city of Columbia
Utilities

TO: De'Carlon Seewood, City Manager
FROM: David Sorrell, Director of Utilities DS 5-30-24
DATE: May 30, 2024
RE: Update on Electric Substation Improvements and Recommendations for Electric Transmission System Upgrades

Below, I have included a brief history of the need to upgrade the City's electric transmission system, status of electric substation upgrades, followed by a discussion of options and recommendations. I request direction on how to proceed with potential improvements.

Brief History

The need to strengthen the City electric transmission system has been discussed for more than 15 years. Many studies have been completed to investigate the options available for electric system improvements that would meet the needs of the system today, and in the future. These studies have identified the option of connecting the Grindstone Substation to Perche Creek Substation via a new 161 kV transmission line as the best solution to address regulatory and reliability concerns with the current system. The alignment along a path that would run along Scott Boulevard, Vawter School Road, Nifong and Grindstone Parkway was determined to be preferred for constructability and maintenance reasons.

Prior to 2015, a series of public meetings were held. The consensus from these meetings and other public input was that the Scott-Vawter-Nifong-Grindstone transmission line alignment was the best option. A ballot issue to approve bond funding to construct these upgrades was approved by the community in 2015. A previous City Council approved moving forward with the upgrades to the transmission system. An engineering firm was selected and design of the improvements were initiated. The design process requires soil information for foundation design. When equipment was dispatched to obtain soil data, local residents became concerned with the project. A second public hearing and a different Council put the transmission project on "pause".

Following the project being put on "pause", the Council created a task force to develop an integrated management plan and master plan for the electric utility. The plan developed by the task force was presented to Council in December 2021. Staff presented a response in two work sessions in May and June of 2022. At a work session in April 2023, Staff presented recommendations for possible substation expansions instead of a new substation and summarized again the proposed transmission improvement options. The direction of the Council at that time was to proceed with substation expansion improvements and investigate the potential for a transmission system interconnection with Ameren's system west of Columbia.

Discussion

Substation Expansion Status:
Following the work session in April 2023, staff focused on evaluating the expansion of the Perche Creek Substation and the Bolstad Substation, as well as, determining appropriate alternatives to protect Hinkson Substation from the potential for damage due to flooding. The status is as follows:

Perche Creek Substation:
Specifications for materials have been finalized and materials ordered. Final design of the expansion is being completed. Equipment delivery is expected to be between 18 and 24 months. Once equipment is delivered, the expansion work will be completed by a combination of City staff and term and supply contract personnel.

Bolstad Substation:
Specifications for materials have been finalized and materials ordered. Final design of the expansion is being completed. Equipment delivery is expected to be between 18 and 24 months. Once equipment is delivered, the expansion work will be completed by a combination of City staff and term and supply contract personnel.

Hinkson Substation:
The City Land Surveyor has completed an elevation survey of the equipment at the existing substation and surrounding area. Analysis of the results show the flood of June 2021 exceeded the FEMA predicted elevations for the 1 percent storm (100 year flood). The substation was constructed at such an elevation that it was protected during that event. However, there is a potential for a flood that would exceed these elevations. Evaluation of the survey data indicates flood water would go over the levee on the south side of Hinkson Creek in larger flood events. The substation can be adequately protected from larger flood events if the existing equipment is raised by a little less than one foot. Elevating this equipment can be performed by staff and will be completed as part of routine maintenance over the next few years.

Transmission System:
Every year, staff is required by regulatory authorities to analyze the City's transmission system. By regulation, the system is required to be able to provide energy in any scenario when any one component of the system is not available, the n-1 scenario. The n-1 scenario is when a single component of the system is unavailable. As an example, if a vehicle hits a transmission pole and that section is out of service until repaired, the remainder of the system must be able to provide energy to customers. In addition, staff is required to do an analysis where two components are taken out of service at the same time, the n-1-1 scenario. The n-1-1 scenario is when two components of the system are unavailable, at the same time. In this in condition, the utility is not required to provide energy to customers and can "shed load". In reality this means the utility would shut off electric power to customers for necessary periods of time to ensure the safety of the entire electric grid. This would only happen during certain n-1-1 conditions when loads at the peak on the hottest or coldest days of the year when heat or air conditioning are most needed. Currently, the City's system meets all regulatory requirements for the n-1 scenario. However, the existing system can only withstand certain n-1-1 scenarios during high peak times by

shedding load. Thus, shutting off energy to customers for periods of time would be required in these scenarios.
The most feasible recommendations from the plan created by the task force resulted in three alternatives for transmission improvements. Attached is a diagram that that shows the three alternatives. They are described, as follows:

- Option 1: Construct a new transmission line connecting Perche Creek Substation and Grindstone Substation by creating a dual circuit line along the existing alignment of the current transmission line. This was the preferred alternative by the task force. The Siemens report estimated this project to cost approximately $30 million.

- Option 2: Construct a new transmission line connecting Perche Creek Substation and Grindstone Substation along a path that follows Scott Boulevard, Vawter School Road, Nifong and Grindstone Parkway. The Siemens report estimated this project to cost approximately $22 million.

- Option 3: Request Ameren build a new substation west of town and construct a transmission line to provide a second feed to Perche Substation. The Siemens report estimated this project to cost approximately $24 million. In discussions with Ameren, the estimated cost to construct the substation necessary to connect the City's system will be in excess of $26 million. The cost for the transmission line from the new substation to Perche substation would increase the project costs to be in excess of $34 million.

Staff has considered all three of these alternatives. The costs would be higher than estimated by Siemens due to inflation. Each provides different benefits and some are more reasonable to pursue, as follows:

Option 1:
This option and Option 2 are basically the same from an electric operation perspective. It addresses issue with the need to shed load in a n-1-1 scenario while only requiring two units at the Columbia Energy Center being available. However, this option would prove to be very difficult to construct as it requires the existing 69 kV transmission line to be removed and a new combination 69 kV/161kV line to be installed. The window for construction is limited to a few weeks in the spring and fall and would likely take multiple years to construct. Much of the work would be in residential easement areas and not along street rights of way. In addition, having two circuits on one structure reduces reliability.

Option 2:
This option and Option 1 are basically the same from an electric operation perspective. It addresses the issue with the need to shed load in a n-1-1 scenario while only requiring two units at the Columbia Energy Center being available. This option has the most ease in construction and maintenance. A majority of the construction would be along major road rights of way. Previous studies have identified this solution and staff believes it is the solution that best fits needs of the system now and in the future.

Option 3 requires the use of all four units of the Columbia Energy Center to address n-1-1

scenarios. Additionally this option provides no benefit to the overall reliability of the system as it has system overloads under high load conditions.

Additional discussion of the different scenarios would require closed work sessions with Council due to regulatory requirements regarding the disclosure of system vulnerabilities.

Recommendations

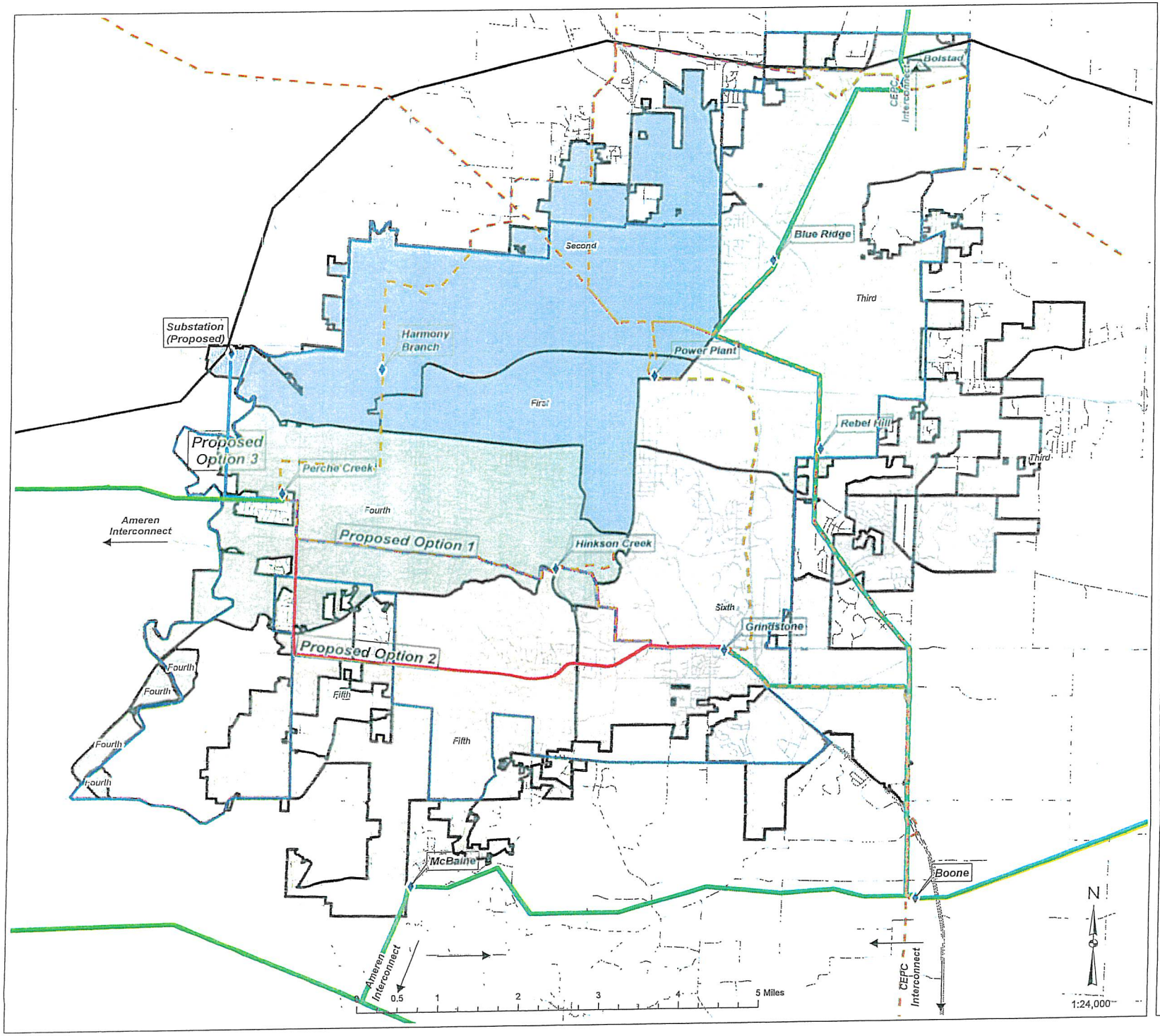
Substations:
It is recommended the substation expansions outlined above continue and that staff proceed with elevating the critical equipment at the Hinkson Substation to make it reasonably safe from flooding.

Transmission:
It is recommended that staff be directed to proceed with the Option 2 solution and construct a 161 kV transmission line along the south alignment. This option addresses the current issues with the need to shed load during an n-1-1 scenario in high load situations and provides the most reliable service to our customers.

It is important to remember our system currently meets all regulatory requirements today and that no improvements are required at this time. However, these improvements are necessary if shedding load is not an acceptable option for reliable service to customers. I do not believe load shedding is a responsible service to our customers. The transmission upgrades are needed now to ensure long-term reliability to customers.

Upgrades to the transmission system will be required in the future due to changes in regulations or increases in load. Loads will increase in the future due to additional demand created by electrification. The reality is that transmission system expansion will be required in the future on both the south side of town and eventually the north side of town. The construction of a new transmission line will likely be a five to ten year project due to the process for receiving approval from regulatory authorities. Upgrades should be initiated to reduce the potential that load shedding becomes a reality and to ensure system reliability is in place for the community.

Direction on how to proceed with possible transmission system improvements is requested.



- Substations
- Proposed Option 1
- Proposed Option 2
- Proposed Option 3
- Ameren
- 161Kv Existing Transmission Line
- 69Kv Existing Transmission Line
- Water & Light Electric Territory

city of Columbia
Water & Light

February 2023

Sources:
Transmission Lines-City of Columbia Water & Light Department
Wards-City of Columbia Geospatial Information Services Office