total project cost is $1,652k and is included in the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. Subsequent to the 2017 BP, a decision was made to replace thirteen (13) additional structures to accommodate the TEP West Frankfort-Clay Village project (139742). All spending will occur in 2017.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the West Frankfort-Shelbyville 69kV line was completed in 2013, and thirty-one (31) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. An additional thirteen (13) structures will also be replaced to accommodate the TEP West Frankfort-Clay Village project. There are 289 total structures along this 19.45 mile line.

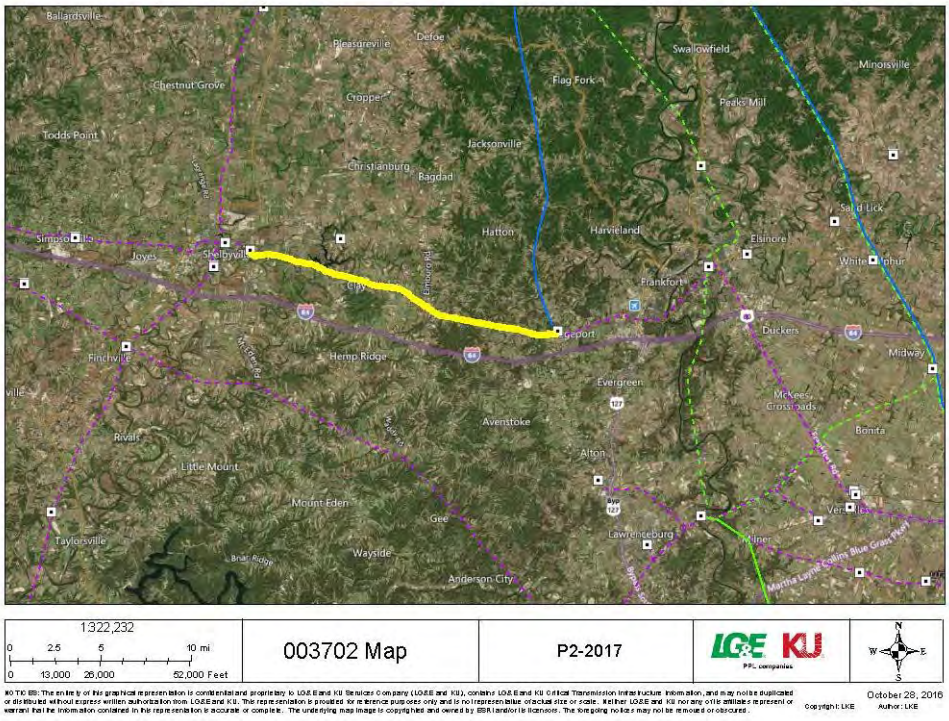
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,072k
     The recommendation is to replace all forty-four (44) structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $2,724k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next two years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $2,111k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty-six (36) steel single pole tangent structures, four (4) standard steel H-frame structures, four (4) steel single pole running corners, and associated hardware and material, and the removal of forty-four (44) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B, Elliot, Groves and Pike are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in January of 2017 and be completed in April of 2017.

Construction Milestones	
November 2016	Engineering and Design
January 2017	Steel Pole Charged
January 2017	Line Construction Begins
April 2017	Line Construction Completed

A facility map of the West Frankfort-Shelbyville 69kV line is shown below:
Line length: 19.45 miles



- **Project Cost**
  The total project cost is $1,652k and is included in the proposed 2017 Business Plan under the K9-2017 priority pole replacement blanket. All spending will occur in 2017. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $577k. This project will utilize standard steel structures. The line construction will be based on continuing contracts with our line contractors. Davis

H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$558k
Hardware	$19k
Total	$577k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	1,567	-	-	-	1,567
2. Cost of Removal Proposed	85	-	-	-	85
3. Total Capital and Removal Proposed (1+2)	1,652	-	-	-	1,652
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(1,567)	-	-	-	(1,567)
8. Cost of Removal variance to BP (5-2)	(85)	-	-	-	(85)
9. Total Capital and Removal variance to BP (6-3)	(1,652)	-	-	-	(1,652)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project included in the proposed 2017 BP under the K9-2017 Priority Pole Replacement Blanket. All spending will occur in 2017.

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$20k
Contract Labor:	$764k
Materials:	$577k
Local Engineering:	$107k
Burdens:	$36k
Contingency:	$148k
Reimbursements:	($0)
Net Capital Expenditure:	$1,652k

- **Assumptions**

  Recommendation – This alternative assumes that the line outage will be available and that all forty-four (44) structures will be replaced during this timeframe.

  Alternative #1 – This cost of this alternative would be approximately 60% higher for replacements in 2017 and 2018 due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 20% the cost of the steel poles, and that the wood poles would be replaced again in 30 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the West Frankfort-Shelbyville 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays. Schedule delays may also occur if the requested outage is not obtained to complete the scheduled work.

Conclusions and Recommendation
It is recommended that Management approve the West Frankfort-Shelbyville Pole Replacement project for $1,652k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $1 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Chief Financial Officer	Victor A. Staffieri Chairman, CEO and President

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: Cane Run SW Switch Replacements

Total Expenditures: $1,747k (Including $159k of Contingency)

Project Number(s): 153667

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Chris Talley – Director Transmission Engineering & Construction

Executive Summary

The scope of this project includes the replacement of cap and pin type switches at the Cane Run SW substation. The specific equipment that is being replaced is listed below in the "Background" section. All of the equipment being targeted for replacement under this project is part of the overall Transmission System Improvement Plan.

The cap and pin insulators at Cane Run SW being planned for replacement are connected to the bus. This equipment has a historically high failure rate and must be replaced to ensure a high degree of reliability within the Transmission system.

The project was opened during 2016 for $188k for preliminary engineering only with the understanding that the project would be presented for approval of the full amount once detailed engineering was completed. The total cost of this project will be $1,747k, with $60k spending in 2016 and $1,687k spending in 2017. This project was not specifically included in the 2017 BP. Funding for this project will be covered through the 1+11 RAC process. The estimated total project figure includes a 10% contingency. This contingency is reasonable based on the level of detailed engineering and is expected to cover uncertainty with the contract labor costs based upon variances that have been observed on past similar projects.

Background
The switch replacements are driven by the need to remove cap and pin insulators, which have a history of mechanical failures. Insulators are used to isolate from ground and support energized conductors and substation equipment such as disconnect switches. The entire switch will be replaced instead of only replacing the insulators and reusing the old switch assembly.

The specific failure mode for the cap and pin design is at the joint where the cement used to connect the metallic cap to the porcelain deteriorates. The insulators at the highest risk are those that are part cantilevered or underhung from the steel as well as those that are part of a disconnect switch.

List of Equipment Being Replaced:

Insulators/Switches:

- (48) Underhung Insulators
- (33) Cantilever Insulators
- (36) Vertical Breaker Gang Operated Switches

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,888k
     It is recommended to replace the various switches at the Cane Run SW substation.

  2. Alternative #1: NPVRR: ($000s) $2,287k
     The next best alternative is to replace all of the identified equipment gradually over a period of several years instead of completing the numerous replacements in one time period. Intermittently completing the required work is not recommended as inherent risks will remain for extended durations. Additionally, this alternative will result in a loss of efficiency that comes with packaging similar work at one location.

  3. Do Nothing: NPVRR: ($000s) $684k
     This option is not advisable as the various equipment currently in-service has a history of maintenance issues and many of the parts necessary to alleviate their known issues are generally no longer available. Risk to the system include, unplanned outages that impact SAIDI & SAIFI numbers, release of oil into nearby waterways, increases cost to do maintenance, collateral damage to nearby equipment. The "Do Nothing" estimate applies a 15% premium to labor cost and includes the potential cost of oil cleanup and repair of collateral damage.

Project Description
The equipment to be replaced has been highlighted on the single line included in Appendix A.

- **Project Scope and Timeline**

Description	Date
Project Initially Approved	December, 2016
Project Approved	February, 2017
Materials Ordered	February, 2017
Materials Received	April, 2017
Switch Replacement Work Begins	April, 2017
Switch Work Completed	June, 2017
Project Complete	July, 2017

- **Project Cost**
  The total cost of this project will be $1,747k, with $60k spending in 2016 and $1,687k spending in 2017. This project was not specifically included in the 2017 BP. Funding for this project will be covered through the 1+11 RAC process. The estimated total project figure includes a 10% contingency. This contingency is reasonable based on the level of detailed engineering and is expected to cover uncertainty with the contract labor costs based upon variances that have been observed on past similar projects.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. All contract labor will be performed by residential contractors under the localized crew contract. As such, contractor bidding is not warranted.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2016	2017	2018	Post 2018	Total
1. Capital Investment Proposed	60	1,481	-	-	1,541
2. Cost of Removal Proposed	-	206	-	-	206
3. Total Capital and Removal Proposed (1+2)	60	1,687	-	-	1,747
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(60)	(1,481)	-	-	(1,541)
8. Cost of Removal variance to BP (5-2)	-	(206)	-	-	(206)
9. Total Capital and Removal variance to BP (6-3)	(60)	(1,687)	-	-	(1,747)

Financial Detail by Year - O&M ($000s)	2017	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.5%
Capital Breakdown:	
Labor:	$25k
Contract Labor:	$866k
Materials:	$511k
Other:	$0k
Local Engineering:	$138k
Burdens:	$48k
Contingency:	$159k
Net Capital Expenditure:	$1,747k

- **Assumptions**
  - Suppliers and contractors will meet reasonable and customary delivery dates for materials and services.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of the LKE Transmission system and introduces risks to the operation of the Cane Run Generating Station.

Conclusions and Recommendation
It is recommended that the Cane Run SW Switch Replacements project be approved for $1,747k to enhance the reliability of the Transmission system.

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Appendix A

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: Bardstown (2) 138kV, (4) 69kV Breaker Replacements

Total Expenditures: $1,412k (Including $128k of Contingency)

Project Number(s): 153668

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Chris Talley – Director Transmission Engineering & Construction

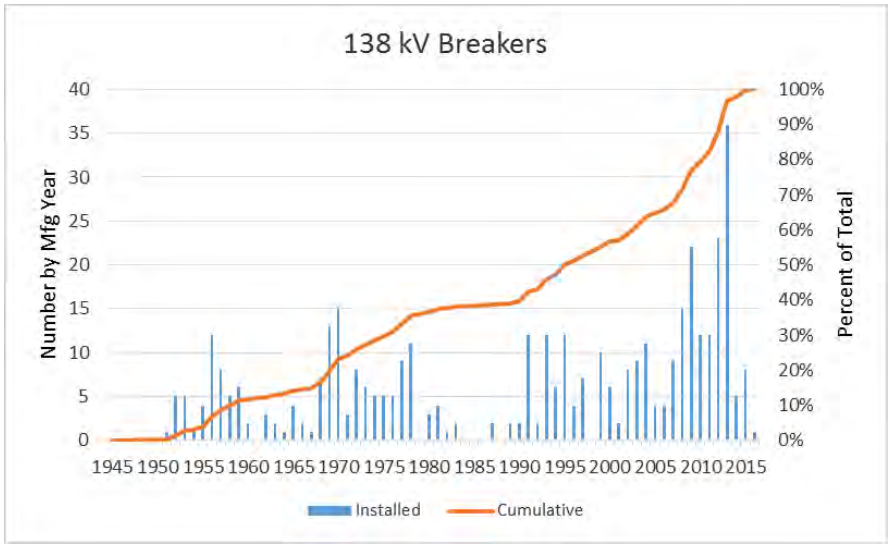
Executive Summary

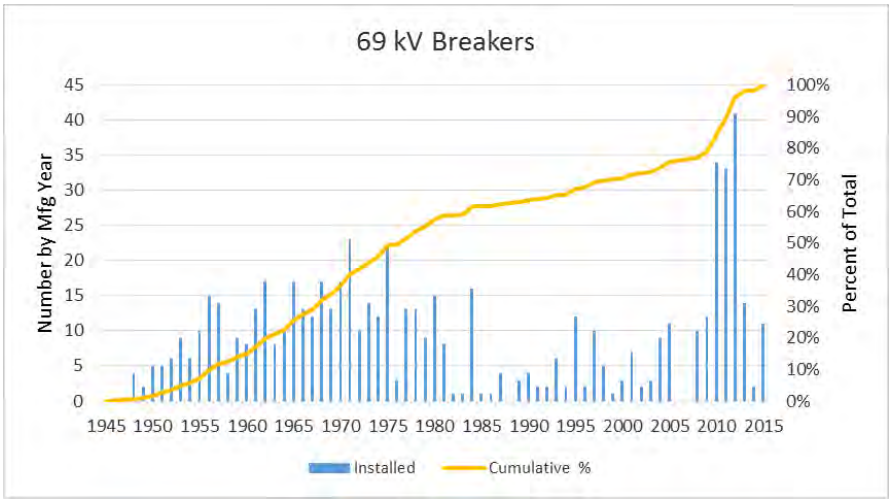
The scope of this project includes the replacement of (2) 138kV and (4) 69kV circuit breakers along with any associated equipment at the Bardstown substation. A redundant station service transformer will also be added. The specific equipment that is being replaced is listed below in the "Background" section. All of the equipment being targeted for replacement under this project is part of the overall Transmission System Improvement Plan.

The (2) 138kV and (4) 69kV breakers being targeted for replacement at Bardstown are part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The criteria driving the replacements of this equipment include maintenance history, insufficient continuous current capacity, insufficient interrupting current capability, repair vs. replace economics, and management of the age of the breaker fleet.

The project was opened during 2016 for $232k for preliminary engineering only with the understanding that the project would be presented for approval of the full amount once detailed engineering was completed. The total cost of this project will be $1,412k, with $24k spending in 2016 and $1,388k spending in 2017. This project was not specifically included in the 2017 BP, so funding for this project will be covered through the 1+11 RAC process. The estimated total project figure includes a 10% contingency. This contingency is reasonable based on the level of detailed engineering and is expected to cover uncertainty with the contract labor costs based upon variances that have been observed on past similar projects.

Background
Based on historical data, most circuit breakers reach the end of useful life at 60 years. The charts below outlines the age of the (417) 138kV and (679) 69kV breakers that are currently in-service in the LKE system. Failure to fund this project and others that are similar will contribute to the ongoing concern of an aging infrastructure with equipment in service that has reached the end of its useful life and can no longer be properly maintained. The technology used for the construction of these breakers is antiquated and the high number of moving parts makes it challenging to keep all of the measurements within manufacturers specifications.





List of Equipment Being Replaced:
Breakers:

- 155-704
- 155-714
- 155-604
- 155-608
- 155-624
- 155-634

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,526k
     It is recommended to replace the various 138kV and 69kV breakers at the Bardstown substation. Parts from the breakers that are retired will be used to support other similar breakers that are still in-service on the system.

  2. Alternative #1: NPVRR: ($000s) $2,125k
     The next best alternative is to replace all of the identified equipment gradually over a period of several years instead of completing the numerous replacements in one time period. Intermittently completing the required work is not recommended as inherent risks will remain for extended durations. Additionally, this alternative will result in a loss of efficiency that comes with packaging similar work at one location.

  3. Do Nothing: NPVRR: ($000s) $2,188k
     This option is not advisable as the various equipment currently in-service at Bardstown Switching a history of maintenance issues and many of the parts necessary to alleviate their known issues are generally no longer available increases the cost to do maintenance costs as well. Risk to the system include, unplanned outage that impact SAIDI & SAIFI numbers, release of oil into nearby waterways and collateral damage to nearby equipment damage. This estimate applies a premium labor mark up and includes the potential cost of oil cleanup.

Project Description

The equipment to be replaced has been highlighted on the single line included in Appendix A.

- **Project Scope and Timeline**

Description	Date
Project Initially Approved	December, 2016
Project Approved	February, 2017
Materials Ordered	February, 2017
Materials Received	March, 2017
138kV Breaker Replacement Work Begins	March, 2017
69kV Breaker Replacement Work Begins	April, 2017
138kV Breaker Replacement Work Completed	May, 2017
69kV Breaker Replacement Work Completed	May, 2017

Project Complete	June, 2017

- **Project Cost**
  The total cost of this project will be $1,412k, with $24k spending in 2016 and $1,388k spending in 2017. This project was not specifically included in the 2017 BP. Funding for this project will be covered through the 1+11 RAC process. The estimated total project figure includes a 10% contingency. This contingency is reasonable based on the level of detailed engineering and is expected to cover uncertainty with the contract labor costs based upon variances that have been observed on past similar projects.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2016	2017	2018	Post 2018	Total
1. Capital Investment Proposed	24	1,339	-	-	1,363
2. Cost of Removal Proposed	-	49	-	-	49
3. Total Capital and Removal Proposed (1+2)	24	1,388	-	-	1,412
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(24)	(1,339)	-	-	(1,363)
8. Cost of Removal variance to BP (5-2)	-	(49)	-	-	(49)
9. Total Capital and Removal variance to BP (6-3)	(24)	(1,388)	-	-	(1,412)

Financial Detail by Year - O&M ($000s)	2017	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.5%
Capital Breakdown:	
Labor:	$50k
Contract Labor:	$613k
Materials:	$477k
Other:	$0k
Local Engineering:	$87k
Burdens:	$57k
Contingency:	$128k
Net Capital Expenditure:	$1,412k

- **Assumptions**
  - Suppliers and contractors will meet reasonable and customary delivery dates for materials and services.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of the LKE Transmission system.

Conclusions and Recommendation

It is recommended that the Bardstown (2) 138kV, (4) 69kV Breaker Replacements project be approved for $1,412k to enhance the reliability of the Transmission system.

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Appendix A

Capital Investment Proposal Project 153823

Investment Proposal

Project Name: Wickliffe-Clinton Pole Replacement

Total Expenditures: $1,216k
Total Contingency: $112k (10%)

Project Number(s): 153823

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Ronnie Bradford/Adam Smith

Executive Summary

The proposed project is to replace twenty-three (23) wood structures on the Wickliffe-Clinton 69kV line with steel during a scheduled outage. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

The total project cost is $1,216k. The proposed pole replacement project was included in the 2017 Business Plan under the K9-2017 priority pole replacement blanket.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Wickliffe-Clinton 69kV line was completed in 2013, and twenty-three (23) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. There are 204 total structures along this 23.70 mile line.

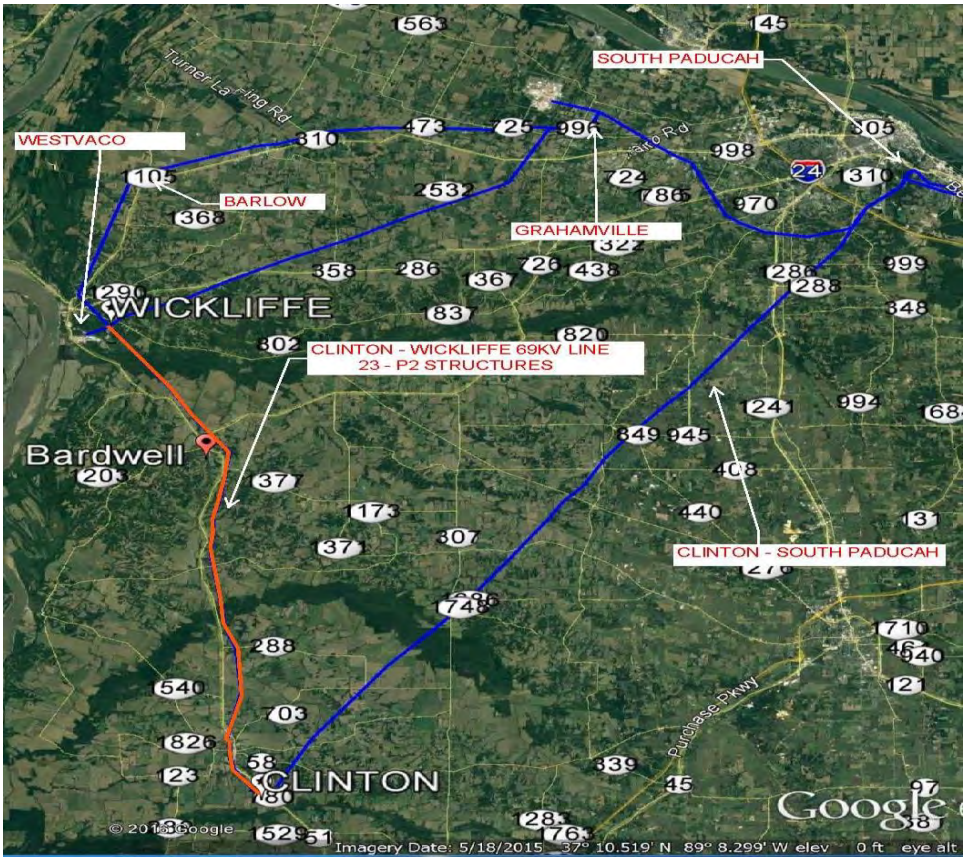
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) 1,525k
     The recommendation is to replace all twenty-three (23) structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $2,337k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $1,797k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing twenty-one (21) standard steel H-frame structures, and two (2) steel 3-pole running corners, and associated hardware and material, and the removal of twenty-three (23) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B, Elliot, Groves and Pike are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in April of 2017 and be completed in May of 2017.

Construction Milestones	
December 2016	Engineering and Design
January 2017	Steel Poles Ordered
March 2017	Steel Poles Received
April 2017	Line Construction Begins
May 2017	Line Construction Completed

A facility map of the Wickliffe-Clinton 69kV line is shown below:
Line length: 23.7 miles



- **Project Cost**
  The total project cost is $1,216k. The proposed pole replacement is included in the 2017 Business Plan under the K9-2017 priority pole replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, and structure access.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $451k. This project will utilize standard steel structures. The steel structures will be purchased through our steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with our line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$423k
Hardware	$28k
Total	$451k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	1,123	-	-	-	1,123
2. Cost of Removal Proposed	94	-	-	-	94
3. Total Capital and Removal Proposed (1+2)	1,216	-	-	-	1,216
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(1,123)	-	-	-	(1,123)
8. Cost of Removal variance to BP (5-2)	(94)	-	-	-	(94)
9. Total Capital and Removal variance to BP (6-3)	(1,216)	-	-	-	(1,216)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$38k
Contract Labor:	$495k
Materials:	$451k
Local Engineering:	$76k
Burdens:	$44k
Contingency:	$112k
Reimbursements:	($0)
Net Capital Expenditure:	$1,216k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available and all twenty-three (23) structures will completed during this timeframe.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 39% the cost of the steel poles, and that the wood poles would be replaced again in 30 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Wickliffe-Clinton 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Wickliffe-Clinton Pole Replacement project for $1,216k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project 153838 Fawkes-Clark County Pole Replacement

Investment Proposal for Investment Committee Meeting on: February 23, 2017

Project Name: Fawkes-Clark Pole Replacement

Total Expenditures: $2,377k
Total Contingency: $219k (10%)

Project Number(s): 153838

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Terry Snow/Adam Smith

Executive Summary

The proposed project is to replace forty-two (42) wood structures on the Fawkes-Clark County 138kV line with steel. Due to the difficulty in obtaining an extended outage, approximately 50% of the forty-two (42) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $389k.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures. This alternative would also have a negative impact on network reliability.

The total project cost is $2,377k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on the current priority of Transmission Lines work and was approved by the RAC in the 1+11 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Fawkes-Clark County 138kV line was completed in 2015, and forty-two (42) structures were identified to be in need of replacement in order to ensure the integrity and reliability of this line. There are 129 total structures along this 18.24 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,982k
     Due to the difficulty in obtaining an extended outage, approximately 50% of the forty-two (42) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $389k and the NPVRR by $489k.
  2. Alternative #1: NPVRR: ($000s) $4,568k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $3,512k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

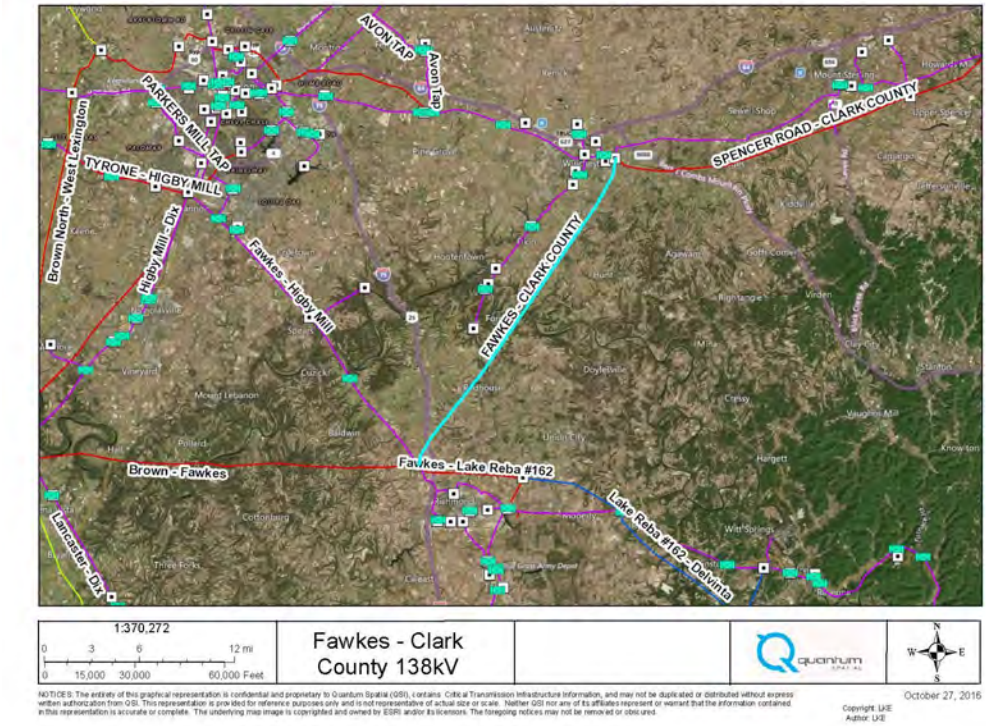
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty-nine (39) standard steel H-frame structures, two (2) custom steel H-frame structures, one (1) custom steel 3-pole running corner, and associated hardware and material, and the removal of forty-two (42) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the
  T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in July of 2017 and be completed in December of 2017.

Construction Milestones	
March 2017	Engineering and Design
April 2017	Steel Poles Ordered
June 2017	Steel Poles Received

July 2017	Line Construction Begins
December 2017	Line Construction Completed

A facility map of the Fawkes-Clark County 138kV line is shown below:
Line length: 18.24 miles



- **Project Cost**
  The total project cost is $2,377k and was not included in the 2017 Business Plan. However, it was approved by the RAC in the 0+12 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $867k. This project will utilize standard and custom

steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$802k
Hardware	$65k
Total	$867k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	2,185	-	-	-	2,185
2. Cost of Removal Proposed	192	-	-	-	192
3. Total Capital and Removal Proposed (1+2)	2,377	-	-	-	2,377
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(2,185)	-	-	-	(2,185)
8. Cost of Removal variance to BP (5-2)	(192)	-	-	-	(192)
9. Total Capital and Removal variance to BP (6-3)	(2,377)	-	-	-	(2,377)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$58k
Contract Labor:	$1,013k
Materials:	$867k
Local Engineering:	$145k
Burdens:	$75k
Contingency:	$219k
Reimbursements:	($0)
Net Capital Expenditure:	$2,377k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the forty-two (42) structures will need to be completed with the 138kV line energized.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 45% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Fawkes-Clark County 138kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Fawkes-Clark County Pole Replacement project for $2,377k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Paul W. Thompson
President and Chief Operating Officer

Investment Proposal Project 153839 Somerset North-Stanford Pole Replacement

Investment Proposal

Project Name: Somerset North-Stanford

Total Expenditures: $1,640k
Total Contingency: $149k (10%)

Project Number(s): 153839

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Anthony Mount/Adam Smith

Executive Summary

The proposed project is to replace thirty-seven (37) structures on the Somerset North-Stanford 69kV line with wood during a scheduled outage. The scope of work includes the replacement of thirty-five (35) structures identified through an inspection. The replacement of one (1) additional adjacent structures is required to accommodate an increase in height of the new structures. One (1) existing switch pole will also be replaced. Utilizing wood will allow for replacement of the priority poles and enable the line to continue to operate as designed until the conductor is replaced and the line rebuilt. The age and type of existing conductor indicate this line will need to be rebuilt before the expected useful life of the new wood poles is exhausted. Based on the current condition and replacement priority of the conductor, the plan is to rebuild the line during 2031-2034.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $1,640k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the 4+8 forecast. A complete rebuild of this line, due to the age and type of conductor, is not included in the 2017 Business Plan, however is included in a separate project (135363) in years 2031-2034 for a rebuild at a cost of $30,691k.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Somerset North-Stanford 69kV line was completed in 2014, and thirty-five (35) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. One (1) existing switch pole will also be replaced, and to meet current codes and engineering standards, the replacement of one (1) additional adjacent structures is required to accommodate height increases of the defective structures being replaced. There are 239 total structures along this 29.23 mile line.

In addition to the poles needing to be replaced as soon as possible, the age and type of the existing conductor along this line indicate that this line will need to be rebuilt within the next fifteen years. A project is included in years 2031-2034 to rebuild (project 135363).

If we replace the poles now and rebuild the line in 2031-2034, the poles installed now will need to be replaced again in 2031-2034 which is before exhausting the useful life of the poles (wood poles 30 years; steel 90 years). As such, rebuilding the line now (as soon as engineering could be completed) was also considered in order to accommodate replacing the structures only once. Not only does the condition of the conductor not warrant accelerating the replacement, the NPVRR of replacing the line now is higher than the NPVRR of replacing the wood poles now and rebuilding the line as planned in 2031-2034.

Although steel is often used to replace wood structures, since lower cost wood structures would still allow for the line to continue to operate as designed until the conductor is replaced, this project would replace the existing structures with wood.

- **Alternatives Considered**
  1. Recommendation: NPVRR: $2,088k
     The recommendation is to replace all thirty-seven (37) structures with wood during a scheduled outage.

  2. Alternative #1: Do Nothing NPVRR: $3,097k
     The alternative of doing nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.

  3. Alternative #2: Recommendation plus rebuild in 15 years NPVRR: $18,034k
     This alternative would replace the structures in 2017 and rebuild the line in 2031-2034. The rebuild project is not being requested at this time. The NPVRR calculation was part of an analysis to determine whether or not it would be more cost effective to rebuild the line as soon as possible (2019) instead of in 15 years as planned.

  4. Alternative #3: Do Nothing and rebuild line ASAP NPVRR: $38,889k

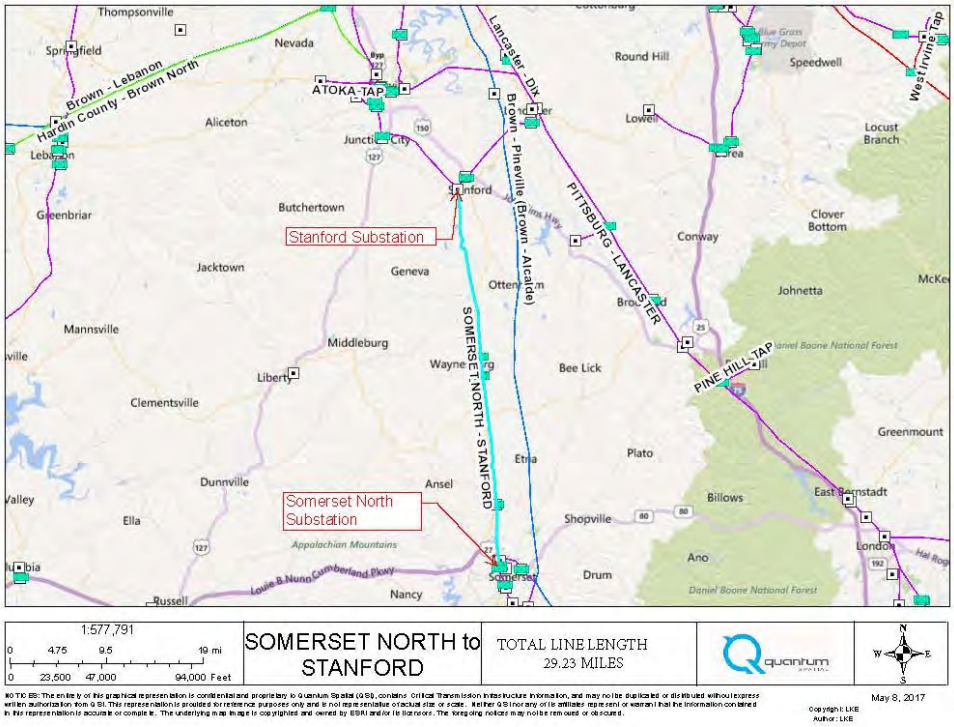
This alternative would replace poles upon failure and accelerate the rebuild of the line to as soon as possible (as soon as detailed engineering could be completed). This alternative assumes only two years of failures since the line would be rebuilt in 2019. In addition to having a higher cost, this alternative is also not recommended since the condition of the conductor does not warrant a need for accelerated replacement.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty-five (35) standard wood H-frame structures, one (1) single pole wood switch structure, one (1) single pole wood tap structure, and associated hardware and material, and the removal of thirty-seven (37) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in April 2017. Construction is scheduled to begin in June of 2017 and be completed in August of 2017.

Construction Milestones	
May 2017	Engineering and Design
June 2017	Material Charged
June 2017	Line Construction Begins
August 2017	Line Construction Completed

A facility map of the Somerset North-Stanford 69kV line is shown below:
Line length: 29.23 miles



- **Project Cost**
  The total project cost is $1,640k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the 4+8 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**

  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $179k. This project will utilize standard wood structures. The line construction will be based on continuing contracts with our line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four

main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	2019	Post 2019	Total
1. Capital Investment Proposed	1,203	-	-	-	1,203
2. Cost of Removal Proposed	437	-	-	-	437
3. Total Capital and Removal Proposed (1+2)	1,640	-	-	-	1,640
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(1,203)	-	-	-	(1,203)
8. Cost of Removal variance to BP (5-2)	(437)	-	-	-	(437)
9. Total Capital and Removal variance to BP (6-3)	(1,640)	-	-	-	(1,640)

Financial Detail by Year - O&M ($000s)	2017	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$69k
Contract Labor:	$1,040k
Materials:	$179k
Local Engineering:	$98k
Burdens:	$105k
Contingency:	$149k
Reimbursements:	($0)
Net Capital Expenditure:	$1,640k

- **Assumptions**

Recommendation – The cost of this alternative assumes that the line outage will be available and all thirty-seven (37) structures will be completed during this timeframe.

Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

Alternative #2 – Utilizing wood poles would be the best use of existing resources. Due to the age of the conductor, the Somerset North-Stanford 69kV line will need to be re-built. This alternative assumes the poles will fail and be replaced, consistent with the Do Nothing Alternative (Alt. #1). It is assumed that there would not be any additional failure to poles not currently identified.

Alternative #3 – The cost of this alternative assumes that the structures will be replaced as they fail until the rebuild is complete in 2019.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Somerset North-Stanford 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Somerset North-Stanford Pole Replacement project for $1,640k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project 153922 Carrollton-East Frankfort Pole Replacement

Investment Proposal for Investment Committee Meeting on: April 26, 2017

Project Name: Carrollton-East Frankfort Pole Replacement

Total Expenditures: $2,816k
Total Contingency: $256k (10%)

Project Number(s): 153922

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Terry Snow/Adam Smith

Executive Summary

The proposed project is to replace forty-three (43) wood structures on the Carrollton-East Frankfort 138kV line with steel. Due to the difficulty in obtaining an extended outage, approximately 50% of the forty-three (43) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $383k.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures. This alternative would also have a negative impact on network reliability.

The total project cost is $2,816k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on the current priority of Transmission Lines work and was approved by the RAC in the 2+10 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Carrollton-East Frankfort 138kV line was completed in 2015, and forty-three (43) structures were identified to be in need of replacement in order to ensure the integrity and reliability of this line. There are 277 total structures along this 39.15 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $3,586k
     Due to the difficulty in obtaining an extended outage, approximately 50% of the forty-three (43) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $383k and the NPVRR by $488k.
  2. Alternative #1: NPVRR: ($000s) $5,319k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $4,470k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty-four (34) standard steel H-frame structures, eight (8) custom steel H-frame structures, one (1) standard steel single pole structure, and associated hardware and material, and the removal of forty-three (43) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in August of 2017 and be completed in December of 2017.

Construction Milestones	
July 2017	Engineering and Design
July 2017	Steel Poles Ordered

August 2017	Steel Poles Received
August 2017	Line Construction Begins
December 2017	Line Construction Completed

A facility map of the Carrollton-East Frankfort 138kV line is shown below:
Line length: 39.15 miles

- **Project Cost**
  The total project cost is $2,816k and was not included in the 2017 Business Plan. However, it was approved by the RAC in the 2+10 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $878k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$810k
Hardware	$68k
Total	$878k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	2,618	-	-	-	2,618
2. Cost of Removal Proposed	198	-	-	-	198
3. Total Capital and Removal Proposed (1+2)	2,816	-	-	-	2,816
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(2,618)	-	-	-	(2,618)
8. Cost of Removal variance to BP (5-2)	(198)	-	-	-	(198)
9. Total Capital and Removal variance to BP (6-3)	(2,816)	-	-	-	(2,816)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$70k
Contract Labor:	$1,345k
Materials:	$878k
Local Engineering:	$178k
Burdens:	$89k
Contingency:	$256k
Reimbursements:	($0)
Net Capital Expenditure:	$2,816k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the forty-three (43) structures will need to be completed with the 138kV line energized.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 46% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Carrollton-East Frankfort 138kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Carrollton-East Frankfort Pole Replacement project for $2,816k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Chief Financial Officer	Paul W. Thompson President and Chief Operating Officer

Investment Proposal Project 153944 Millersburg-Murphysville Pole Replacement

Investment Proposal for Investment Committee Meeting on: February 23, 2017

Project Name: Millersburg-Murphysville Pole Replacement

Total Project Expenditures: $3,270k
Total Contingency Included: $296k (10%)

Project Number(s): 153944

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Nick Poston/Adam Smith

Executive Summary

The proposed project is to replace eighty-four (84) structures on the Millersburg-Murphysville 69kV line with wood during a scheduled outage. The scope of work includes the replacement of seventy-three (73) structures identified through an inspection. The replacement of an additional eleven (11) adjacent structures is required to accommodate an increase in height of the new structures. Utilizing wood will allow for replacement of the priority poles and enable the line to continue to operate as designed until the conductor is replaced and the line rebuilt. The age and type of existing conductor indicate this line will need to be rebuilt before the expected useful life of the new wood poles is exhausted. Based on the current condition and replacement priority of the conductor, the plan is to rebuild the line during 2026-2027.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $3,270k and is included in the 2017 Business Plan under the K9-2017 Priority Pole Replacement Blanket. A complete rebuild of this line, due to the age and type of conductor, has been included in the Business Plan since the 2014 BP and was included in the 2017 BP for a rebuild in 2026-2027 at a cost of $31,500k.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Millersburg-Murphysville 69kV line was completed in 2014, and seventy-three (73) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. To meet current codes and engineering standards, the replacement of an additional eleven (11) adjacent structures is required to accommodate height increases of the defective structures being replaced. There are 404 total structures along this 25.19 mile line.

In addition to the poles needing to be replaced as soon as possible, the age and type of the existing conductor along this line indicate that this line will need to be rebuilt within the next ten years. The current plan (2017 BP) includes a project to rebuild the line during 2026-2027 (project 139958).

If we replace the poles now and rebuild the line in 2026-2027, the poles installed now will need to be replaced again in 2026-2027 which is before exhausting the useful life of the poles (wood poles 30 years; steel 90 years). As such, rebuilding the line now (as soon as engineering could be completed) was also considered in order to accommodate replacing the structures only once. Not only does the condition of the conductor not warrant accelerating the replacement, the NPVRR of replacing the line now is higher than the NPVRR of replacing the wood poles now and rebuilding the line as planned in 2026-2027.

Although steel is often used to replace wood structures, since lower cost wood structures would still allow for the line to continue to operate as designed until the conductor is replaced, this project would replace the existing structures with wood.

- **Alternatives Considered**
  1. Recommendation: Replace structures NPVRR: ($000s) $4,110k
     The recommendation is to replace all eighty-four (84) structures with wood during a scheduled outage.

  2. Alternative #1: Do Nothing NPVRR: ($000s) $6,407k
     The alternative of doing nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.

  3. Alternative #2: Recommendation plus rebuild in 10 years NPVRR: ($000s) $29,143k
     This alternative would replace the structures in 2017 and rebuild the line in 2026-2027, consistent with the BP. The rebuild project is not being requested at this time. The NPVRR calculation was part of an analysis to determine whether or not it would

be more cost effective to rebuild the line as soon as possible (2019) instead of in 10 years as planned.

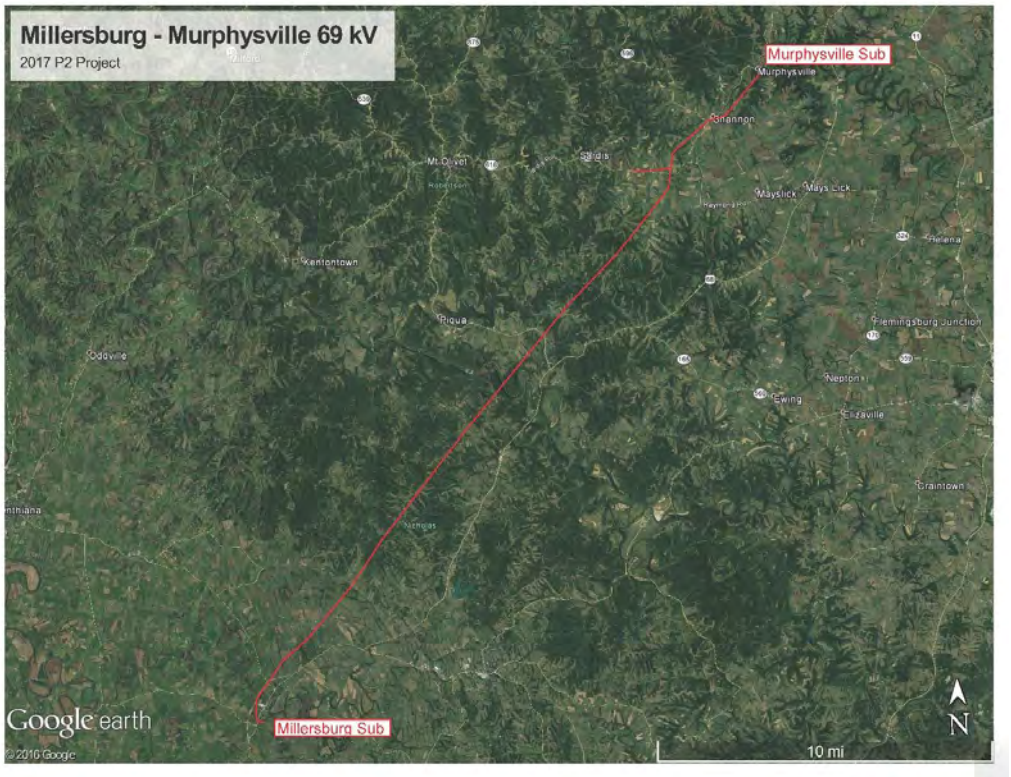
4. Alternative #3: Do Nothing and rebuild line ASAP NPVRR: ($000s) $34,826k
This alternative would replace poles upon failure and accelerate the rebuild of the line to as soon as possible (as soon as detailed engineering could be completed). This alternative assumes only two years of failures since the line would be rebuilt in 2019. In addition to having a higher cost, this alternative is also not recommended since the condition of the conductor does not warrant a need for accelerated replacement.

Project Description

- **Project Scope and Timeline**
The scope of work will consist of installing seventy-one (71) wood tangent structures, thirteen (13) wood dead-end structures, and associated hardware and material, and the removal of eighty-four (84) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from our line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in May of 2017 and be completed in October of 2017.

Construction Milestones	
January 2017	Engineering and Design
March 2017	Hardware Ordered
May 2017	Hardware Received/Wood Poles Charged
May 2017	Line Construction Begins
October 2017	Line Construction Completed

A facility map of the Millersburg-Murphysville 69kV line is shown below:
Line length: 25.19 miles



- **Project Cost**
  The total project cost is $3,270k and is included in the 2017 Business Plan under the K9-2017 Priority Pole Replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $301k. This project will utilize standard wood structures. Hardware will be purchased through Brownstown Electric Supply. The line construction will be based on continuing contracts with our line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Wood Poles	$218k
Hardware	$83k
Total	$301k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	2,303	-	-	-	2,303
2. Cost of Removal Proposed	967	-	-	-	967
3. Total Capital and Removal Proposed (1+2)	3,270	-	-	-	3,270
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(2,303)	-	-	-	(2,303)
8. Cost of Removal variance to BP (5-2)	(967)	-	-	-	(967)
9. Total Capital and Removal variance to BP (6-3)	(3,270)	-	-	-	(3,270)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Although not included in the 2017 BP under this project number, pole replacements such as this were budgeted in K9-2017.

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$154k
Contract Labor:	$2,125k
Materials:	$301k
Local Engineering:	$194k
Burdens:	$200k
Contingency:	$296k
Reimbursements:	($0)
Net Capital Expenditure:	$3,270k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available and all eighty-four (84) structures will be completed during this timeframe.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – Utilizing wood poles would be the best use of existing resources. Due to the age of the conductor, the Millersburg-Murphysville 69kV line will need to be re-built. This alternative assumes the poles will fail and be replaced, consistent with the Do Nothing Alternative (Alt. #1). It is assumed that there would not be any additional failure to poles not currently identified.

  Alternative #3 – The cost of this alternative assumes that the structures will be replaced as they fail until the rebuild is complete in 2019.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Millersburg-Murphysville 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Millersburg-Murphysville project for $3,270k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Paul W. Thompson
President and Chief Operating Officer

Investment Proposal Project 154086 Pittsburg-Lancaster Pole Replacement

Investment Proposal for Investment Committee Meeting on: March 29, 2017

Project Name: Pittsburg-Lancaster Pole Replacement

Total Expenditures: $4,218k
Total Contingency: $384k (10%)

Project Number(s): 154086

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Nick Poston/Adam Smith

Executive Summary

The proposed project is to replace seventy-six (76) wood structures on the Pittsburg-Lancaster 69kV line with steel. Due to the difficulty in obtaining an extended outage, approximately 50% of the seventy-six (76) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $407k.

Eleven (11) structures will be replaced in 2017 and sixty-five (65) structures will be replaced in 2018. Steel pole inventory will be used for the eleven (11) replacements in 2017 identified from a walking inspection completed in 2013. Material requirements for the remaining sixty-five (65) structures to be replaced in 2018 could not be identified until the climbing inspection was completed in November of 2016 and therefore were not planned for replacement until 2018. Procurement space has now been reserved for 2017 and the structures are expected to be delivered during July 2017. If other project schedules should change and labor resources are available during 2017, the structures will be replaced sooner.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line, and to prevent outages resulting from such failures. This alternative would also have a negative impact on network reliability.

The total project cost is $4,218k. The cost of the 2017 replacements was not included in a separate project in the 2017 Business Plan (BP) but was included in funding projects K9-2017. K9-2017 was reduced to fund this project and the change was approved by the RAC in the 2+10 forecast. The 2018 funding will be addressed in the 2018 BP.

Background
Pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine walking inspection of the Pittsburg-Lancaster 69kV line was completed in 2013, and eleven (11) structures were identified to be in need of replacement. In addition, a climbing inspection was completed in November of 2016, and an additional sixty-five (65) structures were identified as priority poles also in need of replacement. Replacing the identified seventy-six (76) structures will ensure the integrity and reliability of the line. There are 328 structures along this 48.01 mile line, which includes the main line and associated taps.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $5,231k
     Due to the difficulty in obtaining an extended outage, approximately 50% of the seventy-six (76) structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $407k and the NPVRR by $493k.
  2. Alternative #1: NPVRR: ($000s) $8,105k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $7,103k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

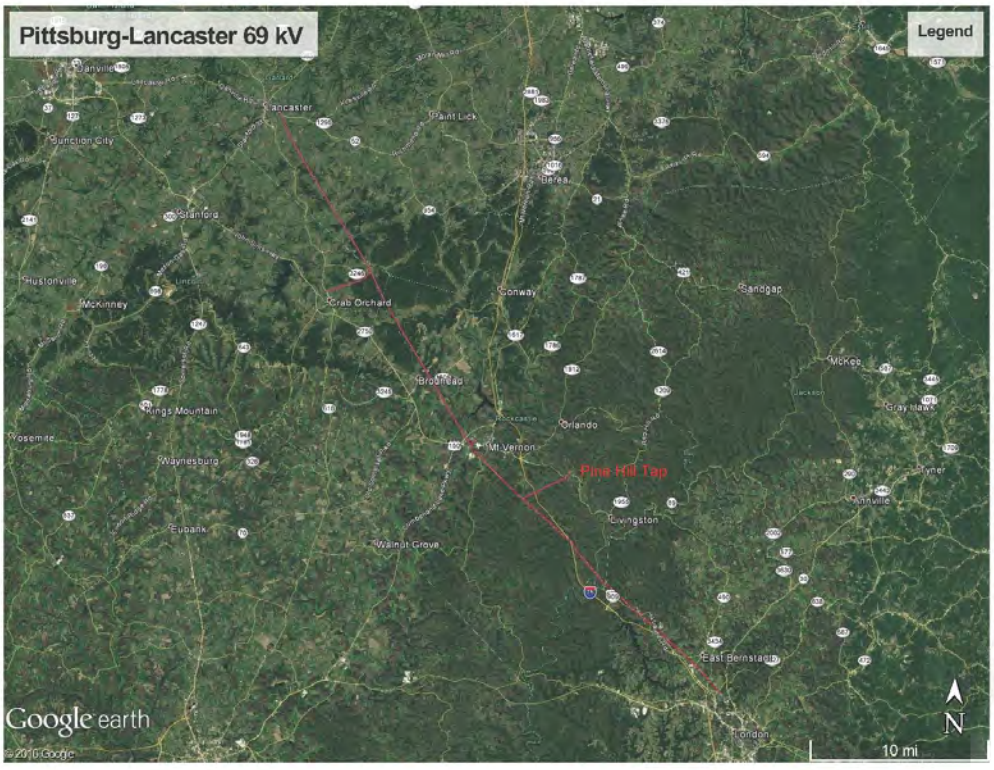
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing sixty-one (61) standard steel H-frame structures, fifteen (15) steel single pole structures, and associated hardware and material, and the removal of seventy-six (76) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in May of 2017 and be completed in May of 2018.

Construction Milestones	
February 2017	Engineering and Design charged to Local Engineering

April 2017	Steel Poles Ordered for 2018 Replacements
May 2017	Steel Poles Charged for 2017 Replacements
May 2017	Line Construction Begins
July 2017	Steel Poles Received for 2018 Replacements
May 2018	Line Construction Completed

A facility map of the Pittsburg-Lancaster 69kV line is shown below:
Line length: 48.01 miles, which includes the main line and associated taps.



- **Project Cost**
  The total project cost is $4,218k and was not included in the 2017 Business Plan, however it was approved by the RAC in the 2+10 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $1,327k. This project will utilize standard steel structures. Steel pole inventory will be used for the eleven (11) structures to be replaced in 2017. The steel structures for the remaining sixty-five (65) structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer during 2017 for replacement during 2018. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,190k
Hardware	$137k
Total	$1,327k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	1,793	1,603	-	-	3,396
2. Cost of Removal Proposed	108	713	-	-	822
3. Total Capital and Removal Proposed (1+2)	1,901	2,317	-	-	4,218
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(1,793)	(1,603)	-	-	(3,396)
8. Cost of Removal variance to BP (5-2)	(108)	(713)	-	-	(822)
9. Total Capital and Removal variance to BP (6-3)	(1,901)	(2,317)	-	-	(4,218)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$147k
Contract Labor:	$1,915k
Materials:	$1,327k
Local Engineering:	$244k
Burdens:	$201k
Contingency:	$384k
Reimbursements:	($0)
Net Capital Expenditure:	$4,218k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the seventy-six (76) structures will need to be completed with the 69kV line energized.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 49% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Pittsburg-Lancaster 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Pittsburg-Lancaster Pole Replacement project for $4,218k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Paul W. Thompson
President and Chief Operating Officer

Investment Proposal Project 154178 Lake Reba 162-Delvinta Pole Replacement

Investment Proposal for Investment Committee Meeting on: April 26, 2017

Project Name: Lake Reba 162-Delvinta Pole Replacement

Total Expenditures: $3,713k
Total Contingency: $338k (10%)

Project Number(s): 154178

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Gary King/Adam Smith

Executive Summary
The proposed project is to replace fifty-six (56) wood structures on the Lake Reba 162-Delvinta 161kV line with steel. Due to the difficulty in obtaining an extended outage, approximately 50% of the fifty-six (56) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $370k.

Twenty-one (21) structures will be replaced in 2017 and thirty-five (35) structures will be replaced in 2018. All of the structures will be purchased through KU's (the Company's) steel pole alliance partner, Trinity Meyer. Twenty-one (21) of the replacements in 2017 were identified from walking and aerial patrol inspections. The remaining thirty-five (35) structures were identified through an inspection completed during 2017. Material requirements for the thirty-five (35) structures to be replaced in 2018 could not be identified until the climbing inspection was completed in February of 2017 and therefore were not planned for replacement until 2018. Procurement space has now been reserved for 2017 and the structures are expected to be delivered during December 2017.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures. This alternative would also have a negative impact on network reliability.

The total project cost is $3,713k. The cost of twenty-one (21) structures to be replaced in 2017 was included in the 2017 Business Plan (BP) under the K9-2017 Priority Pole Replacement Blanket. The additional thirty-five (35) structures were identified through an inspection completed during 2017, after the BP was prepared. K9-2017 will be reduced to fund the twenty-one (21) structures that were planned for 2017. The 2017 funding changes have been approved by the RAC

in the 3+9 forecast. The labor costs to replace the thirty-five (35) structures in 2018 is included in the proposed 2018 BP.

Background
Pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. An inspection of the Lake Reba 162-Delvinta 161kV line was completed, and twenty-one (21) structures were identified to be in need of replacement. In addition, a climbing inspection was completed in 2017, and an additional thirty-five (35) structures were identified as priority poles also in need of replacement. Replacing the identified fifty-six (56) structures will ensure the integrity and reliability of the line. There are 200 total structures along this 33.72 mile line.

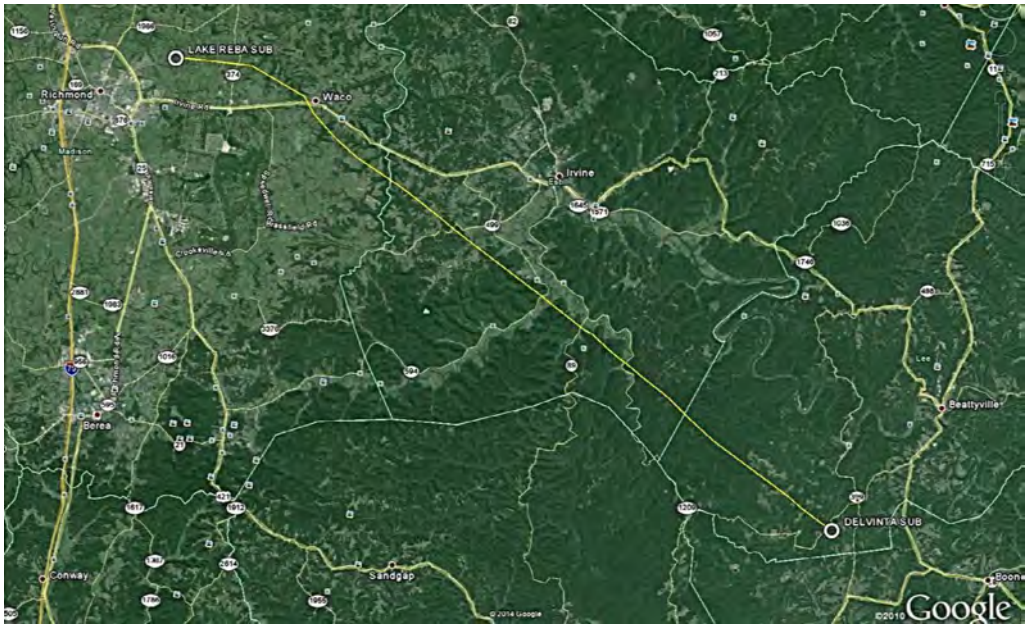
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $4,728k
     Due to the difficulty in obtaining an extended outage, approximately 50% of the fifty-six (56) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $370k and the NPVRR by $458k.
  2. Alternative #1: NPVRR: ($000s) $7,060k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $5,287k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing forty-one (41) standard steel H-frame structures, ten (10) custom steel H-frame structures, four (4) custom steel 3-pole running corners, one (1) custom steel dead end structure, and associated hardware and material, and the removal of fifty-six (56) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in May of 2017 and be completed in May of 2018.

Construction Milestones	
February 2017	Engineering and Design
April 2017	Steel Poles Ordered for 2017 Replacements
May 2017	Steel Poles Received for 2017 Replacements
May 2017	Steel Poles Ordered for 2018 Replacements
May 2017	Line Construction Begins
December 2017	Steel Poles Received for 2018 Replacements
May 2018	Line Construction Completed

A facility map of the Lake Reba 162-Delvinta 161kV line is shown below:
Line length: 33.72 miles



- **Project Cost**
  The total project cost is $3,713k. The twenty-one (21) structures to be replaced in 2017 were included in the 2017 Business Plan (BP) under the K9-2017 Priority Pole Replacement Blanket. The additional thirty-five (35) structures were identified through an inspection completed during 2017, after the BP was prepared. K9-2017 will be reduced to fund the twenty-one (21) structures that were planned for 2017. The 2017 funding changes have been approved by the RAC in the 3+9 forecast. The labor costs to replace the thirty-five (35) structures in 2018 is included in the proposed 2018 BP. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering,

confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $1,313k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,141k
Hardware	$172k
Total	$1,313k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	2,212	1,205	-	-	3,417
2. Cost of Removal Proposed	111	185	-	-	296
3. Total Capital and Removal Proposed (1+2)	2,324	1,390	-	-	3,713
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(2,212)	(1,205)	-	-	(3,417)
8. Cost of Removal variance to BP (5-2)	(111)	(185)	-	-	(296)
9. Total Capital and Removal variance to BP (6-3)	(2,324)	(1,390)	-	-	(3,713)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$61k
Contract Labor:	$1,679k
Materials:	$1,313k
Local Engineering:	$229k
Burdens:	$93k
Contingency:	$338k
Reimbursements:	($0)
Net Capital Expenditure:	$3,713k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the fifty-six (56) structures will need to be completed with the 161kV line energized.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 43% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Lake Reba 162-Delvinta 161kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Lake Reba 162-Delvinta Pole Replacement project for $3,713k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Paul W. Thompson
President and Chief Operating Officer

Investment Proposal Project 154371 Loudon Avenue-Winchester Pole Replacement

Investment Proposal

Project Name: Loudon Avenue-Winchester Pole Replacement

Total Expenditures: $841k
Total Contingency: $73k (10%)

Project Number(s): 154371

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Addam Gooch/Adam Smith

Executive Summary

The proposed project is to replace twenty (20) wood structures on the Loudon Avenue-Winchester 69kV line with steel during a scheduled outage. Of the twenty (20) structures being replaced, fifteen (15) were identified as needing to be replaced based on the results of a routine line inspection. In addition to the fifteen (15) structures, five (5) adjacent structures will be replaced in order to accommodate the increased height of the new structures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

The total project cost is $841k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the RAC in the 3+9 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Loudon Avenue-Winchester 69kV line was completed in 2013, and fifteen (15) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. The replacement of an additional five (5) adjacent structures is required to accommodate an increase of the height of the new structures. There are 329 total structures along this 17.7 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,070k
     The recommendation it to replace all twenty (20) structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $1,589k
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $1,354k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

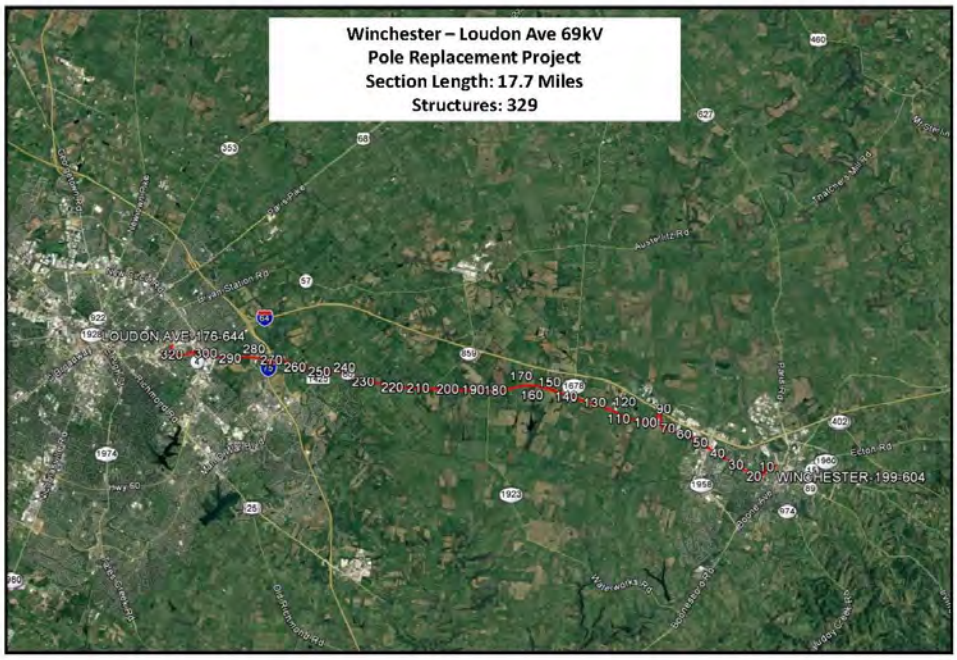
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing seventeen (17) standard steel single pole structures, two (2) standard steel H-frame structures, one (1) custom steel H-frame structure, and associated hardware and material, and the removal of twenty (20) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. The contract extension was re-approved by the IC in July of 2014. Construction is scheduled to begin in August of 2017 and be completed in October of 2017.

Construction Milestones	
April 2017	Engineering and Design
May 2017	Custom Steel Pole Ordered
July 2017	Custom Steel Pole Received
July 2017	Additional Material Charged
August 2017	Line Construction Begins

October 2017	Line Construction Completed

A facility map of the Loudon Avenue-Winchester 69kV line is shown below:
Line length: 17.7 miles



- **Project Cost**
  The total project cost is $841k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the RAC in the 3+9 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $239k. This project will utilize standard and custom

steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$180k
Hardware	$59k
Total	$239k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	655	-	-	-	655
2. Cost of Removal Proposed	186	-	-	-	186
3. Total Capital and Removal Proposed (1+2)	841	-	-	-	841
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(655)	-	-	-	(655)
8. Cost of Removal variance to BP (5-2)	(186)	-	-	-	(186)
9. Total Capital and Removal variance to BP (6-3)	(841)	-	-	-	(841)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$29k
Contract Labor:	$380k
Materials:	$239k
Local Engineering:	$50k
Burdens:	$70k
Contingency:	$73k
Reimbursements:	($0)
Net Capital Expenditure:	$841k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all twenty (20) structures will be replaced during this timeframe.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 39% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Loudon Avenue-Winchester 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Loudon Avenue-Winchester 69kV project for $841k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project 154585 Clay Village-West Frankfort Conductor Replacement

Investment Proposal for Investment Committee Meeting on: August 29, 2018

Project Name: Clay Village-West Frankfort Conductor Replacement

Total Expenditures: $9,735k
Total Contingency: $851k (10%)

Project Number(s): Transmission Lines - 154585
Distribution Operations – 152813

Business Unit/Line of Business: Transmission Lines/Distribution Operations

Prepared/Presented By: Anthony Mount/Adam Smith

Executive Summary

The proposed project is to replace 10.87 miles of overhead transmission line with conductor that is over 77 years old and beyond its expected useful life. Performance of this line has diminished, with the most recent conductor failure occurring in 2015. Over 5,000 customers with over 10.5 MVA of load are served by the facilities being replaced. These customers include The City of Shelbyville, Shelbyville Municipal Water, RJ Corman Railroad Company, Sonoco Protective Solutions, and Mt. Eden Fire Department. In addition, the Transmission Expansion Plan (TEP) has identified this line as a potential overload during summer conditions after an outage of the East Frankfort to West Frankfort 138kV line. This project will address the planning need, improve reliability, maintain system integrity, and reduce the risk of failures and unplanned transmission interruptions to the Shelbyville and West Frankfort areas.

A Transmission System Improvement Plan was submitted as support in the 2016 Rate Case, outlining programs and projects aimed at reducing the risk of failure, avoiding extended sustained outages, and limiting costly emergency repairs. The programs submitted with the plan were selected to ensure long-term system integrity and modernize the transmission system to avoid degradation of performance over time due to aging infrastructure. Replacement of overhead wires beyond or approaching their expected useful lives was included as part of the Transmission System Improvement Plan to replace aging infrastructure.

Transmission Lines plans to replace the 10.87 mile section of 69kV line between the Clay Village Tap and the West Frankfort Substation. In addition, one hundred sixty (160) wood structures will be replaced with one hundred forty-five (145) new steel structures. The proposed project utilizes a new design which optimizes the structure placement, removing fifteen (15) structures. Thirty-two (32) existing steel structures will remain. Distribution Operations will provide the layout work and transferring of underbuilt distribution conductors where needed.

The total project cost is $9,735k ($9,455k Transmission Lines, $280k Distribution Operations). This project was included in the 2018 Business Plan (BP) for $10,000k, including estimated spend of $300k in 2018, $2,218k in 2019, $5,291k in 2020, and $2,191k in 2021. As the scope, timing and certainty of work has evolved, the estimates have been further refined.

The current total project cost is $9,735k, with actuals of $199k in 2018, estimated spend of $7,853k in 2019, and $1,683k in 2020. 2018 Spend was included in the BP. Spend in 2019-2020 is $74k lower than the proposed 2019 BP.

Background
The existing 10.87 mile section of 69kV line between the Clay Village Tap and the West Frankfort substation contains the original 2/0 copper conductor installed in 1941. Inspections revealed that the existing 2/0 copper conductor and 4A CWC static wire show signs of corrosion and are in fair to poor condition. Similar copper conductors with 75+ years of service life often have sections with broken conductor strands and significant corrosion at the clamps where the conductor attaches to the structure. This line has experienced two (2) wire failures since 2012, with the most recent conductor failure occurring in 2015.

In addition, the Transmission Expansion Plan (TEP) has identified this line as a potential overload during summer conditions after an outage of the East Frankfort to West Frankfort 138kV line. The project is required to meet the LG&E/KU planning guidelines and is approved by the Independent Transmission Organization (ITO). If the project is not completed, generation at Trimble Co will need to decrease while generation at Brown is increased during summer peak conditions. Using generation re-dispatch to mitigate the overload is not allowed by the planning guidelines unless unexpected delays of the project occur.

Due to the condition of this line, there is risk for additional failures that will expose the transmission network to further unscheduled outages. The following pictures are representative of the 2/0 conductor condition on this line.

The aging copper conductor will be replaced with aluminum conductor steel-reinforced (ACSR) conductor and the deteriorating 4A CWC static wire will be replaced with OPGW (optical ground wire). In addition, new steel structures will be installed in place of existing wood structures, and most span guys crossing US 60 have been eliminated.

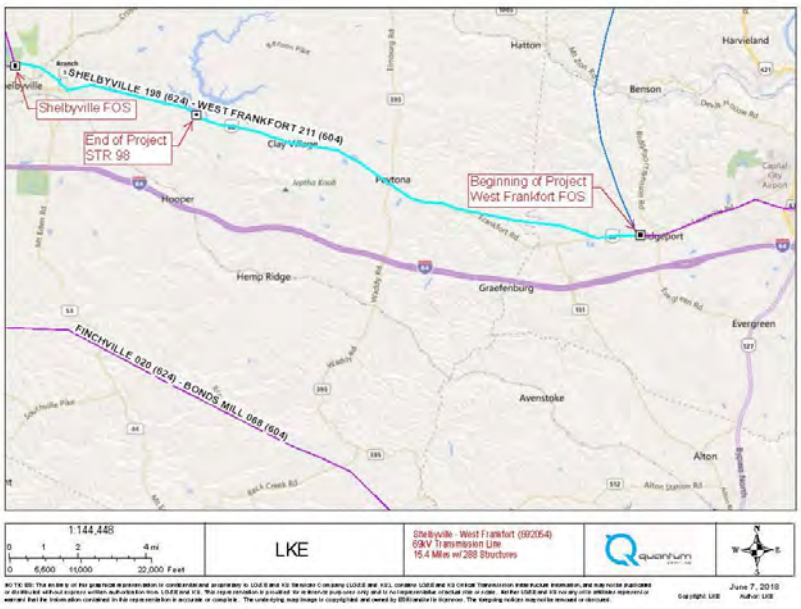
In January 2018, the transmission project was opened to support preliminary engineering and project scope development. Preliminary engineering included design development, structure design and selection, and development of the construction plan. Soil borings were also taken to provide geotechnical reports to support drilled shaft foundation design. In addition, plats were provided for the entire corridor to assist with easement acquisition. The transmission line design was provided to all departments involved for comment and review.

The existing centerline follows the edge of the US 60 road right of way. Structures lie on both private and public land. Company owned easement and KYTC owned road right of way will be used to access the structures. The purchase of three (3) easements for guying will be required along the route due to increased structure heights.

This project also includes a supporting project from Distribution Operations. Distribution Operations will provide the layout work and transferring of underbuilt distribution conductors where needed. Utility stake holders, Frankfort Plant Board and East Kentucky Power, were involved in the kickoff meeting and subsequent planning discussions. The primary theme of the subsequent planning discussions was how to mitigate customer impacts by minimizing the time it takes to transfer their facilities to our new structures. It was also conveyed to both parties that all costs incurred by the owner of the facility is the responsibility of that utility.

- **Alternatives Considered**
    1. Recommendation: NPVRR: ($000s) $11,419
    The recommendation is to replace 10.87 miles containing 2/0 copper with new 556 ACSR conductor, and the existing 4A CWC static wire with new OPGW. In addition, one hundred sixty (160) wood structures will be replaced with one hundred forty-five (145) new steel structures, and thirty-two (32) existing steel structures will remain.
    2. Alternative #1 Do Nothing: NPVRR: ($000s) N/A
    This option is not advisable as this line is nearing the end of its useful life and puts Transmission at risk of not being able to accomplish the objectives established as part of the Transmission System Improvement Plan that was filed as support in the 2016 Rate Case and assumed the completion of this project. These objectives include reducing the risk of failure, avoiding an extended sustained outage, and costly emergency repairs.
    3. Alternative #2 Next Best Alternative: NPVRR: ($000s) $17,821
    The Next Best Alternative would be to construct a new 10.87 mile transmission line which would provide an alternate route, and would parallel the existing line along different roadways for 0.25 miles. Constructing a new route would require the purchase of 10.4 miles of new right of way that customers may not be willing to sell. Selecting a new route for this alternative would likely cause project delays and result in community concerns and opposition over the new route.

Project Description
Clay Village-West Frankfort Conductor Replacement Facility Map



- **Project Scope and Timeline**
  Transmission Lines Project Description – Project 154585
  The Transmission Lines project involves the upgrade of 10.87 miles of existing conductor with ACSR, and existing static wire with OPGW between East Kentucky Power Clay Village Tap and the West Frankfort Substation. This project also involves the replacement of one hundred sixty (160) wood structures with one hundred forty-five (145) new steel structures, and thirty-two (32) existing steel structures will remain.

  Transmission Lines Project Scope and Timeline

Design Start	January 2018
Design Complete	June 2018
Space reserved for steel pole production with manufacturer	July 2018
Materials Delivered	January 2019
Construction Start	March 2019
Facility In-Service	July 2019
Permit Close Out / Project Completion	February 2020

Distribution Operations Project Description – Project 152813
Distribution Operations plans to transfer distribution equipment to the new transmission structures.

Distribution Operations Project Scope and Timeline

Design Start	May 2018
Design Complete	August 2018
Materials Ordered	1st Quarter 2019
Materials Delivered	1st Quarter 2019
Construction Start	1st Quarter 2019
Construction Finish	June 2020

- **Project Cost**

	Transmission Lines	Distribution Operations	Total
Total 2018	$199k	$0k	$199k
Total 2019	$7,603k	$250k	$7,853k
Total 2020	$1,653k	$30k	$1,683k
Project Total	$9,455k	$280k	$9,735k
Contingency	10%	10%	

Economic Analysis and Risks

- **Bid Summary**
  Transmission Lines
  Based on detailed engineering, Transmission Lines has estimated the material package for this project to be $2,750k. The project will utilize conductor, OPGW, custom steel structures, standard steel structures, and standard line material. The OPGW will be purchased through AFL. The conductor will be competitively bid through normal Supply Chain processes. The line construction will be based on continuing contracts with our line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors which have been awarded the Transmission Overhead Construction Maintenance contracts.

  Distribution Operations:
  Distribution Operations line relocation will be performed by company labor (no bids required).

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2018	2019	2020	Post 2020	Total
1. Capital Investment Proposed	199	6,430	1,266	-	7,895
2. Cost of Removal Proposed	-	1,423	417	-	1,840
3. Total Capital and Removal Proposed (1+2)	199	7,853	1,683	-	9,735
4. Capital Investment 2018 BP	300	2,218	5,291	2,191	10,000
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	300	2,218	5,291	2,191	10,000
7. Capital Investment variance to BP (4-1)	101	(4,212)	4,025	2,191	2,105
8. Cost of Removal variance to BP (5-2)	-	(1,423)	(417)	-	(1,840)
9. Total Capital and Removal variance to BP (6-3)	101	(5,635)	3,608	2,191	266

Financial Detail by Year - O&M ($000s)	2018	2019	2020	Post 2020	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Discount Rate: 6.59%
Capital Breakdown:

	154585 Trans Lines	152813 Dist Ops	Total
Labor	$151k	$17k	$154k
Contract Labor	$4,368k	$120k	$4,527k
Materials	$2,750k	$17k	$2,767k
Local Engineering	$660k	$28k	$694k
Burdens	$647k	$18k	$655k
Contingency	$851k	$0k	$851k
Other	$28k	$80k	$87k
Reimbursements	$0k	$0k	$0k
Net Capital Expenditure	$9,455k	$280k	$9,735k

- **Assumptions**
  Recommendation - This assumes that the 10.87 miles of existing conductor will be replaced with ACSR and the existing static wire will be replaced with OPGW. An outage must be obtained to complete the project and is scheduled for 2019. This also assumes that all highway crossing permits will be granted by the Kentucky Transportation Cabinet (KYTC). It is anticipated that no customers will be out of service for the duration of this work.

  Alternative #1 – Do Nothing - This option is not advisable as this line is nearing the end of its useful life and puts Transmission at risk of not being able to accomplish the objectives established as part of the Transmission System Improvement Plan, that was filed as support in the 2016 Rate Case, which assumed the completion of this project. These objectives

include reducing the risk of failure, avoiding and extended sustained outage, and costly emergency repairs.

Alternative #2 – Next Best Alternative – This alternative assumes that a new 10.87 mile transmission line would be constructed. This option would require additional funding due to the need to purchase 10.4 miles of new right of way, in which the property owners may not be willing to sell. The impacts associated with this option would be more disruptive and have a larger negative impact on the community during construction.

- **Environmental**
  There are no known environmental issues regarding air, water, lead, asbestos, etc., associated with this project.

- **Customer Experience**
  A communication plan is being developed in coordination with the project proponents, corporate communications, and external affairs. This plan will be executed to limit the impacts to the community and businesses along the route.

- **Risks**
  - Without the proposed replacement of the existing wire in the Clay Village-West Frankfort 69kV line, the company risks increased exposure to line outages. The wire along the 10.87 miles has deteriorated over time, and is beyond its expected useful life. There have been notable failures in the conductor's 77 year service life. Unplanned outages are often time-consuming and costly when it comes to repairs.
  - This project requires an easement acquisition from three private land owners. These easements have been informally agreed upon and are currently being processed for formal execution.
  - A significant portion of construction will occur adjacent to US Highway 60. No major traffic impacts are expected. Property owners will have access during construction to minimize customer impact.
  - The local community may react negatively to the work and potential inconvenience of the project. A communication plan is being developed in coordination with the project proponents, corporate communications, and external affairs. This plan will be executed to limit the impacts to the community and businesses.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Clay Village-West Frankfort conductor replacement project for $9,735k to improve reliability of the electric transmission system.

Approval Confirmation for Capital Projects Greater Than $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	Chairman, CEO and President

Investment Proposal Project 154617 PR Pocket-Pennington Gap 69kV Pole Replacement

Investment Proposal

Project Name: Pocket-Pennington Gap 69kV Pole Replacement

Total Expenditures: $1,779k
Total Contingency: $161k (10%)

Project Number(s): 154617

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Nick Poston/Adam Smith

Executive Summary

The proposed project is to replace seventeen (17) wood structures, on the Pocket-Pennington Gap 69kV line, and four (4) wood structures on the Poor Valley Tap with new steel structures. In addition to the twenty-one (21) structures being replaced, two (2) new one way switches will be installed on the Pocket-Pennington Gap 69kV line. The switches were identified for replacement in 2021 by the Transmission Reliability Performance & Standards group, and are being accelerated to align with this project. The new line will be built parallel to the existing line in order to minimize customer impact. The existing static and conductor wire on the Pocket-Pennington Gap 69kV line will be replaced. New static wire will be installed on the Poor Valley Tap, and the existing conductor on this line will also be replaced. A planned outage will be required to disconnect the existing line and place the new line in service.

The alternative of replacing the poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $1,779k. This cost was not included in the 2017 Business Plan (BP). This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the 5+7 forecast.

Background
The Pocket-Pennington Gap 69kV line contains twenty-four (24) structures along the 1.71 mile line. The Poor Valley Tap contains four (4) structures along the 0.17 mile line. A pole replacement project (150687) was completed in 2016 to replace seven (7) of the twenty-four (24) structures on the Pocket-Pennington Gap 69kV line. The seven structures that were replaced in 2016 were built parallel to the existing line due to outage restrictions. A climbing inspection of the Pocket-Pennington Gap 69kV line was completed January 10, 2017. During this inspections, eleven (11) additional structures were identified as priority poles and determined to be in need of replacement, and four (4) structures were found to be in need of repair in order to ensure the integrity and reliability of this line. Six additional (6) structures will be replaced in order to accommodate the height of the new line. In addition to the poles needing to be replaced as soon as possible, the age and type of the existing static wire along this line indicate that the static wire will also need to be replaced. This project will also consist of the installation of two (2) new one way switches on the Pocket-Pennington Gap 69kV line. The switches were identified for replacement in 2021 by the Transmission Reliability Performance & Standards group, and are being accelerated to align with this project. The new line will be built parallel to the existing line in order to minimize customer impact. In addition to the twenty-one structures being replaced, the existing static and conductor wire on the Pocket-Pennington Gap Tap 69kV line will be replaced. New static wire will be installed on the Poor Valley Tap, and the existing conductor on this line will also be replaced.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,265k
     The recommendation is to replace twenty-one (21) structures, complete the installation of two (2) one-way switches, and complete the replacement and installation of the static and conductor prior to the planned outage to place the new line in service.
  2. Alternative #1: NPVRR: ($000s) $3,360k
     The alternative of doing nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $3,131k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

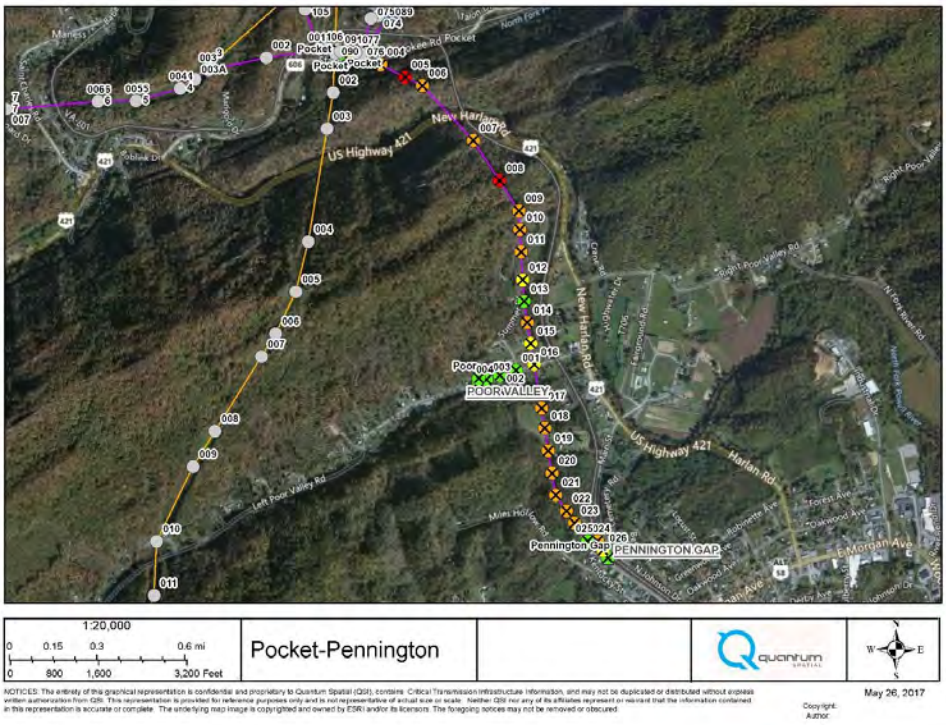
Project Description

- **Project Scope and Timeline**

The scope of work will consist of installing twenty-one (21) standard steel single pole structures, and the installation of two (2) new one-way switches, and associated hardware and material, the the removal of twenty-one (21) wood structures, and associated hardware and material. Existing static and conductor on the Pocket-Pennington Gap 69kV line will be replaced. New static wire will be installed, and existing conductor replaced on the Poor Valley Tap. The existing conductor will also be replaced. The line construction will be based on continuing contracts from our line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in July of 2017 and be completed in September of 2017.

Construction Milestones	
June 2017	Engineering and Design
June 2017	Switches and Switch Hardware Ordered
July 2017	Switches and Hardware Received
July 2017	Steel Poles and Static Charged
July 2017	Line Construction Begins
September 2017	Line Construction Completed

A facility map of the Pocket-Pennington Gap 69kv line is shown below:
Main line length: 1.71 miles, tap length: 0.17 miles



- **Project Cost**
  The total project cost is $1,779k. This cost was not included in the 2017 Business Plan (BP). This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the 5+7 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $337k. This project will utilize standard steel structures. The line construction will be based on continuing contracts with our line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown

Material	Cost
Steel Poles	$145k
Switches and Switch Hardware	$36k
Conductor	$36k
Static	$4k
Hardware	$116k
Total	$337k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	2019	Post 2019	Total
1. Capital Investment Proposed	1,628	-	-	-	1,628
2. Cost of Removal Proposed	151	-	-	-	151
3. Total Capital and Removal Proposed (1+2)	1,779	-	-	-	1,779
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(1,628)	-	-	-	(1,628)
8. Cost of Removal variance to BP (5-2)	(151)	-	-	-	(151)
9. Total Capital and Removal variance to BP (6-3)	(1,779)	-	-	-	(1,779)

Financial Detail by Year - O&M ($000s)	2017	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$61k
Contract Labor:	$981k
Materials:	$337k
Local Engineering:	$124k
Burdens:	$115k
Contingency:	$161k
Reimbursements:	($0)
Net Capital Expenditure:	$1,779k

- **Assumptions**

Recommendation – The cost of this alternative assumes that the new line will be built parallel to the existing line, and the line outage will be available to disconnect the existing line and place the new line in service.

Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 33% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Pocket-Pennington Gap 69kV line, including the Poor Valley Tap, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Pocket-Pennington Gap Tap pole replacement project for $1,779k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project 154618 Fawkes-Higby Mill Pole Replacement

Investment Proposal

Project Name: Fawkes-Higby Mill Pole Replacement

Total Expenditures: $922k
Total Contingency: $83k (10%)

Project Number(s): 154618

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Addam Gooch/Adam Smith

Executive Summary

The proposed project is to replace fifteen (15) wood structures on the Fawkes to Higby Mill 69kV line with steel. The scope of work includes the replacement of fourteen (14) structures identified through inspection. The replacement of one (1) additional adjacent structure is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, approximately 50% of the fifteen (15) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $92k.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $922k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the RAC in the 4+8 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Fawkes-Higby Mill 69kV line was completed in 2016, and fourteen (14) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. The replacement of one (1) additional adjacent structure is required to accommodate an increase of the height of the new structures. There are 122 total structures along this 24.60 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,174k
     Due to the difficulty in obtaining an extended outage, approximately 50% of the fifteen (15) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $92k and the NPVRR by $118k.

  2. Alternative #1: NPVRR: ($000s) $1,741k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.

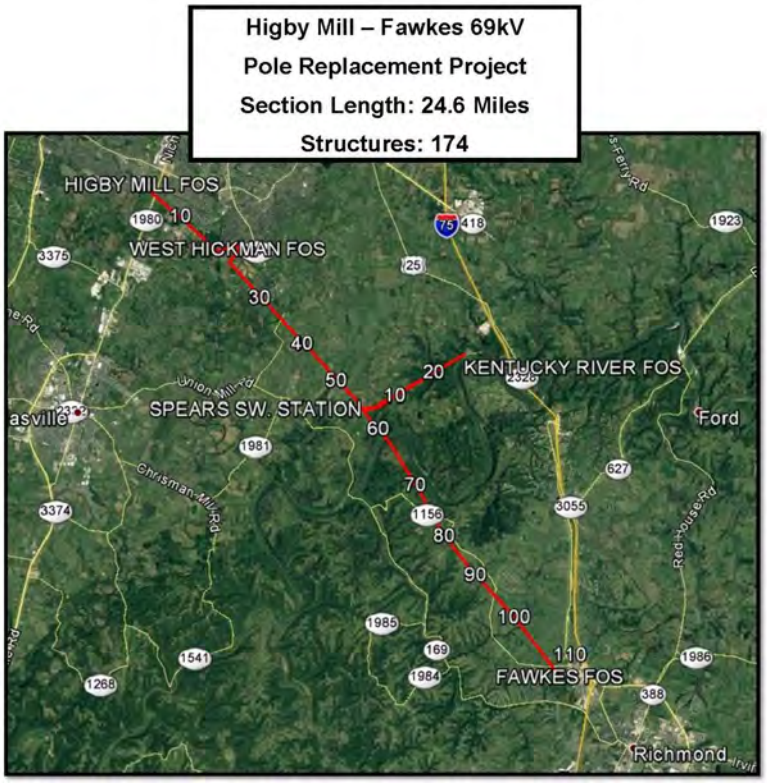
  3. Alternative #2: NPVRR: ($000s) $1,402k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing fourteen (14) standard steel H-frame structures, one (1) steel single pole dead end structure, and associated hardware and material, and the removal of fifteen (15) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting (IC). The contract was re-approved by the IC in April 2017. Construction is scheduled to begin in September of 2017 and be completed in October of 2017.

Construction Milestones	
May 2017	Engineering and Design
June 2017	Steel Poles Ordered
August 2017	Steel Poles Received
September 2017	Line Construction Begins
October 2017	Line Construction Completed

A facility map of the Fawkes-Higby Mill 69kV line is shown below:
Line length: 17.9 miles



- **Project Cost**
  The total project cost is $922k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the RAC in the 4+8 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $325k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$285k
Hardware	$40k
Total	$325k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	726	-	-	-	726
2. Cost of Removal Proposed	196	-	-	-	196
3. Total Capital and Removal Proposed (1+2)	922	-	-	-	922
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(726)	-	-	-	(726)
8. Cost of Removal variance to BP (5-2)	(196)	-	-	-	(196)
9. Total Capital and Removal variance to BP (6-3)	(922)	-	-	-	(922)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$30k
Contract Labor:	$385k
Materials:	$325k
Local Engineering:	$57k
Burdens:	$42k
Contingency:	$83k
Reimbursements:	($0)
Net Capital Expenditure:	$922k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the fifteen (15) structures will need to be completed with the 69kV line energized.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 36% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Fawkes-Higby Mill 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Fawkes-Higby Mill Pole Replacement project for $922k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project 154693 Brown-Fawkes 138kV Pole Replacement

Investment Proposal for Investment Commttee Meeting on: June 28, 2017

Project Name: Brown-Fawkes 138kV Pole Replacement

Total Expenditures: $3,514k
Total Contingency: $320k (10%)

Project Number(s): 154693

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Addam Gooch/Adam Smith

Executive Summary
The proposed project is to replace forty-four (44) wood structures on the Brown-Fawkes 138kV line with steel. The scope of work includes the replacement of thirty-nine (39) structures identified through inspection. The replacement of five (5) additional adjacent structures is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, all forty-four (44) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $487k.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $3,514k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the RAC in the 5+7 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Brown-Fawkes 138kV line was completed in 2015, and thirty-nine (39) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. The replacement of five (5) additional adjacent structures is required to accommodate an increase of the height of the new structures. There are 133 total structures along this 21.70 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $4,474k
     Due to the difficulty in obtaining an extended outage, all forty-four (44) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $487k and the NPVRR by $620k.
  2. Alternative #1: NPVRR: ($000s) $6,636k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $5,464k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty-one (31) standard steel H-frame structures, eleven (11) custom steel H-frame structures, one (1) custom steel three-pole running corner, one (1) custom steel three-pole dead end structure, and associated hardware and material, and the removal of forty-six (46) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in September of 2017 and be completed in December of 2017.

Construction Milestones	
June 2017	Engineering and Design
June 2017	Steel Poles Ordered
August 2017	Steel Poles Received
September 2017	Line Construction Begins
December 2017	Line Construction Completed

A facility map of the Brown-Fawkes 138kV line is shown below:
Line length: 21.70 miles

- **Project Cost**
  The total project cost is $3,514k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the RAC in the 5+7 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $1,148k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,007k
Hardware	$141k
Total	$1,148k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	2,744	-	-	-	2,744
2. Cost of Removal Proposed	770	-	-	-	770
3. Total Capital and Removal Proposed (1+2)	3,514	-	-	-	3,514
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(2,744)	-	-	-	(2,744)
8. Cost of Removal variance to BP (5-2)	(770)	-	-	-	(770)
9. Total Capital and Removal variance to BP (6-3)	(3,514)	-	-	-	(3,514)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.49%
Capital Breakdown:	
Labor:	$120k
Contract Labor:	$1,547k
Materials:	$1,148k
Local Engineering:	$216k
Burdens:	$163k
Contingency:	$320k
Reimbursements:	($0)
Net Capital Expenditure:	$3,514k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and all forty-four (44) structures will need to be completed with the 138kV line energized.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 36% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Brown-Fawkes 138kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Brown-Fawkes 138kV Pole Replacement project for $3,514k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Paul W. Thompson
President and Chief Operating Officer

Investment Proposal

Investment Proposal for Investment Committee Meeting on: June 26, 2017

Project Name: Trimble Co. TCT (4) breaker replacement

Total Expenditures: $3,130k ($240k of Contingency)

Project Number(s): 154843

Business Unit/Line of Business: Transmission Substation Construction

Prepared By: Chris Talley – Director Transmission Construction

Executive Summary

The purpose of this project is to eliminate risk associated with existing ABB type 362 PMI63-20 breakers used for unit synchronization at Trimble Co. The scope of this project addresses the replacement of (4) 345kV Generation breakers at the Trimble County (Co.) Combustion Turbine (TCT) substation, TCT TR 7, TCT TR 8, TCT TR 9 and TCT TR 10 and (3) PASCOR 345kV switches model VBPA at (TCT) substation, TCT TR8 LINE, TCT TR9 LINE, and TCT TR10 LINE seen in Appendix A. In addition to the proposed project, LG&E and KU Energy LLC (LKE) Transmission is separately submitting and funding two companion projects, seen in Appendix B & C.

The installed ABB breaker type has experienced issues with flashovers during unit synchronization to LKE's system. This issue causes severe delays and potential loss of life to LKE's generating units. ABB has evaluated and confirmed the misapplication of its installed 345kV breakers. ABB made no claims to the reliability of its breakers during unit synchronization and the improper application of these breakers is not the responsibility of the manufacturer.

LKE will utilize the Trimble County ABB breakers retired as part of this project for a proposed project at the Middletown substation. The Middletown proactive replacement project is part of the transmission system improvement plan to address existing 345kV high pressure live tank breakers prone to issues and failure and is currently submitted to the Investment Committee as a separate project. This project is scheduled for 2018 in the current business plan.

No funding was included in the 2017 BP for this project. The total cost of this project will be $3,130k and the 2017 amount was included in the 2017 5+7 RAC approved forecast. The 2018 amount will be requested as part of the 2018BP process. The estimated total project figure includes an 8% contingency.

The purpose of this project is to eliminate risk associated with existing PASCOR 345kV switches model VBPA at (TCT) substation. The motor operated device (MOD's) for these switches are operating the 345kV switches every time the gas turbines go on and off line. Therefore these

switches have had many cycles of operation and they were not designed for that. The new Southern States RDA-1 switch is designed for this type of operation.

Background
LG&E/KU has maintenance responsibilities for one hundred nine 345kV breakers. Forty-six of these are ABB type 362PMI63-20. Since 2004, there have been five 345kV breakers that experienced dielectric failures. All of these breakers are ABB type 362PMI63-20. Four of the failures were at Trimble County while synchronizing generators. The other failure took place at Ghent during a typical switching operation.

Each teardown has resulted in factory diagnostics pointing towards misapplications of ABB 362 PMI63-20 breakers and there is not a corrective action that can be taken to make these breakers suitable for this application. Based on ABB's analysis, the resulting flashovers were attributed to syncing two dissimilar voltages at different frequencies. ABB offered two recommendations to alleviate the flashover issues: Install a new low side generator breaker or replace the existing 345kV ABB unit breakers with 500kV models, equipped with 345kV bushing. ABB was confident these solutions would alleviate the flashover issues.

The breakers proposed to be replaced are single points of failure that can prevent bringing a combustion turbine online. The four failures have introduced substantial delays in bringing a needed generation unit online. Typical turnaround time for these four failures have ranged from two to five weeks.

A Request for Proposal went out to multiple breaker manufacturers to solicit bids for a breaker suitable for this specific application. LKE Transmission and Generation engineering have evaluated the proposals to select the most cost-effective solution. Transmission engineering and generation evaluated solutions proposed from multiple breaker manufacturers. A majority of the proposals followed ABB's lead and suggested 500kV breakers with 345kV bushings to increase insulation levels of the breakers interrupting devices. Hyosung Corporation (HICO) proposed a 345kV breaker that can withstand the electrical stress introduced as part of synchronizing a generator due to the robust design of the breaker.

HICO, on the other hand, proposed a solution with its 362-HCBP model 345kV breaker. After addressing several questions posed relating to the performance of its breaker, HICO remained confident that its breaker was suitable for this application due to larger than required interrupter insulation levels, specifically insulation levels between the internal open contacts. It should be noted that LKE has not seen dielectric failures with the 345kV Hitachi HVB breakers on the high side of unit 5 and unit 6. HICO presented documentation to highlight 345kV HICO and Hitachi breaker similarities. The similarities of these breakers stem from previous merger of the two companies which prompted HICO to manufacture high voltage breakers based on the Hitachi design. After these discussions, Generation and Transmission are confident with HICO's proposal and its breaker was chosen as the preferred breaker solution.

ABB 362PMI63-120 failures have been observed with the bus disconnects closed and with them open. The issue exists due to the margin of insulation in the breaker internals. Appendix D shows

testing data on the Hitachi HVB's breakers. ABB only test up to 1300BIL while Hitachi test up to 1560BIL. This value equates to a classification of internal insulation strength.

Transmission and Generation are also proposing to replace the bus side disconnects, seen in Appendix A, as an opportunity project during the first available outage. Replacing the switches will mitigate bus work issues associated with installation of new breakers.

Alternatives Considered (1 –Recommendation, 2 – Next Best Alt, 3 – Do Nothing)
Recommendation: NPVRR: ($000s) $3,537
It is recommended to replace TCT TR7, TCT TR8, TCT TR9 and TCT TR10 breakers at Trimble County. The retired breakers will be used to support the 345kV proactive replacement efforts at Middletown 345kV substation during 2018.

Next Best Alternative(s): NPVRR: ($000s) $3,813
Following ABB's recommendation and replacing (1) Trimble Co. 345kV breaker with a 500kV breaker equipped with 345kV bushings.

Do Nothing: NPVRR: ($000s) $5,120
A spare breaker could be purchased and stored at Trimble County. In the event of a breaker failure, the spare could be installed in one week. The combustion turbine would be unavailable during this time and could cause concerns since dispatch counts on TC8 and TC10 for spinning reserve. This option is not advisable as it introduces risk to the CT and associated generator step up (GSU) transformer for a known issue that cannot be corrected.

With the "Do Nothing" option, Existing ABB breakers will continue to fail. Each failure will introduce large forces on each nearby GSU. Each of these failures will have an aggregate negative effect the GSU's, where internal transformer insulation and fastenings will continue to loosen. These compounded actions will increase the likelihood of a GSU failure over time. While the timeline of a GSU failure cannot be quantified, it is well known in the industry that faults passing through a transformer especially faults in close proximity to transformers are the most common transformer failure mode.

Project Description

- **Project Scope and Timeline**
  - Breaker replacement will be coordinated with planned unit outages making the schedule outlined below subject to change.

Description	Date
Project Originally Approved	June, 2017
Engineering Complete	December, 2017
Materials Ordered	July, 2017
Materials Received	Jan, 2018
Below Grade Work Begins	March, 2018
Below Grade Work Completed TR7/TR8	March, 2018

Above Grade Work Begins TR7/TR8	March, 2018
Above Grade Work Completed TR7/TR8	March, 2018
Below Grade Work Begins TR9/TR10	October, 2018
Below Grade Work Completed TR9/TR10	October, 2018
Above Grade Work Begins TR9/TR10	November, 2018
Above Grade Work Completed TR9/TR10	December, 2018
Project Complete	December, 2018

- **Project Cost**
  No funding was included in the 2017 BP for this project. The total cost of this project will be $3,130k and was approved by the RAC through the 2017 5+7 Forecast. The 2018 amount will be requested as part of the 2018BP process. The estimated total project figure includes an 8% contingency.

Economic Analysis and Risks

- **Bid Summary**
  The 345kV breakers were bid out to multiple manufacturers. HICO offered the most prudent solution at the best cost.

  Services related to construction and commissioning these breaker projects will be bid out in compliance with company policy.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	2019	Post 2019	Total
1. Capital Investment Proposed	728	1,478	-	-	2,206
2. Cost of Removal Proposed	-	923	-	-	923
3. Total Capital and Removal Proposed (1+2)	728	2,401	-	-	3,129
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(728)	(1,478)	-	-	(2,206)
8. Cost of Removal variance to BP (5-2)	-	(923)	-	-	(923)
9. Total Capital and Removal variance to BP (6-3)	(728)	(2,401)	-	-	(3,129)

Financial Detail by Year - O&M ($000s)	2017	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):
Discount Rate: 6.5%
Capital Breakdown:
Labor: $120
Contract Labor: $1,160

Materials:	$1,130
Local Engineering:	$335
Burdens:	$145
Contingency:	$240
Net Capital Expenditure:	$3,130

- **Assumptions**
  - The requested outages for construction will be granted.
  - Suppliers and contractors will meet reasonable and customary delivery dates for materials and services.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

  This project involves the removal and installation of sulfur hexafluoride (SF6). There are no current environmental regulatory implications related to SF6 gas.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work.

  The risk with new breaker type delivery will be mitigated through multiple meetings and conversations of LKE's standards before HICO completes drawings for review.

  The risk with installation of new breaker type will be mitigated through manufacturer reps and crews assisting and possibly completing construction and commissioning.

  Project timeline is based on 2018 Trimble Co. unit outages. Schedule is subject to change.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Trimble Co. TCT (4) breaker replacement project for $3,130k to enhance the reliability of the Transmission system as well as reduce extended outage to four of the TCT combustion turbines.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Paul W. Thompson
President and Chief Operating Officer

Investment Proposal Project 155198 Tyrone-Adams Pole Replacement

Investment Proposal

Project Name: Tyrone-Adams Pole Replacement

Total Expenditures inclusive of Contingency: $1,906k
Total Contingency: $170k (10%)

Project Number(s): 155198

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Addam Gooch/Adam Smith

Executive Summary

The proposed project is to replace thirty-six (36) wood structures on the Tyrone-Adams 138kV line with steel during a scheduled outage. The scope of work includes the replacement of thirty-three (33) structures identified through inspection. The replacement of three (3) additional adjacent structures is required to accommodate the increased height of the new structures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $1,906k. Procurement space has been reserved in 2017 for all material associated with the thirty-six (36) structures, and will be delivered in October of 2017.
The cost for the material in 2017 was not included in a separate project in the 2017 Business Plan (BP) but was targeted for completion in 2018 under funding project K9-2018. The project has been accelerated based on the current priority of Transmission Lines work and was approved by the RAC in the 7+5 forecast for $895k in 2017. The 2018 funding will be addressed in the proposed 2018 BP.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Tyrone-Adams 138kV line was completed in 2016, and thirty-three (33) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. The replacement of three (3) additional adjacent structures is required to accommodate the increase of the height of the new structures. There are 167 total structures along this 19.5 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,366k
     The recommendation is to replace all thirty-six (36) structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $3,570k
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $2,727k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

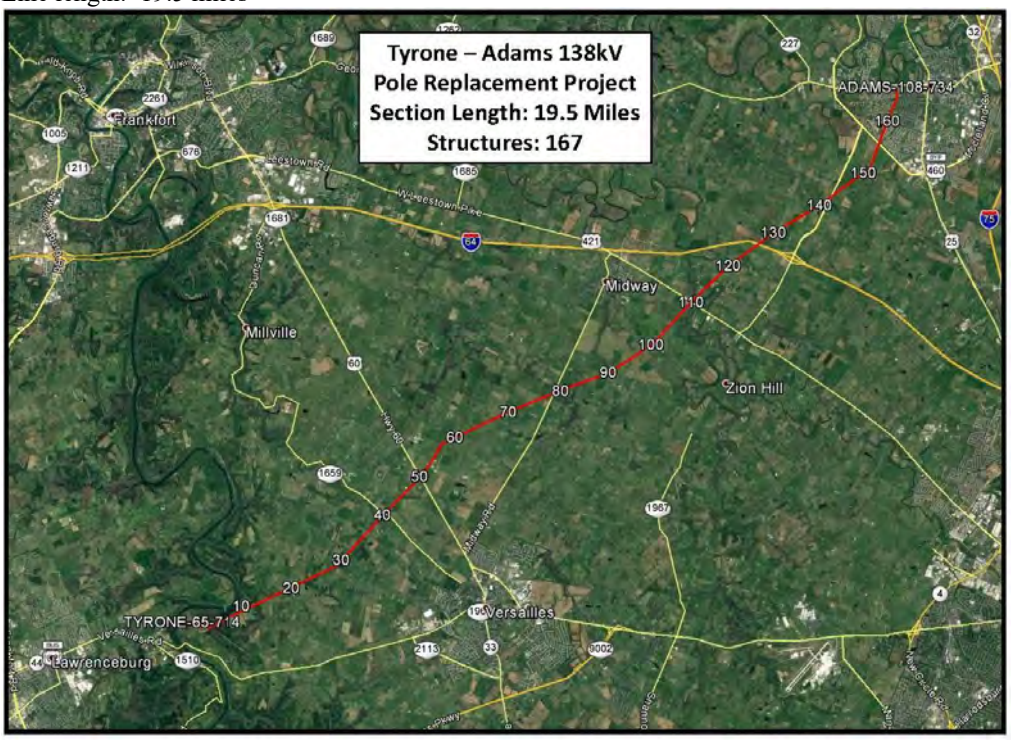
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty-four (34) standard steel H-frames, one (1) steel three-pole running corner, one (1) steel three-pole dead end, and associated hardware and material, and the removal of thirty-six (36) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Procurement space has been reserved in 2017 for all material associated with the thirty-six (36) structures, and will be delivered in October of 2017. Construction is scheduled to begin in January of 2018 and be completed in March of 2018.

Construction Milestones	
August 2017	Engineering and Design
August 2017	Steel Poles Ordered
October 2017	Steel Poles Received
January 2018	Line Construction Begins

March 2018	Line Construction Completed

A facility map of the Tyrone-Adams 138kV line is shown below:
Line length: 19.5 miles



- **Project Cost**
  The total project cost is $1,906k. Procurement space has been reserved in 2017 for all material associated with the thirty-six (36) structures, and will be delivered in October of 2017. The cost for the material in 2017 was not included in a separate project in the 2017 Business Plan (BP) but was targeted for completion in 2018 under funding project K9-2018. The project has been accelerated based on the current priority of Transmission Lines work and was approved by the RAC in the 7+5 forecast for $895k in 2017. The 2018 funding will be addressed in the proposed 2018 BP. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**

Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $795k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$723k
Hardware	$72k
Total	$795k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	895	688	-	-	1,583
2. Cost of Removal Proposed		324	-	-	324
3. Total Capital and Removal Proposed (1+2)	895	1,012	-	-	1,906
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(895)	(688)	-	-	(1,583)
8. Cost of Removal variance to BP (5-2)	-	(324)	-	-	(324)
9. Total Capital and Removal variance to BP (6-3)	(895)	(1,012)	-	-	(1,906)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed					-
2. Project O&M 2017 BP					-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.32%
Capital Breakdown:	
Labor:	$35k
Contract Labor:	$700k
Materials:	$795k
Local Engineering:	$138k
Burdens:	$68k
Contingency:	$170k
Reimbursements:	($0)
Net Capital Expenditure:	$1,906k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all thirty-six (36) structures will be replaced during this timeframe.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 40% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Tyrone-Adams 138kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Tyrone-Adams Pole Replacement project for $1,906k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project 155206 Rosine-Leitchfield Pole Replacement

Investment Proposal for Investment Committee Meeting on: July 26, 2017

Project Name: Rosine-Leitchfield Pole Replacement

Total Expenditures inclusive of Contingency: $11,204k
Total Contingency: $1,008k (10%)

Project Number(s): 155206

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Joe Mina/Adam Smith

Executive Summary

The proposed project is to replace one hundred eighty-five (185) wood structures, and two (2) existing two-way switches on the Rosine-Leitchfield 69kV line. The existing wood structures will be replaced with new steel structures. In addition to the poles needing to be replaced, the age and condition of the existing static wire along this line indicate that the static wire will also need to be replaced. Optical Ground Wire (OPGW) will be installed as replacement for existing static wire. Providing a communications medium is a strategic objective within IT for any static replacement where OPGW is not already in place or available on a nearby parallel path. In this case, the OPGW, when coupled with other planned fiber builds, will provide needed diversity for existing communications transport in the western portion of the state, yielding greater reliability for existing utility communications traffic. It will also serve as collection points and backhaul for anticipated data from upcoming and proposed business initiatives such as Advanced Metering Systems (AMS), Distribution Automation (DA), Distribution Supervisory Control And Data Acquisition (DSCADA), Conservation Voltage Reduction (CVR), etc.

All work will be completed during a scheduled outage. Procurement space has been reserved in 2017 for all material associated with eighty-nine (89) structures and will be delivered in August and December of 2017. Material for the remaining ninety-six (96) structures will be delivered in January and February of 2018.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line, and to prevent outages resulting from such failures. This alternative would also have a negative impact on network reliability.

This project was opened for $725k during June 2017 for the replacement of 20 structures that required immediate attention, with the understanding that the project would be revised for the total

cost of replacing one hundred eighty-five (185) structures along with the existing static wire. The total project cost is $11,204k. The cost of the 2017 replacements was not included in a separate project in the 2017 Business Plan (BP) but was targeted for completion in 2018 under funding project K9-2018. The project has been accelerated based on the current priority of Transmission Lines work and was approved by the RAC in the 6+6 forecast for $2,737k in 2017 and $425k funded through the Technology Portfolio Project Management Committee (TPMC). The 2018 funding will be addressed in the proposed 2018 BP.

Background
Pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A climbing and comprehensive visual inspection (CVI) of the Rosine-Leitchfield 69kV line identified a total of (180) structures that are in need of replacement. In addition to the poles needing to be replaced, the age and condition of the existing static wire along this line indicate that the static wire will also need to be replaced. The existing static wire will be replaced with OPGW, and five (5) additional structures will also need to be replaced to accommodate the new OPGW wire. Replacing the identified one hundred eighty-five (185) structures and existing static wire will ensure the integrity and reliability of the line. There are 233 structures along this 24.67 mile line.

- **Alternatives Considered**

Recommendation NPVRR: ($000s) $13,709k
The recommendation is to replace all one hundred eight-five (185) structures, existing switches, and existing static wire with OPGW, during a scheduled outage. The total funding requested represents the cost to install the OPGW in support of the strategic initiative to extend the fiber network.

Alternative #1 NPVRR: ($000) $15,701k
Alternative #1 is to replace all one hundred eighty five (185) structures, existing switches, and existing static wire with 7#8 Alumoweld overhead static wire AND underbuilt All-Dielectric Self Supporting (ADSS) fiber optic cable during a scheduled outage. In addition to the one hundred eighty five (185) structures being replaced, forty-eight (48) additional structures will need to be replaced due to the ADSS fiber installation.

Alternative #2: NPVRR: ($000s) $21,050k
The alternative of doing nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.

Project Description

- **Project Scope and Timeline**

The scope of work will consist of installing one hundred four (104) standard steel single pole structures, seventy-six (76) standard steel H-frame structures, one (1) steel three-pole structure, one (1) steel dead end structure, one (1) steel single pole running corner, two (2) steel switch structures, and replacing two (2) two-way switches, and associated hardware and material. This project also includes removal of one hundred eighty-five (185) wood structures, and associated hardware and material. Existing static wire on the Rosine-Leitchfield 69kV line will be replaced with OPGW. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in September of 2017 and be completed in June of 2018.

Construction Milestones	
June 2017	Line construction begins for 20 critical structures
June 2017	Engineering and Design for remaining scope
July 2017	Steel Poles Ordered for 2017 Replacements
August/September 2017	Steel Poles Received for 2017 Replacements
September 2017	Line Construction Begins
October 2017	Steel Poles Ordered for 2018 Replacements
January 2018	Steel Poles Received for 2018 Replacements
June 2018	Line Construction Completed

A facility map of the Rosine-Leitchfield 69kV line is shown below:
Line length: 24.67 miles

CONFIDENTIAL INFORMATION REDACTED

A map of the OPGW route on the Rosine-Leitchfield 69kV line is shown below:

- **Project Cost**
  The total project cost is $11,204k. The cost of the 2017 replacements was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. The project has been accelerated based on the current priority of Transmission Lines work and was approved by the RAC in the 6+6 forecast. The 2018 funding will be addressed in the proposed 2018 BP. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $2,856k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E.

Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$2,516k
OPGW	$216k
Hardware	$124k
Total	$2,856k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	2,545	5,979			8,524
2. Cost of Removal Proposed	618	2,063			2,680
3. Total Capital and Removal Proposed (1+2)	3,162	8,041	-	-	11,204
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(2,545)	(5,979)	-	-	(8,524)
8. Cost of Removal variance to BP (5-2)	(618)	(2,063)	-	-	(2,680)
9. Total Capital and Removal variance to BP (6-3)	(3,162)	(8,041)	-	-	(11,204)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.32%
Capital Breakdown:	
Labor:	$299k
Contract Labor:	$5,696k
Materials:	$2,856k
Local Engineering:	$785k
Burdens:	$560k
Contingency:	$1,008k
Reimbursements:	($0)
Net Capital Expenditure:	$11,204k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project and that the existing static wire will be replaced with OPGW. Two (2) existing two-way switches will also be replaced.

  Alternative #1 – The cost of this alternative assumes one hundred eighty-five (185) structures and existing static wire will be replaced. The existing static wire will be replaced with 7#8 Alumoweld overhead static wire rather than the recommended OPGW, and will also include ADSS underbuild. An additional forty-eight (48) structures will also need to be replaced due to the ADSS fiber installation.

  Alternative #2 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles and existing static wire on the Rosine-Leitchfield 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays. The project cost could also increase if the line cannot be taken out of service for the duration of the project and a portion of poles are replaced with the line energized.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Rosine-Leitchfield Pole Replacement project for $11,204k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Chief Financial Officer	Paul W. Thompson President and Chief Operating Officer

Investment Proposal Project 155708 Arnold-Evarts Pole Replacement

Investment Proposal

Project Name: Arnold-Evarts Pole Replacement

Total Expenditures inclusive of Contingency: $1,819k
Total Contingency: $165k (10%)

Project Number(s): 155708

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Nick Poston/Adam Smith

Executive Summary
The proposed project is to replace twenty-five (25) wood structures on the Arnold-Evarts 69kV line with steel during a scheduled outage. The scope of work includes the replacement of twenty-four (24) structures identified through inspection. The replacement of one (1) additional adjacent structure is required to accommodate the increased height of the new structures. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

The total project cost is $1,819k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the RAC in the 7+5 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Arnold-Evarts 69kV line was completed in 2015, and twenty-four (24) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. The replacement of one (1) additional adjacent structure is required to accommodate an increase of the height of the new structures. There are 135 total structures along this 18.17 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,282k
     The recommendation is to replace all twenty-five (25) structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $3,394k
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $2,837k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing seventeen (17) standard steel H-frames, five (5) steel three-pole running corners, two (2) steel single pole structures, one (1) custom steel switch structure, and associated hardware and material, and the removal of twenty-four (24) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in October of 2017 and be completed in December of 2017.

Construction Milestones	
August 2017	Engineering and Design
August 2017	Steel Poles Ordered
September 2017	Steel Poles Received
October 2017	Line Construction Begins
December 2017	Line Construction Completed

A facility map of the Arnold-Evarts 69kV line is shown below:
Line length: 18.17 miles

- **Project Cost**
  The total project cost is $1,819k. This cost was not included in a separate project in the 2017 Business Plan (BP) but was included in funding project K9-2018. This project has been accelerated based on current priority of Transmission Lines work and was approved by the RAC in the RAC in the 7+5 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**

Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $504k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$454k
Hardware	$50k
Total	$504k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	1,453	-	-	-	1,453
2. Cost of Removal Proposed	366	-	-	-	366
3. Total Capital and Removal Proposed (1+2)	1,819	-	-	-	1,819
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(1,453)	-	-	-	(1,453)
8. Cost of Removal variance to BP (5-2)	(366)	-	-	-	(366)
9. Total Capital and Removal variance to BP (6-3)	(1,819)	-	-	-	(1,819)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.32%
Capital Breakdown:	
Labor:	$40k
Contract Labor:	$906k
Materials:	$504k
Local Engineering:	$133k
Burdens:	$71k
Contingency:	$165k
Reimbursements:	($0)
Net Capital Expenditure:	$1,819k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all twenty-five (25) structures will be replaced during this timeframe.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 29% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Arnold-Evarts 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Arnold-Evarts Pole Replacement project for $1,819k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: Indian Hill Control House Replacement

Total Expenditures: $1,489k (Including $130k of Contingency)

Project Number(s): 155741

Business Unit/Line of Business: Transmission Substation Engineering

Prepared/Presented By: Brent Birchell – Manager, Transmission Substation Engineering

Executive Summary

The Indian Hill Substation currently houses transmission protection and control (P&C) equipment that is aging past the date of reasonable repair. Much of this equipment was installed over fifty years ago and will begin to fail without proactive replacement of these assets. Maintenance of said equipment is also becoming more difficult as replacement parts are difficult to find.

By installing a new, pre-fabricated control house with microprocessor relays, the obsolete, aging equipment will be replaced with reliable, digital protective relays while also enhancing safe and reliable performance of the Transmission protection system. This project is part of the overall 2016 Transmission Reliability Plan (TRP).

This project was approved for $225k during August 2017 for preliminary engineering and is being revised for the full project cost based on the results of detailed engineering. The total cost of this project will be $1,489k with $205k in 2017 and $1,284k in 2017. This project was not included in the 2017 BP, however the 2017 portion was approved by the RAC in the 8+4 forecast and the 2018 portion will be addressed in 2018.

Background
The Indian Hill Substation contains a 69kV bus which connects three transmission lines. The equipment currently used for relaying and controls for the switchyard is located inside an aging control building with no climate control. This affects the lifespan of equipment as weather changes can damage sensitive electronics and battery cells. A new control house would provide a climate controlled environment and ensure that safe working conditions are provided for any individuals working inside.

The existing P&C equipment is composed of electromechanical relays. Nine of these relays are General Electric GCX type electromechanical relays which have been marked as a priority by the Transmission P&C department to replace, due to the age of these relays and a higher percentage of misoperations caused by these relays. New microprocessor relays will provide an improvement to reliability along with an increase in functionality, including disturbance monitoring and event reporting. This will allow faults in the area to be studied in greater detail so they can be properly identified with a root-cause, allowing a more specified approach to improving the reliability of the transmission system overall.

- **Alternatives Considered**
    1. Recommendation: NPVRR: ($000s) $1,667k
       It is recommended that all P&C equipment located inside the existing control house be decommissioned and new, microprocessor based relays be installed in a new control house within the substation yard. This control house is part of the 2016 TRP.

    2. Delay Project NPVRR: ($000s) $1,744k
       This option is not advisable as the possibility of misoperations will increase with time as well as the availability of replacement parts of the existing GCX relays will diminish as they become increasingly obsolete.

    3. Do Nothing: NPVRR: ($000s) N/A
       This option is not advisable as the failure of these relays will be imminent over a period of years, which will greatly increase the risk of misoperations. The scarcity of parts will surely increase and the existing control house condition will continue to deteriorate over many years. In addition, this option would prevent us from being able to achieve the goal of completing this project in accordance with the TRP.

Project Description

- **Project Scope and Timeline**

Description	Date
Order Materials	November, 2017
Receive Materials	May, 2018
Begin Below Grade Work	April, 2018
Complete Below Grade Work	July, 2018
Begin Above Grade Work	July, 2018
Complete Above Grade Work	September, 2018
Project Complete	September, 2018

- **Project Cost**

This project was approved for $225k during August 2017 for preliminary engineering and is being revised for the full project cost based on the results of detailed engineering. The total cost of this project will be $1,489k with $205k in 2017 and $1,284k in 2017. This project was not included in the 2017 BP, however the 2017 portion was approved by the RAC in the 8+4 forecast and the 2018 portion will be addressed in 2018.

Economic Analysis and Risks

- **Bid Summary**

Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	2019	Post 2019	Total
1. Capital Investment Proposed	205	1,269	-	-	1,474
2. Cost of Removal Proposed	-	15	-	-	15
3. Total Capital and Removal Proposed (1+2)	205	1,284	-	-	1,489
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(205)	(1,269)	-	-	(1,474)
8. Cost of Removal variance to BP (5-2)	-	(15)	-	-	(15)
9. Total Capital and Removal variance to BP (6-3)	(205)	(1,284)	-	-	(1,489)

Financial Detail by Year - O&M ($000s)	2017	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.5%
Capital Breakdown:	
Labor:	$80k
Contract Labor:	$497k
Materials:	$594k
Other:	$0
Local Engineering:	$100k
Burdens:	$88k
Contingency:	$130k
Reimbursements:	($0)
Net Capital Expenditure:	$1,489k

- **Assumptions**
  Required outages are assumed to be able to be obtained within the requested timeframe. The control house is assumed to be placed in our initial location with no impact due to hard rocks underground. Weather is assumed to be fair enough to work on schedule with no delays to mobilization of contractors or delivery of material.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  Poor reliability and potential misoperations is a risk of not doing this project.
  Outages may be delayed due to system loading requirements, weather, or other outages in the area.

Conclusions and Recommendation
It is recommended that the Indian Hill Control House Replacement project be approved for $1,489k to enhance the reliability of the Transmission system.

Investment Proposal Project 156687 Carrollton-Clifty Creek Pole Replacement

Investment Proposal for Investment Committee Meeting on: August 29, 2018

Project Name: Carrollton-Clifty Creek Pole Replacement

Total Expenditures: $3,731k
Total Contingency: $339k (10%)

Project Number(s): 156687

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Andrew Bailey/Adam Smith

Executive Summary

The proposed project is to replace fifty-six (56) wood structures on the Carrollton-Clifty Creek 138kV line with steel. The scope of work includes the replacement of fifty-six (56) structures identified through inspection in 2017. Due to the difficulty in obtaining an extended outage, approximately 50% of the fifty-six (56) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $244k. This project will begin in January of 2019 and is being submitted for approval in 2018 to ensure the project will be open and ready for charges beginning January 1, 2019.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The current total project cost is $3,731k and was included in the 2018 Business Plan (BP) under the K9-2019 Priority Pole Replacement blanket for work to be completed in 2019.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Carrollton-Clifty Creek 138kV line was completed in 2017, and fifty-six (56) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $4,649
     Due to the difficulty in obtaining an extended outage, 50% of the fifty-six (56) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $244k and the NPVRR by $305k.
  2. Alternative #1: NPVRR: ($000s) $6,686
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $4,841
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing fifty-six (56) standard steel H-frame structures, and associated hardware and material, and the removal of fifty-six (56) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in January of 2019 and be completed in May of 2019.

Construction Milestones	
June 2018	Engineering and Design
July 2018	Space reserved for steel pole production with manufacturer
October 2018	Steel Poles Ordered
December 2018	Steel Poles Received
January 2019	Line Construction Begins

May 2019	Line Construction Completed

A facility map of the Carrollton-Clifty Creek 138kV line is shown below:

- **Project Cost**
  The current total project cost is $3,731k and was included in the 2018 Business Plan (BP) under the K9-2019 Priority Pole Replacement blanket for work to be completed in 2019. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $1,356k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,321k
Hardware	$35k
Total	$1,356k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	-	3,303	-	-	3,303
2. Cost of Removal Proposed	-	428	-	-	428
3. Total Capital and Removal Proposed (1+2)	-	3,731	-	-	3,731
4. Capital Investment 2018 BP	-	-	-	-	-
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	-	(3,303)	-	-	(3,303)
8. Cost of Removal variance to BP (5-2)	-	(428)	-	-	(428)
9. Total Capital and Removal variance to BP (6-3)	-	(3,731)	-	-	(3,731)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project was included in the 2018 BP under the K9-2019 Priority Replacement blanket for work to be completed in 2019.

Financial Summary:

Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$87k
Contract Labor:	$1,375k
Materials:	$1,356k
Local Engineering:	$257k
Burdens:	$317k
Contingency:	$339k
Reimbursements:	($0)
Net Capital Expenditure:	$3,731k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the fifty-six (56) structures will need to be completed with the 138kV line energized.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 40% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Carrollton-Clifty Creek 138kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Carrollton-Clifty Creek Pole Replacement project for $3,731k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	Chairman, CEO and President

Investment Proposal Project 156690 Paducah Primary-South Paducah Pole Replacement

Investment Proposal

Project Name: Paducah Primary-South Paducah Pole Replacement

Total Expenditures: $802k
Total Contingency: $73k (10%)

Project Number(s): 156690

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: David Todd/Adam Smith

Executive Summary

This AIP is to request approval to proceed with opening the Paducah Primary-South Paducah Pole Replacement project to ensure the project is open and active, and is ready for construction in early 2019. The proposed project is to replace ten (10) wood structures on the Paducah Primary-South Paducah 161kV line with new steel structures during a schedule outage. The scope of work includes the replacement of ten (10) structures identified through inspection in 2017.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $802k and is consistent with the proposed 2019 Business Plan.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Paducah Primary-South Paducah 161kV line was completed in 2017, and ten (10) structures were determined to be in need of replacement in order to ensure the integrity and reliability of this line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $852
     The recommendation is to replace all ten (10) wood structures with new steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $1,226
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $954
     The next best alternative would be to replace ten (10) existing wood structures with new wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

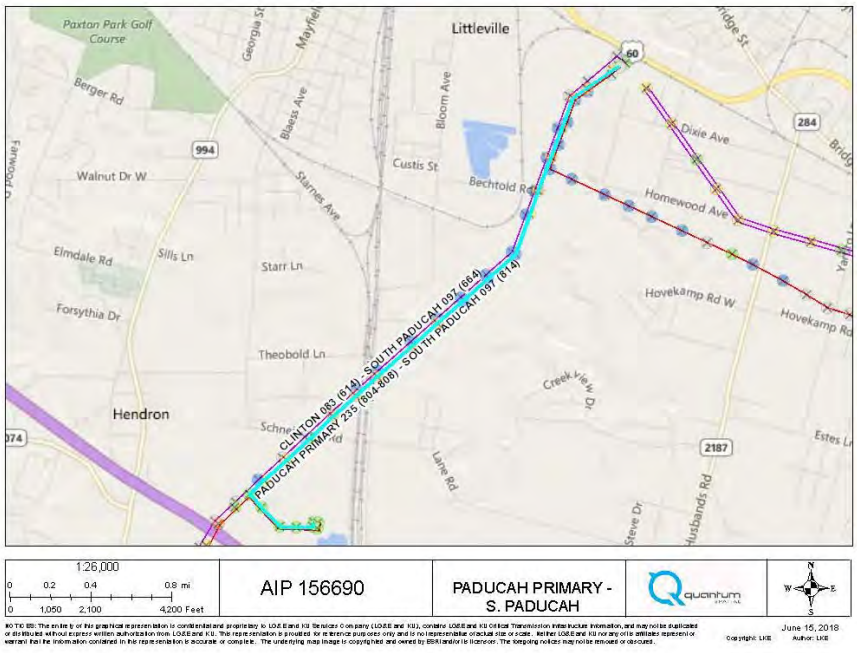
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing nine (9) standard steel H-frame structures, one (1) steel three-pole dead end structure, and associated hardware and material, and the removal of ten (10) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in January of 2019 and be completed in March of 2019.

Construction Milestones	
June 2018	Engineering and Design
August	Space Reserved with Steel Pole Manufacturer
October 2018	Steel Poles Ordered to Inventory
December 2018	Steel Poles Received to Inventory
January 2019	Material Charged

January 2019	Line Construction Begins
March 2019	Line Construction Completed

A facility map of the Paducah Primary-South Paducah 161kV line is shown below:
Line length: 2.61 miles Total structures in the line: 25



- **Project Cost**
  The total project cost is $802k and is consistent with the proposed 2019 Business Plan. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $266k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E.

Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$238k
Hardware	$28k
Total	$266k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	-	778	-	-	778
2. Cost of Removal Proposed	-	24	-	-	24
3. Total Capital and Removal Proposed (1+2)	-	802	-	-	802
4. Capital Investment 2018 BP	-	-	-	-	-
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	-	(778)	-	-	(778)
8. Cost of Removal variance to BP (5-2)	-	(24)	-	-	(24)
9. Total Capital and Removal variance to BP (6-3)	-	(802)	-	-	(802)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project is consistent with the proposed 2019 BP.

Financial Summary ($000s):

Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$19k
Contract Labor:	$325k
Materials:	$266k
Local Engineering:	$55k
Burdens:	$64k
Contingency:	$73k
Reimbursements:	($0)
Net Capital Expenditure:	$802k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all ten (10) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 41% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Paducah Primary-South Paducah 161kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Paducah Primary-South Paducah pole replacement project for $802k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project 156696 Eastwood-Shelbyville Pole Replacement

Investment Proposal for Investment Committee Meeting on: September 26, 2018

Project Name: Eastwood-Shelbyville Pole Replacement

Total Expenditures: $2,539k
Total Contingency: $231k

Project Number(s): 156696

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Tony Mount/Adam Smith

Executive Summary

The proposed project is to replace eighty-five (85) wood structures on the Eastwood-Shelbyville 69kV line with new steel structures during a scheduled outage. The scope of work includes the replacement of eighty-one (81) structures identified through inspection in 2017. The replacement of four (4) additional adjacent structures is required to accommodate the increased height of the new structures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

This project was included in the 2018 Business Plan for $2,139k under the K9-2019 pole replacement blanket for work to be completed in 2019. Subsequent to the 2018 BP planning, four (4) additional adjacent structures were identified to be in need of replacement in order to accommodate the height of the new structures. In addition, $200k was identified for traffic control and property reclamation. The current total project cost is $2,539k and is consistent with the proposed 2019 BP. The incremental funding of $400k was funded by a reduction in the K9-2019 pole replacement blanket.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Eastwood-Shelbyville 69kV line was completed in 2017, and eighty-one (81) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. Four (4) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. There are 255 total structures in this 12.25 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $3,163
     The recommendation is to replace all eighty-five (85) wood structures with new steel structures during a scheduled outage.
  2. Alternative #1: Do Nothing NPVRR: ($000s) $4,549
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $3,213
     The next best alternative would be to replace eighty-five (85) existing wood structures with new wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

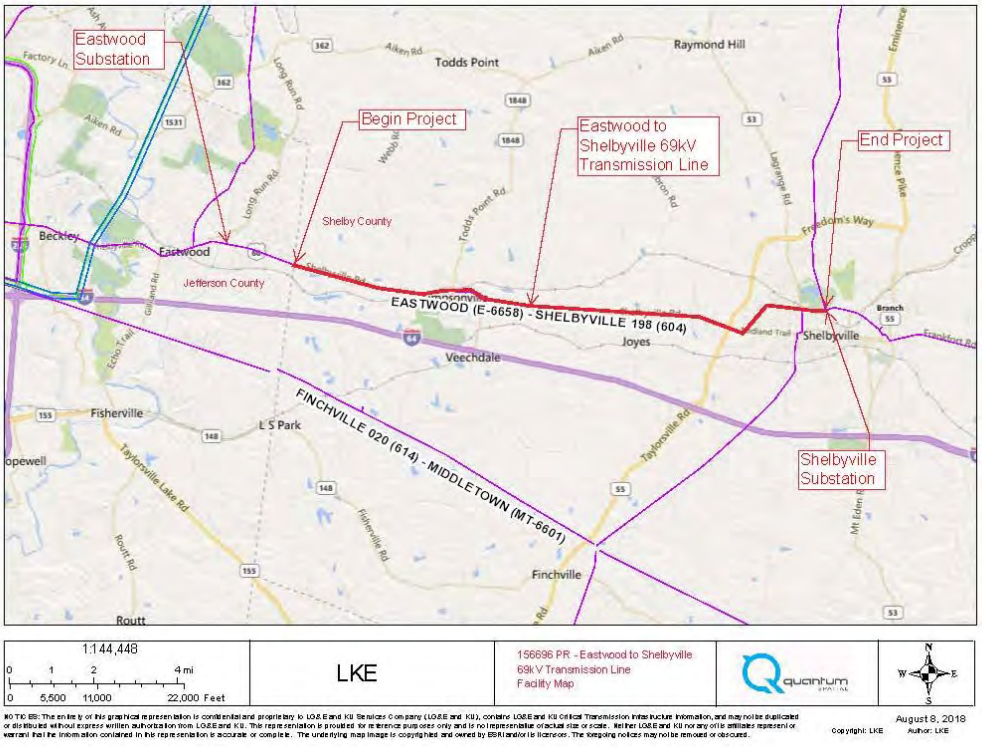
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing eighty-five (85) standard steel single pole structures, and associated hardware and material, and the removal of eighty-five (85) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in January of 2019 and be completed in April of 2019.

Construction Milestones	
June 2018	Engineering and Design
July 2018	Space Reserved with Steel Pole Manufacturer
October 2018	Steel Poles Ordered to Inventory

December 2018	Steel Poles Received to Inventory
January 2019	Material Charged
January 2019	Line Construction Begins
April 2019	Line Construction Completed

A facility map of the Eastwood-Shelbyville 69kV line is shown below:



- **Project Cost**
  This project was included in the 2018 Business Plan under the K9-2019 pole replacement blanket for $2,139k, for work to be completed in 2019. Subsequent to the 2018 BP planning, four (4) additional adjacent structures were identified to be in need of replacement in order to accommodate the height of the new structures. In addition, $200k was identified for traffic control and property reclamation. The current total project cost is $2,539k and is consistent with the proposed 2019 BP. The incremental funding of $400k was funded by a reduction in the K9-2019 pole replacement blanket. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $939k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$732k
Hardware	$207k
Total	$939k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	-	2,373	-	-	2,373
2. Cost of Removal Proposed		167	-	-	167
3. Total Capital and Removal Proposed (1+2)	-	2,539	-	-	2,539
4. Capital Investment 2018 BP	-	2,139	-	-	2,139
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	2,139	-	-	2,139
7. Capital Investment variance to BP (4-1)	-	(234)	-	-	(234)
8. Cost of Removal variance to BP (5-2)	-	(167)	-	-	(167)
9. Total Capital and Removal variance to BP (6-3)	-	(400)	-	-	(400)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project was included in the 2018 BP under the K9-2019 pole replacement blanket for $2,139k.

Financial Summary:	
Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$48k
Contract Labor:	$936k
Materials:	$939k
Local Engineering:	$176k
Burdens:	$209k
Contingency:	$231k
Reimbursements:	($0)
Net Capital Expenditure:	$2,539k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all eighty-five (85) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 22% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Eastwood-Shelbyville 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Shelbyville-Eastwood project for $2,539k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	Chairman, CEO and President

Investment Proposal Project 157999 KU Park-Middlesboro Pole Replacement

Investment Proposal

Project Name: KU Park-Middlesboro Pole Replacement

Total Expenditures: $935k
Total Contingency: $85k (10%)

Project Number(s): 157999

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Gary King/Adam Smith

Executive Summary

The proposed project is to replace twelve (12) wood structures on the KU Park-Middlesboro 69KV line with new steel structures during a schedule outage. The scope of work includes the replacement of ten (10) structures identified through inspection in 2016. The replacement of two (2) additional adjacent structures is required to accommodate the height of the new structures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project was included in the 2018 Business Plan (BP) under the K9-2018 Priority Pole Replacement blanket to replace nine (9) structures on the KU Park-Middlesboro 69kV line. Additional analysis of the inspection results identified one (1) additional structure for replacement, and two (2) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. In addition, additional funding in the amount of $150k was identified for incremental site clearing to gain access to right of way. The current total project cost is $935k and was approved in the RAC 9+3 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the KU Park-Middlesboro 69kV line was completed in 2016, and nine (9) structures were determined to be in need of replacement in order to ensure the integrity and reliability of this line. Additional analysis of the inspection results identified one (1) additional structure for replacement, and two (2) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. In addition, additional funding in the amount of $150k was identified for incremental site clearing to gain access to right of way.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,165
     The recommendation is to replace all twelve (12) wood structures with new steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $1,675
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $1,348
     The next best alternative would be to replace twelve (12) existing wood structures with new wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing eleven (11) standard steel H-frame structures, one (1) steel single pole structure, and associated hardware and material, and the removal of twelve (12) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in October of 2018 and be completed in December of 2018.

Construction Milestones	
June 2018	Engineering and Design
July 2018	Space Reserved with Steel Pole Manufacturer

August 2018	Steel Poles Ordered to Stock
September 2018	Steel Poles Received to Stock
November 2018	Line Construction Begins
December 2018	Line Construction Completed

A facility map of the Ku Park-Middlesboro 69kV line is shown below:
Line length: 13.14 miles

- **Project Cost**
  The current total project cost is $935k and was approved in the RAC 9+3 forecast.
  This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $280k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E.

Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$246k
Hardware	$34k
Total	$280k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	869	-	-	-	869
2. Cost of Removal Proposed	66	-	-	-	66
3. Total Capital and Removal Proposed (1+2)	935	-	-	-	935
4. Capital Investment 2018 BP	-	-	-	-	-
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	(869)	-	-	-	(869)
8. Cost of Removal variance to BP (5-2)	(66)	-	-	-	(66)
9. Total Capital and Removal variance to BP (6-3)	(935)	-	-	-	(935)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):	
Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$22
Contract Labor:	$425
Materials:	$280
Local Engineering:	$61
Burdens:	$62
Contingency:	$85
Reimbursements:	($0)
Net Capital Expenditure:	$935

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all twelve (12) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 39% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the KU Park-Middlesboro 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the KU Park-Middlesboro pole replacement project for $935k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000001 Leitchfield 138kV Tap Pole Replacement

Investment Proposal

Project Name: Leitchfield 138kV Tap Pole Replacement

Total Expenditures: $995k
Total Contingency: $90k (10%)

Project Number(s): LI-000001

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Ronnie Bradford/Adam Smith

Executive Summary

The proposed project is to replace twenty (20) wood structures identified through inspection on the Leitchfield Tap 138kV line with steel during a scheduled outage. To ensure construction of this project will begin in January of 2018, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2018.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $995k and in included in the proposed 2018 Business Plan (BP).

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Leitchfield 138kV Tap line was completed in 2014, and twenty (20) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. There are 59 total structures along this 8.43 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,266k
     The recommendation is to replace all twenty (20) structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $1,893k
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $1,233k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing seventeen (17) standard steel H-frames, three (3) steel three-pole running corners, and associated hardware and material, and the removal of twenty (20) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in January of 2018 and be completed in February of 2018.

Construction Milestones	
October 2017	Engineering and Design
November 2017	Steel Poles Ordered
January 2018	Steel Poles Received
January 2018	Line Construction Begins
February 2018	Line Construction Completed

A facility map of the Leitchfield 138kV Tap line is shown below:
Line length: 42.8 miles

- **Project Cost**
  The total project cost is $995k and is included in the proposed 2018 BP. To ensure construction of this project will begin in January of 2018, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2018. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $479k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner,

Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$450k
Hardware	$29k
Total	$479k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	-	921	-	-	921
2. Cost of Removal Proposed	-	74	-	-	74
3. Total Capital and Removal Proposed (1+2)	-	995	-	-	995
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	-	(921)	-	-	(921)
8. Cost of Removal variance to BP (5-2)	-	(74)	-	-	(74)
9. Total Capital and Removal variance to BP (6-3)	-	(995)	-	-	(995)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.32%
Capital Breakdown:	
Labor:	$11k
Contract Labor:	$270k
Materials:	$479k
Local Engineering:	$68k
Burdens:	$77k
Contingency:	$90k
Reimbursements:	($0)
Net Capital Expenditure:	$995k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all twenty (20) structures will be replaced during this timeframe.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 39% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Leitchfield 138kV Tap line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Leitchfield 138kV Tap pole replacement project for $995k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Revised Capital Investment Proposal Project LI-000001 Leitchfield Tap Pole Replacement

Investment Proposal

Project Name: Leitchfield Tap Pole Replacement

Total Approved Expenditures: $995k (Approved on 11/10/2017)

Total Revised Expenditures: $1,433k

Project Number(s): LI-000001

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Ronnie Bradford/Adam Smith

Reason for Revision
Prior to completion of the project, a transformer failure at River Queen changed system conditions resulting in the need to complete a portion of the work energized. Additionally, site access due to wet conditions created challenges which required additional crews and equipment support, including mud boats, large bulldozers, and cranes to complete this work beyond what was included in the original estimate.

Financial Summary

Financial Summary ($000s):	**Approved**	**Revised**
Discount Rate:	6.32%	6.58%
Capital Breakdown:		
Labor:	$11k	$41k
Contract Labor:	$270k	$710k
Materials:	$479k	$477k
Other	$0	$7k
Local Engineering:	$68k	$89k
Burdens	$77k	$109k
Contingency:	$90k	$0
Reimbursements:	($0)	($0)
Net Capital	$995k	$1,433k
Expenditure:		
NPVRR:	$1,266k	$1,728k

Financial Detail by Year - Capital ($000s)	Pre-2018	2018	2019	Post 2019	Total
1. Capital Investment Proposed	484	911	-	-	1,395
2. Cost of Removal Proposed		38	-	-	38
3. Total Capital and Removal Proposed (1+2)	484	949	-	-	1,433
4. Capital Investment 2018 BP	-	1,000	-	-	1,000
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	1,000	-	-	1,000
7. Capital Investment variance to BP (4-1)	(484)	89	-	-	(395)
8. Cost of Removal variance to BP (5-2)	-	(38)	-	-	(38)
9. Total Capital and Removal variance to BP (6-3)	(484)	51	-	-	(433)

Financial Detail by Year - O&M ($000s)	Pre-2018	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M Variance to BP (2-1)	-	-	-	-	-

Conclusions and Recommendation
It is recommended that Management approve the Leitchfield Tap pole replacement project for $1,433k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000002 Kenton-Carntown Pole Replacement

Investment Proposal for Investment Committee Meeting on: November 28, 2017

Project Name: Kenton-Carntown Pole Replacement

Total Expenditures: $2,559k
Total Contingency: $233k (10%)

Project Number(s): LI-000002

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Joe Mina/Adam Smith

Executive Summary

The proposed project is to replace forty-seven (47) wood structures on the Kenton-Carntown 69kV line with steel. The scope of work includes the replacement of forty-one (41) structures on the Kenton-Carntown 69kV line, and five (5) structures on the Augusta 69kV tap identified through inspections in 2015. The replacement of one (1) additional adjacent structure is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, approximately 50% of the forty-seven (47) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $370k. The project is being submitted for approval now to ensure the project will be approved and active beginning January 1, 2018, which is when construction is scheduled to begin.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the proposed 2018 Business Plan (BP) for $2,050k to replace forty-one (41) structures on the Kenton-Carntown 69kV line. Subsequent to the 2018 BP planning process, replacement of five structures on the Augusta 69kV tap were added to the project scope for project execution efficiencies. The Augusta 69kV tap is off of the Kenton-Carntown 69kV line. One adjacent structure will also need to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to complete 50% of the structures energized. The current total project cost is $2,559k. The difference of $509k was funded by a reduction in the K9-2018 Priority Pole Replacement blanket.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Kenton-Carntown 69kV line was completed in 2015, and forty-one (41) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. Subsequent to the 2018 BP planning process, five structures on the Augusta 69kV tap were added to project scope for project execution efficiencies. The August 69kV tap is off of the Kenton-Carntown 69kV line. One adjacent structure will also need to be replaced in order to accommodate the height of the new structures. There are 276 total structures along this 37.99 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $3,256
     Due to the difficulty in obtaining an extended outage, 50% of the forty-seven (47) wood structures will be energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $370k and the NPVRR by $470k.
  2. Alternative #1: NPVRR: ($000s) $4,870
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $3,904
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

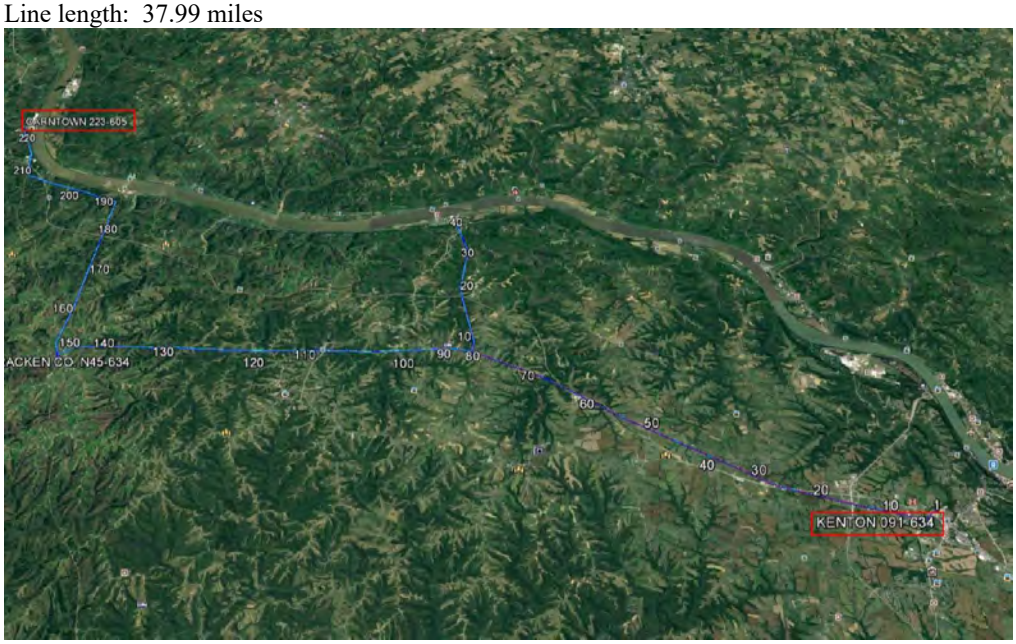
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing forty-four (44) standard steel H-frame structures, one (1) custom steel H-frame structure, one (1) steel three-pole dead end structure, one (1) steel three-pole running corner, and associated hardware and material, and the removal of forty-seven (47) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in January of 2018 and be completed in April of 2018.

Construction Milestones

October 2017	Engineering and Design
November 2017	Steel Poles Ordered
January 2018	Steel Poles Received
January 2018	Line Construction Begins
April 2018	Line Construction Completed

A facility map of the Kenton-Carntown 69kV line is shown below:
Line length: 37.99 miles



- **Project Cost**

The total project cost is $2,559k. The project is being submitted for approval now to ensure the project will be approved and active beginning January 1, 2018, which is when construction is scheduled to begin. The project is included in the proposed 2018 Business Plan (BP) for $2,050k. Subsequent to the 2018 BP planning, five (5) structures on the Augusta 69kV tap were added to the project scope for project execution efficiencies. One adjacent structure will also need to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to complete 50% of the structures energized. The current total project cost is $2,559k. The difference of $509k was funded by a reduction in the K9-2018 Priority Pole Replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**

Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $785k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$766k
Hardware	$19k
Total	$785k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	-	2,132	-	-	2,132
2. Cost of Removal Proposed	-	427	-	-	427
3. Total Capital and Removal Proposed (1+2)	-	2,559	-	-	2,559
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	-	(2,132)	-	-	(2,132)
8. Cost of Removal variance to BP (5-2)	-	(427)	-	-	(427)
9. Total Capital and Removal variance to BP (6-3)	-	(2,559)	-	-	(2,559)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.32%
Capital Breakdown:	
Labor:	$30k
Contract Labor:	$1,179k
Materials:	$785k
Local Engineering:	$179k
Burdens:	$153k
Contingency:	$233k
Reimbursements:	($0)
Net Capital Expenditure:	$2,559k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the forty-seven (47) structures will need to be completed with the 69kV line energized.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 45% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Kenton-Carntown 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Kenton-Carntown pole replacement project for $2,559k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Chief Financial Officer	Paul W. Thompson President and Chief Operating Officer

Investment Proposal Project LI-000004 Carrollton-Warsaw Pole Replacement

Investment Proposal

Project Name: Carrollton-Warsaw Pole Replacement

Total Expenditures: $1,023k
Total Contingency: $93k (10%)

Project Number(s): LI-000004

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Kelly Mefford/Adam Smith

Executive Summary

The proposed project is to replace fifteen (15) wood structures on the Carrollton-Warsaw 69kV line with steel. The scope of work includes the replacement of fourteen (14) structures identified through inspection. The replacement of one (1) additional adjacent structure is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, approximately 50% of the fifteen (15) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $112k. To ensure construction of this project will begin in February of 2018, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2018.

As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures. The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability.

The project is included in the proposed 2018 Business Plan (BP) for $600k. Subsequent to the 2018 BP planning, two (2) additional structures were identified and found to be in need of replacement. The replacement of one (1) additional adjacent structures is required to accommodate the increased height of the new structures. In addition, a decision was made to complete 50% of the structures energized. The current total project cost is $1,023k. The difference of $423k was funded by a reduction in the K9-2018 Priority Pole Replacement blanket.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Carrolton-Warsaw 69kV line was completed in 2016, and twelve (12) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. Subsequent to the 2016 BP planning, two (2) additional structures were identified and found to be in need of replacement. The replacement of one (1) additional adjacent structure is required to accommodate the increased height of the new structures. There are 198 total structures along this 18.47 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,302k
     Due to the difficulty in obtaining an extended outage, approximately 50% of the fifteen (15) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $112k and the NPVRR by $143k.
  2. Alternative #1: NPVRR: ($000s) $1,947k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $1,558k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

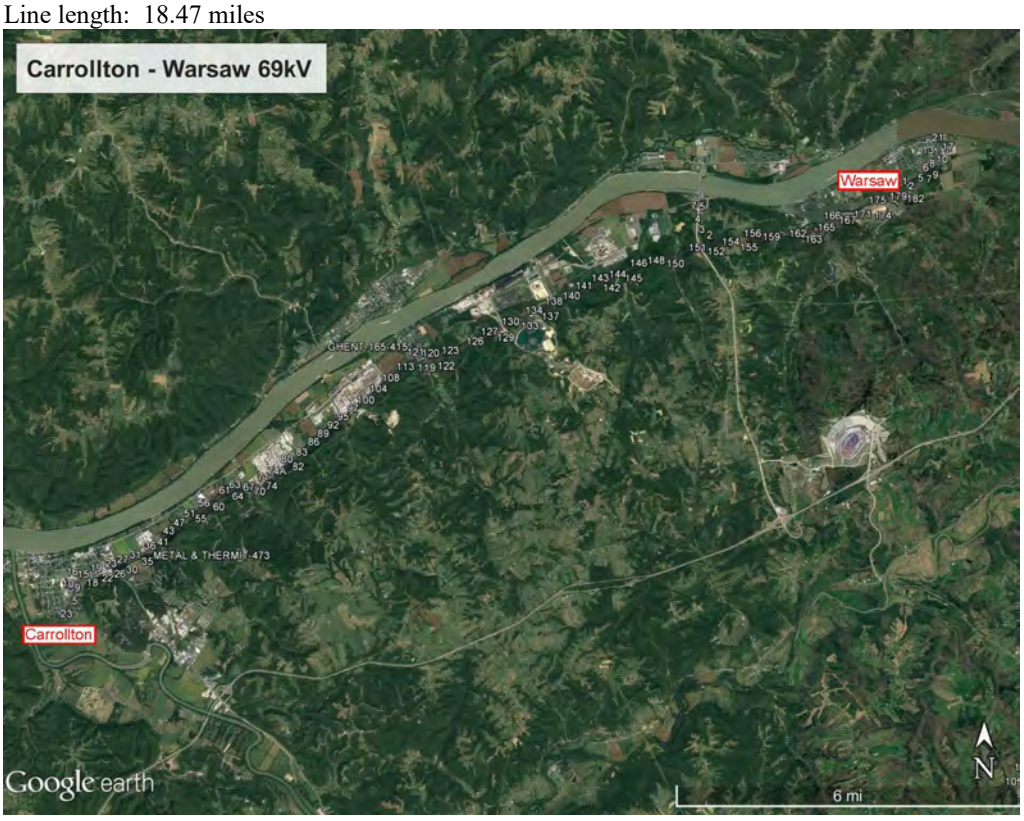
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing four (4) standard steel single pole structures, eight (8) standard steel H-frame structures, three (3) custom steel dead end structures, and associated hardware and material, and the removal of fifteen (15) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting (IC). The contract was re-approved by the IC in April 2017. Construction is scheduled to begin in February of 2018 and be completed in March of 2018.

Construction Milestones

October 2017	Engineering and Design
November 2017	Steel Poles Ordered
January 2018	Steel Poles Received
February 2018	Line Construction Begins
March 2018	Line Construction Completed

A facility map of the Carrollton-Warsaw 69kV line is shown below.
Line length: 18.47 miles



- **Project Cost**
  The total project cost is $1,023k. To ensure construction of this project will begin in February of 2018, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2018. The project is included in the proposed 2018 Business Plan (BP) for $600k. Subsequent to the 2018 BP planning, two (2) additional structures were identified and found to be in need of replacement. The replacement of one (1) additional adjacent structures is required to accommodate the increased height of the new structures. In addition, a decision was made to complete 50% of the structures energized. The current total project cost is $1,023k. The difference of $423k was funded by a reduction in the K9-2018 Priority Pole Replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains

a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $280k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$270k
Hardware	$10k
Total	$280k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	-	762	-	-	762
2. Cost of Removal Proposed	-	261	-	-	261
3. Total Capital and Removal Proposed (1+2)	-	1,023	-	-	1,023
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	-	(762)	-	-	(762)
8. Cost of Removal variance to BP (5-2)	-	(261)	-	-	(261)
9. Total Capital and Removal variance to BP (6-3)	-	(1,023)	-	-	(1,023)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.32%
Capital Breakdown:	
Labor:	$22k
Contract Labor:	$520k
Materials:	$280k
Local Engineering:	$73k
Burdens:	$35k
Contingency:	$93k
Reimbursements:	($0)
Net Capital Expenditure:	$1,023k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the fifteen (15) structures will need to be completed with the 69kV line energized.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 19% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Carrollton-Warsaw 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Carrollton-Warsaw Pole Replacement project for $1,023k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000005 Finchville-Bardstown Pole Replacement

Investment Proposal

Project Name: Finchville-Bardstown Pole Replacement

Total Expenditures: $1,336k
Total Contingency: $121k (10%)

Project Number(s): LI-000005

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Tony Mount/Adam Smith

Executive Summary

The proposed project is to replace twenty (20) wood structures on the Finchville-Bardstown 69kV line with steel, during a routine outage. The scope of work includes the replacement of twenty (20) structures identified through inspection in 2016.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $850k to replace twenty (20) structures on the Finchville-Bardstown 69kV line. Subsequent to the 2018 BP planning process, additional funding in the amount of $486k was identified for incremental site clearing and road building to gain access to the right-of way. The difference of $486k was funded by a reduction in the KOTH-2018 Priority Other Replacement blanket.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Finchville-Bardstown 69kV line was completed in 2016, and twenty (20) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line.

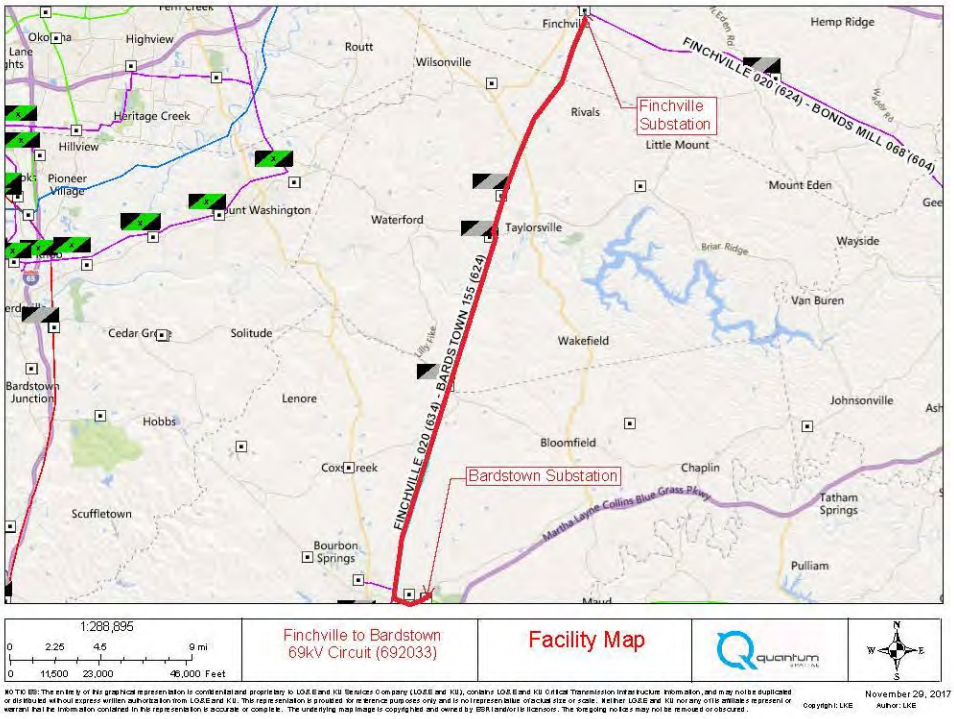
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,670k
     The recommendation is to replace all twenty (20) wood structures with steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $2,404k
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $1,903k
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing eighteen (18) standard steel H-frame structures, two (2) steel three-pole running corners, and associated hardware and material, and the removal of twenty (20) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in March of 2018 and be completed in May of 2018.

Construction Milestones	
December 2017	Engineering and Design
December 2017	Space reserved for steel pole production with steel pole manufacturer
January 2018	Steel poles ordered
February 2018	Steel Poles Received
March 2018	Line Construction Begins
May 2018	Line Construction Completed

A facility map of the Finchville-Bardstown 69kV line is shown below:
Line length: 25.48 Total structures in the line: 203



- **Project Cost**
  The total project cost is $1,336k. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $440k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$392k
Hardware	$48k
Total	$440k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	1,218	-	-	-	1,218
2. Cost of Removal Proposed	117	-	-	-	117
3. Total Capital and Removal Proposed (1+2)	1,336	-	-	-	1,336
4. Capital Investment 2018 BP	850	-	-	-	850
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	850	-	-	-	850
7. Capital Investment variance to BP (4-1)	(368)	-	-	-	(368)
8. Cost of Removal variance to BP (5-2)	(117)	-	-	-	(117)
9. Total Capital and Removal variance to BP (6-3)	(486)	-	-	-	(486)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$19k
Contract Labor:	$591k
Materials:	$440k
Local Engineering:	$80k
Burdens:	$85k
Contingency:	$121k
Reimbursements:	($0)
Net Capital Expenditure:	$1,336k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all twenty (20) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 42% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Finchville-Bardstown 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Finchville-Bardstown pole replacement project for $1,336k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000006 Beattyville-West Irvine Pole Replacement

Investment Proposal for Investment Committee Meeting on: December 20, 2017

Project Name: Beattyville-West Irvine Pole Replacement

Total Expenditures: $4,286k
Total Contingency: $390k (10%)

Project Number(s): LI-000006

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Addam Gooch/Adam Smith

Executive Summary
The proposed project is to replace seventy-four (74) wood structures on the Beattyville-West Irvine 69kV line with steel. The scope of work includes the replacement of sixty-one (61) structures identified through inspection in 2016. The replacement of thirteen (13) additional adjacent structures is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, approximately 50% of the seventy-four (74) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $459k.

The project was submitted for preliminary approval in November of 2017 for material purchases to begin in December of 2017. This will ensure the project remains on schedule for construction in early 2018. An Investment Proposal with total project estimates and NPVRR analysis will be prepared for review and approval by the Investment Committee (IC) in December. If IC approval is not received, the structures will be placed into inventory and used on future projects.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the proposed 2018 Business Plan (BP) for $3,250k to replace sixty-one (61) structures on the Beattyville-West Irvine 69kV line. Subsequent to the 2018 BP planning, thirteen (13) adjacent structures were added to the project scope and will need to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to complete 50% of the structures energized. The current total project cost is $4,286k. 2017 spend was funded by a reduction in project 148857 ($196k) and project K9-2017 ($674k). The

difference of $166k for spend in 2018 was funded by a reduction in the KOTH-2018 Priority Pole Replacement blanket.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Beattyville-West Irvine 69kV line was completed in 2016, and sixty-one (61) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. Subsequent to the 2018 BP planning, thirteen (13) adjacent structures were added to the project scope and will need to be replaced in order to accommodate the height of the new structures. There are 274 total structures along this 22.8 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $5,212k
     Due to the difficulty in obtaining an extended outage, 50% of the seventy-four (74) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $459k and the NPVRR by $549k.
  2. Alternative #1: NPVRR: ($000s) $8,053k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $6,762k
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing twenty-six (26) standard steel H-frame structures, thirty-four (34) standard steel Z-frame structures, four (4) steel single pole running corners, one (1) steel single pole dead end structure, eight (8) steel three-pole running corners, one (1) steel three-pole dead end structure, and associated hardware and material, and the removal of seventy-four (74) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded

the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in February of 2018 and be completed in July of 2018.

Construction Milestones	
November 2017	Engineering and Design
December 2017	Steel Poles Ordered
January 2018	Steel Poles Received
February 2018	Line Construction Begins
July 2018	Line Construction Completed

A facility map of the Beattyville-West Irvine 69kV line is shown below:
Line length: 22.8 miles

- **Project Cost**
  The total project cost is $4,286k. To ensure construction of this project will begin in February of 2018, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2018. The project is included in the proposed 2018 Business Plan (BP) for $3,250k to replace sixty-one (61) structures on the Beattyville-West Irvine 69kV line. Subsequent to the 2018 BP planning, thirteen (13) adjacent structures were added to the project scope and will need to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to complete 50% of the structures energized. The current total project cost is $4,286k. The difference of $1,036k was funded by a reduction in the KOTH-2018 Priority Pole Replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $1,127k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,043k
Hardware	$84k
Total	$1,127k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	870	2,698	-	-	3,568
2. Cost of Removal Proposed	-	718	-	-	718
3. Total Capital and Removal Proposed (1+2)	870	3,416	-	-	4,286
4. Capital Investment 2018 BP	-	3,250	-	-	3,250
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	3,250	-	-	3,250
7. Capital Investment variance to BP (4-1)	(870)	552	-	-	(318)
8. Cost of Removal variance to BP (5-2)	-	(718)	-	-	(718)
9. Total Capital and Removal variance to BP (6-3)	(870)	(166)	-	-	(1,036)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project was not budgeted as an individual project in the 2017 BP.

Financial Summary ($000s):
Discount Rate: 6.32%
Capital Breakdown:
Labor: $45k

Contract Labor:	$2,255k
Materials:	$1,127k
Local Engineering:	$313k
Burdens:	$156k
Contingency:	$390k
Reimbursements:	($0)
Net Capital Expenditure:	$4,286k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the seventy-four (74) structures will need to be completed with the 69kV line energized.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 38% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Beattyville-West Irvine 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Beattyville-West Irvine Pole Replacement project for $4,286k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake
Chief Financial Officer

Paul W. Thompson
President and Chief Operating Officer

Investment Proposal Project LI-000008 Boyle County-Lancaster Pole Replacement

Investment Proposal for Investment Committee Meeting on: January 31, 2018

Project Name: Boyle County-Lancaster Pole Replacement

Total Expenditures: $4,171k
Total Contingency: $379k (10%)

Project Number(s): LI-000008

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Addam Gooch/Adam Smith

Executive Summary

The proposed project is to replace ninety-seven (97) wood structures on the Boyle County-Lancaster 69kV line with steel. The scope of work includes the replacement of eighty-two (82) structures identified through inspection in 2016. The replacement of fifteen (15) additional adjacent structures is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, approximately 25% of the ninety-seven (97) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $268k.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $3,600k to replace seventy-two (72) structures on the Boyle County-Lancaster 69kV line. Subsequent to the 2018 BP planning, additional analysis of the inspection results identified ten (10) additional structures for replacement. Fifteen (15) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to complete 25% of the structures energized. The current total project cost is $4,171k and the incremental funding of $571k was approved in the RAC 0+12 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Boyle County-Lancaster 69kV line was completed in 2016, and seventy-two (72) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. Subsequent to the 2018 BP planning, additional analysis of the inspection results identified ten (10) additional structures for replacement. Fifteen (15) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to complete 25% of the structures energized. There are 304 total structures along this 21.5 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $5,215
     Due to the difficulty in obtaining an extended outage, 25% of the ninety-seven (97) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $268k and the NPVRR by $335k.
  2. Alternative #1: NPVRR: ($000s) $7,504
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $5,873
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

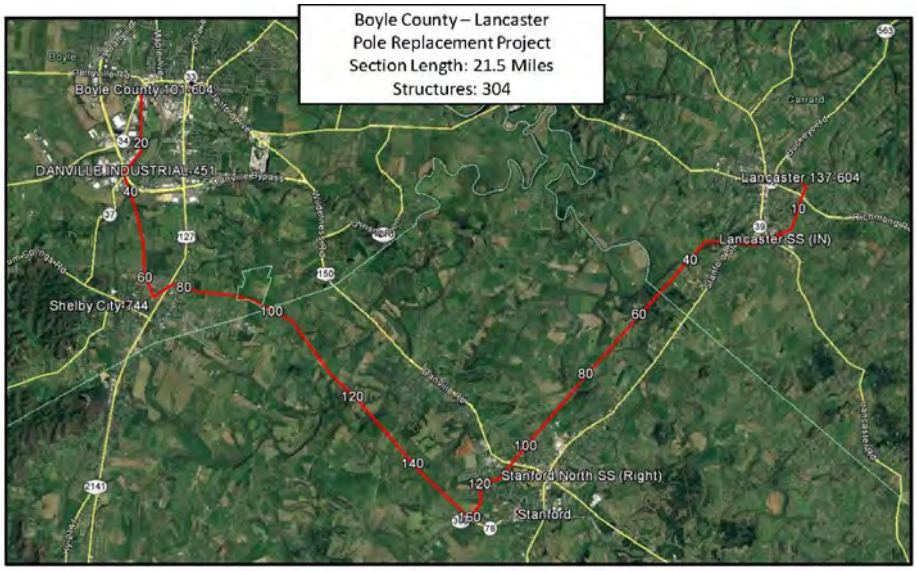
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty (30) standard steel H-frame structures, two (2) custom steel H-frame structures, fifty-eight (58) standard steel Z-frame structures, three (3) steel single pole running corners, three (3) steel single pole dead end structures, one (1) steel three-pole running corner, and associated hardware and material, and the removal of ninety-seven (97) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in

April of 2017. Construction is scheduled to begin in March of 2018 and be completed in August of 2018.

Construction Milestones	
November 2017	Engineering and Design
December 2017	Space reserved for steel pole production with manufacturer
January 2018/February 2018	Steel Poles Ordered upon Project Approval
February 2018	Steel Poles Received
March 2018	Line Construction Begins
August 2018	Line Construction Completed

A facility map of the Boyle County-Lancaster 69kV line is shown below:
Line length: 21.5 miles



- **Project Cost**
  The total project cost is $4,171k. The project is included in the 2018 Business Plan (BP) for $3,600k to replace seventy-two (72) structures on the Boyle County-Lancaster 69kV line. Subsequent to the 2018 BP planning, additional analysis of the inspection results identified ten (10) additional structures for replacement. Fifteen (15) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to complete 25% of the structures energized. The current total project cost is $4,171k and the incremental funding of $571k was approved by the RAC in the 0+12 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and

contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $1,272k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,185k
Hardware	$87k
Total	$1,272k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	-	3,369	-	-	3,369
2. Cost of Removal Proposed	-	801	-	-	801
3. Total Capital and Removal Proposed (1+2)	-	4,171	-	-	4,171
4. Capital Investment 2018 BP	-	3,600	-	-	3,600
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	3,600	-	-	3,600
7. Capital Investment variance to BP (4-1)	-	231	-	-	231
8. Cost of Removal variance to BP (5-2)	-	(801)	-	-	(801)
9. Total Capital and Removal variance to BP (6-3)	-	(571)	-	-	(571)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):	
Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$45k
Contract Labor:	$1,980k
Materials:	$1,272k
Local Engineering:	$251k
Burdens:	$244k
Contingency:	$379k
Reimbursements:	($0)
Net Capital Expenditure:	$4,171k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 25% of the ninety-seven (97) structures will need to be completed with the 69kV line energized.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 37% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Boyle County-Lancaster 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Boyle County-Lancaster Pole Replacement project for $4,171k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	President and Chief Operating Officer

Investment Proposal Project LI-000009 Clinton-Wickliffe Pole Replacement

Investment Proposal

Project Name: Clinton-Wickliffe Pole Replacement

Total Expenditures: $1,766k
Total Contingency: $161k (10%)

Project Number(s): LI-000009

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Ronnie Bradford/Adam Smith

Executive Summary
The proposed project is to replace thirty-four (34) wood structures on the Clinton-Wickliffe 69kV line with steel, during a routine outage. The scope of work includes the replacement of thirty-four (34) structures identified through inspection in 2017.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $1,700k to replace thirty-four (34) structures on the Clinton-Wickliffe 69kV line. Subsequent to the 2018 BP planning process, additional funding in the amount of $66k was identified for incremental site clearing to gain access to the right-of way. The total project cost is $1,766k and was approved by the RAC in the 0+12 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Clinton-Wickliffe 69kV line was completed in 2017, and thirty-four (34) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line.

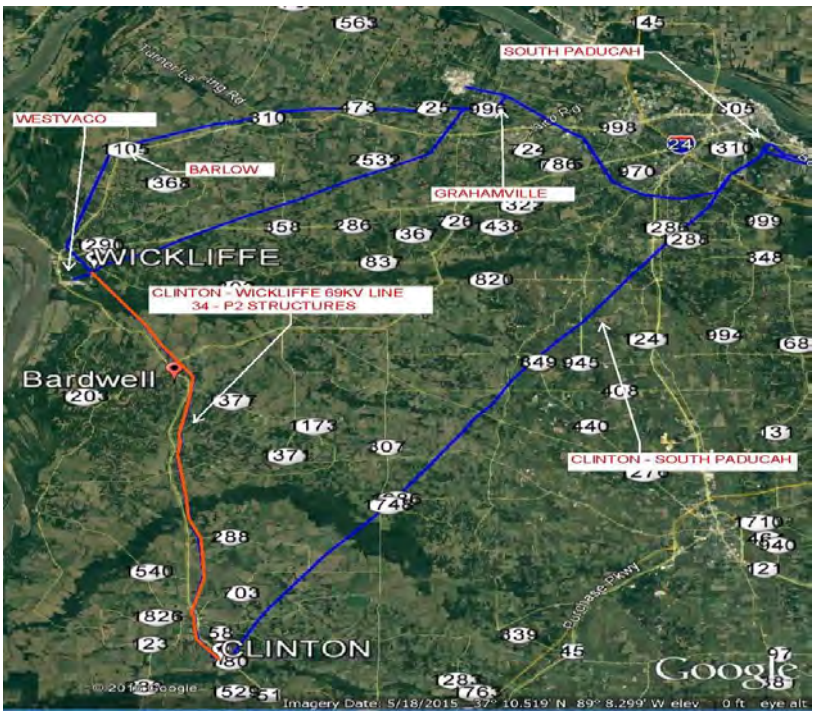
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,208k
     The recommendation is to replace all thirty-four (34) wood structures with steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $3,178k
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $2,338k
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty-four (34) steel H-frame structures, and associated hardware and material, and the removal of thirty-four (34) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in April of 2018 and be completed in May of 2018.

Construction Milestones	
January 2018	Engineering and Design
January 2018	Space reserved for steel pole production with steel pole manufacturer
February 2018	Steel poles ordered
March 2018	Steel Poles Received
April 2018	Line Construction Begins
May 2018	Line Construction Completed

A facility map of the Clinton-Wickliffe 69kV line is shown below:
Line length: 23.56 miles Total structures in the line: 204



- **Project Cost**
  The total project cost is $1,766k. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $756k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$683k
Hardware	$73k
Total	$756k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	1,678	-	-	-	1,678
2. Cost of Removal Proposed	88	-	-	-	88
3. Total Capital and Removal Proposed (1+2)	1,766	-	-	-	1,766
4. Capital Investment 2018 BP	1,700	-	-	-	1,700
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	1,700	-	-	-	1,700
7. Capital Investment variance to BP (4-1)	22	-	-	-	22
8. Cost of Removal variance to BP (5-2)	(88)	-	-	-	(88)
9. Total Capital and Removal variance to BP (6-3)	(66)	-	-	-	(66)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$32k
Contract Labor:	$576k
Materials:	$756k
Local Engineering:	$104k
Burdens:	$137k
Contingency:	$161k
Reimbursements:	($0)
Net Capital Expenditure:	$1,766k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all thirty-four (34) structures will be completed during the scheduled outage.

Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 44% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Clinton-Wickliffe 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Clinton-Wickliffe Pole Replacement project for $1,766k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000010 Spencer Road-Farmers Pole Replacement

Investment Proposal

Project Name: Spencer Road-Farmers Pole Replacement

Total Expenditures: $973k
Total Contingency: $88k (10%)

Project Number(s): LI-000010

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Gary King/Adam Smith

Executive Summary

The proposed project is to replace twenty-six (26) wood structures on the Spencer Road-Farmers 69kV line during a scheduled outage. The scope of work includes the replacement of thirteen (13) existing wood structures with new steel structures, and thirteen (13) existing wood structures with new wood structures. All twenty-six (26) structures were identified through inspection in 2015. Utilizing wood to replace thirteen (13) structures will allow for the replacement of the poles and enable the line to continue to operate as designed until the conductor is replaced and the line rebuilt. The age and type of the existing conductor indicate that a portion of the line will need to be rebuilt before the expected useful life of the new wood poles is exhausted. Based on current condition and replacement priority of the conductor, the plan is to rebuild the line with preliminary engineering beginning in 2019 and construction to occur in years 2020-2022 (project 152706).

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $973k and is included in the 2018 Business Plan (BP).

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Spencer Road-Farmers 69kV line was completed in 2015, and twenty-six (26) structures were identified and determined to be in need of replacement in order to ensure the integrity and reliability of this line.

In addition to the poles needing to be replaced as soon as possible, the age and type of the existing conductor along this line indicate that this line will need to be rebuilt within the next ten years. The current plan (2018 BP) includes a project to rebuild the line with preliminary engineering beginning in 2019, and construction to occur in years 2020-2022 (project 152706).

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,217
     The recommendation is to replace all twenty-six (26) structures during a scheduled outage.
  2. Alternative #1: Do Nothing NPVRR: ($000s) $1,751
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.

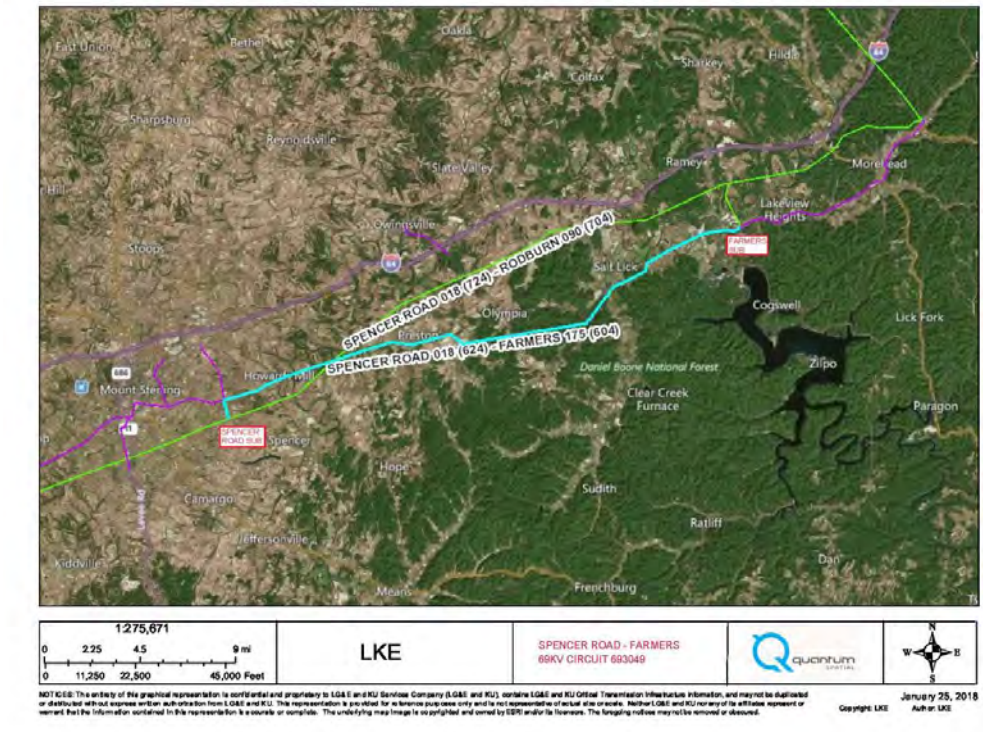
  3. Alternative #2: Recommendation plus rebuild in 2 years NPVRR: ($000s) $13,779
     This alternative would replace the structures in 2018 and rebuild the line in 2020-2022, consistent with the BP. The rebuild project is not being requested at this time. Analysis was completed to determine if the rebuild could be accelerated. Due to the amount of time needed for engineering, and the condition of (13) of the wood structures, it was determined that engineering and construction could not feasibly be completed soon enough to avoid having to replace the 13 structures with wood while still maintaining the integrity and reliability of the line.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing four (4) standard steel H-frame structures, nine (9) standard steel single pole structures, thirteen (13) standard wood structures, and associated hardware and material, and the removal of twenty-six (26) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in May of 2018 and be completed in July of 2018.

Construction Milestones	
January 2018	Engineering and Design
February 2018	Space reserved for steel pole production with steel pole manufacturer
March 2018	Steel poles ordered
April 2018	Steel poles received
April 2018	Wood poles charged
May 2018	Line Construction Begins
July 2018	Line Construction Completed

A facility map of the Spencer Road-Farmers 69kv line is shown below:
Line length: 21.90 miles Total structures in the line: 363



- **Project Cost**
  The total project cost is $973k and is included in the 2018 BP. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $180k. This project will utilize standard steel and wood structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$147k
Wood Poles	$14k
Hardware	$19k
Total	$180k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	895	-	-	-	895
2. Cost of Removal Proposed	78	-	-	-	78
3. Total Capital and Removal Proposed (1+2)	973	-	-	-	973
4. Capital Investment 2018 BP	1,800	-	-	-	1,800
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	1,800	-	-	-	1,800
7. Capital Investment variance to BP (4-1)	905	-	-	-	905
8. Cost of Removal variance to BP (5-2)	(78)	-	-	-	(78)
9. Total Capital and Removal variance to BP (6-3)	827	-	-	-	827

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$28k
Contract Labor:	$561k
Materials:	$180
Local Engineering:	$58k
Burdens:	$58k

Contingency:	$88k
Reimbursements:	($0)
Net Capital Expenditure:	$973k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all twenty-six (26) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – Utilizing wood poles would be the best use of existing resources. Due to the age of the conductor, a portion of the Spencer Road-Farmers 69kV line will need to be re-built.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Spencer Road-Farmers 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Spencer Road-Farmers Pole Replacement project for $973k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000011 Millersburg-Renaker Pole Replacement

Investment Proposal for Investment Committee Meeting on: January 31, 2018

Project Name: Millersburg-Renaker Pole Replacement

Total Expenditures: $2,286k
Total Contingency: $208k (10%)

Project Number(s): LI-000011

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Joe Mina/Adam Smith

Executive Summary
The proposed project is to replace forty-two (42) wood structures on the Millersburg-Renaker 69kV line with steel, during a routine outage. The scope of work includes the replacement of forty-two (42) structures identified through inspections in 2014.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $2,100k to replace forty-two (42) structures on the Millersburg-Renaker 69kV line. Subsequent to the 2018 BP planning process, additional funding in the amount of $103k was identified for incremental site clearing and road building to gain access to the right-of way. In addition, the material estimate included in the 2018 BP was entered on a non-burdenable expenditure type. Once the burdens were calculated on the correct expenditure type, the total project cost increased an additional $83k. The total project cost is $2,286k and the incremental funding of $186k was approved by the RAC in the 0+12 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Millersburg-Renaker 69kV line was completed in 2014, and forty-two (42) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line.

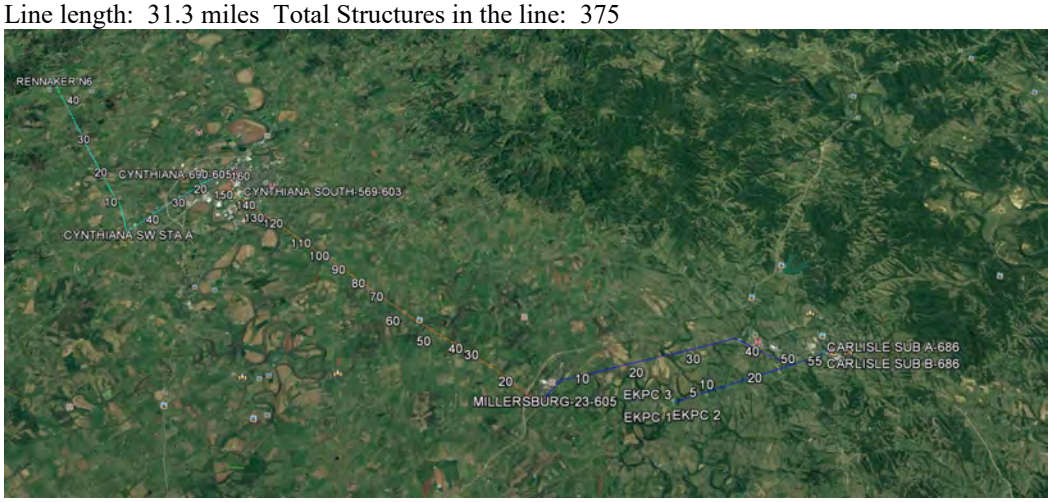
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,858
     The recommendation is to replace all forty-two (42) wood structures with steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $4,113
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $3,152
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty-seven (37) standard steel H-frame structures, four (4) custom steel H-frame structures, one (1) steel three-pole running corner, and associated hardware and material, and the removal of forty-two (42) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in April of 2018 and be completed in June of 2018.

Construction Milestones	
January 2018	Engineering and Design
January 2018	Space reserved for steel pole production with steel pole manufacturer
February 2018	Steel Poles Ordered
March 2018	Steel Poles Received
April 2018	Line Construction Begins
June 2018	Line Construction Completed

A facility map of the Millersburg-Renaker 69kV line is shown below:
Line length: 31.3 miles Total Structures in the line: 375



- **Project Cost**
  The total project cost is $2,286k and the incremental funding of $186k was approved by the RAC in the 0+12 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $752k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$730k
Hardware	$22k
Total	$752k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	2019	Post 2019	Total
1. Capital Investment Proposed	-	1,979	-	-	1,979
2. Cost of Removal Proposed	-	307	-	-	307
3. Total Capital and Removal Proposed (1+2)	-	2,286	-	-	2,286
4. Capital Investment 2018 BP	-	2,100	-	-	2,100
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	2,100	-	-	2,100
7. Capital Investment variance to BP (4-1)	-	121	-	-	121
8. Cost of Removal variance to BP (5-2)	-	(307)	-	-	(307)
9. Total Capital and Removal variance to BP (6-3)	-	(186)	-	-	(186)

Financial Detail by Year - O&M ($000s)	2017	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$49k
Contract Labor:	$985k
Materials:	$752k
Local Engineering:	$134k
Burdens:	$158k
Contingency:	$208k
Reimbursements:	($0)
Net Capital Expenditure:	$2,286k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all forty-two (42) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 40% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Millersburg-Renaker 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Millersburg-Renaker pole replacement project for $2,286k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	President and Chief Operating Officer

Investment Proposal Project LI-000012 Carrollton-Eminence Pole Replacement

Investment Proposal for Investment Committee Meeting on: January 31, 2018

Project Name: Carrollton-Eminence Pole Replacement

Total Expenditures: $2,697k
Total Contingency: $245k (10%)

Project Number(s): LI-000012

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Tony Mount/Adam Smith

Executive Summary
The proposed project is to replace forty-eight (48) wood structures on the Carrollton-Eminence 69kV line with steel, during a routine outage. The scope of work includes the replacement of forty-eight (48) structures identified through inspections in 2015.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $2,400k to replace forty-eight (48) structures on the Carrollton-eminence 69kV line. Subsequent to the 2018 BP planning process, additional funding in the amount of $175k was identified for incremental site clearing and road building to gain access to the right-of way. In addition, the material estimate included in the 2018 BP was entered on a non-burdenable expenditure type. Once the burdens were calculated on the correct expenditure type, the total project cost increased an additional $122k. The total project cost is $2,697k and the incremental funding of $297k was approved by the RAC in the 0+12 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Carrollton-Eminence 69kV line was completed in 2015, and forty-eight (48) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. There are 249 total structures along this 21.1 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $3,373
     The recommendation is to replace all forty-eight wood structures with steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $4,852
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $3,489
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

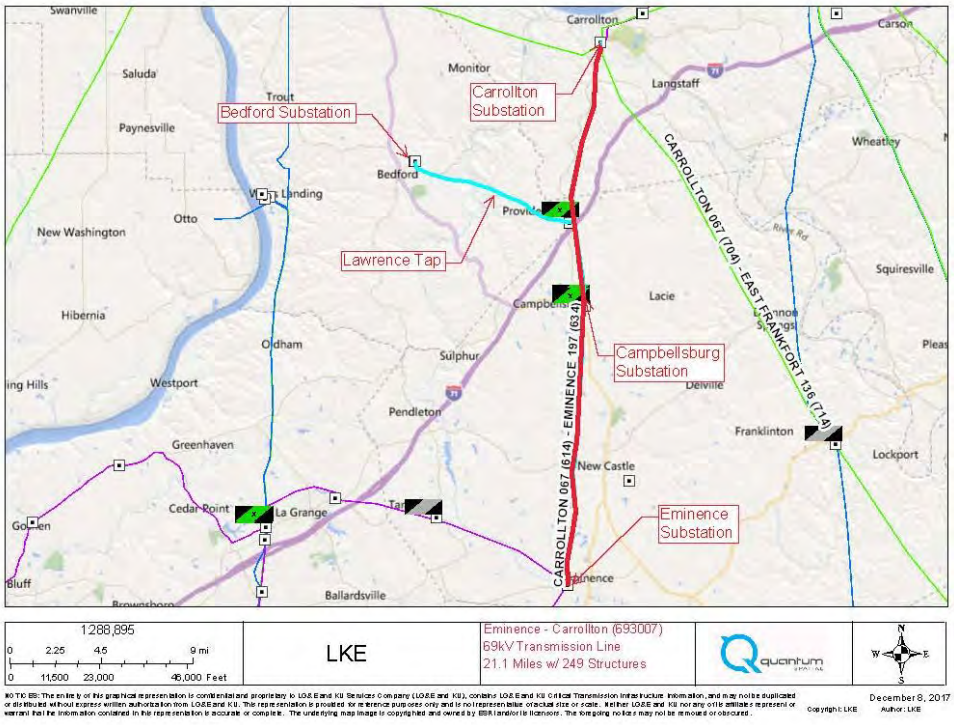
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing forty-five (45) standard steel H-frame structures, one (1) custom steel H-frame structure, two (2) steel three-pole running corners, and associated hardware and material, and the removal of forty-eight (48) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in April of 2018 and be completed in June of 2018.

Construction Milestones	
December 2017	Engineering and Design
February 2018	Steel Poles Ordered
March 2018	Steel Poles Received

April 2018	Line Construction Begins
June 2018	Line Construction Completed

A facility map of the Carrollton-Eminence 69kV line is shown below:
Line length: 21.1 miles



- **Project Cost**
  The project is included in the 2018 Business Plan (BP) for $2,400k to replace forty-eight (48) structures on the Carrollton-eminence 69kV line. Subsequent to the 2018 BP planning process, additional funding in the amount of $175k was identified for incremental site clearing and road building to gain access to the right-of way. In addition, the material estimate included in the 2018 BP was entered on a non-burdenable expenditure type. Once the burdens were calculated on the correct expenditure type, the total project cost increased an additional $122k. The total project cost is $2,697k and the incremental funding of $297k was approved by the RAC in the 0+12 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $1,110k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$1,022k
Hardware	$88k
Total	$1,110k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	-	2,497	-	-	2,497
2. Cost of Removal Proposed		201	-	-	201
3. Total Capital and Removal Proposed (1+2)	-	2,697	-	-	2,697
4. Capital Investment 2018 BP	-	2,400	-	-	2,400
5. Cost of Removal 2018 BP		-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	2,400	-	-	2,400
7. Capital Investment variance to BP (4-1)	-	(97)	-	-	(97)
8. Cost of Removal variance to BP (5-2)	-	(201)	-	-	(201)
9. Total Capital and Removal variance to BP (6-3)	-	(297)	-	-	(297)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$42k
Contract Labor:	$944k
Materials:	$1,110k
Local Engineering:	$158k
Burdens:	$198k

Contingency:	$245k
Reimbursements:	($0)
Net Capital Expenditure:	$2,697k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all forty-eight (48) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 38% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Carrollton-Eminence 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Carrollton-Eminence Pole Replacement project for $2,697k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	President and Chief Operating Officer

Investment Proposal Eminence-Shelbyville Pole Replacement

Investment Proposal

Project Name: Eminence-Shelbyville Pole Replacement

Total Expenditures: $1,256k
Total Contingency: $114k (9%)

Project Number(s): LI-000013

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Tony Mount/Adam Smith

Executive Summary

The proposed project is to replace fifteen (15) wood structures on the Eminency-Shelbyville 69kV line with steel. The scope of work includes the replacement of fifteen (15) structures identified through inspection in 2015. Due to the difficulty in obtaining an extended outage, all fifteen (15) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $184k.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $750k to replace fifteen (15) structures on the Eminence-Shelbyville 69kV line. Subsequent to the 2018 BP planning process, a decision was made to complete all fifteen (15) structures energized. In addition, funding in the amount of $140k was identified for incremental site clearing and road building to gain access to the right-of way. The total project cost is $1,256k and the incremental funding of $506k was approved by the RAC in the 3+9 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Eminence-Shelbyville 69kV line was completed in 2015, and fifteen (15) structures were identified and determined to be in need of replacement in order to ensure the integrity and reliability of this line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,570
     Due to the difficulty in obtaining an extended outage, all fifteen (15) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $184k and the NPVRR by $230k.
  2. Alternative #1: NPVRR: ($000s) $2,260
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $1,787
     The next best alternative would be to replace the fifteen (15) existing wood structures with new wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

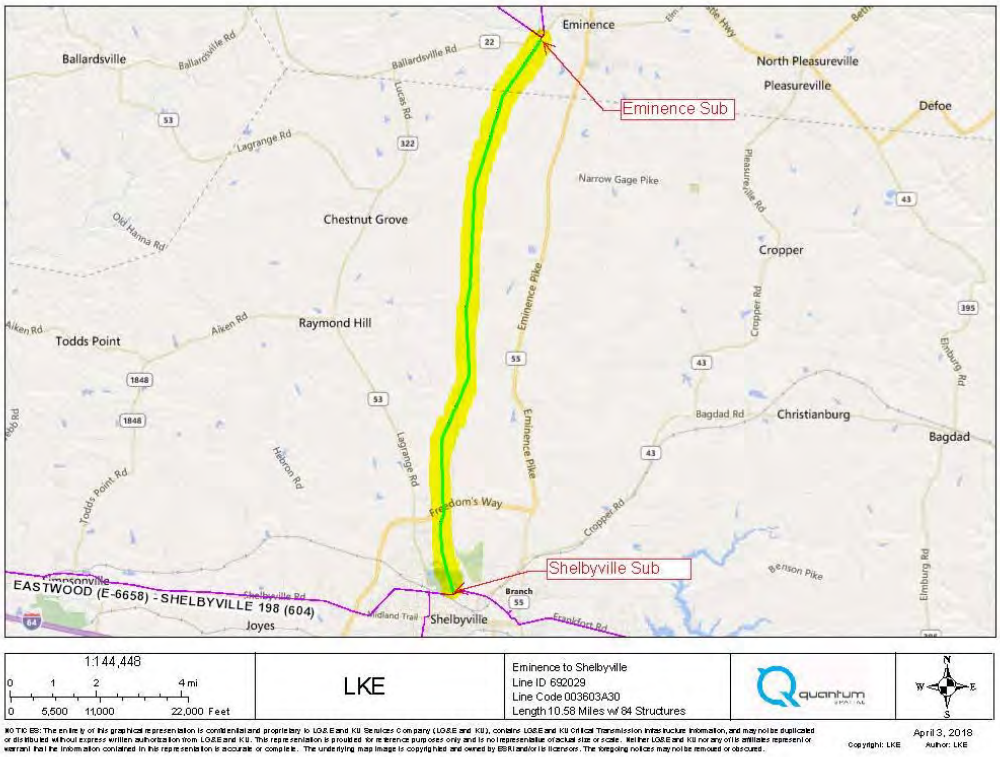
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirteen (13) standard steel H-frame structures, two (2) steel three-pole running corners, and associated hardware and material, and the removal of fifteen (15) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in July of 2018 and be completed in September of 2018.

Construction Milestones	
April 2018	Engineering and Design
April 2018	Space Reserved with Steel Pole Manufacturer
May 2018	Steel Poles Ordered
June 2018	Steel Poles Received

July 2018	Line Construction Begins
September 2018	Line Construction Completed

A facility map of the Eminence-Shelbyville 69kV line is shown below:
Line length: 10.58 miles Total structures in line: 84



- **Project Cost**
  The project is included in the 2018 Business Plan (BP) for $750k to replace fifteen (15) structures on the Eminence-Shelbyville 69kV line. Subsequent to the 2018 BP planning process, a decision was made to complete all fifteen (15) structures energized. In addition, funding in the amount of $140k was identified for incremental site clearing and road building to gain access to the right-of way. The total project cost is $1,256k and the incremental funding of $506k was approved by the RAC in the 3+9 forecast. This project contains a 9% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $324k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$300k
Hardware	$24k
Total	$324k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	1,064	-	-	-	1,064
2. Cost of Removal Proposed	192	-	-	-	192
3. Total Capital and Removal Proposed (1+2)	1,256	-	-	-	1,256
4. Capital Investment 2018 BP	750	-	-	-	750
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	750	-	-	-	750
7. Capital Investment variance to BP (4-1)	(314)	-	-	-	(314)
8. Cost of Removal variance to BP (5-2)	(192)	-	-	-	(192)
9. Total Capital and Removal variance to BP (6-3)	(506)	-	-	-	(506)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$29k
Contract Labor:	$620k
Materials:	$324k
Local Engineering:	$90k

Burdens:	$79k
Contingency:	$114k
Reimbursements:	($0)
Net Capital Expenditure:	$1,256k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and all fifteen (15) structures will need to be completed with the 69kV line energized.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 28% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Eminence-Shelbyville 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Eminence-Shelbyville pole replacement project for $1,256k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000015 Lake Reba-West Irvine Pole Replacement

Investment Proposal

Project Name: Lake Reba-West Irvine Pole Replacement

Total Expenditures: $1,148k
Total Contingency: $104k (10%)

Project Number(s): LI-000015

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Gary King/Adam Smith

Executive Summary

The proposed project is to replace eighteen (18) wood structures on the Lake Reba-West Irvine 69kV line with steel during a scheduled outage. The scope of work includes the replacement of seventeen (17) structures identified through inspection in 2016. The replacement of one (1) additional adjacent structure is required to accommodate the increased height of the new structures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $850k to replace seventeen (17) structures on the Lake Reba-West Irvine 69kV line. Subsequent to the 2018 BP planning, one (1) adjacent structure was added to the project scope and will need to be replaced in order to accommodate the height of the new structures. In addition, additional funding in the amount of $75k was identified for incremental site clearing to gain access to the right-of-way. The total project cost is $1,148k and was approved by the RAC in the 1+11 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Lake Reba-West Irvine 69kV line was completed in 2016, and seventeen (17) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. In addition, one (1) adjacent structure was added to the project scope and will need to be replaced in order to accommodate the height of the new structures.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,436
     The recommendation is to replace all eighteen (18) wood structures with steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $2,065
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $1,607
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

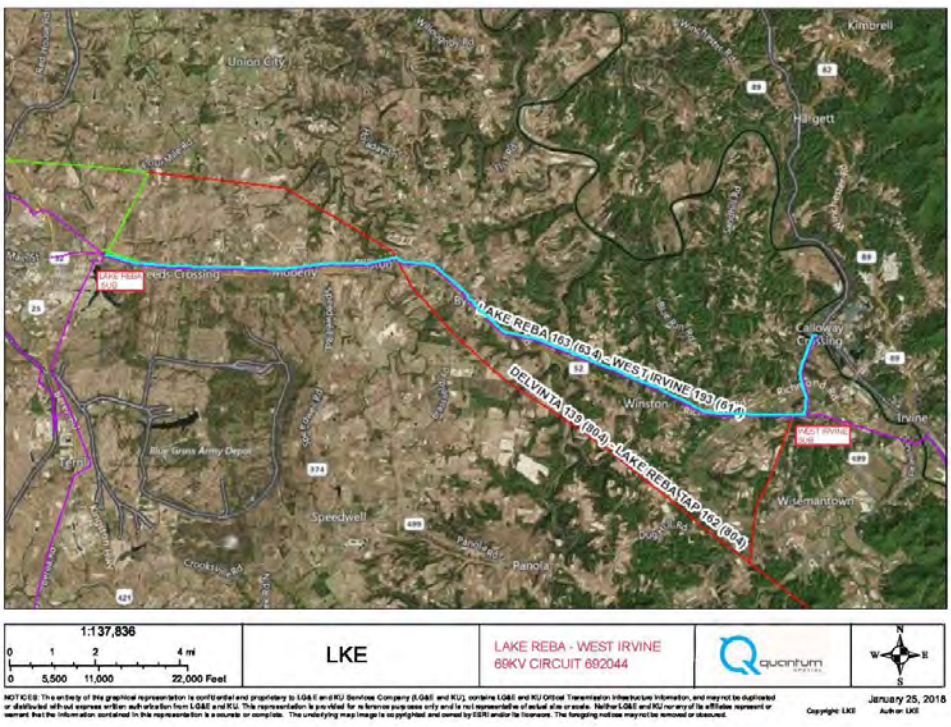
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing eleven (11) standard steel H-frame structures, seven (7) standard steel single pole structures, and associated hardware and material, and the removal of eighteen (18) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in June of 2018 and be completed in July of 2018.

Construction Milestones	
January 2018	Engineering and Design
February 2018	Space reserved for steel pole production with steel pole manufacturer
April 2018	Steel poles ordered
May 2018	Steel Poles Received

June 2018	Line Construction Begins
July 2018	Line Construction Completed

A facility map of the Lake Reba-West Irvine 69kv line is shown below:
Line length: 13.92 miles Total structures in the line: 194



- **Project Cost**
  The total project cost is $1,148k and was approved by the RAC in the 1+11 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $304k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the

Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$280k
Hardware	$24k
Total	$304k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	1,063	-	-	-	1,063
2. Cost of Removal Proposed	86	-	-	-	86
3. Total Capital and Removal Proposed (1+2)	1,148	-	-	-	1,148
4. Capital Investment 2018 BP	850	-	-	-	850
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	850	-	-	-	850
7. Capital Investment variance to BP (4-1)	(213)	-	-	-	(213)
8. Cost of Removal variance to BP (5-2)	(86)	-	-	-	(86)
9. Total Capital and Removal variance to BP (6-3)	(298)	-	-	-	(298)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$31k
Contract Labor:	$565k
Materials:	$304k
Local Engineering:	$68k
Burdens:	$76k
Contingency:	$104k
Reimbursements:	($0)
Net Capital Expenditure:	$1,148k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all eighteen (18) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 25% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Lake Reba-West Irvine 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Lake Reba-West Irvine Pole Replacement project for $1,148k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal LI-000016 Tyrone-Higby Mill Pole Replacement

Investment Proposal

Project Name: Tyrone-Higby Mill Pole Replacement

Total Expenditures: $1,408k
Total Contingency: $128k (9%)

Project Number(s): LI-000016

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Addam Gooch/Adam Smith

Executive Summary

The proposed project is to replace twenty-four (24) wood structures on the Tyrone-Higby Mill 69kV line with new steel structures during a schedule outage. The scope of work includes the replacement of nineteen (19) structures identified through inspection in 2015. The replacement of five (5) additional adjacent structures is required to accommodate the increased height of the new structures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project was included in the 2018 Business Plan (BP) for $1,000k to replace nineteen (19) structures on the Tyrone-Higby Mill 69kV line. In addition, five (5) adjacent structures will also need to be replaced in order to accommodate the height of the new structures. The current total project cost is $1,408k. The incremental funding of $408k was approved in the RAC 3+9 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Tyrone-Higby Mill 69kV line was completed in 2015, and nineteen (19) structures were determined to be in need of replacement in order to ensure the integrity and reliability of this line. In addition, five (5) adjacent structures will also need to be replaced in order to accommodate the height of the new structures.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,761
     The recommendation is to replace all twenty-four (24) wood structures with new steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $2,533
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $1,835k
     The next best alternative would be to replace twenty-four (24) existing wood structures with new wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing twenty-three (23) custom steel H-frame structures, one (1) steel three-pole running corner, and associated hardware and material, and the removal of twenty-four (24) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in September of 2018 and be completed in November of 2018.

Construction Milestones	
April 2018	Engineering and Design
April 2018	Space Reserved with Steel Pole Manufacturer
May 2018	Steel Poles Ordered
August 2018	Steel Poles Received
September 2018	Line Construction Begins
November 2018	Line Construction Completed

A facility map of the Tyrone-Higby Mill 69kV line is shown below:

- **Project Cost**
  The project was included in the 2018 Business Plan (BP) for $1,000k to replace nineteen (19) structures on the Tyrone-Higby Mill 69kV line. In addition, five (5) adjacent structures will also need to be replaced in order to accommodate the height of the new structures. The current total project cost is $1,408k. The incremental funding of $408k was approved in the RAC 3+9 forecast. This project contains a 9% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $593k. This project will utilize custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$547k
Hardware	$46k
Total	$593k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2018	2019	2020	Post 2020	Total
1. Capital Investment Proposed	1,251	-	-	-	1,251
2. Cost of Removal Proposed	157	-	-	-	157
3. Total Capital and Removal Proposed (1+2)	1,408	-	-	-	1,408
4. Capital Investment 2018 BP	1,000	-	-	-	1,000
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	1,000	-	-	-	1,000
7. Capital Investment variance to BP (4-1)	(251)	-	-	-	(251)
8. Cost of Removal variance to BP (5-2)	(157)	-	-	-	(157)
9. Total Capital and Removal variance to BP (6-3)	(408)	-	-	-	(408)

Financial Detail by Year - O&M ($000s)	2018	2019	2020	Post 2020	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$27k
Contract Labor:	$452k
Materials:	$593k
Local Engineering:	$99k
Burdens:	$109k
Contingency:	$128k
Reimbursements:	($0)
Net Capital Expenditure:	$1,408k

- **Assumptions**

Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all twenty-four (24) structures will be completed during the scheduled outage.

Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 44% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Tyrone-Higby Mill 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Tyrone-Higby Mill Pole Replacement project for $1,408k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000017 Middlesboro-Pineville Pole Replacement

Investment Proposal for Investment Committee Meeting on: July 31, 2018

Project Name: Middlesboro-Pineville Pole Replacement

Total Expenditures: $2,041k
Total Contingency: $184k (10%)

Project Number(s): LI-000017

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Gary King/Adam Smith

Executive Summary

The proposed project is to replace twenty (20) wood structures on the Middlesboro-Pineville 69kV line with steel. The scope of work includes the replacement of nineteen (19) structures identified through inspection in 2016. The replacement of one (1) additional adjacent structure is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, approximately 50% of the twenty (20) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $152k.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $950k to replace nineteen (19) structures on the Middlesboro-Pineville 69kV line. The total cost included in the BP was based on an average structure cost of $50k for all structures. Subsequent to the 2018 BP planning, the cost for H-Frames was updated to reflect an average H-Frame structure cost of $80k from similar past projects in this region. In addition, funding in the amount of $250k was identified for incremental site clearing to gain access to the right-of-way, and a decision was made to complete 50% of the structures energized. The current total project cost is $2,041k. The 2018 spend of $950k is included in the 2018 BP. The 2019 spend of $1,091k is consistent with the proposed 2019 BP.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Middlesboro-Pineville 69kV line was completed in 2016, and nineteen (19) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. Subsequent to the 2018 BP planning, additional analysis identified one (1) additional adjacent structure for replacement in order to accommodate the height of the new structures. There are 187 total structures along this 15.16 mile line.

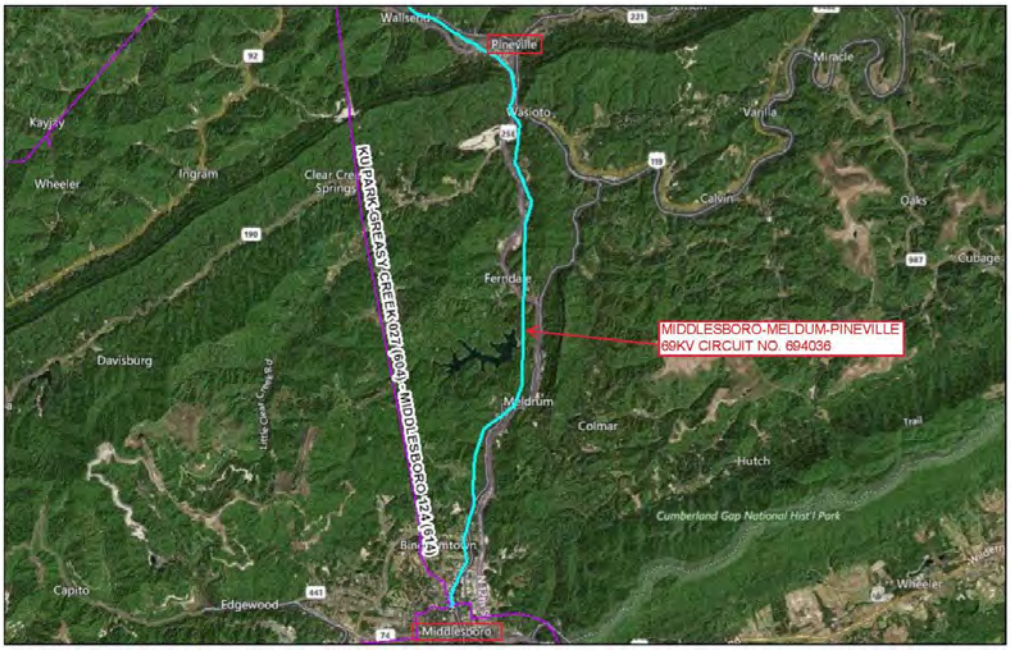
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,459
     Due to the difficulty in obtaining an extended outage, 50% of the twenty (20) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $152k and the NPVRR by $106k.
  2. Alternative #1: NPVRR: ($000s) $3,658
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $3,142
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirteen (13) standard steel H-frame structures, seven (7) steel single pole structures, and associated hardware and material, and the removal of twenty (20) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in October of 2018 and be completed in April of 2019.

Construction Milestones	
May 2018	Engineering and Design
June 2018	Space reserved for steel pole production with manufacturer
July 2018	Steel Poles Ordered upon Project Approval
September 2018	Steel Poles Received
October 2018	Line Construction Begins
April 2019	Line Construction Completed

A facility map of the Middlesboro-Pineville 69kV line is shown below:



- **Project Cost**
  The project is included in the 2018 Business Plan (BP) for $950k to replace nineteen (19) structures on the Middlesboro-Pineville 69kV line. The replacement of one additional adjacent structure is required to accommodate the increased height of the new structures. The total cost included in the BP was based on an average structure cost of $50k for all structures. Subsequent to the 2018 BP planning, the cost for H-Frames was updated to reflect an average H-Frame structure cost of $80k from similar past projects in this region. In addition, funding in the amount of $250k was identified for incremental site clearing to gain access to the right-of-way, and a decision was made to complete 50% of the structures energized. The current total project cost is $2,041k. The 2018 spend of $950k is included in the 2018 BP. The 2019 spend of $1,091k is consistent with the proposed 2019 BP. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable

based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $444k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$388k
Hardware	$56k
Total	$444k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	950	774	-	-	1,724
2. Cost of Removal Proposed	-	318	-	-	318
3. Total Capital and Removal Proposed (1+2)	950	1,091	-	-	2,041
4. Capital Investment 2018 BP	950	-	-	-	950
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	950	-	-	-	950
7. Capital Investment variance to BP (4-1)	-	(774)	-	-	(774)
8. Cost of Removal variance to BP (5-2)	-	(318)	-	-	(318)
9. Total Capital and Removal variance to BP (6-3)	-	(1,091)	-	-	(1,091)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):	
Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$49
Contract Labor:	$1,109
Materials:	$444
Local Engineering:	$134
Burdens:	$119
Contingency:	$184
Reimbursements:	($0)
Net Capital Expenditure:	$2,041

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the twenty (20) structures will need to be completed with the 69kV line energized.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 36% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Middlesboro-Pineville 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Middlesboro-Pineville pole replacement project for $2,041k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	Chairman, CEO and President

Investment Proposal Project LI-000018 Bimble-London Pole Replacement

Investment Proposal

Project Name: Bimble-London Pole Replacement

Total Expenditures: $1,208k
Total Contingency: $108k (10%)

Project Number(s): LI-000018

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Ashley Burns/Adam Smith

Executive Summary

The proposed project is to replace thirteen (13) wood structures on the Bimble-London 69kV line with steel. The scope of work includes the replacement of thirteen (13) structures identified through inspection in 2012. Due to the difficulty in obtaining an extended outage, all thirteen (13) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $156k.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $800k to replace thirteen (13) structures on the Bimble-London 69kV line. Subsequent to the 2018 BP planning process, a decision was made to complete the structures energized, and additional funding was identified for incremental site clearing and road building to gain access to the right-of way. The project was submitted for preliminary approval in December of 2017 for $22k for engineering to ensure the project remained on schedule for construction to begin in summer of 2018. 2017 spend was approved by the RAC in the 11+1 forecast. The 2018 spend difference of $408k approved by the RAC in the 3+9 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Bimble-London 69kV line was completed in 2012, and thirteen (13) structures were identified and determined to be in need of replacement in order to ensure the integrity and reliability of this line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,417
     Due to the difficulty in obtaining an extended outage, thirteen (13) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $156k and the NPVRR by $182k.
  2. Alternative #1: NPVRR: ($000s) $2,179
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $1,742
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

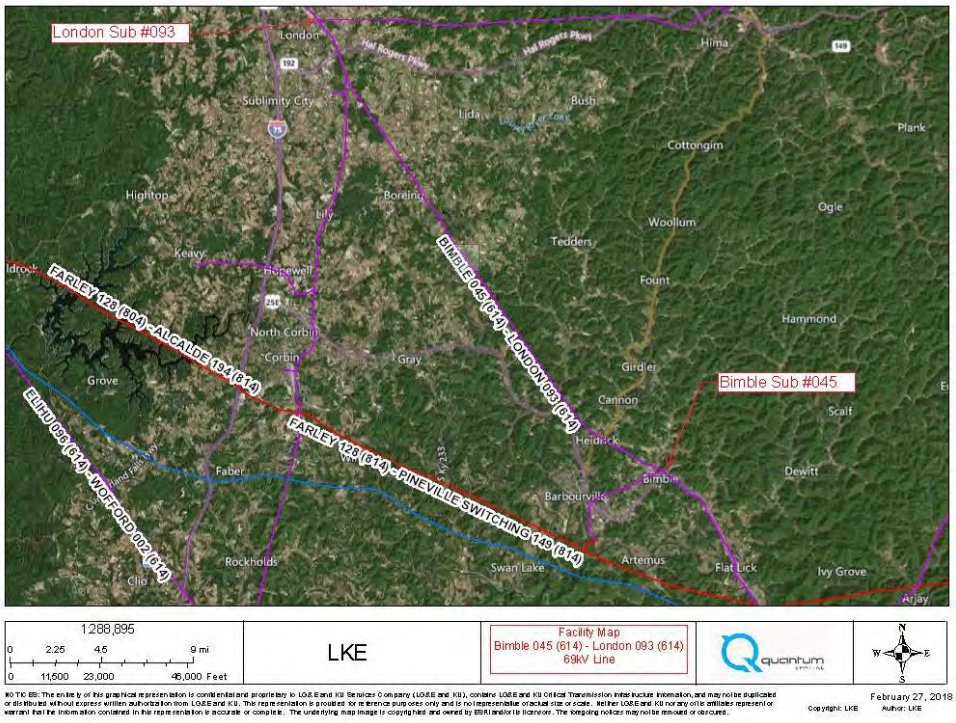
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing 10 (10) steel H-frame structures, one (1) steel three-pole running corner, two (2) steel three-pole dead end structures, and associated hardware and material, and the removal of thirteen (13) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in April of 2018 and be completed in June of 2018.

Construction Milestones	
November 2017	Engineering and Design
March 2018	Space reserved for steel pole production with steel pole manufacturer
April 2018	Steel Poles Ordered
June 2018	Steel Poles Received

July 2018	Line Construction Begins
August 2018	Line Construction Completed

A facility map of the Bimble-London 69kV line is shown below:
Line length: 22.8 miles Total structures in the line: 155



- **Project Cost**
  The total project cost is $1,208k. 2017 spend of $22k was approved by the RAC in the 11+1 forecast. The 2018 spend difference of $408k approved by the RAC in the 3+9 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $284k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole

alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$263k
Hardware	$21k
Total	$284k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	1	1,174	-	-	1,175
2. Cost of Removal Proposed		33	-	-	33
3. Total Capital and Removal Proposed (1+2)	1	1,207	-	-	1,208
4. Capital Investment 2018 BP	-	800	-	-	800
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	800	-	-	800
7. Capital Investment variance to BP (4-1)	(1)	(374)	-	-	(375)
8. Cost of Removal variance to BP (5-2)	-	(33)	-	-	(33)
9. Total Capital and Removal variance to BP (6-3)	(1)	(407)	-	-	(408)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$43k
Contract Labor:	$604k
Materials:	$284k
Local Engineering:	$84k
Burdens:	$85k
Contingency:	$108k
Reimbursements:	($0)
Net Capital Expenditure:	$1,208k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and all thirteen (13) structures will need to be completed with the 69kV line energized. .

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 42% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Bimble-London 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Bimble-London pole replacement project for $1,208k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal LI-000020 Dix Dam-Lancaster Pole Replacement

Investment Proposal for Investment Committee Meeting on: March 28, 2018

Project Name: Dix Dam-Lancaster Pole Replacement

Total Expenditures: $2,352k
Total Contingency: $214k (10%)

Project Number(s): LI-000020

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Addam Gooch/Adam Smith

Executive Summary
The proposed project is to replace thirty-one (31) wood structures, and one (1) lattice steel tower on the Dix Dam-Lancaster 69kV line with new steel structures during a schedule outage. The scope of work includes the replacement of twenty-nine (29) structures identified through inspection in 2016. The replacement of three (3) additional adjacent structures is required to accommodate the increased height of the new structures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project was included in the 2018 Business Plan (BP) for $1,300k to replace twenty-six (26) structures, and repair one lattice steel tower on the Dix Dam-Lancaster 69kV line. The lattice steel tower was identified through an inspection subsequent to the 2018 BP, and a decision was made to replace the lattice steel tower with a tubular steel structure. The decision to replace the steel tower rather than repair it resulted in an increase of $790k from what was assumed in the 2018 BP. Additional analysis of the inspection results identified two (2) additional structures for replacement. In addition, three (3) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. The current total project cost is $2,352k and the incremental funding of $1,052k was approved in the RAC 2+10 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Dix Dam-Lancaster 69kV line was completed in 2016, and twenty-six (26) structures were determined to be in need of replacement in order to ensure the integrity and reliability of this line. Additional analysis of the inspection results identified two (2) additional structures for replacement. The lattice steel tower was identified through an inspection subsequent to the 2018 BP. The lattice steel tower is located at the edge of a rock cliff. Due to concerns about the quality of rock at the existing structure site, the lattice steel tower will be replaced with a new tubular steel structure. The new structure will be relocated to a site that will provide better foundation support, which will facilitate construction and future maintenance. In addition, three (3) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures.

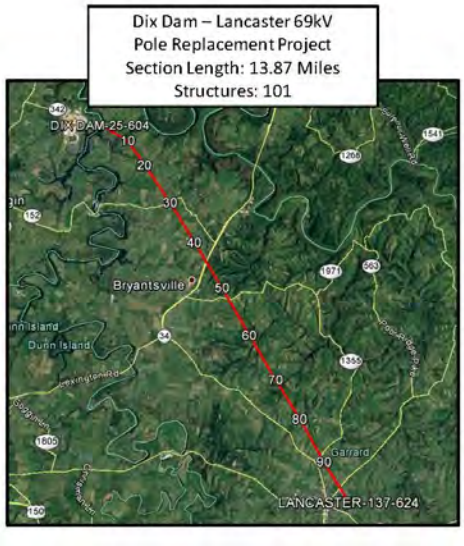
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,941
     The recommendation is to replace all thirty-one (31) wood structures, and one (1) lattice steel tower with new steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $4,231
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $3,006
     The next best alternative would be to replace thirty-one (31) existing wood structures with new wood structures, and one (1) lattice steel tower with a new steel structure. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty (30) standard steel H-frame structures, one (1) steel three-pole running corner, and one (1) steel three-pole foundation structure, and associated hardware and material, and the removal of thirty-one (31) wood structures, one (1) lattice steel tower, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in September of 2018 and be completed in November of 2018.

Construction Milestones	
February 2018	Engineering and Design
February 2018	Space Reserved with Steel Pole Manufacturer
April 2018	Steel Poles Ordered
August 2018	Steel Poles Received
September 2018	Line Construction Begins
November 2018	Line Construction Completed

A facility map of the Dix Dam-Lancaster 69kV line is shown below:



- **Project Cost**
  The project is included in the 2018 Business Plan (BP) for $1,300k to replace twenty-six (26) structures on the Dix Dam-Lancaster 69kV line. Subsequent to the 2018 BP planning process, additional analysis of the inspection results identified three (3) additional structures for replacement. Three (3) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to utilize a tubular steel structure for the lattice steel tower replacement. The current total project cost is $2,352k and the incremental funding of $1,052k was approved in the RAC 2+10 forecast. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**

Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $753k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$723k
Hardware	$30k
Total	$753k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	2,065	-	-	-	2,065
2. Cost of Removal Proposed	287	-	-	-	287
3. Total Capital and Removal Proposed (1+2)	2,352	-	-	-	2,352
4. Capital Investment 2018 BP	1,300	-	-	-	1,300
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	1,300	-	-	-	1,300
7. Capital Investment variance to BP (4-1)	(765)	-	-	-	(765)
8. Cost of Removal variance to BP (5-2)	(287)	-	-	-	(287)
9. Total Capital and Removal variance to BP (6-3)	(1,052)	-	-	-	(1,052)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$44k
Contract Labor:	$1,045k
Materials:	$753k
Local Engineering:	$140k
Burdens:	$156k
Contingency:	$214k
Reimbursements:	($0)
Net Capital Expenditure:	$2,352k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all thirty-two (32) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 34% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Dix Dam-Lancaster 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Dix Dam-Lancaster pole replacement project for $2,352k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	Chairman, CEO and President

Investment Proposal LI-000021 Eminence-LaGrange Pole Replacement

Investment Proposal

Project Name: Eminence-LaGrange Pole Replacement

Total Expenditures: $847k
Total Contingency: $77k (10%)

Project Number(s): LI-000021

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Tony Mount/Adam Smith

Executive Summary

The proposed project is to replace seventeen (17) wood structures on the Eminence-LaGrange 69kV line with new steel structures during a scheduled outage. The scope of work includes the replacement of seventeen (17) structures identified through inspection in 2015.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The total project cost is $847k and was included in the 2018 Business Plan (BP).

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Eminence-LaGrange 69kV line was completed in 2015, and seventeen (17) structures were determined to be in need of replacement in order to ensure the integrity and reliability of this line.

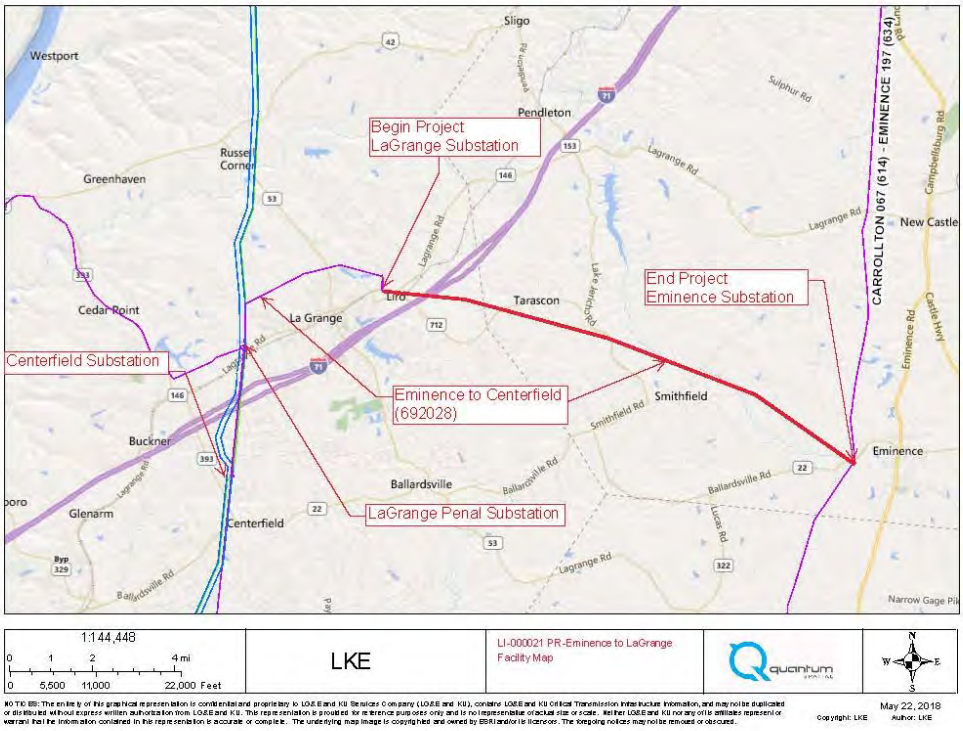
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,056
     The recommendation is to replace all seventeen (17) structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $1,517
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $1,153
     The next best alternative would be to replace seventeen (17) existing wood structures with new wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing seven (7) standard steel H-frame structures, ten (10) steel single pole structures, and associated hardware and material, and the removal of eighteen (18) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in August of 2018 and be completed in November of 2018.

Construction Milestones	
May 2018	Engineering and Design
June 2018	Steel Poles Ordered
August 2018	Steel Poles Received
August 2018	Line Construction Begins
November 2018	Line Construction Completed

A facility map of the Eminence-LaGrange 69kV line is shown below:
Line length: 9.73 miles Total number of structures in the line: 127



- **Project Cost**
  The total project cost is $847k and was included in the 2018 BP. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $261k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$218k
Hardware	$43k
Total	$261k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	724	-	-	-	724
2. Cost of Removal Proposed	123	-	-	-	123
3. Total Capital and Removal Proposed (1+2)	847	-	-	-	847
4. Capital Investment 2018 BP	850	-	-	-	850
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	850	-	-	-	850
7. Capital Investment variance to BP (4-1)	126	-	-	-	126
8. Cost of Removal variance to BP (5-2)	(123)	-	-	-	(123)
9. Total Capital and Removal variance to BP (6-3)	3	-	-	-	3

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$21k
Contract Labor:	$370k
Materials:	$261k
Local Engineering:	$60k
Burdens:	$58k
Contingency:	$77k
Reimbursements:	($0)
Net Capital Expenditure:	$847k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all seventeen (17) structures will be completed during the scheduled outage.

Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 25% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead, asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Eminence-LaGrange 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Eminence-LaGrange pole replacement project for $847k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000023 Warsaw-Owen County EKPC Pole Replacement

Investment Proposal

Project Name: Warsaw-Owen County EKPC Pole Replacement

Total Expenditures: $1,212k
Total Contingency: $110k (10%)

Project Number(s): LI-000023

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Kelly Mefford/Adam Smith

Executive Summary

The proposed project is to replace eighteen (18) wood structures on the Warsaw-Owen County EKPC 69kV line with steel. The scope of work includes the replacement of sixteen (16) structures identified through inspection. The replacement of two (2) additional adjacent structures is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, approximately 50% of the eighteen (18) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $161k. To ensure construction of this project will begin in January of 2018, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2018.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the proposed 2018 Business Plan (BP) for $800k. Subsequent to the 2018 BP planning, a decision was made to complete 50% of the structures energized. The current total project cost is $1,212k. The difference of $412k was funded by a reduction in the K9-2018 Priority Pole Replacement blanket.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Warsaw-Owen County EKPC 69kV line was completed in 2016, and sixteen (16) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. The replacement of two (2) additional adjacent structures is required to accommodate the increased height of the new structures. There are 212 total structures along this 21.21 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,542k
     Due to the difficulty in obtaining an extended outage, approximately 50% of the eighteen (18) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $161k and the NPVRR by $204k.
  2. Alternative #1: NPVRR: ($000s) $2,306k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $1,822k
     The next best alternative would be to replace the poles with wood structures. The manufacturer's recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing five (5) standard steel single pole structures, twelve (12) standard steel H-frame structures, one (1) custom steel dead end structure, and associated hardware and material, and the removal of eighteen (18) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting (IC). The contract was re-approved by the IC in April 2017. Construction is scheduled to begin in January of 2018 and be completed in February of 2018.

Construction Milestones	
October 2017	Engineering and Design
November 2017	Steel Poles Ordered

January 2018	Steel Poles Received
January 2018	Line Construction Begins
February 2018	Line Construction Completed

A facility map of the Warsaw-Owen County EKPC 69kV line is shown below.
Line length: 21.21 miles

- **Project Cost**
  The total project cost is $1,212k. To ensure construction of this project will begin in January of 2018, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2018. The project is included in the proposed 2018 Business Plan (BP) for $800k. Subsequent to the 2018 BP planning, a decision was made to complete 50% of the structures energized. The current total project cost is $1,212k. The difference of $412k was funded by a reduction in the K9-2018 Priority Pole Replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $318k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$303k
Hardware	$15k
Total	$318k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	-	905	-	-	905
2. Cost of Removal Proposed	-	307	-	-	307
3. Total Capital and Removal Proposed (1+2)	-	1,212	-	-	1,212
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	-	(905)	-	-	(905)
8. Cost of Removal variance to BP (5-2)	-	(307)	-	-	(307)
9. Total Capital and Removal variance to BP (6-3)	-	(1,212)	-	-	(1,212)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.32%
Capital Breakdown:	
Labor:	$23k
Contract Labor:	$635k
Materials:	$318k
Local Engineering:	$87k
Burdens:	$39k
Contingency:	$110k
Reimbursements:	($0)
Net Capital Expenditure:	$1,212k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the eighteen (18) structures will need to be completed with the 69kV line energized.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 16% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Warsaw-Owen County EKPC 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Warsaw-Owen County EKPC Pole Replacement project for $1,212k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal LI-000024 Green River-Green River Steel Pole Replacement

Investment Proposal for Investment Committee Meeting on: July 31, 2018

Project Name: Green River-Green River Steel Pole Replacement

Total Expenditures: $8,426k
Total Contingency: $758k (10%)

Project Number(s): LI-000024

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Ted Hornbuckle/Adam Smith

Executive Summary
The proposed project is to replace one hundred forty-one (141) wood structures on the Green River-Green River Steel 138kV line with new steel structures during a scheduled outage. The scope of work includes the replacement of one hundred twenty-four (124) structures identified through inspection in 2017. The replacement of seventeen (17) additional adjacent structures is required to accommodate the increased height of the new structures. One (1) additional structure will be added in order to remove an adjacent 69kV circuit from an existing structure.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project was included in the 2018 Business Plan (BP) for $1,550k with funding in 2019 to replace thirty-one (31) structures on the Green River-Green River Steel 138kV line. Subsequent to the 2018 BP, the inspections were finalized with one hundred twenty-four (124) structures identified for replacement. In addition, seventeen (17) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. One (1) additional structure will be added in order to remove an adjacent 69kV circuit from an existing structure. In addition, $198k in additional funding was identified for incremental site clearing for structure access, and wetlands permitting. The current total project cost is $8,426k. The incremental funding of $4,860k in 2018 was approved in the RAC 6+6 forecast. The 2019 spend of $3,566k is consistent with the proposed 2019 BP.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Green River-Green River Steel 138kV line was completed in 2017, and one hundred twenty-four (124) structures were determined to be in need of replacement in order to ensure the integrity and reliability of this line. In addition, seventeen (17) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. One (1) additional steel structure will be added in order to remove an adjacent 69kV circuit from an existing structure.

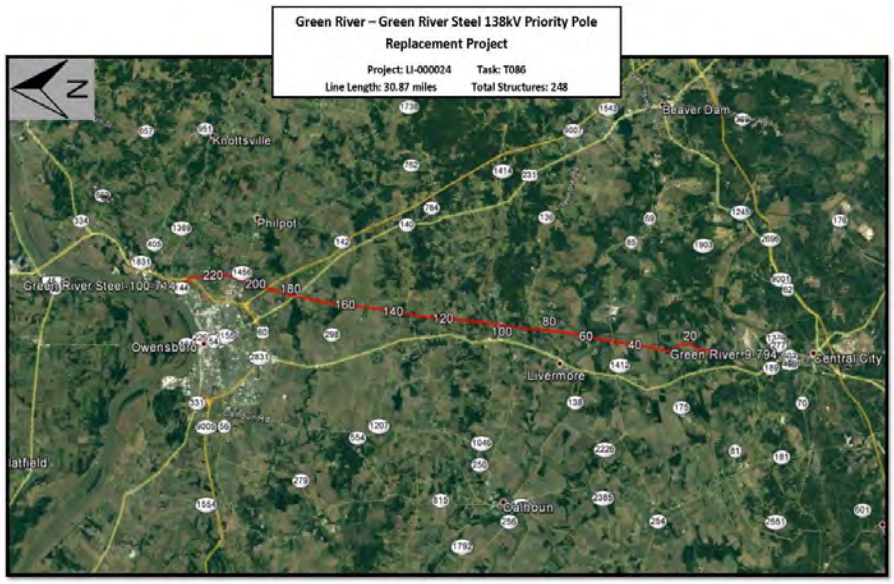
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $10,315
     The recommendation is to replace all one hundred forty-one (141) wood structures with new steel structures, and complete the addition of one (1) new steel structure during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $15,163
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $10,628
     The next best alternative would be to replace one hundred forty-one (141) existing wood structures with new wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing one hundred thirty-seven (137) standard steel H-frame structures, two (2) steel three-pole angle structures, two (2) steel three-pole dead end structures, and associated hardware and material, and the removal of one hundred forty-one (141) wood structures, and associated hardware and material. One (1) steel structure will be added in order to remove an adjacent 69kV circuit from an existing structure. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. In April of 2018, the Transmission Lines engineering phase of the project was approved and initiated. The engineering phase consisted of development of a project plan, structure design and selection, and the development of the construction sequence. Construction is scheduled to begin in October of 2018 and be completed in March of 2019.

Construction Milestones	
April 2018	Engineering and Design
May 2018	Space Reserved with Steel Pole Manufacturer
July 2018	Steel Poles Ordered
August-December 2018	Steel Poles Received
October 2018	Line Construction Begins
March 2019	Line Construction Completed

A facility map of the Green River-Green River Steel 138kV line is shown below:
Total line length: 30.87 miles Total structures in the line: 246



- **Project Cost**
  The project was included in the 2018 Business Plan (BP) for $1,550k to replace thirty-one (31) structures on the Green River-Green River Steel 138kV line. The 2018 BP amount was based on a formula estimate that was incorrect for the number of structures to be replaced. Subsequent to the 2018 BP, revised analysis of the inspection results identified one hundred twenty-four (124) structures for replacement. In addition, seventeen (17) additional adjacent structures will also need to be replaced in order to accommodate the height of the new structures. One (1) additional structure will be added in order to remove an adjacent 69kV circuit from an existing structure. In addition, $198k in additional funding was identified for incremental site clearing for structure access, wetlands permitting and construction staking,

and anticipated damages. The current total project cost is $8,426k. The incremental funding of $4,860k in 2018 was approved in the RAC 6+6 forecast. The 2019 spend of $3,566k is consistent with the proposed 2019 BP. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $3,843k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$3,252k
Hardware	$591k
Total	$3,843k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	4,479	3,306	-	-	7,786
2. Cost of Removal Proposed	380	260	-	-	640
3. Total Capital and Removal Proposed (1+2)	4,860	3,566	-	-	8,426
4. Capital Investment 2018 BP	-	1,550	-	-	1,550
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	1,550	-	-	1,550
7. Capital Investment variance to BP (4-1)	(4,479)	(1,756)	-	-	(6,236)
8. Cost of Removal variance to BP (5-2)	(380)	(260)	-	-	(640)
9. Total Capital and Removal variance to BP (6-3)	(4,860)	(2,016)	-	-	(6,876)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed		-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):	
Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$141
Contract Labor:	$2,389
Materials:	$3,843
Local Engineering:	$565
Burdens:	$730
Contingency:	$758
Reimbursements:	($0)
Net Capital Expenditure:	$8,426

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and construction for all one hundred forty-two (142) structures will be completed during the scheduled outage.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 41% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Green River-Green River Steel 138kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Green River-Green River Steel Pole Replacement project for $8,426k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	Chairman, CEO and President

Investment Proposal Indian Hill-Hillside Pole Replacement

Investment Proposal

Project Name: Indian Hill-Hillside Pole Replacement

Total Expenditures: $1,134k
Total Contingency: $103k (10%)

Project Number(s): LI-000027

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Tony Mount/Adam Smith

Executive Summary

The proposed project is to replace twenty-one (21) wood structures on the Hillside-Indian Hill 69kV line with steel. The scope of work includes the replacement of nineteen (19) structures identified through inspection. The replacement of two (2) additional adjacent structures is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, approximately 50% of the twenty-one (21) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $169k. To ensure construction of this project will begin in January of 2018, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2018.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the proposed 2018 Business Plan (BP) for work to be completed in 2019 for $950k. Subsequent to the 2018 BP planning, a decision was made to complete 50% of the structures energized. The current total project cost is $1,134k. A decision was made to accelerate the project based on the current level of Transmission work. The project was funded by a reduction in the KOTH-2018 Priority Pole Replacement blanket.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Hillside-Indian Hill 69kV line was completed in 2017, and nineteen (19) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. The replacement of two (2) additional adjacent structures is required to accommodate the increased height of the new structures. There are 179 total structures along this 13.04 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,443k
     Due to the difficulty in obtaining an extended outage, approximately 50% of the twenty-one (21) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $169k and the NPVRR by $215k.
  2. Alternative #1: NPVRR: ($000s) $2,158k
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $1,634k
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

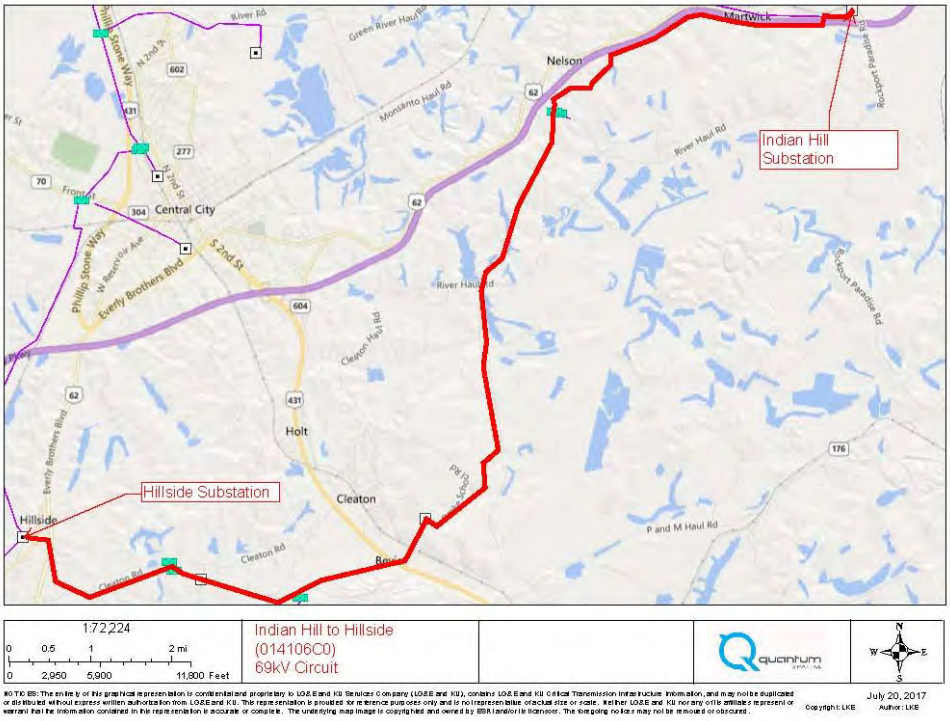
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing ten (10) standard steel H-frame structures, three (3) standard steel davit arm structures, three (3) custom steel dead end structures, three (3) steel horizontal post structures, two (2) custom steel three pole running corners, and associated hardware and material, and the removal of twenty-one (21) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the T&D Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting (IC). The contract was re-approved by the IC in April 2017. Construction is scheduled to begin in February of 2018 and be completed in March of 2018.

Construction Milestones	
November 2017	Engineering and Design

November 2017	Steel Poles Ordered
January 2018	Steel Poles Charged
February 2018	Line Construction Begins
March 2018	Line Construction Completed

A facility map of the Hillside-Indian Hill 69kV line is shown below:
Line length: 13.04 miles



- **Project Cost**
  The total project cost is $1,134k. To ensure construction of this project will begin in January of 2018, the project is being submitted for approval to ensure the project will be approved and active beginning January 1, 2018. The project is included in the proposed 2018 Business Plan (BP) for work to be completed in 2019 for $950k. Subsequent to the 2018 BP planning, a decision was made to complete 50% of the structures energized. A decision was made to accelerate the project based on the current level of Transmission work. The project was funded by a reduction in the KOTH-2018 Priority Pole Replacement blanket. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $404k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the T&D Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$321k
Hardware	$83k
Total	$404k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Capital Investment Proposed	-	1,065	-	-	1,065
2. Cost of Removal Proposed	-	69	-	-	69
3. Total Capital and Removal Proposed (1+2)	-	1,134	-	-	1,134
4. Capital Investment 2017 BP	-	-	-	-	-
5. Cost of Removal 2017 BP	-	-	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-	-	-
7. Capital Investment variance to BP (4-1)	-	(1,065)	-	-	(1,065)
8. Cost of Removal variance to BP (5-2)	-	(69)	-	-	(69)
9. Total Capital and Removal variance to BP (6-3)	-	(1,134)	-	-	(1,134)

Financial Detail by Year - O&M ($000s)	**2017**	**2018**	**2019**	**Post 2019**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2017 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.32%
Capital Breakdown:	
Labor:	$24k
Contract Labor:	$443k
Materials:	$404k
Local Engineering:	$781k
Burdens:	$82k
Contingency:	$103k
Reimbursements:	($0)
Net Capital Expenditure:	$1,134k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the twenty-one (21) structures will need to be completed with the 69kV line energized.

  Alternative #1 – This cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 33% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Hillside-Indian Hill 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Hillside-Indian Hill pole replacement project for $1,134k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Bimble-Artemus Pole Replacement

Investment Proposal

Project Name: Bimble-Artemus Pole Replacement

Total Expenditures: $959k
Total Contingency: $87k (9%)

Project Number(s): LI-000031

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Nick Poston/Adam Smith

Executive Summary

The proposed project is to replace fifteen (15) wood structures on the Bimble-Barbourville-Artemus 69kV line with new steel structures during a schedule outage. The scope of work includes the replacement of twelve (12) structures identified through inspection in 2017. The replacement of three (3) additional adjacent structures is required to accommodate the increased height of the new structures.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project was included in the 2018 Business Plan (BP) for $600k to replace twelve (12) structures on the Bimble-Barbourville-Artemus 69kV line. In addition, three (3) adjacent structures will also need to be replaced in order to accommodate the height of the new structures. The current total project cost is $959k. The incremental funding of $359k was approved in the RAC 3+9 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Bimble-Barbourville-Artemus 69kV line was completed in 2017, and twelve (12) structures were determined to be in need of replacement in order to ensure the integrity and reliability of this line. In addition, three (3) adjacent structures will also need to be replaced in order to accommodate the height of the new structures.

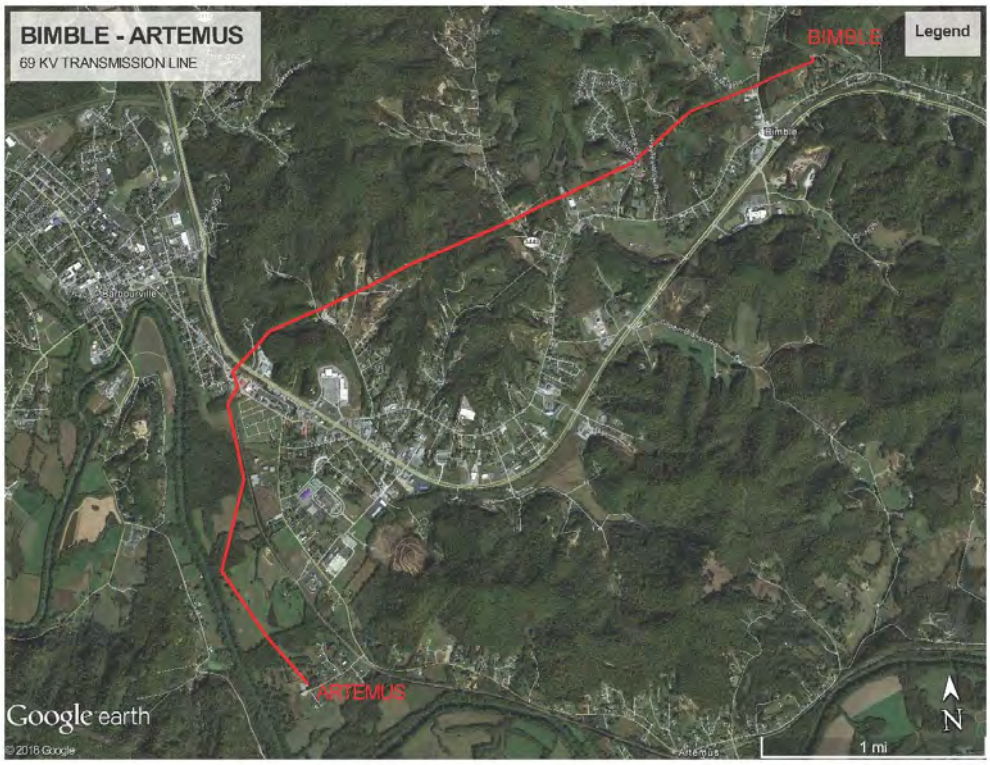
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,199
     The recommendation is to replace all fifteen (15) wood structures with new steel structures during a scheduled outage.
  2. Alternative #1: NPVRR: ($000s) $1,725
     The alternative of do nothing would result in replacing poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on reliability.
  3. Alternative #2: NPVRR: ($000s) $1,479
     The next best alternative would be to replace fifteen (15) existing wood structures with new wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended life span of 90 years. This option assumes replacement of wood structures in 30 years and an escalation factor of 4% which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing four (4) standard steel H-frame structures, three (3) steel three-pole running corners, eight (8) steel single pole structures, and associated hardware and material, and the removal of fifteen (15) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee meeting. A two-year optional contract extension was approved by the IC in April of 2017. Construction is scheduled to begin in August of 2018 and be completed in October of 2018.

Construction Milestones	
April 2018	Engineering and Design
April 2018	Space Reserved with Steel Pole Manufacturer
May 2018	Steel Poles Ordered
July 2018	Steel Poles Received
August 2018	Line Construction Begins
October 2018	Line Construction Completed

A facility map of the Bimble-Barbourville-Artemus 69kV line is shown below:
Line length: 4.76 Miles Total structures in line: 44



- **Project Cost**
  The project was included in the 2018 Business Plan (BP) for $600k to replace twelve (12) structures on the Bimble-Barbourville-Artemus 69kV line. In addition, three (3) adjacent structures will also need to be replaced in order to accommodate the height of the new structures. The current total project cost is $959k. The incremental funding of $359k was approved in the RAC 3+9 forecast. This project contains a 9% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $187k. This project will utilize standard steel structures. The steel structures will be purchased through the Company's steel pole alliance partner,

Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$175k
Hardware	$13k
Total	$187k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Capital Investment Proposed	898	-	-	-	898
2. Cost of Removal Proposed	62	-	-	-	62
3. Total Capital and Removal Proposed (1+2)	959	-	-	-	959
4. Capital Investment 2018 BP	600	-	-	-	600
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	600	-	-	-	600
7. Capital Investment variance to BP (4-1)	(297)	-	-	-	(297)
8. Cost of Removal variance to BP (5-2)	(62)	-	-	-	(62)
9. Total Capital and Removal variance to BP (6-3)	(359)	-	-	-	(359)

Financial Detail by Year - O&M ($000s)	**2018**	**2019**	**2020**	**Post 2020**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$29k
Contract Labor:	$529k
Materials:	$187k
Local Engineering:	$68k
Burdens:	$59k
Contingency:	$87k
Reimbursements:	($0)
Net Capital Expenditure:	$959k

- **Assumptions**

Recommendation – The cost of this alternative assumes that the line outage will be available for the duration of the project, and all fifteen (15) structures will be completed during the scheduled outage.

Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 32% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Bimble-Barbourville-Artemus 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that Management approve the Bimble-Artemus pole replacement project for $959k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Investment Proposal Project LI-000032 Elihu-Somerset North Pole Replacement

Investment Proposal for Investment Committee Meeting on: January 31, 2018

Project Name: Elihu-Somerset North Pole Replacement

Total Expenditures: $2,071k
Total Contingency: $188k (10%)

Project Number(s): LI-000032

Business Unit/Line of Business: Transmission Lines

Prepared/Presented By: Nick Poston/Adam Smith

Executive Summary

The proposed project is to replace thirty-seven (37) wood structures on the Elihu-Somerset North 69kV line with steel. The scope of work includes the replacement of thirty (30) structures on the Elihu-Somerset North 69kV line, and one (1) structure on the Somerset GE 69kV tap, identified through inspections in 2016. The replacement of six (6) additional adjacent structures is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, seven (7) of the thirty-seven (37) structures will be completed energized when they are replaced. If the opportunity to complete the seven (7) structures de-energized would occur, this option would be pursued and would reduce the cost by $213k.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

The project is included in the 2018 Business Plan (BP) for $1,550k to replace thirty-one (31) structures on the Elihu-Somerset North 69kV line. Subsequent to the 2018 BP planning process, additional funding in the amount of $460k was identified for the replacement of six (6) additional structures in order to accommodate the height of the new structures, and a decision was made to complete seven (7) of the thirty-seven (37) structures energized. Furthermore, the material estimate included in the 2018 BP was entered on a non-burdenable expenditure type. Once the burdens were calculated on the correct expenditure type, the total project cost increased an additional $61k. The current total project cost is $2,071k and the incremental funding of $521k was approved by the RAC in the 0+12 forecast.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Elihu-Somerset North 69kV line was completed in 2016, and thirty-one (31) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. Subsequent to the 2018 BP planning process, the replacement of six (6) additional structures were added to the project scope in order to accommodate the height of the new structures. In addition, a decision was made to complete seven (7) of the thirty-seven (37) structures energized. There are 87 structures along this 5.89 mile line.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,590
     Due to the difficulty in obtaining an extended outage, seven (7) of the thirty-seven (37) wood structures will be energized when they are replaced with steel structures. If the opportunity to complete the seven (7) structures de-energized would occur, this option would be pursued and would reduce the cost by $213k and the NPVRR by $267k.
  2. Alternative #1: NPVRR: ($000s) $3,726
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $2,913
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

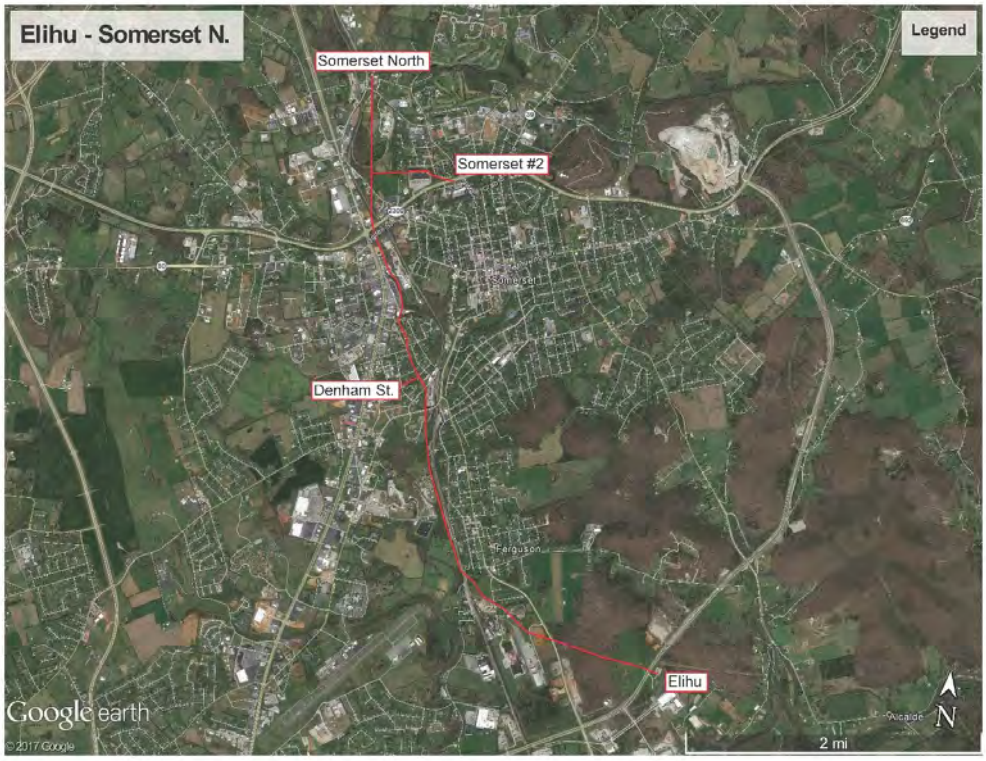
Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing eleven (11) standard and custom steel H-frame structures, one (1) steel three-pole running corner, one (1) custom steel single pole switch structure, twenty-four (24) standard steel single pole structures, and associated hardware and material, and the removal of thirty-seven (37) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. A two-year optional contract extension

was approved by the IC in April of 2017. Construction is scheduled to begin in February of 2018 and be completed in May of 2018.

Construction Milestones	
December 2017	Engineering and Design
December 2017	Space reserved for steel pole production with manufacturer
January 2018/February 2018	Steel Poles Ordered upon Project Approval
February 2018	Steel Poles Received
February 2018	Line Construction Begins
May 2018	Line Construction Completed

A facility map of the Elihu-Somerset North 69kV line is shown below:
Line length: 5.89 miles



- **Project Cost**
  The project is included in the 2018 Business Plan (BP) for $1,550k to replace thirty-one (31) structures on the Elihu-Somerset North 69kV line. Subsequent to the 2018 BP planning

process, additional funding in the amount of $460k was identified for the replacement of six (6) additional structures in order to accommodate the height of the new structures, and a decision was made to complete seven (7) of the thirty-seven (37) structures energized. Furthermore, the material estimate included in the 2018 BP was entered on a non-burdenable expenditure type. Once the burdens were calculated on the correct expenditure type, the total project cost increased an additional $61k. The current total project cost is $2,071k and the incremental fudning of $521k was approved by the RAC in the 0+12 forecast. Historical and existing contract and purchasing agreements were used to estimate the cost of material and contract labor. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $556k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$496k
Hardware	$60k
Total	$556k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	2019	Post 2019	Total
1. Capital Investment Proposed	-	1,938	-	-	1,938
2. Cost of Removal Proposed	-	134	-	-	134
3. Total Capital and Removal Proposed (1+2)	-	2,071	-	-	2,071
4. Capital Investment 2018 BP	-	1,550	-	-	1,550
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	1,550	-	-	1,550
7. Capital Investment variance to BP (4-1)	-	(388)	-	-	(388)
8. Cost of Removal variance to BP (5-2)	-	(134)	-	-	(134)
9. Total Capital and Removal variance to BP (6-3)	-	(521)	-	-	(521)

Financial Detail by Year - O&M ($000s)	2017	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.58%
Capital Breakdown:	
Labor:	$51k
Contract Labor:	$1,020k
Materials:	$556k
Local Engineering:	$122k
Burdens:	$134k
Contingency:	$188k
Reimbursements:	($0)
Net Capital Expenditure:	$2,071k

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and seven (7) of the thirty-seven (37) structures will need to be completed with the 69kV line energized.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 25% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Elihu-Somerset North 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Elihu-Somerset North pole replacement project for $2,071k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than or Equal to $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	President and Chief Operating Officer

Investment Proposal Project LI-000037 Can Run Switching-Shively Pole Replacement

Investment Proposal for Investment Committee Meeting on: October 31, 2018

Project Name: Cane Run Switching-Shively Pole Replacement

Total Expenditures: $2,030k
Total Contingency: $185k (10%)

Project Number(s): LI-000037

Business Unit/Line of Business: Transmission

Prepared/Presented By: Andrew Bailey/Adam Smith

Executive Summary
The proposed project is to replace thirty-five (35) wood structures on the Can Run Switching-Shively 69kV line with steel. The scope of work includes the replacement of twenty-three (23) structures identified through inspection in 2017. The replacement of twelve (12) additional adjacent structures is required to accommodate the increased height of the new structures. Due to the difficulty in obtaining an extended outage, approximately 50% of the thirty-five (35) structures will be completed energized when they are replaced. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $358k. This project will begin in January of 2019 and is being submitted for approval in 2018 to ensure the project will be open and ready for charges beginning January 1, 2019.

The alternative of replacing poles upon failure will result in much higher long term replacement costs due to mobilization of crews back to the site each time one fails and the probable overtime work involved in replacing each during an emergency situation. This alternative would also have a negative impact on network reliability. As such, this proposal is to proactively replace them over the course of the next year, prior to failure, to ensure the integrity and reliability of this line and to prevent outages resulting from such failures.

This project was included in the 2019 BP for $731k. The 2019 BP estimate was a per structure cost estimate to replace twenty-three (23) standard single pole structures. The current total project cost is $2,030k. Subsequent to the 2019 BP planning, detailed engineering analysis was completed and identified twelve (12) adjacent structures to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to complete 50% of the structures energized. Also, funding in the amount of $100k was identified for incremental site clearing and property reclamation. Incremental funding in the amount of $1,299k was funded by a reduction in capital pole replacement projects.

Background
Above ground pole inspections are performed by the company at defined intervals in order to discover problems that may impact the integrity and reliability of the Transmission System. A routine climbing inspection of the Cane Run Switching-Shively 69kV line was completed in 2017, and twenty-three (23) structures were identified as priority poles and determined to be in need of replacement in order to ensure the integrity and reliability of this line. Subsequent to the 2019 BP planning, detailed engineering analysis was completed and identified twelve (12) adjacent structures to be replaced in order to accommodate the height of the new structures. This project was included in the 2019 BP for $731k. The 2019 BP estimate was a per structure cost estimate to replace twenty-two (22) standard single pole structures.

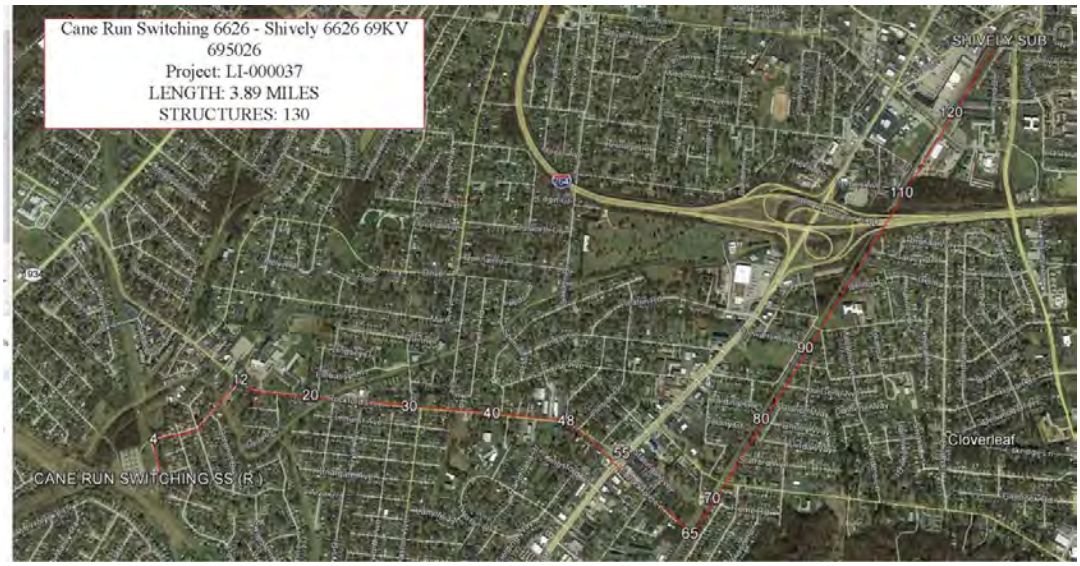
- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $2,517
     Due to the difficulty in obtaining an extended outage, 50% of the thirty-five (35) wood structures will be completed energized when they are replaced with steel structures. If the opportunity to complete the entire project de-energized would occur, this option would be pursued and would reduce the cost by $358k and the NPVRR by $444k.
  2. Alternative #1: NPVRR: ($000s) $3,621
     The alternative of do nothing would result in replacing the poles upon failure, which would result in a much higher long term replacement cost due to contract crew mobilization and overtime costs. This cost was derived by an estimated percentage of failure over the next four years. The failure rate and costs may vary depending on environmental factors. This option would also have a negative impact on network reliability.
  3. Alternative #2: NPVRR: ($000s) $3,027
     The next best alternative would be to replace the poles with wood structures. The recommended life span of a wood pole is 30-35 years, whereas steel poles have a recommended lifespan of 90 years. This option assumes replacement of wood structures in 30 years and an escalation rate of four percent (4%) which is in line with market cost increases over the last 15 years.

Project Description

- **Project Scope and Timeline**
  The scope of work will consist of installing thirty (30) standard steel single pole structures, five (5) custom steel dead end structures, and associated hardware and material, and the removal of thirty-five (35) wood structures, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. Construction is scheduled to begin in January of 2019 and be completed in May of 2019.

Construction Milestones	
May 2018	Engineering and Design
July 2018	Space reserved for steel pole production with manufacturer
October 2018	Steel Poles Ordered to Inventory
January 2019	Steel Poles Received to Inventory
January 2019	Line Construction Begins
May 2019	Line Construction Completed

A facility map of the Cane Run-Switching-Shively 69kV line is shown below:



- **Project Cost**
  This project was included in the 2019 BP for $731k. The 2019 BP estimate was a per structure cost estimate to replace twenty-three (23) structures. The current total project cost is $2,030k. Subsequent to the 2019 BP planning, detailed engineering analysis was completed and identified twelve (12) adjacent structures to be replaced in order to accommodate the height of the new structures. In addition, a decision was made to complete 50% of the structures energized. Also, funding in the amount of $100k was identified for incremental site clearing and property reclamation. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Based on preliminary engineering, Transmission Lines has estimated the material packages for construction of this project to be $454k. This project will utilize standard and custom steel structures. The steel structures will be purchased through the Company's steel pole alliance partner, Trinity Meyer. The line construction will be based on continuing contracts with the Company's line contractors. Davis H. Elliot, Pike Electric, B&B Electric and William E. Groves are the four main contractors which have been awarded the Transmission Overhead Construction and Maintenance contracts.

Transmission Lines Material Cost Breakdown	
Material	**Cost**
Steel Poles	$400k
Hardware	$54k
Total	$454k

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	**2019**	**2020**	**2021**	**Post 2021**	**Total**
1. Capital Investment Proposed	1,649	-	-	-	1,649
2. Cost of Removal Proposed	381	-	-	-	381
3. Total Capital and Removal Proposed (1+2)	2,030	-	-	-	2,030
4. Capital Investment 2019 BP	731	-	-	-	731
5. Cost of Removal 2019 BP	-	-	-	-	-
6. Total Capital and Removal 2019 BP (4+5)	731	-	-	-	731
7. Capital Investment variance to BP (4-1)	(918)	-	-	-	(918)
8. Cost of Removal variance to BP (5-2)	(381)	-	-	-	(381)
9. Total Capital and Removal variance to BP (6-3)	(1,299)	-	-	-	(1,299)

Financial Detail by Year - O&M ($000s)	**2019**	**2020**	**2021**	**Post 2021**	**Total**
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2019 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):	
Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$53
Contract Labor:	$960
Materials:	$454
Local Engineering:	$279
Burdens:	$99
Contingency:	$185
Reimbursements:	($0)
Net Capital Expenditure:	$2,030

- **Assumptions**

  Recommendation – The cost of this alternative assumes that the line outage will not be available for the duration of the project, and approximately 50% of the thirty-five (35) structures will need to be completed with the 69kV line energized.

  Alternative #1 – The cost of this alternative would be approximately 60% higher due to overtime labor charges and the cost to mobilize and demobilize construction crews. These poles would fail and require replacement within the next four years.

  Alternative #2 – The cost of this alternative assumes the cost of the wood poles is 34% the cost of the steel poles, and that the wood poles would be replaced again in 30 years. The estimated life of the steel poles is 90 years.

- **Environmental**
  There are no known environmental issues regarding air, water, lead asbestos, etc., associated with this project.

- **Risks**
  Without the proposed replacement of the priority poles on the Cane Run Switching-Shively 69kV line, the company risks unplanned outages and increased cost of repairs in emergency situations. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the Cane Run Switching-Shively pole replacement project for $2,030k to maintain system integrity, reliability, and to prevent failures and unplanned outages.

Approval Confirmation for Capital Projects Greater Than $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	Chairman, CEO and President

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: July 31, 2018

Project Name: PCH-Princeton Control House

Total Expenditures: $2,017k (Includes $183k (10%) Contingency)

Project Number(s): SU-000004

Business Unit/Line of Business: Transmission Substation

Prepared/Presented By: Aaron Burns, Sargent & Lundy/Brent Birchell

Executive Summary

This project is part of the existing Transmission System Improvement Plan (TSIP) and represents the aggregation of several system integrity programs into one holistic project. The project includes the replacement of (2) 69kV breakers, (4) sets of line arresters, and the replacement of the transmission control house at Princeton Substation. The new control house will be installed in the Northeast corner of the substation. The existing substation perimeter fence will be expanded to create adequate space inside the substation for the new control house.

The Princeton Substation control house currently houses transmission protection and control (P&C) equipment that is aging past the date of reasonable repair (GCX Type). Much of this equipment was installed over fifty years ago and will begin to fail without proactive replacement of these assets. Maintenance of said equipment is also becoming more difficult as replacement parts are difficult to find. By installing a new, pre-fabricated control house with microprocessor relays, aging equipment will be replaced with reliable, digital protective relays while also enhancing safe and reliable performance of the Transmission protection system.

This project was approved for $462k during May 2018 for preliminary engineering with the understanding that it would be presented to the Investment Committee for approval of full funding once detailed engineering was complete. The total cost of this project will be $2,017k with $537k in 2018 and $1,480k in 2019. The project was included in the 2018 BP for $1,043k in 2018 and $225k in 2019. The proposed amount is higher than the 2018 BP due to the addition of age-related breaker and arrester replacements which were added after the 2018 BP was finalized. The project is included in the proposed 2019 BP for $537k in 2018 and $1,446k in 2019, additional spending above the proposed 2019 BP will be covered through the 2019 RAC forecast process.

Background

The (2) 69kV breakers 003-644 and 003-654 are aging oil filled breakers. In addition to age, these breakers have a history of maintenance issues. Asset Management has identified these two breakers as overdue for replacement.

The (4) sets of line surge arresters are being replaced as part of a program due to the limited protection they provide.

The substation control house currently houses transmission protection and control (P&C) equipment that is aging past the date of reasonable repair. Maintenance of said equipment is also becoming more difficult as replacement parts are difficult to find. By installing a new, pre-fabricated control house with microprocessor relays, the obsolete, aging equipment will be replaced with reliable, digital protective relays while also ensuring safe and reliable performance of the Transmission protection system. The new control house will include integrated relay panels, batteries, AC and DC systems, etc. for the protection of bus and lines within the Princeton substation. Due to the limited space and steep incline of the substation, installation of this new control house will be uphill from the existing substation near the drivepath. The new substation control house will be the standard "small" control house design consisting of six (6) standard line protection panels (single breaker), one (1) bus differential panel, one (1) RTU panel, one (1) DFR panel, AC distribution equipment including ATS, DC system including battery, charger, and distribution panelboards, and one (1) telecomm rack.

For proposed site plan and aerial view see Appendix A – Site Plan and Aerial View

Alternatives Considered

1. Recommendation: NPVRR: ($000s) $2,229
   It is recommended that the breakers, arresters, and control house be replaced to reduce the potential risk to the Transmission system.

2. Alternative #1: NPVRR: ($000s) $2,397
   The next best alternative is to replace all of the identified equipment gradually over a period of several years instead of completing the numerous replacements in one time period. Taking a logical approach the Control House, arresters, (2) 69kV breakers, and DFR would be split into four separate projects completed over the next four years. Intermittently completing the required work is not recommended as inherent risks will remain for extended durations. Additionally, this alternative will ensure higher forecasted costs as well due to mobilization/demobilization of work crews and additional time spent on engineering.

3. Do Nothing: NPVRR: ($000s) N/A
   This option is not advisable as it puts Transmission at risk of not being able to accomplish targets established as part of the Transmission System Improvement Plan.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Originally Approved for Preliminary Engineering	May 2018
Full project funding requested	July 2018
Materials Ordered	August 2018
Materials Received	February 2019
Project Complete	August 2019

Project Cost
This project was approved for $462k during May 2018 for preliminary engineering with the understanding that it would be presented to the Investment Committee for approval of full funding in July. The total cost of this project will be $2,017k with $537k in 2018 and $1,480k in 2019. The project was included in the 2018 BP for $1,043k in 2018 and $225k in 2019. The project is included in the proposed 2019 BP for $541k in 2018 and $1,448k in 2019. The estimated total project figure includes an 10% contingency. This contingency is reasonable based on the level of detailed engineering and is expected to cover uncertainty with the contract labor costs based upon variances that have been observed on past similar projects.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2018	2019	Total
1. Capital Investment Proposed	515	1,435	1,950
2. Cost of Removal Proposed	22	45	67
3. Total Capital and Removal Proposed (1+2)	537	1,480	2,017
4. Capital Investment 2018 BP	1,043	225	1,268
5. Cost of Removal 2018 BP	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	1,043	225	1,268
7. Capital Investment variance to BP (4-1)	528	(1,210)	(682)
8. Cost of Removal variance to BP (5-2)	(22)	(45)	(67)
9. Total Capital and Removal variance to BP (6-3)	506	(1,255)	(749)

The project is included in the proposed 2019 BP for $540k in 2018 and $1,446k in 2019.

Financial Summary ($000s):

Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$99
Contract Labor:	$660
Materials:	$737
Other:	$0
Local Engineering:	$129
Burdens:	$209
Contingency:	$183
Net Capital Expenditure:	$2,017

Assumptions

Recommendation - Required outages are assumed to be able to be obtained within the requested timeframe. The control house is assumed to be placed in the proposed location with no impact due to hard rocks underground. Weather is assumed to be fair enough to work on schedule with no delays to mobilization of contractors or delivery of material.

Alternative #1 – The cost of this alternative is assumed to be 15% higher due to the cost to mobilize and demobilize work crews, additional cost of engineering, and project close-out if the job is broken down into multiple projects.

- **Environmental**
  This project does not require permitting in order to install the new control house in a currently unused area. There are no known issues regarding air, water, waste, or lead. It is assumed the oil in the breaker, the breaker bushings, and the bushing potential devise are PCB free.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of Princeton substation. Delaying this project exposes our system to the continuing risk of impacts from other potential transmission failures.

Conclusions and Recommendation
It is recommended that the Investment Committee approve replacement of Princeton 69kV breakers, arresters, and control house for $2,017k to enhance the reliability of the Transmission system.

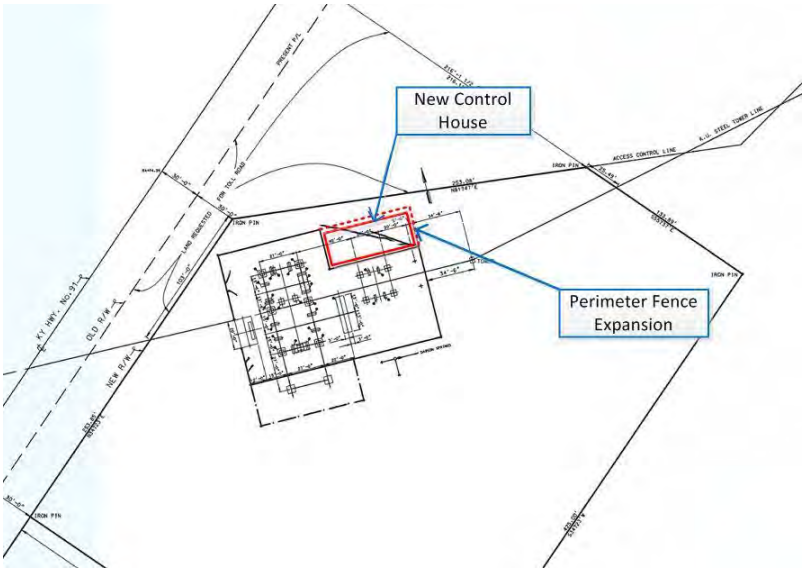
Approval Confirmation for Capital Projects Greater Than $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul Thompson Date
Chief Financial Officer	Chairman, CEO and President

Appendix A

Site Plan



Aerial View

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: Watterson 138kV breakers and switches replacement

Total Expenditures: $1,434k (Includes $130k (10%) Contingency)

Project Number(s): SU-000007

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Ayman El-Amouri – Sr. Electrical Eng. - Transmission Asset Management & Construction

Executive Summary

This project includes the replacements of (3) 138kV breakers, (11) 138kV cap and pin switches, (6) 138kV PTs, (8) 69kV cap and pin switches and (3) 69kV PTs.

The (3) 138kV breakers are being targeted for replacement are part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The replacement of these breakers will reduce risk of a potential failure and improve the reliability of the Transmission system.

The (11) 138kV and (8) 69kV cap and pin insulators are being planned for replacement under the "Replace Substation Insulators" TRP plan to increase reliability. These insulators have a known history of failures and will be removed from service. This project takes a systematic Approach, replacing multiple insulators as part of a planned outage as it is more cost effective than continually replacing failed insulators as part of a forced outage.

The (3) 69kV PT's are an opportunity replacement during associated 69kV insulator bus outage. 69kV PT's are showing signs of imminent failure and need to be replaced through the 2018 equipment failure program.

The total cost of this project will be $1,434k with $354k in 2017 and $1,080k in 2018. This project was not included in the 2017 BP, however the 2017 spending has been approved by the RAC in the 2017 9+3 forecast. The 2018 spending was only partially included in the 2018 BP and will be addressed by the RAC in the 0+12 forecast.

Background

The (3) 138kV (WT-3842, WT-138KV BUS TIE, and WT-3837) are circuit breakers are vintage 1950's Westinghouse GM and GE FK breakers. In addition to age, these breakers have a history of maintenance and test that show deterioration in the internal breaker system. This trend increases the likelihood of potential failure. The impact of failure results in a loss of customers and thus reflect negatively on SAIDI & SAIFI metrics.

In addition to the above criteria restoration time is factored into the breaker change out criteria. The two breakers WT-3837 and WT-3842 have bushing potential devices for relaying which increase the time needed for restoration event. These devices will be replaced with free standing PTs to provide continued protection and reduce restoration times.

The (11) 138kV and (8) 69kV cap and pin insulators are being targeted per the TRP insulator program "Replace Substation Insulators". Criteria for selection is determined through number of customers associated insulators in the station. This targeted approach allows LKE to maximize the impact of these replacements, lower the number of in-service failures and minimize customer outages.

In addition to the proposed TRP programs an opportunity "equipment failure" replacement has been identified and will be acted upon during the 69kV bus outage. The failure replacement of (2) 69kV PT's reduces potential un-planned failure impact associated with the loss of the 69kV bus. By replacing these PT' during the TRP project, overall cost is reduced and reliability is increase. PT's slotted for replacement are vintage 1950's, two bushing PT's with visable leaks.

- **Alternatives Considered**
    1. Recommendation: NPVRR: ($000s) $1,622k
       It is recommended that the breakers and switches be replaced to reduce the potential risk to the Transmission system.

    2. Alternative #1: NPVRR: ($000s) $2,734k
       This option would involve replacing the equipment over seven years. The 138kV breakers, potential transformers and disconnects would be replaced in years 2018, 2021 and 2024. The 69kV equipment would be replaced in years 2019 and 2022 and the surge arresters would be replaced in years 2020 and 2023. The costs are inflated by 3% per year.

    3. Do Nothing: NPVRR: ($000s) $0k
       This option is not advisable as it puts Transmission at risk of not being able to accomplish targets established as part of the Transmission Reliability Plan.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Originally Approved	August 2017
Materials Ordered	September 2017
Materials Received	Dec17-May18
Project Complete	September 2018

Project Cost

The total cost of this project will be $1,434k with $354k in 2017 and $1,080k 2018. The estimated total project figure includes a 10% contingency. This contingency is expected to cover uncertainty with the cost of expediting materials and premium cost for construction due to this being a pull forward project.

Economic Analysis and Risks

- **Bid Summary**

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	Total
1. Capital Investment Proposed	343	1,036	1,379
2. Cost of Removal Proposed	11	44	55
3. Total Capital and Removal Proposed (1+2)	354	1,080	1,434
4. Capital Investment 2017 BP	-	-	-
5. Cost of Removal 2017 BP	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-
7. Capital Investment variance to BP (4-1)	(343)	(1,036)	(1,379)
8. Cost of Removal variance to BP (5-2)	(11)	(44)	(55)
9. Total Capital and Removal variance to BP (6-3)	(354)	(1,080)	(1,434)

Financial Detail by Year - O&M ($000s)	2017	2018	Total
1. Project O&M Proposed	-	-	-
2. Project O&M 2017 BP	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-

Financial Summary ($000s):

Discount Rate:

Capital Breakdown:

Labor:	$49k
Contract Labor:	$580k
Materials:	$452k
Other:	$0k
Local Engineering:	$158k
Burdens:	$65k
Contingency:	$130k

Net Capital Expenditure: $1,434k

Assumptions

No major assumptions were included in the capital evaluation model. It is assumed material can be obtained in a timely manner.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos. It is assumed the oil in the breaker, the breaker bushings, and the bushing potential devise are PCB free.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of Watterson substation. Delaying this project exposes our system to the continuing risk of impacts from other potential transmission failures.

Conclusions and Recommendation

It is recommended that the Investment Committee approve replacement of Watterson 138kV breakers and Cap and Pin switches purchase project for $1,434k to enhance the reliability of the Transmission system.

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: PBR-Algonquin PIN PRLY

Total Expenditures: $1,575k (Including $138k of contingency)

Project Number(s): SU-000041

Business Unit/Line of Business: Transmission

Prepared/Presented By: Kyle D. Phillips, Mesa Associates Inc. / Brent Birchell

Executive Summary

The scope of this project includes the removal of and installation of new (1) 138kV circuit breaker, (20) 69kV switches with Cap & Pin (C&P) insulators, (3) 69kV lighting arrestors with C&P insulators, (1) set of line relays at Algonquin, and (2) 69kV lockout relays. The project will also install new equipment including (3) 138kV lighting arrestors, (3) 69kV lighting arrestors, and (3) 69kV C&P insulators. The project will remove (6) 69kV emergency bypass/transfer switches. Finally, the project will evaluate the integrity of the static wires and connections in the spans over the 138kV and 69kV buses and replace/modify as necessary.

The circuit breaker being targeted for removal of and installation of new is nearing the end of its useful life and require additional maintenance and inspections for continued proper operation. Failure of the breaker is very likely to eventually occur if it is not replaced.

The 69kV lockout relays are GE model HEA11 which are a known failure point throughout the LG&E and KU (LKE) system and are being systematically eliminated from the system.

C&P insulators are a known failure point throughout the LKE system and are being systematically eliminated from the system. With the replacement of the 69kV lockout relays and the accompanying 69kV bus outages this is an optimal opportunity to eliminate the C&P insulators from the 69kV portion of the site.

The line relays identified by this project are older models that require removal of and installation of new. The 69kV bus outage required for the 69kV lockout relays and 69kV switch replacement/removals will extend beyond the time required for the relay replacements and thus this is an ideal opportunity to remove of and installation new line relays.

The total cost of this project will be $1,575k with $191k in 2018 and $1,384k in 2019. This project was included in the 2018 BP for $250k with $50k in 2018 and $200k in 2019. The scope was to replace one breaker. Subsequently, it was decided that it would be prudent to complete the additional needed replacements described in this request while crews are on-site. The additional costs for 2018 are covered by the RAC in the approved 6+6 forecast plus $30k from

project 158149. The 2019 BP includes $161k for 2018 and $721k for 2019. The additional costs for 2019 are the result of detailed engineering and are covered by reductions in the following projects: 154146 ($250k), SU-000335 ($134k), and SU-000256 ($279k).

Background

The (1) 138kV breaker is being targeted for removal of and installation of new as part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The replacement of this breaker will reduce risk of a potential failure and improve the reliability of the Transmission system.

The various C&P insulators are being planned for replacement/removal under the "Replace Substation Insulators" TRP plan to increase reliability. These insulators have a known history of failures and will be removed from service. This project takes a systematic approach, replacing multiple insulators as part of a planned outage as it is more cost effective than continually replacing failed insulators as part of a forced outage.

The (3) 138kV and (6) 69kV line surge arresters are being added/replaced as part of a program to increase lighting protection throughout the system. The new 138kV SF6 gas circuit breaker does not have existing arresters and thus new ones will be installed. One of the 69kV breakers was upgrade in the past and arresters were not added but should have been and thus this project will add those to correct the deficiency. (3) 69kV arrestors will be replaced due to C&P insulators.

The line relays are being targeted for removal of and installation of new as they are outdated models for which replacement parts or replacement units are no longer readily available.

The (6) 69kV bypass/transfer switches to be removed currently utilize C&P insulators. These switches are no longer needed by operations. Removal of the switches simplifies operation of the system and it also simplifies the design and operation of the line relaying protection schemes. Thus the switches will be removed to eliminate the C&P insulators and to simplify system operation.

The replacements/additions/removals to be completed under this project will remove/replace most of the ageing and problematic equipment in the 69kV and 138kV yards at the Algonquin station. The changes will reduce the amount of maintenance required at the station and greatly reduce the risk of equipment failure and associated forced outages.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) 1,721

     It is recommended to perform the work detail in this document in 2018/2019.

2. Alternative #1: NPVRR: ($000s) 1,807

   Complete the 69kV work in 2018/2019 as currently planned and complete the remaining 138kV work in 2021.

   Performing all the work at once is preferred because it reduces engineering and construction labor costs due to efficiencies gained in performing some functions once instead of twice. Also, delaying the work leaves LKE open to failure of the equipment which could result in unnecessary outages, additional damage/stress on transmission equipment, and decreased system reliability.

3. Alternative #2: NPVRR: ($000s) N/A

   Do nothing. This is not a viable alternative. Oil circuit breakers of this vintage will eventually fail with a high likelihood of that happening in the near future. The system is experiencing occasional, unpredictable failures of the pilot wire line relaying and C&P insulators of the types proposed to be replaced and the same will eventually happen here if the equipment is not replaced.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Approved	Aug 29, 2018
Major Materials Ordered	Nov 1, 2018
Major Materials Received	Mar- Apr 2019
Project Complete	December 2019

- **Project Cost**
  The total cost of this project will be $1,575k with $191k in 2018 and $1,384k in 2019. This project was included in the 2018 BP for $250k with $50k in 2018 and $200k in 2019. The scope was to replace one breaker. Subsequently, it was decided that it would be prudent to complete the additional needed replacements described in this request while crews are on-site. The additional costs for 2018 are covered by the RAC in the approved 6+6 forecast plus $30k from project 158149. The 2019 BP includes $161k for 2018 and $721k for 2019. The additional costs for 2019 are the result of detailed engineering and are covered by reductions in the following projects: 154146 ($250k), SU-000335 ($134k), and SU-000256 ($279k). The estimated total project figure includes an 10% contingency. This contingency is reasonable based on the level of detailed engineering and is expected to cover uncertainty with the contract labor costs based upon variances that have been observed on past similar projects.

Economic Analysis and Risks

- **Bid Summary**
  Breakers, contract labor, switches, and relay panels will be procured under existing blanket contracts. Pricing will be requested soon after project approval and purchase orders (POs) issued as required. All other material costs will fall below thresholds requiring competitive bids and will be awarded as deemed appropriate to meet schedule and budget requirements.

- **Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2018	2019	2020	Post 2020	Total
1. Capital Investment Proposed	191	1,341	-	-	1,531
2. Cost of Removal Proposed	-	43	-	-	43
3. Total Capital and Removal Proposed (1+2)	191	1,384	-	-	1,575
4. Capital Investment 2018 BP	50	200	-	-	250
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	50	200	-	-	250
7. Capital Investment variance to BP (4-1)	(141)	(1,141)	-	-	(1,281)
8. Cost of Removal variance to BP (5-2)	-	(43)	-	-	(43)
9. Total Capital and Removal variance to BP (6-3)	(141)	(1,184)	-	-	(1,325)

Financial Detail by Year - O&M ($000s)	2018	2019	2020	Post 2020	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):

Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$101
Contract Labor:	$583
Materials:	$423
Local Engineering:	$205
Burdens:	$125
Contingency:	$138
Reimbursements:	($-)
Net Capital Expenditure:	$1,575

- **Assumptions**
  Equipment lead time is similar to that of other standard breakers, switches and control panels recently ordered and will be similar for this work. Outages can be obtained during the projected times.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of the lines and substations discussed in this document. Delaying this project exposes our system to the continuing risk of impacts from other potential transmission failures.

Conclusions and Recommendation
It is recommended that Management approve the PBR-Algonquin PIN PRLY project for $1,575k to enhance the reliability of the Transmission system

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: PBR-Delvinta 161kV Breaker Replacement

Total Expenditures: $1,571k (Includes $130k (9%) Contingency)

Project Number(s): SU-000043

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Ayman El-Amouri – Sr. Electrical Eng. - Transmission Asset Management & Construction

Executive Summary

This project includes the replacements of (4) 161kV breakers, (8) 161kV cap and pin insulators, and install new line surge arresters for Delvinta Substation.

The (4) 161kV breakers are being targeted for replacement are part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The replacement of these breakers will reduce risk of a potential failure and improve the reliability of the Transmission system.

The (3) new line arresters are being installed at Delvinta Substation as part of the breaker replacements.

The (8) 161kV cap and pin insulators are being planned for replacement under the "Replace Substation Insulators" TRP plan to increase reliability. These insulators have a known history of failures and will be removed from service. This project takes a systematic approach, replacing multiple insulators as part of a planned outage as it is more cost effective than continually replacing failed insulators as part of a forced outage.

The (3) 161kV PTs are also being planned for replacement. These PTs are 1960s vintage and leaking oil. The 161kV fuses that go along with them will also be removed.

The 161kV coupling capacitors are being planned for replacement. These coupling capacitors are known to be tied directly to wave traps for support. This project plans to replace multiple coupling capacitors as part of a planned outage, since it is more effective than replacing failed coupling capacitors units and wave trap assemblies. This project will relocate the coupling capacitors as a support, reducing the threat of a failure.

The total cost of this project will be $1,571k with $92k in 2017 and $1,479k in 2018. This project was not included in the 2017 BP. $78k of the 2017 spending was approved by the RAC in the 9+3 forecast and $13.5k was funded by a reduction in KRELAY-17. The 2018 spending was partially included in the 2018 BP ($600k) and the remainder will be funded by a reduction in LBRFAIL18 ($374k) and a reduction in LOTFAIL18 ($505k).

Background

The (4) 161kV breaker(s) 139-804, 139-814, 139-824, and 139-834 are vintage 1960's breakers. In addition to age, these breakers have a history of maintenance and are reaching their maximum interrupting ability. This trend increases the likelihood of potential failure. The impact of failure results in a loss of customers and thus reflect negatively on SAIDI & SAIFI metrics.

In addition to the above criteria, these breakers in proximity to water increasing the likelihood of oil reaching navigable water.

The (8) 161kV switches with cap and pin insulators are being targeted per the TRP insulator program "Replace Substation Insulators". Criteria for selection is determined through number of customers associated insulators in the station. This targeted approach allows LKE to maximize the impact of these replacements, lower the number of in-service failures and minimize customer outages.

In addition to the proposed TRP programs an opportunity "equipment failure" replacement has been identified and will be acted upon during the 161kV bus outage. The failure replacement of (3) 161kV Bus PT's reduces potential un-planned failure impact associated with the loss of the 161kV bus. By replacing these PT's during the TRP project, overall cost is reduced and reliability is increase. PT's slotted for replacement are vintage 1960's with visable leaks.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,748k
     It is recommended that the breakers and insulators be replaced to reduce the potential risk to the Transmission system.

  2. Alternative #1: NPVRR: ($000s) $2,404k
     This option would involve replacing the equipment over eleven years. The 161kV breakers along with the associated 161kV insulators and surge arresters would be replaced every three years: 2018, 2021, 2024, and 2027. The costs are inflated by 3% per year.

  3. Do Nothing: NPVRR: ($000s) $0k
     This option is not advisable as it puts Transmission at risk of not being able to accomplish targets established as part of the Transmission Reliability Plan.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Originally Approved	October 2017
Materials Ordered	November 2017
Materials Received	Feb-Apr 2018
Project Complete	June 2018

Project Cost

The total cost of this project will be $1,571k with $92k in 2017 and $1,479k in 2018. The estimated total project figure includes a 9% contingency. This contingency is expected to cover uncertainty with the cost of expediting materials and premium cost for construction due to this being a pull forward project.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	Total
1. Capital Investment Proposed	92	1,428	1,520
2. Cost of Removal Proposed	-	51	51
3. Total Capital and Removal Proposed (1+2)	92	1,479	1,571
4. Capital Investment 2017 BP	-	-	-
5. Cost of Removal 2017 BP	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-
7. Capital Investment variance to BP (4-1)	(92)	(1,428)	(1,520)
8. Cost of Removal variance to BP (5-2)	-	(51)	(51)
9. Total Capital and Removal variance to BP (6-3)	(92)	(1,479)	(1,571)

Financial Detail by Year - O&M ($000s)	2017	2018	Total
1. Project O&M Proposed	-	-	-
2. Project O&M 2017 BP	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-

Financial Summary ($000s):
Discount Rate:
Capital Breakdown:
Labor: $52k

Contract Labor:	$470k
Materials:	$673k
Other:	$0k
Local Engineering:	$104k
Burdens:	$142k
Contingency:	$130k
Net Capital Expenditure:	$1,571k

Assumptions

No major assumptions were included in the capital evaluation model. It is assumed material can be obtained in a timely manner. All assumptions were made prior to site visit.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos. It is assumed the oil in the breaker, the breaker bushings, and the bushing potential devise are PCB free.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of Delvinta substation. Delaying this project exposes our system to the continuing risk of impacts from other potential transmission failures.

Conclusions and Recommendation

It is recommended that management approve the PBR Delvinta (4) 161kV Breaker Replacement project for $1,571k to enhance the reliability of the Transmission system.

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: PR-Kenwood (3) 69kV Breaker Replacement

Total Expenditures: $825k (Includes $76k (10%) Contingency)

Project Number(s): SU-000049

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Ayman El-Amouri – Sr. Electrical Eng. - Transmission Asset Management & Construction

Executive Summary

This project includes the replacements of (3) 69kV breakers, and remove spark gaps and install new line surge arresters for Kenwood Substation.

The (3) 69kV breakers are being targeted for replacement are part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The replacement of these breakers will reduce risk of a potential failure and improve the reliability of the Transmission system.

The (2) spark gaps are being replaced with surge arresters. These spark gaps are being targeted for replacement at Kenwood Substation as part of the breaker replacements due to the lack of protection they provide.

The (9) 69kV cap and pin insulators are being planned for replacement under the "Replace Substation Insulators" TRP plan to increase reliability. These insulators have a known history of failures and will be removed from service. This project takes a systematic approach, replacing multiple insulators as part of a planned outage as it is more cost effective than continually replacing failed insulators as part of a forced outage.

The total cost of this project will be $825k with $83k in 2017 and $743k in 2018. This project was not included in the 2017 BP, however the 2017 spending has been approved by the RAC in the 2017 9+3 forecast. The 2018 spending will be covered by a $625k reduction in LTFFAIL18 and a $118k reduction in KBRFAIL18. This project was included in the 2018 BP for 2017 ($105k) and 2019 ($650k), with zero in 2018.

Background

The (3) 69kV (KE-6638, KE-6649, and KE-69KV BUS TIE) circuit breakers are vintage 1950's breakers. In addition to age, these breakers have a history of maintenance and are reaching their maximum interrupting ability. This trend increases the likelihood of potential failure. The impact of failure results in a loss of customers and thus reflect negatively on SAIDI & SAIFI metrics.

In addition to the above criteria, these breakers are in proximity to water increasing the likelihood of oil reaching navigable water, and have a direct impact on generation.

The (9) 69kV switches with cap and pin insulators are being targeted per the TRP insulator program "Replace Substation Insulators". Criteria for selection is determined through number of customers associated insulators in the station. This targeted approach allows LKE to maximize the impact of these replacements, lower the number of in-service failures and minimize customer outages.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $923k
     It is recommended that the breakers and insulators be replaced to reduce the potential risk to the Transmission system.

  2. Alternative #1: NPVRR: ($000s) $1,447k
     This option would involve replacing the equipment over nine years. The 69kV breakers would be replaced in years 2018, 2021, and 2024. The 69kV insulators would be replaced in years 2019, 2022, and 2025 and the surge arresters would be replaced in years 2020, 2023, and 2026. The costs are inflated by 3% per year.

  3. Do Nothing: NPVRR: ($000s) $0k
     This option is not advisable as it puts Transmission at risk of not being able to accomplish targets established as part of the Transmission Reliability Plan.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Originally Approved	October 2017
Materials Ordered	November 2017
Materials Received	Feb-Mar 2018
Project Complete	June 2018

Project Cost

The total cost of this project will be $825k with $83k in 2017 and $743k in 2018. The estimated total project figure includes a 10% contingency. This contingency is expected to

cover uncertainty with the cost of expediting materials and premium cost for construction due to this being a pull forward project.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	Total
1. Capital Investment Proposed	83	702	785
2. Cost of Removal Proposed	-	40	40
3. Total Capital and Removal Proposed (1+2)	83	743	825
4. Capital Investment 2017 BP	-	-	-
5. Cost of Removal 2017 BP	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-
7. Capital Investment variance to BP (4-1)	(83)	(702)	(785)
8. Cost of Removal variance to BP (5-2)	-	(40)	(40)
9. Total Capital and Removal variance to BP (6-3)	(83)	(743)	(825)

Financial Detail by Year - O&M ($000s)	2017	2018	Total
1. Project O&M Proposed	-	-	-
2. Project O&M 2017 BP	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-

Financial Summary ($000s):
Discount Rate:
Capital Breakdown:

Labor:	$37k
Contract Labor:	$354k
Materials:	$217k
Other:	$0k
Local Engineering:	$82k
Burdens:	$59k
Contingency:	$76k
Net Capital Expenditure:	$825k

Assumptions
No major assumptions were included in the capital evaluation model. It is assumed material can be obtained in a timely manner. All assumptions were made prior to site visit.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos. It is assumed the oil in the breaker, the breaker bushings, and the bushing potential devise are PCB free.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of Kenwood substation. Delaying this project exposes our system to the continuing risk of impacts from other potential transmission failures.

Conclusions and Recommendation
It is recommended that management approve the PBR Kenwood (3) 69kV breakers replacement project for $825k to enhance the reliability of the Transmission system.

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: PBR-London (5) 69kV Breaker Replacement

Total Expenditures: $995k (Includes $94k (10%) Contingency)

Project Number(s): SU-000050

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Ayman El-Amouri – Sr. Electrical Eng. - Transmission Asset Management & Construction

Executive Summary

This project includes the replacements of (5) 69kV breakers, (14) 69kV cap and pin insulators, and install new line surge arresters for London Substation.

The (5) 69kV breakers are being targeted for replacement are part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The replacement of these breakers will reduce risk of a potential failure and improve the reliability of the Transmission system.

The 69kV cap and pin insulators are being planned for replacement under the "Replace Substation Insulators" TRP plan to increase reliability. These insulators have a known history of failures and will be removed from service. This project takes a systematic approach, replacing multiple insulators as part of a planned outage as it is more cost effective than continually replacing failed insulators as part of a forced outage.

The 69kV coupling capacitors are being planned for replacement. These coupling capacitors are tied directly to wave traps for support. This project plans to replace multiple coupling capacitors as part of a planned outage, since it is more effective than replacing failed coupling capacitors units and wave trap assemblies. This project will relocate the coupling capacitors as a support, reducing the threat of a failure.

The total cost of this project will be $995k with $79k in 2017 and $916k in 2018. This project was not included in the 2017 BP, however the 2017 spending has been approved by the RAC in the 2017 9+3 forecast. The 2018 spending was only partially included in the 2018 BP ($675k) and the remaining $241k will be funded by a reduction in KBRFAIL18.

Background

The (5) 69kV breaker(s) 093-602, 093-604, 093-614, 093-624, and 093-634 are vintage 1960's breakers. In addition to age, these breakers have a history of maintenance and are reaching their maximum interrupting ability. This trend increases the likelihood of potential failure. The impact of failure results in a loss of customers and thus reflect negatively on SAIDI & SAIFI metrics.

In addition to the above criteria, these breakers have a high tank loss index (deterioration in either lift rod guide assembly, contact assembly interrupter, or upper portion of the lift rod). These breakers are also in proximity to water, increasing the likelihood of oil reaching navigable water, and have a direct impact on generation.

The 69kV switches with cap and pin insulators are being targeted per the TRP insulator program "Replace Substation Insulators". Criteria for selection is determined through number of customers associated insulators in the station. This targeted approach allows LKE to maximize the impact of these replacements, lower the number of in-service failures and minimize customer outages.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,109k
     It is recommended that the breakers and insulators be replaced to reduce the potential risk to the Transmission system.

  2. Alternative #1: NPVRR: ($000s) $2,211k
     This option would involve replacing the equipment over eleven years. The 69kV breakers along with the associated 69kV insulators and surge arresters would be replaced every three years: 2018, 2021, 2024, 2026, and 2028. The costs are inflated by 3% per year.

  3. Do Nothing: NPVRR: ($000s) $0k
     This option is not advisable as it puts Transmission at risk of not being able to accomplish targets established as part of the Transmission Reliability Plan.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Originally Approved	October 2017
Materials Ordered	November 2017
Materials Received	Feb-Mar 2018
Project Complete	June 2018

Project Cost

The total cost of this project will be $995k with $79k in 2017 and $916k in 2018. The estimated total project figure includes a 10% contingency. This contingency is expected to

cover uncertainty with the cost of expediting materials and premium cost for construction due to this being a pull forward project.

Economic Analysis and Risks

- **Bid Summary**
  Previously established blanket contract agreements will be utilized for related materials. Bids for any other necessary materials, as well as the below and above grade construction, will be sent out soon after project approval.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	Total
1. Capital Investment Proposed	79	852	931
2. Cost of Removal Proposed	-	64	64
3. Total Capital and Removal Proposed (1+2)	79	916	995
4. Capital Investment 2017 BP	-	-	-
5. Cost of Removal 2017 BP	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-
7. Capital Investment variance to BP (4-1)	(79)	(852)	(931)
8. Cost of Removal variance to BP (5-2)	-	(64)	(64)
9. Total Capital and Removal variance to BP (6-3)	(79)	(916)	(995)

Financial Detail by Year - O&M ($000s)	2017	2018	Total
1. Project O&M Proposed	-	-	-
2. Project O&M 2017 BP	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-

Financial Summary ($000s):
Discount Rate:
Capital Breakdown:

Labor:	$55k
Contract Labor:	$435k
Materials:	$260k
Other:	$0k
Local Engineering:	$64k
Burdens:	$87k
Contingency:	$94k
Net Capital Expenditure:	$995k

Assumptions
No major assumptions were included in the capital evaluation model. It is assumed material can be obtained in a timely manner. All assumptions were made prior to site visit.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos. It is assumed the oil in the breaker, the breaker bushings, and the bushing potential devise are PCB free.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of London substation. Delaying this project exposes our system to the continuing risk of impacts from other potential transmission failures.

Conclusions and Recommendation
It is recommended that management approve the PBR London (5) 69kV breakers replacement project for $995k to enhance the reliability of the Transmission system.

Sample Template for Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: PRLY-Canal-Del Park 6616 Relay Repl

Total Expenditures: $772k (Including $70k of contingency)

Project Number(s): SU-000072

Business Unit/Line of Business: Transmission

Prepared/Presented By: Kyle D. Phillips, Mesa Associates Inc. / Brent Birchell

Executive Summary

This project includes the replacement of the line relays protecting the 69kV transmission line from Canal to Del Park (line 6616). A new 69kV line breaker & 69kV disconnect switches will be installed at Del Park. The addition of the breaker will create a new 69kV bus segment and thus new Bus PT's and a bus differential relay panel will also be installed.

The existing relays are being targeted for replacement as they are outdated models for which replacement parts or replacement units are no longer available. Furthermore, the relays recently experienced a failure and require replacement.

The Transmission Reliability Performance and Standards group identified the need for a breaker at the Del Park substation to reduce the MegaWatt-Mile (MW-Mile is calculated by multiplying total miles of line exposure times the MWs served from the line) exposure on the Del Park to Canal 69kV line. This line has significant MW-Mile exposure.

Bus PT's will be installed at Del Park on the small bus segment created by installing the new breaker. The new PT's will provide bus/line voltages to the new relay panels.

The total cost of this project will be $772k with $126k in 2018 and $646k in 2019. This project was included in the 2018 BP for $240k in 2019 but was not included in the 2019 BP. The project is being funded by reductions to project SU-000370 for 2018 spending and to KOTFAIL19 for 2019 spending. The project is being accelerated to address the recent failure of the pilot wire scheme on the 6616 line.

Background

The new line relay panels will include a standard relay configuration consisting of one SEL-411L and one SEL-421 and various other auxiliary relays, test switches, and etc. for line 6616. The new relaying will be more reliable and will provide a greater array of protective functions for line faults and will thus lead to increased system reliability.

The relays identified in this project are older models and based on historical data it is evident that these are nearing the end of their useful, and cost effective life. The 6616 line recently experienced a pilot wire failure. Repairs to the relays are becoming more difficult and expensive as replacement sets and parts are becoming more scarce. Furthermore, most available replacement parts come from other retired sets which are also older and nearing the end of their useful lives.

The existing relays will eventually fail and will require replacement. Proactively replacing these relays will eliminate future emergency replacements and additional temporary work-arounds during failures.

The Del Park breaker addition was identified by the Transmission Reliability Performance and Standards group to reduce the MW-Mile exposure. Installing the breaker at the same time as the relays will lead to several engineering and construction efficiencies. Performing both tasks at the same time also results in one outage rather than two which increases system performance and reliability.

Additionally, two 69kV switches with Cap and Pin (C&P) insulators are being planned for replacement/removal under the "Replace Substation Insulators" TRP plan to increase reliability. These insulators have a known history of failures and will be removed from service. This project takes a systematic approach, replacing multiple insulators as part of a planned outage as it is more cost effective than continually replacing failed insulators as part of a forced outage.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $847

     Replace the line 6616 line relays. Install a new breaker at Del Park. Install new Bus PT's and differential relay panel at Del Park.

  2. Alternative #1: NPVRR: ($000s) $1,241

     Replace the line 6616 relays, which have failed, and install new bus PTs now. Postpone the breaker/bus diff panel install, cap and pin replacement until 2020.

     Performing all the work at once is preferred because it reduces engineering and construction labor costs due to efficiencies gained in performing some functions once instead of two or three times. Furthermore, postponing the breaker installation

continues to leave the system open to additional MW-Mile exposure for 2 additional years.

3. Alternative #2: NPVRR: ($000s) N/A

   Do nothing. This is not a viable alternative. The 6616 relays have already failed and will again. The system wide attempt to reduce MW-Mile exposure would also be negatively impacted by failing to add this breaker.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Approved for Full Funding	September 2018
Major Materials Ordered	October 2018
Engineering Complete	December 2018
Materials Received	March 2018
Construction Begins	April 2019
Construction Completed	May 2019
Project Complete	July 2019

- **Project Cost**
  The total cost of this project will be $772k with $126k in 2018 and $646k in 2019. This project was included in the 2018 BP for $240k in 2019 but was not included in the 2019 BP. The project includes 10% contingency which is reasonable based on the amount of risk associated with the project.

Economic Analysis and Risks

- **Bid Summary**
  Labor, Breaker, PT's, and relay panels will be procured under existing blanket contracts. Pricing will be requested soon after project approval and POs issued as required. All other material costs will fall below thresholds requiring competitive bids and will be awarded as deemed appropriate to meet schedule and budget requirements.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2018	2019	2020	Post 2020	Total
1. Capital Investment Proposed	126	635	-	-	761
2. Cost of Removal Proposed	-	10	-	-	10
3. Total Capital and Removal Proposed (1+2)	126	646	-	-	772
4. Capital Investment 2018 BP	-	240	-	-	240
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	240	-	-	240
7. Capital Investment variance to BP (4-1)	(126)	(395)	-	-	(521)
8. Cost of Removal variance to BP (5-2)	-	(10)	-	-	(10)
9. Total Capital and Removal variance to BP (6-3)	(126)	(406)	-	-	(532)

Financial Detail by Year - O&M ($000s)	2018	2019	2020	Post 2020	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

This project was not included in the 2019 BP but is being funded by reductions in projects SU-000370 (for 2018 spending) and KOTFAIL19 (for 2019 spending).

Financial Summary ($000s):

Discount Rate:	6.59%
Capital Breakdown:	
Labor:	$29
Contract Labor:	$278
Materials:	$230
Local Engineering:	$106
Burdens:	$59
Contingency:	$70
Reimbursements:	($-)
Net Capital Expenditure:	$772

- **Assumptions**
  Equipment lead time is similar to that of other standard Breakers, PT's, and control panels recently ordered and will be similar for this work.
  Outages can be obtained during the projected times.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of the lines and substations discussed in this

document. Delaying this project exposes our system to the continued risk of impacts from other potential transmission failures.

Conclusions and Recommendation
It is recommended that Management approve the PRLY-Canal-Del Park 6616 Relay Repl project for $772k to enhance the reliability of the Transmission system.

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: PBR-Wickliffe (4) 69kV Breaker Replacement

Total Expenditures: $873k (Includes $80k (10%) Contingency)

Project Number(s): SU-000243

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Ayman El-Amouri – Sr. Electrical Eng. - Transmission Asset Management & Construction

Executive Summary

This project includes the replacements of (4) 69kV breakers, 69kV surge arresters, 69kV hollow post insulators, (3) 69kV potential transformers (PTs), & 138kV coupling capacitor for Wickliffe Substation.

The (4) 69kV breakers being targeted for replacement are part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The replacement of these breakers will reduce risk of a potential failure and improve the reliability of the Transmission system.

The (3) single bushing 69kV PTs are also being planned for replacement. PTs are 1960's and 1980's vintage and leaking oil.

The 138kV coupling capacitor is being planned for replacement. This coupling capacitor is known to be tied directly to wave traps for support. This project plans to replace coupling capacitor as part of a planned outage, since it is more effective than replacing failed coupling capacitors units and wave trap assemblies. This project will relocate the coupling capacitor as a support, reducing the threat of a failure. The associated wave trap will also be replaced due to cracked or broken fiberglass cage, rods, and connections.

All of the equipment being replaced was included in the Transmission Reliability Plan (TRP).

This project was approved for preliminary engineering and breaker purchases during November 2017 for $204k with the understanding that it would be revised for full funding once detailed engineering was completed. Based on the results of detailed engineering, the total cost of this project will be $873k with $18k in 2017 and $855k in 2018. This project was included in the 2018 BP for $600K during 2019. After the BP was finalized, this project was accelerated to 2018. The 2018 spending was approved by the RAC in the 0+12 forecast. The proposed project total is higher than the amount included in the 2018 BP for 2019 due to the following scope items: estimated cost for (4) 69kV breaker replacements is larger than the 2018 BP amount; PT replacement was not

included in the 2018 BP; in addition to coupling capacitor replacement, wave traps also require replacement and line tuners need to be replaced.

Background

The (4) 69kV breaker(s) 159-604, 159-624, 159-638, and 159-644 are vintage 1960's breakers. In addition to age, these breakers have a history of maintenance and are reaching their maximum interrupting ability. This trend increases the likelihood of potential failure. The impact of failure results in a loss of customers and thus reflect negatively on SAIDI & SAIFI metrics.

In addition to the above criteria, these breakers have a tank loss index of 5 (deterioration in either lift rod guide assembly, contact assemble interrupter, or upper portion of the lift rod). 50% of the breakers have bushings that test poorly and all the the breakers have a history of maintenance.

In addition to the proposed TRP programs, an opportunity "equipment failure" replacement has been identified and will be acted upon during the 69kV bus outages. The failure replacement of 69kV Bus PT's reduces potential un-planned failure impact associated with the loss of the 69kV bus. By replacing these PT's during the TRP project, overall cost is reduced and reliability is increase. PT's slotted for replacement are vintage 1960's and 1980's with visable oil leaks.

- **Alternatives Considered**
    1. Recommendation: NPVRR: ($000s) $950k
       It is recommended that the proposed equipment be replaced to reduce the potential risk to the Transmission system.

    2. Alternative #1: NPVRR: ($000s) $1,481k
       This option would involve replacing the equipment over seven years. The project would be broken out into 3 projects: replacing (2) 69kV breakers along with the associated 69kV surge arresters in 2018 and (2) 69kV breakers with surge arresters in 2021. Replace 69kV PTs and 138kV CCs in 2024. The costs are inflated by 3% per year.

    3. Do Nothing: NPVRR: ($000s) $0k
       This option is not advisable as it puts Transmission at risk of not being able to accomplish targets established as part of the Transmission Reliability Plan.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Originally Approved	November 2017
Materials Ordered (breakers)	December 2017

Materials Received	Apr-May 2018
Project Complete	June 2018

Project Cost

The total cost of this project will be $873k with $18k in 2017 and $855k in 2018. The estimated total project figure includes a 10% contingency. This contingency is expected to cover uncertainty with the cost of expediting materials and premium cost for construction due to this being a pull forward project.

Economic Analysis and Risks

- **Bid Summary**

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	2019	Post 2019	Total
1. Capital Investment Proposed	18	800	-	-	818
2. Cost of Removal Proposed	-	55	-	-	55
3. Total Capital and Removal Proposed (1+2)	18	855	-	-	873
4. Capital Investment 2018 BP	-	-	600	-	600
5. Cost of Removal 2018 BP	-	-	-	-	-
6. Total Capital and Removal 2018 BP (4+5)	-	-	600	-	600
7. Capital Investment variance to BP (4-1)	(18)	(800)	600	-	(218)
8. Cost of Removal variance to BP (5-2)	-	(55)	-	-	(55)
9. Total Capital and Removal variance to BP (6-3)	(18)	(855)	600	-	(273)

Financial Detail by Year - O&M ($000s)	2017	2018	2019	Post 2019	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2018 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Financial Summary ($000s):
Discount Rate:
Capital Breakdown:

Labor:	$51k
Contract Labor:	$377k
Materials:	$241k
Other:	$0k
Local Engineering:	$47k
Burdens:	$77k
Contingency:	$80k
Net Capital Expenditure:	$873k

Assumptions

No major assumptions were included in the capital evaluation model. It is assumed material can be obtained in a timely manner. All assumptions were made prior to site visit.

- **Environmental**
  This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos. It is assumed the oil in the breaker, the breaker bushings, and the bushing potential devise are PCB free.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of Wickliffe substation. Delaying this project exposes our system to the continuing risk of impacts from other potential transmission failures.

Conclusions and Recommendation

It is recommended that the Investment Committee approve replacement of Wickliffe (4) 69kV breakers and Cap and Pin switches purchase project for $873k to enhance the reliability of the Transmission system.

Investment Proposal Project REL Jeffersontown Breaker Addition

Investment Proposal for Investment Committee Meeting on: October 31, 2018

Project Name: REL Jeffersontown Alt 4

Total Expenditures: $3,160k (Including $292k of contingency)

Project Number(s): SU-000261 and LI-000057

Business Unit/Line of Business: Transmission

Prepared/Presented By: Keith Yocum

Executive Summary

The Jeffersontown Breaker Addition project is a transmission reliability project that will eliminate line fault exposure for the Jeffersontown substation and allow planned work to be performed on the lines and stations in this area without needing to offload all of the load at the station. Due to the large load (34 MVA) on both transformers at Jeffersontown, moving the load to other stations has become nearly impossible at all times of the year.

Approximately 7,500 customers are served out of this station, 46 of which are critical, key, or medical alert customers. For a transmission outage at peak load on this line, over 3,000 customers could not be restored or back-fed by distribution. The remaining load could be transferred by distribution, but switching to complete this would require at least 4 to 6 hours. Transfering load from this station has become increasingly difficult even at non-peak times of the year, and load growth in this area of Louisville is expected to continue. This project seeks to eliminate the risk of an outage for the 7,500 customers at Jeffersontown and enable the support of continued load growth at Jeffersontown.

The Jeffersontown station is presently served from a tap off the Watterson to Middletown 3842 line. There is one 138 kV breaker in the Jeffersontown station, as shown in Figure 1. Both Jeffersontown and Bluegrass Parkway were designed and constructed as radial taps with the intention of constructing a line between the two stations at a later date. This possibility was considered and is discussed further in the alternatives section below.

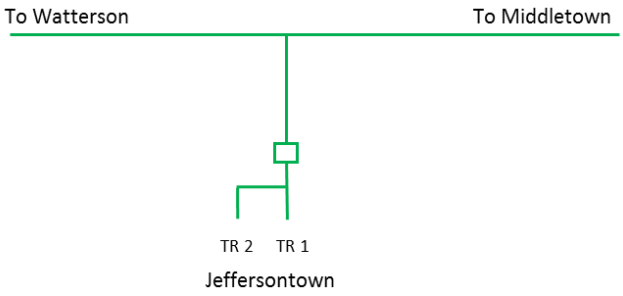


Figure 1 Present configuration at Jeffersontown

The proposed project involves installing three breakers at the Jeffersontown station and building a second tap from the Watterson to Middletown 138 kV line into the station, as shown in Figure 2. This will allow each section of the transmission line to be isolated for planned work and will ensure that the customers at Jeffersontown are not interrupted for a fault on the transmission system. It will also allow for load to be transferred between the two transformers at Jeffersontown as needed for planned work.

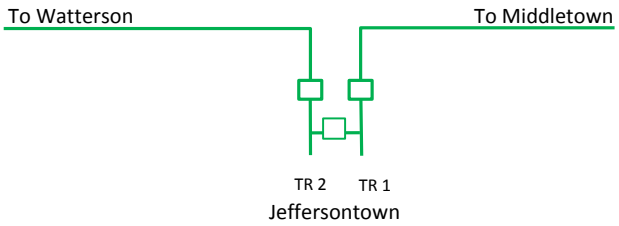


Figure 2 The proposed project to improve Jeffersontown reliability involves installing two breakers and a second tap into the station.

The total cost of this project is $3,160k with $570k in 2018 and $2,590k in 2019. A total of $2,550k was included in the 2018 BP, with $100k in 2018 and $2,550k in 2019. This project is also included in the 2019 BP for $3,338k, with $459k in 2018 and $2,879k in 2019.

Background
The Enhancing Contingencies study identified transmission line segments with high net unserved customers (>3,000) during a transmission outage.

The Watterson to Middletown 138 kV line ranked fourth in a list of transmission segments for net unserved load after both transmission and distribution switching. Over 7,000 customers and 34 MVA are served from a 7 mile line, and over 40% of the customers cannot be restored in the event of a transmission outage on the line under peak load conditions.

There have not been any events on this line, but the inability to transfer the load at Jeffersontown has made even planned outages impossible to schedule. In the event of an outage on this line, 34 MVA, or 7,424 customers, would be interrupted. For a transmission outage at peak load, distribution can restore 6.66 MVA from Bluegrass, 0.02 MVA from Fairmount, 2.69 MVA from Hurstbourne, and 10.5 MVA from Watterson. This leaves 14.2 MVA (3,101 customers) unserved.

The proposed project would ensure that the Jeffersontown station would not be interrupted by an event on the transmission line, eliminating the exposure for the 7,000+ affected customers.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $3,538
     Install two breakers at Jeffersontown: a second line breaker for an in and out scheme at the Jeffersontown tap and a bus tie breaker. The proposed project will eliminate exposure for 7,000+ customers to faults on the transmission line, allow for planned project work to be completed by transmission or distribution, and position us to handle continued load growth in the Jeffersontown area.

  2. Alternative #1: Construct 138 kV line from Jeffersontown to Bluegrass Parkway
     NPVRR: ($000s) $8,410
     This alternative includes installing a breaker at Jeffersontown, constructing a 2.5 mile line from Jeffersontown to Bluegrass Parkway and installing two breakers at Bluegrass Parkway. It provides additional reliability benefits to the Bluegrass Parkway station, which is presently served from a 2 mile radial line out of Hurstbourne. The stations were originally designed and constructed to accommodate this expansion; however, considering the difference in cost, this alternative is not recommended.

  3. Alternative #2: Do nothing NPVRR: ($000s) N/A
     This alternative is not recommended. Without implementing a project on this line, planned projects in the station or on the transmission line will be impossible. A single transmission outage on this circuit would interrupt over 7,000 customers, of which over 3,000 customers could not be restored (by transmission or distribution) until the transmission circuit was restored.

Project Description

- **Project Scope and Timeline**

  Substations Project Scope
  Install (3) 138kV, 3000A, 40kA breakers, (5) 138kV, 2000A gang-operated disconnect switches, (1) 138kV, 1600A motor-operated disconnect switch, (6) 138kV potential transformers, (4) protection panels, (3) HFA electromechanical relays, a new steel structure and extend existing rigid bus, line arresters on the new and existing entrances, and relocate

TR2 high-side connections to new bay. Remove (1) 138kV, 1600A breaker (JT-3842) and (4) 138kV, 1600A disconnect switches.

Substation Construction Milestones	
Design Start	August 2018
Design Complete	January 2019
Materials Ordered	November 2018
Materials Delivered	February 2019
Construction Start	March 2019
Facility In-Service	April 2019
Project Complete	July 2019

Lines Project Scope
The scope of work will consist of installing two (2) double circuit self-supporting steel foundations structures, and associated hardware and material, and the removal of one (1) wood structure, and associated hardware and material. The line construction will be based on continuing contracts from the Company's line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017. Construction is scheduled to begin in March of 2019 and be completed in June of 2019.

Lines Construction Milestones	
Design Start	May 2018
Design Complete	August 2018
Space reserved for steel pole production with manufacturer	June 2018
Materials Delivered	February 2019
Construction Start	March 2019
Facility In-Service	May 2019
Project Complete	June 2019

- **Project Cost**
  The total cost of this project is $3,160k with $570k in 2018 and $2,590k in 2019. A total of $2,550k was included in the 2018 BP, with $100k in 2018 and $2,550k in 2019. This project is also included in the 2019 BP for $3,338k, with $459k in 2018 and $2,879k in 2019. This project contains a 10% contingency which is reasonable based on the level of detailed engineering, confidence in cost of materials and contractors, and potential unknown risks such as weather delays, rock, structure access, and potential outage restrictions.

Economic Analysis and Risks

- **Bid Summary**
  Substation project

Labor, Breaker, PT's, and relay panels will be procured under existing blanket contracts. Pricing will be requested soon after project approval and Purchase Orders (POs) issued as required. All other material costs will fall below thresholds requiring competitive bids and will be awarded as deemed appropriate to meet schedule and budget requirements.

Lines project:
Based on detailed engineering, Transmission Lines has estimated the material package for this project to be $88k. The project will utilize conductor, custom steel structures, standard steel structures, and material. The conductor will be competitively bid through normal Supply Chain processes. The line construction will be based on continuing contracts with our line contractors. B&B Electric, Davis H. Elliot, William E. Groves and Pike Electric are the four contractors awarded the Transmission Overhead Construction and Maintenance contract from the October 2011 Investment Committee (IC) meeting. The contract extension was re-approved by the IC in April of 2017.

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2018	2019	2020	Post 2020	Total
1. Capital Investment Proposed	570	2,505	-	-	3,075
2. Cost of Removal Proposed	-	85	-	-	85
3. Total Capital and Removal Proposed (1+2)	570	2,590	-	-	3,160
4. Capital Investment 2019 BP	459	2,879	-	-	3,338
5. Cost of Removal 2019 BP	-	-	-	-	-
6. Total Capital and Removal 2019 BP (4+5)	459	2,879	-	-	3,338
7. Capital Investment variance to BP (4-1)	(111)	374	-	-	263
8. Cost of Removal variance to BP (5-2)	-	(85)	-	-	(85)
9. Total Capital and Removal variance to BP (6-3)	(111)	289	-	-	178

Financial Detail by Year - O&M ($000s)	2018	2019	2020	Post 2020	Total
1. Project O&M Proposed	-	-	-	-	-
2. Project O&M 2019 BP	-	-	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-	-	-

Discount Rate: 6.59%

Capital Breakdown:

	Substation	Lines	Combined
	SU-000261	LI-000057	Total
Labor:	$ 56	$ 30	$ 86
Contract Labor:	$ 1,114	$ 462	$ 1,576
Materials:	$ 525	$ 88	$ 613
Local Engineering:	$ 335	$ 110	$ 445
Burdens:	$ 111	$ 37	$ 148
Contingency:	$ 219	$ 73	$ 292
Reimbursements:	$ -	$ -	$ -
Net Capital Expenditure:	$ 2,360	$ 800	$ 3,160

- **Assumptions**
  A temporary circuit will be constructed in order keep the substation energized for the duration of the overhead line work. The temporary line can be protected during construction with the existing breaker bypass scheme. No civil permitting is required for the substation work. No control house expansion is required. The existing station service transformer is adequate to support the additional AC load of the new equipment. Materials will be delivered as scheduled.

- **Environmental**
  There are no environmental issues regarding: air, water, waste, lead, asbestos, etc. associated with this project.

- **Risks**
  Without the proposed transmission reliability project, line fault exposure for the Jeffersontown substation will continue and planned work to be performed on the lines and stations in this area will continue to require offloading of all of the load at the station. Due to the large load (34 MVA) on both transformers at Jeffersontown, moving the load to other stations has become nearly impossible at all times of the year. Inclement weather which affects site access and working conditions could increase the project cost and cause schedule delays. Completing the project involves risk related to high voltage substation construction work.

Conclusions and Recommendation
It is recommended that the Investment Committee approve the REL-Jeffersontown Alt 4 project for $3,160k to increase reliability by eliminating line fault exposure for the Jeffersontown substation and allowing planned work to be performed on the lines and stations in this area without needing to offload all of the load at the station.

Approval Confirmation for Capital Projects Greater Than $2 million:

The Capital project spending included in this Investment Proposal has been approved by the members of the LKE Investment Committee. Pursuant to the LKE Authority Limit Matrix, the signatures below are also required for approval of this Capital project spending request.

Kent W. Blake Date	Paul W. Thompson Date
Chief Financial Officer	Chairman, CEO and President

Capital Investment Proposal

Investment Proposal for Investment Committee Meeting on: N/A

Project Name: PR-Ashbottom 138kV Breaker Replacement

Total Expenditures: $1,418k (Includes $134k (10%) Contingency)

Project Number(s): SU-000262

Business Unit/Line of Business: Transmission Substation Construction & Maintenance

Prepared/Presented By: Ayman El-Amouri – Sr. Electrical Eng. - Transmission Asset Management & Construction

Executive Summary

This project includes the replacements of (4) 138kV breakers, (14) 138kV cap and pin insulators, and install new line surge arresters for Ashbottom Substation.

The (4) 138kV breakers are being targeted for replacement are part of a program to replace oil circuit breakers in the LKE system that meet particular criteria developed internally by LKE. The replacement of these breakers will reduce risk of a potential failure and improve the reliability of the Transmission system.

The (14) 138kV cap and pin insulators are being planned for replacement under the "Replace Substation Insulators" TRP plan to increase reliability. These insulators have a known history of failures and will be removed from service. This project takes a systematic approach, replacing multiple insulators as part of a planned outage as it is more cost effective than continually replacing failed insulators as part of a forced outage.

The (3) new line surge arresters are being replaced at Ashbottom Substation as part of a program due to the lack of protection they provide.

The total cost of this project will be $1,418k with $163k in 2017 and $1,255k in 2018. This project was not included in the 2017 BP, however will be funded by a reduction in project KRELAY-17. The 2018 spending was only partially included in the 2018 BP and will be funded by a reduction in LTFFAIL18.

Background

The (4) 138kV breaker(s) AS-3832, AS-138KV BUS TIE &TFR, AS-3829 and AS-3833 are vintage 1960's breakers. In addition to age, these breakers have a history of maintenance and are reaching their maximum interrupting ability. This trend increases the likelihood of potential failure. The impact of failure results in a loss of customers and thus reflect negatively on SAIDI & SAIFI metrics.

In addition to the above criteria, these breakers have a high tank loss index (deterioration in either lift rod guide assembly, contact assembly interrupter, or upper portion of the lift rod).

The (14) 138kV switches with cap and pin insulators are being targeted per the TRP insulator program "Replace Substation Insulators". Criteria for selection is determined through number of customers associated insulators in the station. This targeted approach allows LKE to maximize the impact of these replacements, lower the number of in-service failures and minimize customer outages.

- **Alternatives Considered**
  1. Recommendation: NPVRR: ($000s) $1,585k
     It is recommended that the breakers and insulators be replaced to reduce the potential risk to the Transmission system.

  2. Alternative #1: NPVRR: ($000s) $2,524k
     This option would involve replacing the equipment over ten years. The 138kV breakers along with the associated 138kV insulators and surge arresters would be replaced every three years: 2018, 2021, 2014, and 2017. The costs are inflated by 3% per year.

  3. Do Nothing: NPVRR: ($000s) $0k
     This option is not advisable as it puts Transmission at risk of not being able to accomplish targets established as part of the Transmission Reliability Plan.

Project Description

- **Project Scope and Timeline**

Description	Date
Project Originally Approved	October 2017
Materials Ordered	November 2017
Materials Received	Jan-Mar 2018
Project Complete	June 2018

Project Cost

The total cost of this project will be $1,418k with $163k in 2017 and $1,255k in 2018. The estimated total project figure includes a 10% contingency. This contingency is expected to cover uncertainty with the cost of expediting materials and premium cost for construction due to this being a pull forward project.

Economic Analysis and Risks

- **Bid Summary**

- **Budget Comparison and Financial Summary**

Financial Detail by Year - Capital ($000s)	2017	2018	Total
1. Capital Investment Proposed	163	1,204	1,367
2. Cost of Removal Proposed	-	51	51
3. Total Capital and Removal Proposed (1+2)	163	1,255	1,418
4. Capital Investment 2017 BP	-	-	-
5. Cost of Removal 2017 BP	-	-	-
6. Total Capital and Removal 2017 BP (4+5)	-	-	-
7. Capital Investment variance to BP (4-1)	(163)	(1,204)	(1,367)
8. Cost of Removal variance to BP (5-2)	-	(51)	(51)
9. Total Capital and Removal variance to BP (6-3)	(163)	(1,255)	(1,418)

Financial Detail by Year - O&M ($000s)	2017	2018	Total
1. Project O&M Proposed	-	-	-
2. Project O&M 2017 BP	-	-	-
3. Total Project O&M variance to BP (2-1)	-	-	-

Financial Summary ($000s):
Discount Rate:
Capital Breakdown:

Labor:	$52k
Contract Labor:	$487k
Materials:	$581k
Other:	$0k
Local Engineering:	$98k
Burdens:	$66k
Contingency:	$134k
Net Capital Expenditure:	$1,418k

Assumptions
No major assumptions were included in the capital evaluation model. It is assumed material can be obtained in a timely manner. All assumptions were made prior to site visit.

- **Environmental**

This project does not require permitting and there are no known issues regarding air, water, waste, lead, or asbestos. It is assumed the oil in the breaker, the breaker bushings, and the bushing potential devise are PCB free.

- **Risks**
  Completing the project involves risk related to high voltage substation construction work. Not completing the project decreases the reliability of Watterson substation. Delaying this project exposes our system to the continuing risk of impacts from other potential transmission failures.

Conclusions and Recommendation
It is recommended that the Investment Committee approve replacement of Ashbottom 138kV breakers and Cap and Pin switches purchase project for $1,418k to enhance the reliability of the Transmission system.

LOUISVILLE GAS AND ELECTRIC COMPANY

Response to Attorney General's Initial Data Requests for Information
Dated November 13, 2018

Case No. 2018-00295

Question No. 197

Responding Witness: Lonnie E. Bellar

Q-197. Reference the Bellar testimony, p. 37, lines 9-11, wherein he discusses reliability programs such as sectionalizing. Discuss whether there any other options that might be more cost-effective while still satisfying the stated goals. Provide copies of any and all cost-benefit analyses regarding any such options.

A-197. See the response to Question No. 196.

LOUISVILLE GAS AND ELECTRIC COMPANY

Response to Attorney General's Initial Data Requests for Information
Dated November 13, 2018

Case No. 2018-00295

Question No. 198

Responding Witness: Lonnie E. Bellar

Q-198. Reference the Bellar testimony beginning at p. 59, wherein he discusses LG&E's plans to replace 13.2 miles of gas transmission line segments on the Western Kentucky A and B transmission lines ". . . to achieve uniform diameter and better facilitate enhanced inline inspection capabilities."

a. Cite any applicable PHMSA or other regulatory requirements mandating such replacements, and provide copies of same.

b. State why the inspections must be "continuous."

c. State how LG&E is currently conducting the inspections.

d. State precisely how the proposed replacements will ". . . support compliance with proposed PHMSA regulations relating to expanding construction documentation requirements for natural gas transmission pipelines."

e. State whether LG&E has identified any alternatives to the proposed replacements, and if so: (i) identify all such alternatives; (ii) provide any supporting documentation of same, including all cost estimates; and (iii) provide copies of any and all cost-benefit analyses regarding all such alternatives.

f. Referring to p. 60 of the Bellar testimony, explain how replacing eight (8) road crossings on the Magnolia pipeline will ". . . better facilitate the use of enhanced inline inspection tools on the Magnolia line." State whether LG&E has identified any alternatives to the proposed road crossings, and if so: (i) identify all such alternatives; (ii) provide any supporting documentation of same, including all cost estimates; and (iii) provide copies of any and all cost-benefit analyses regarding all such alternatives.

A-198.

a. 49 CFR Part 192 Subpart O—Gas Transmission Pipeline Integrity Management does mandate performing gas transmission pipeline assessments and inline inspection is the assessment method which provides the most

comprehensive data on the integrity of the pipeline. Enhanced ILI supports compliance with PHMSA regulations by providing additional pipeline information prescribed by current regulations and information PHMSA has stated will be required under the pending Safety of Gas Transmission and Gathering Pipelines. The Safety of Gas Transmission and Gathering Pipelines Notice of Proposed Rulemaking (NPRM) has been in process to become regulation for some time. The original draft of the proposed rulemaking was issued 3/22/2016 and PHMSA has stated the final rule is expected to be released in early 2019. Specific information supplied by the Enhanced ILI tools that will help support compliance with pending regulations include:

a. Determine or confirm locations prescribed testing of unknown material properties (NPRM §192.607)

b. Collection of data for Engineering Critical Assessments (ECA) (NPRM §192.624)

c. Collection of prescribed features, such as cracks and seam defects for segments of pipe for a new classification of pipeline segments called Medium Consequence Areas (MCAs) as defined in the proposed Safety of Gas Transmission and Gathering Pipelines rule (NPRM §192.624)

Enhanced ILI expands Construction Documentation by collecting a more robust set of data than other types of assessments. Some of the data collected confirms unknown pipe characteristics such as pipe grade and seam type.

b. Continuous inspection in Mr. Bellar's testimony refers to inspecting a pipeline in a single run. Replacing the 13.2 miles would make both the WKA and WKB uniform diameter pipelines allowing for a single continuous inline inspection run for both pipelines. Because some enhanced ILI tools can only collect data for a single diameter size, leaving the pipelines multi-diameter would require an individual run at each pipeline diameter change leading to the following issues:

a. Temporary facilities would have to be constructed to launch and receive the ILI tools for each pipeline diameter change in order to run enhanced ILI tools.

b. Some of the diameter changes occur when crossing multilane highways and interstates. Proposed regulations in the Notice of Proposed Rulemaking (NPRM) for the Safety of Gas Transmission and Gathering Pipelines (NPRM 49 CFR §192.710), requires assessment of pipeline crossings of designated interstate, freeway, expressway, or other principal 4-lane arterial roadways.

c. The cost structure for an ILI tool run is based on longer runs, for example 25 miles. Short enhanced ILI tool runs, such as a few hundred feet to inspect a four-lane highway crossing with larger diameter pipe, would have similar cost as for a 25 mile pipeline.

c. The Company is currently running "enhanced" ILI only on pipelines having a single diameter from start to finish and for which the technology exists which can be run in the pipeline. This is because multi-diameter tools are not available for some "enhanced" ILI tools. Enhanced ILI is being conducted to further increase pipeline safety and to comply with proposed regulations (NPRM) PHMSA has stated will be issued in early 2019.

In the past, conventional ILI inspections have been performed using ILI tool types that have multi-diameter capabilities, conducted multiple runs for segments with different diameters, or omitted oversized diameter sections not explicitly required to be assessed by the existing regulations. The Safety of Gas Transmission and Gathering Line rule, as stated in the NPRM, will require more of the pipeline segments having oversized diameters to be inspected. The ILI information required by the new regulation will require some ILI tools to be run that can only inspect single diameter pipelines.

d. See the response to part (a).

e. See the responses to Question No. 55(a) and part (b) of this question.

f. Currently, the Magnolia 16" Line is mostly 16" diameter pipe except for six (6) sections of 20" diameter pipe. The 20" diameter sections range in length from less than 100 feet to almost 300 feet long and are located at highway crossings. At least three (3) of the 20" segments are expected to be required to be assessed when the proposed NPRM becomes final.

The Magnolia 20" Line is mostly 20" diameter pipe except for two (2) sections of 24" diameter pipe. The 24" diameter sections are both just under 300 feet long and are located at major highway crossings. Both of the 24" diameter segments are expected to be required to be assessed when the proposed NPRM becomes final.

The alternative to replacing the road crossings for each line is to inspect each oversized diameter section separately with required single diameter ILI tools. A formal analysis has not been completed, but please see part (b) of this response for increased cost due to multiple runs versus single runs for a pipeline.

LOUISVILLE GAS AND ELECTRIC COMPANY

Response to Attorney General's Initial Data Requests for Information
Dated November 13, 2018

Case No. 2018-00295

Question No. 199

Responding Witness: Lonnie E. Bellar

Q-199. Reference the Bellar testimony, p. 60, regarding the update on the Bullitt County project. Provide the diameter of pipe that LG&E proposes to use for the project.

A-199. The pipeline will be 12-inches in nominal diameter.