Columbus Utilities Capital Improvement Projects

Presentation by Forster Electrical Engineering

Columbus Utilities Commission Meeting

4/17/2025, 6:00 PM

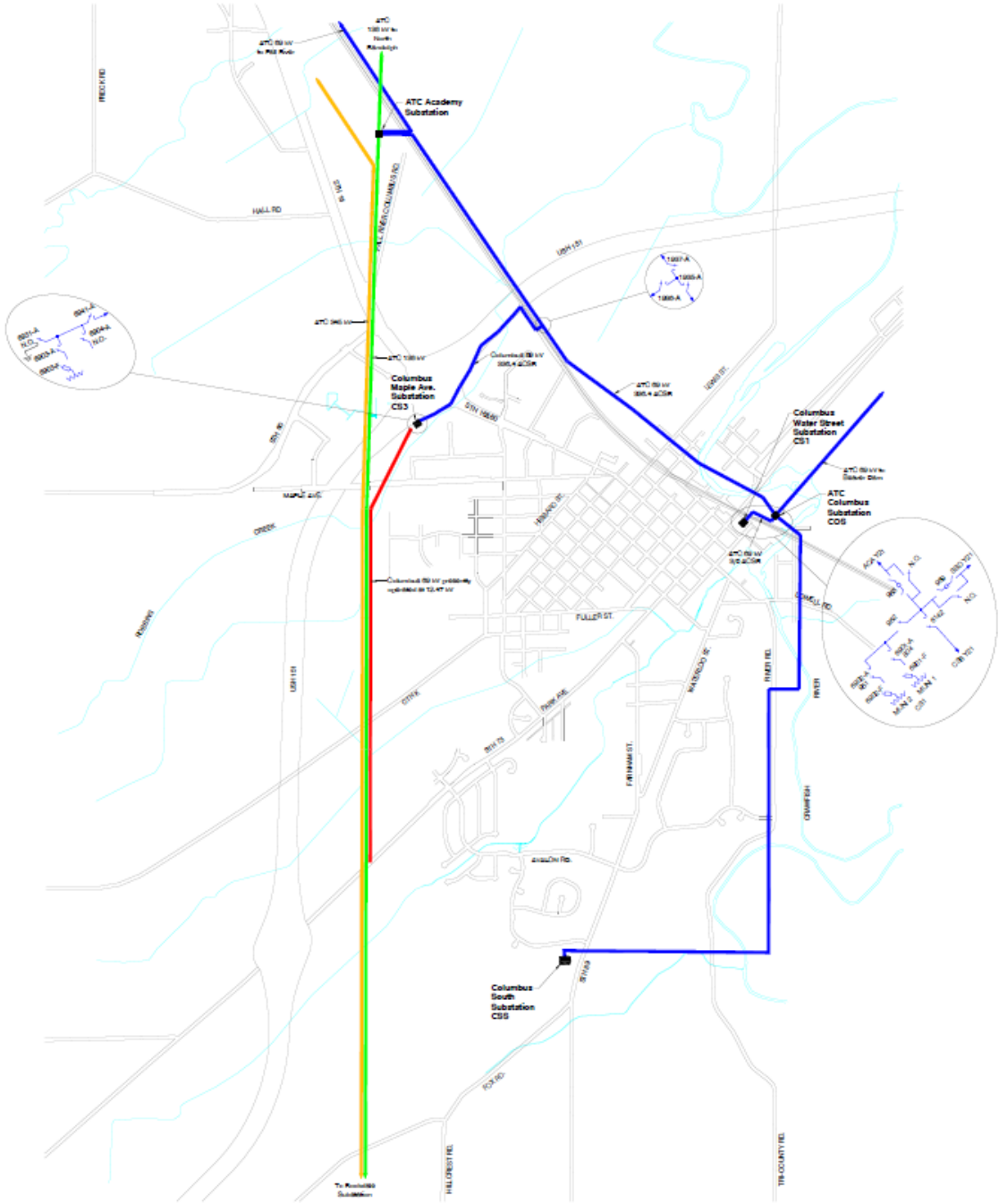
Presentation Agenda

- Electrical System Overview
- Current Projects
- Planned Upgrades by ATC
- Identified Issues and Solutions
- Cashflow Summary
- What is next?

Electrical System Overview

Transmission and Distribution System

Transmission System



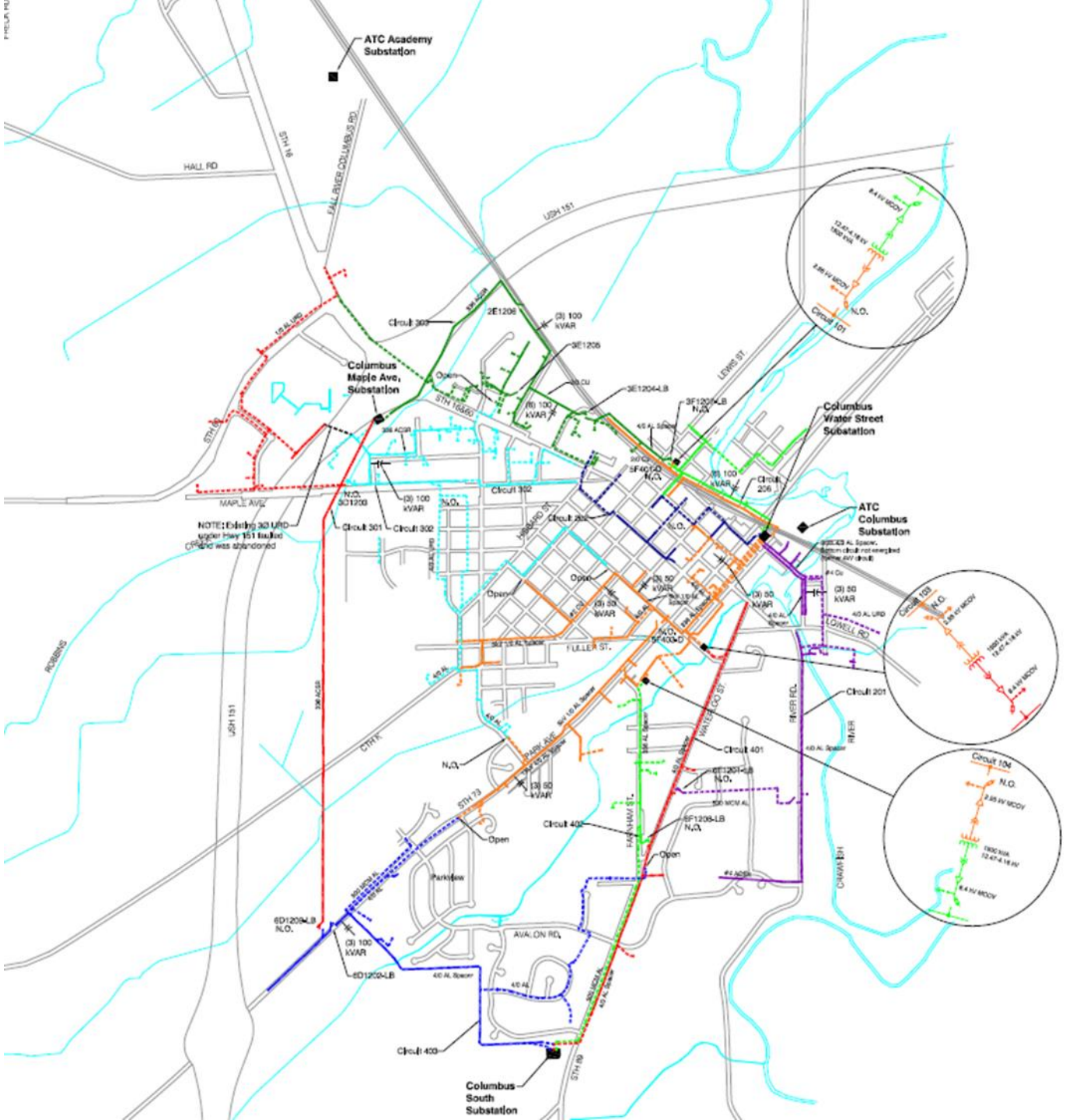
Substation #1 and #2 (Water Street)

Substation #3 (Maple Avenue)

Substation #4 (South)

Distribution System

- Two Distribution Voltage Levels:
  - 4,000 Volts (4 kV) (Substation 1)
  - 12,000 Volts (12 kV) (Substations 2, 3, and 4)



Current Projects

On-going Distribution Projects

Maple Avenue Substation

- Upgrades
  - Voltage Regulators
  - Transformer Protection Device
  - Metering Upgrades
  - General Inspections/Maintenance
- Problematic Bushing Discovered
  - Transformers must be air-tight to hold vacuum or pressure
  - New old stock item located for $2,100 online.

Service Reconfiguration Request

- Service Upgrade:
  - A customer has requested a new service for their new utility building.
- Power line re-route request:
  - The same customer has requested the removal of a segment of the existing overhead power line to accommodate a parking lot expansion.
- Extension costs are estimated to be: $437,100 (charged to customer)
- Columbus should consider ordering the following long lead time items:
  - New transformer $120,000
  - Metering Cabinet $43,800 (metering cabinet, basement, metering equipment)

- Columbus should budget: $62,000
  - Current and voltage transformers
  - Depreciation/Salvage credit
  - Credit for potential load added
  - Spare metering equipment

Planned Upgrades By ATC

Transmission System

Transmission Upgrades

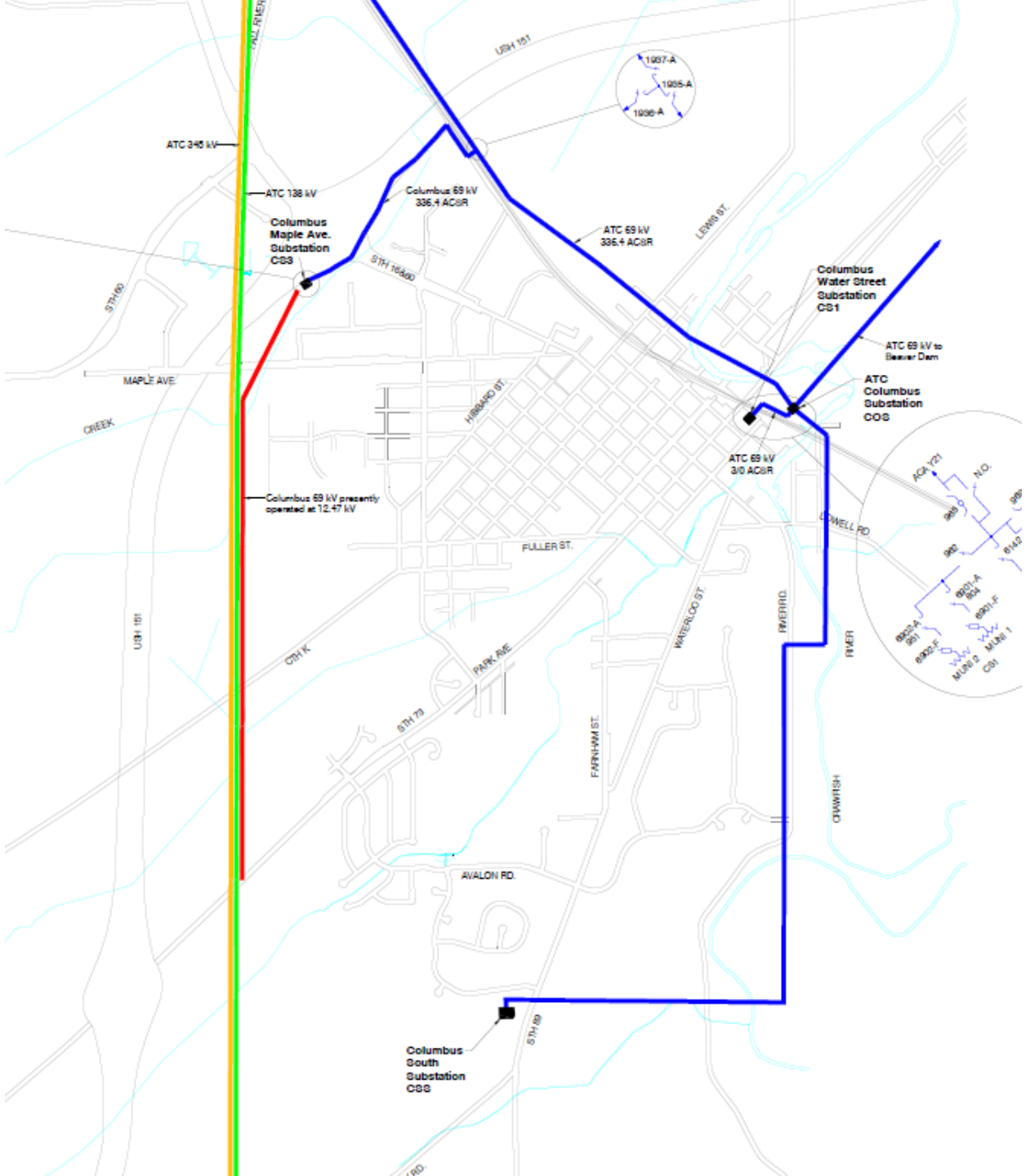
- Since 2022, Columbus has been engaged with Transmission Supplier (ATC) to improve access to the grid.
- Upgrades are necessary for:
  - Reliability (current configuration has limitations)
  - Asset Renewal due to age
  - Equipment upgrades to transport more power
- In the planning stages, several options were considered, including:
  - A new Substation
  - Installing additional transformers within existing substations
  - Constructing new ATC power lines
  - Constructing new Columbus power lines
- The plan that was settled on yielded the best value in system improvements for the cost.
- Both ATC and Columbus would collaborate and make investments

Proposed ATC Upgrades at Sub. 3

- Replacing and upgrading transmission assets within Substation 3
- ATC Investment

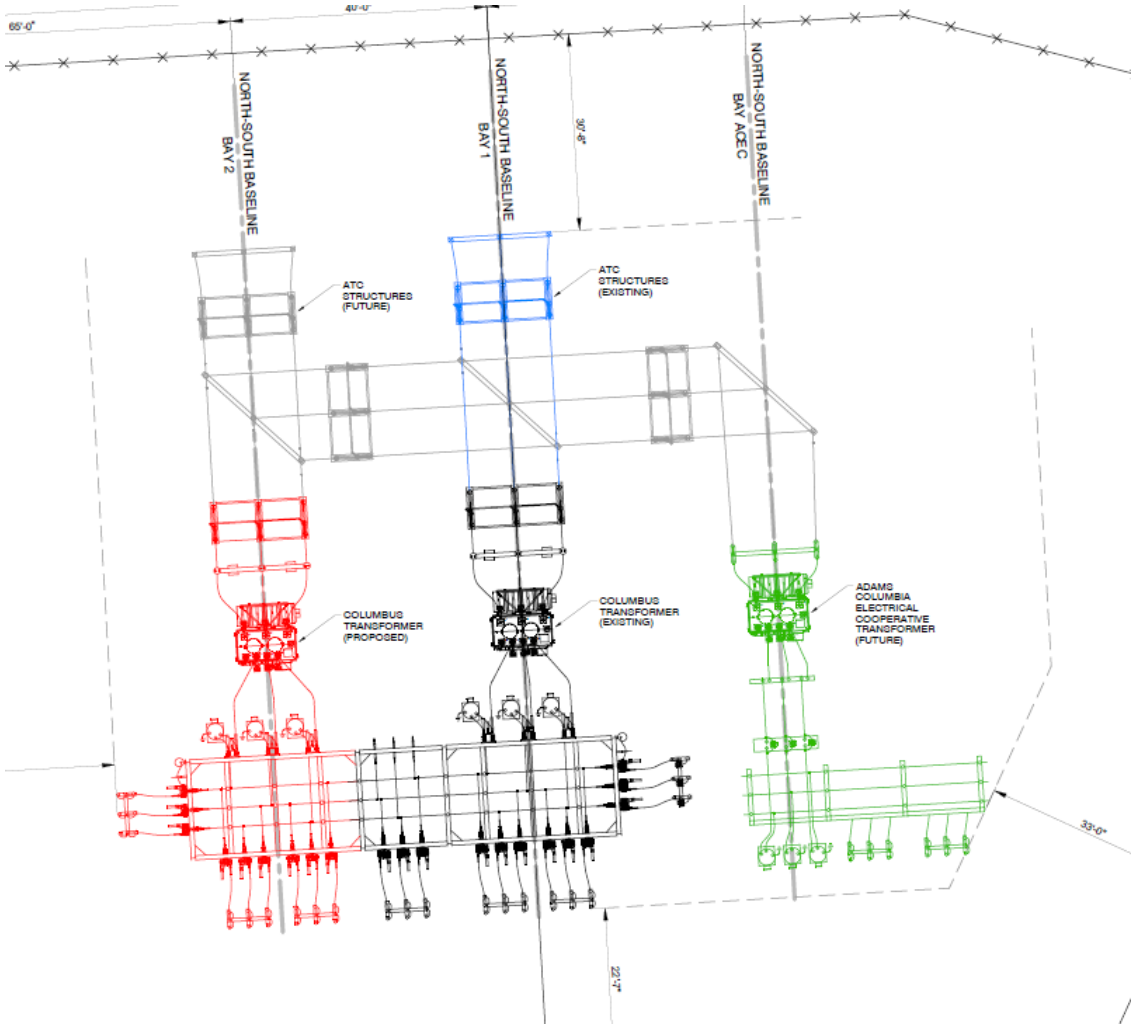
Sale of Circuit 301 to ATC

- 301 History
  - Built to operate as a transmission line (69,000 Volts)
  - Currently operated at 12,000 Volts.
- ATC Investment
  - ATC would buy and take over Circuit 301
  - Perform any required upgrades
  - Extend the power line to connect to Substation #4



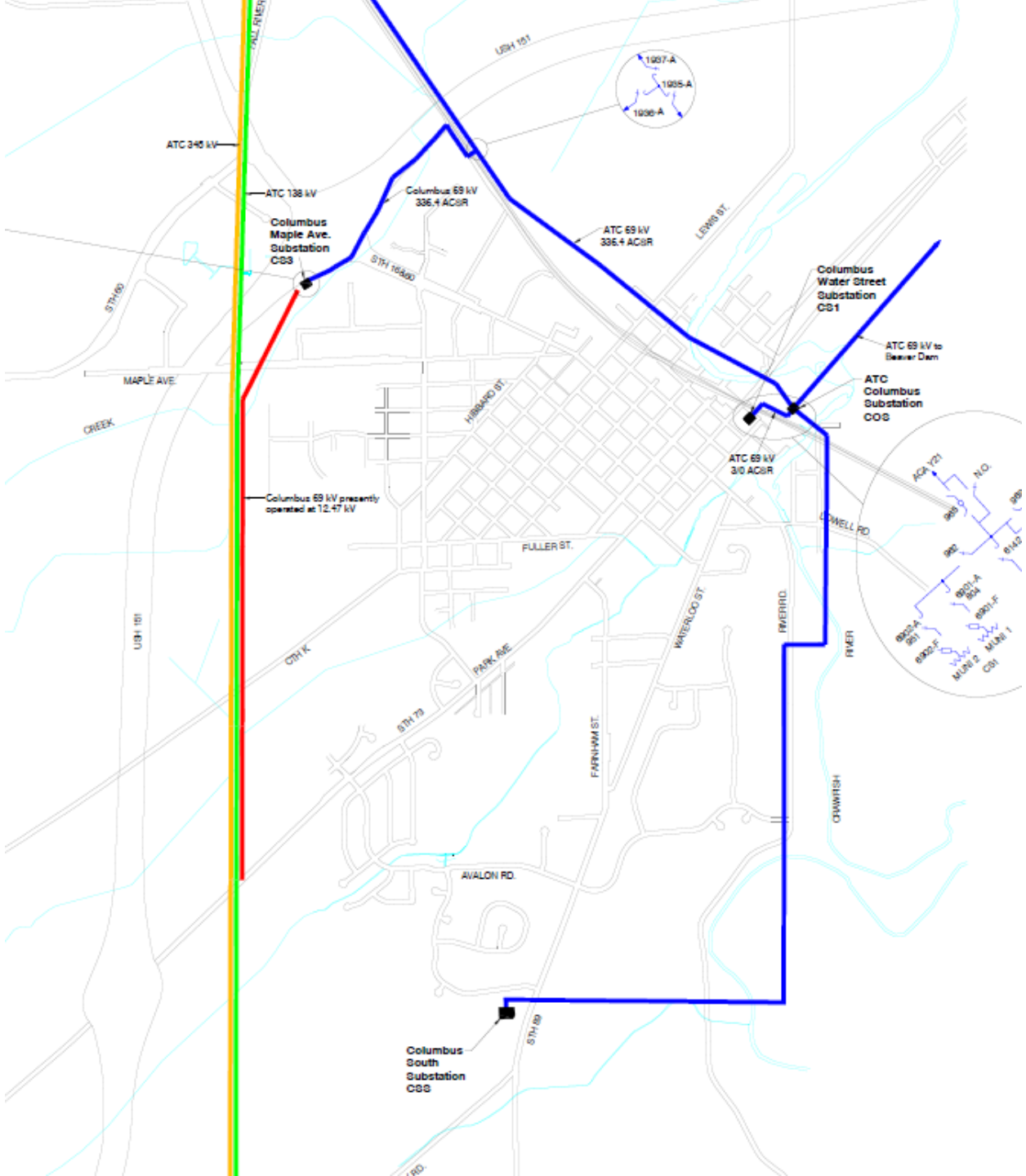
Proposed ATC Upgrades at Sub. 4

- Replacing and upgrading transmission assets within Substation 4
- ATC will provide connection points for 3 transformers
- Provide an opportunity to separate Columbus and Adams-Columbia (ACEC)
  - Adams Columbia currently rents Capacity.
  - Removing ACEC from the Columbus transformer would free up capacity.
- ATC/Adams Columbia Investment



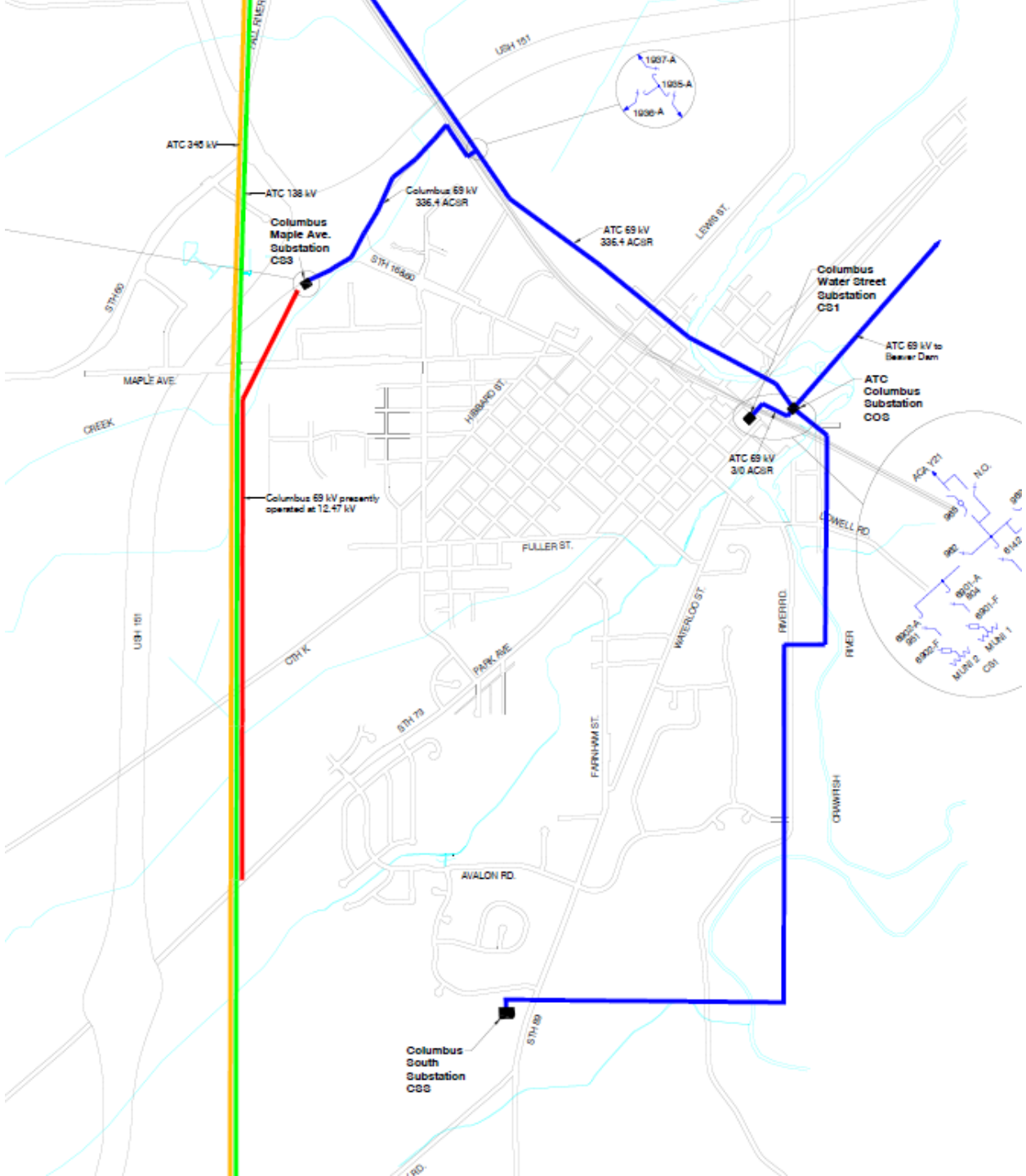
ATC Upgrades Between Sub 4 and Sub 1/2

- ATC will replace and upgrade the power line between Substation 4 and Substation 1/2 as necessary.
  - 3-way switch
- ATC investment



Ultimate Transmission Configuration

- All Columbus Substations will be interconnected
- All Substations will have an alternate source of power
- ATC will retire the line that parallels the Railroad tracks
- The transmission system will be prepared for future load growth



What are the required Columbus Investments?

- Circuit 301
  - Circuit 301 is a trunk feed that provides a high-capacity feed between Substation 3 and Substation 4.
  - An additional high-capacity feeder tie to Substation 4 must be achieved somewhere in the system.
  - **Is an exact replacement of 301 the best option?**
    - Forster determined that a high-capacity tie to Substation 4 could be achieved as a part of asset renewal projects
    - More on this later

Identified Issues Within Electric System

Identified Issues and Solutions

Substation 1 Age and Condition - Problem

- Substation 1 transformer has been in service for 59 years
    - Expected lifetime ~50 years
- Some gauges and dials on the transformer protective device have become nonfunctional
- Sub 1 and Sub 2 are right next to each other
    - A failure of any Sub 1 equipment could cause damage to Sub 2

Substation 1 Age and Condition - Solution

- It is recommended that Substation 1 be decommissioned as soon as possible. **[New Business Agenda Item 4]**
  - Columbus owns three pad-mounted transformers that convert 12 kV to 4 kV.
    - These are smaller than a substation transformer, but large enough to serve several blocks of customers.
  - To serve the existing electrical loads on the 4 kV system, two of these transformers are required to be hooked up and installed.
- Cost estimate to relocate/install the existing pad-mounted transformers: $20,000 **[Summary of Estimate - Item 1]**
- Cost estimate to remove and decommission old Substation 1 equipment: $20,000 **[Summary of Estimate - Item 2]**
- Alternative:
  - Replace Substation 1 in kind for ~$1,800,000

Insufficient Feeder Backups for Large Customers – Problem

- Two significant loads are located between Substation 2 and Substation 3.
- Currently, one feeder normally feeds each large load
  - Under normal circumstances, this is not an issue
  - When either Sub 2 or Sub 3 is out, both loads must be placed on one feeder, creating overload issues during high energy usage times (hot summer days)
  - An overload on either circuit would impact all customers between Sub 2 and Sub 3.

Insufficient Feeder Backups for Large Customers – Solution

- Establish a feeder tie to increase the ways that the two large loads can be fed from.
  - Estimated cost: $361,000.

  [Summary of Estimate - Item B]
- Alternatives:
  - Establish additional circuits sourcing from Sub 2 and Sub 3
    - Estimated Cost: $1,640,000

4 kV Legacy Equipment - Problem

- In general, the existing 4 kV equipment in operation is some of the oldest equipment within the system.
- Retaining 4 kV equipment is not financially sound
  - Maintaining both 12 kV and 4 kV inventory is costly
- Why is 4 kV considered legacy?
  - Limitations in power line distance
  - Limitations in the amount of power transport
  - 12 kV equipment is more efficient (fewer losses)
  - 4 kV power lines are often more expensive due to required ratings compared to 12 kV.

Legacy 4 kV Equipment - Solution

- Upgrade and replace all 4 kV equipment.
- Phase 1: Accomplishing a high-capacity tie between Substation 2 and Substation 4.
  - The size of the wire chosen along Business 151 between Sub 2 and Sub 4 should be appropriately large enough to supplement the power that Circuit 301 could provide.
  - **This is how Circuit 301 can be functionally replaced within the system**
- Estimate of Phase 1: $970,000 **[Summary of Estimate - Item C.1]**
- The timeline on Phase 1 is critical

Legacy 4 kV Equipment - Solution

- Phase 2: Upgrade/replace 4 kV equipment that stems off Business 151
  - Estimated Cost: $2,200,000 **[Summary of Estimate - Item C.2]**
- The timeline of Phase 2 has more flexibility
  - Columbus can utilize the 12 kV to 4 kV pad-mounted transformers as an intermediate solution throughout the completion of Phase 2.

Insufficient Transformer Size at Substation 2 - Problem

- After Substation 1 is decommissioned, all 4 kV loads will be placed directly on the 12 kV system.
  - All 4 kV loads will be split among the remaining 12 kV substations.
  - Most 4 kV loads can be allocated to Sub 4.
- After conversion, Sub 2 will play a critical role in backing up Sub 3 and Sub 4.
- Existing loads indicate Sub 2 will approach overload during an outage of either substation.
  - The system works fine now, because Substation 1 is still in service.
- Substation 2 transformer has been in service for 41 years

Insufficient Transformer Size at Substation 2 - Solution

- Increase Substation 2 Transformer Size
  - Increased from a 7.5/10.5 to a 12/22.4 MVA
  - Estimated Cost: $2,562,000 **[Summary of Estimate - Item D]**
- Alternatives:
  - Any alternatives do not address asset renewal.

Cashflow Summary

Summary of Cost Estimate Construction Items		Construction Type	Estimated Cost (Developer)	Estimated Cost (Utility)	Estimated Year	Priority Level
Item	Location					
1	Implement Step Tie Transformers	URD		$20,000	2025	Critical
2	Decommission Substation 1	Substation		$20,000	2025	Critical
A	Circuit 403 Reroute	URD	$437,100	$62,000	2026	High
B	Circuit Tie to 202/302	URD		$361,000	2025	High
C.1	4 kV Conversion - Phase 1	URD		$970,000	2026	High
C.2	4 kV Conversion - Phase 2	URD		$2,200,000	2027	Low
D	Increase Substation 2 Transformer	Substation		$2,562,000	2028	High
Estimated Total Cost of Project			**$437,100**	**$6,195,000**		

What is next?

- Unit Price Contract **[Agenda Item 6]**
- Order Replacement Bushing for Sub 3
- Order Equipment for Customer Extension **[Agenda Item 5]**
  - Transformer
  - Metering Cabinet
- Regulatory Approval for Conversion and Transformer Upgrade
  - CA threshold is $505,000
  - Recommended to obtain approval for conversion (Phase 1 and 2) and transformer upgrade under the same docket
  - There is no “time limit” to complete a CA
    - Allows flexibility for Phase 2 Conversion.