

DETERMINATION OF ACQUISITION AREA FOR BOULDER LIGHT & POWER

**Presented by Thomas A. Ghidossi, P.E.
Exponential Engineering Company
Condensed from 4/21/14 presentation**

Introduction and Purpose

The following is a condensed text of a presentation done by Tom Ghidossi, P.E., Exponential Engineering Company on April 21, 2014. The presentation and this document are for the purpose of documenting how the Acquisition Area for the Boulder Municipalization was defined. The video can be viewed here: [Utility Acquisition Area](#).

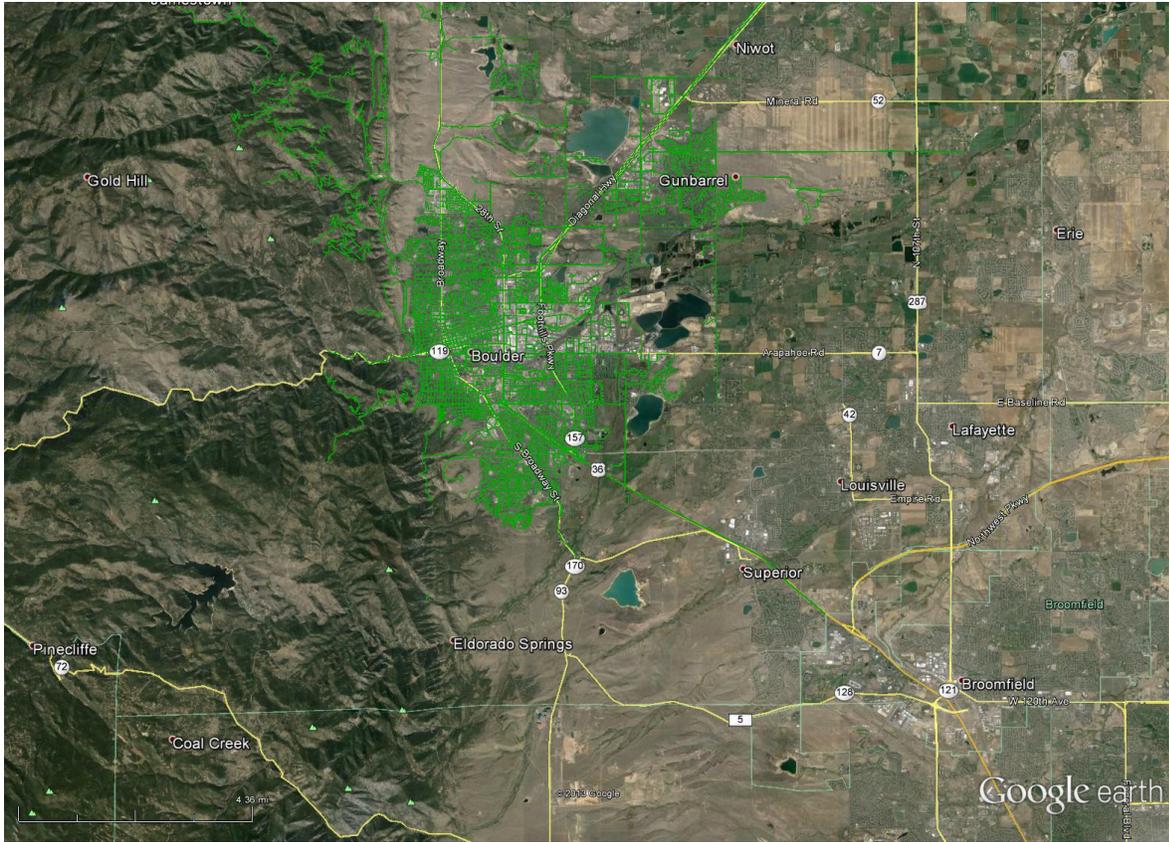
Throughout this presentation, the city municipal boundaries are shown in red and the Acquisition Area boundary is shown in purple. The service area of Boulder Light & Power will be the municipal boundaries, NOT the Acquisition Area boundaries, unless determined otherwise in proceedings before the Colorado Public Utilities Commission. The city proposes ACQUIRING all of Xcel's facilities within the Acquisition Area. The city proposes SERVING customers only within the municipal boundaries unless otherwise directed.

Priorities of the Determination of the Acquisition Area:

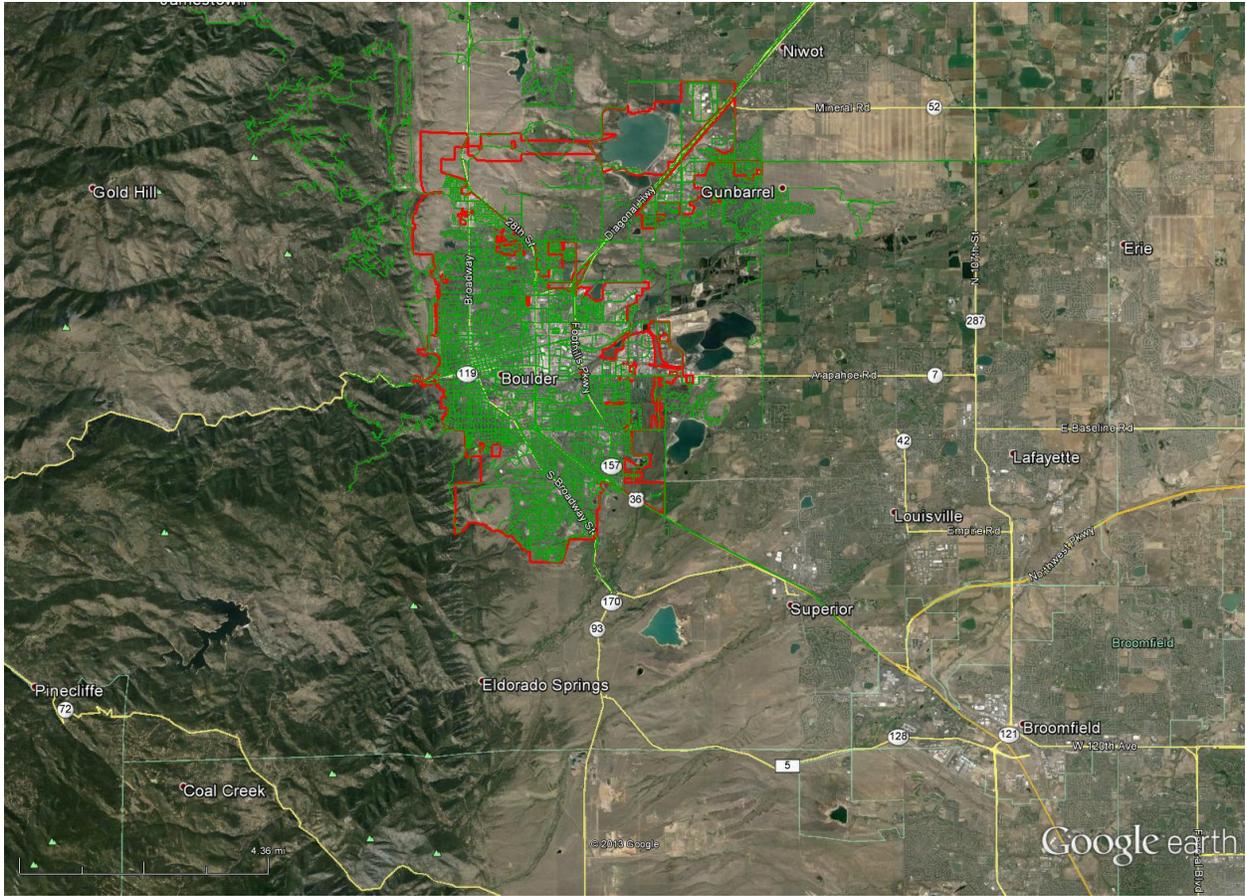
Maintaining at least the existing reliability of the distribution system is a key point for this design. In evaluating the existing distribution system, field inspections, and reviewing maps and other information that has been available to this point, the defined Acquisition Area maintains the level of reliability that Xcel has been able to document and meets or exceeds the charter requirements. The plan utilizes the existing substations and distribution system in the manner in which they were designed. The planned acquisition, capital expenditures, and plans for operation are to be able to improve reliability for the citizens of Boulder and also maintain the reliability for the loads that are interconnected outside the municipal boundaries.

Presentation

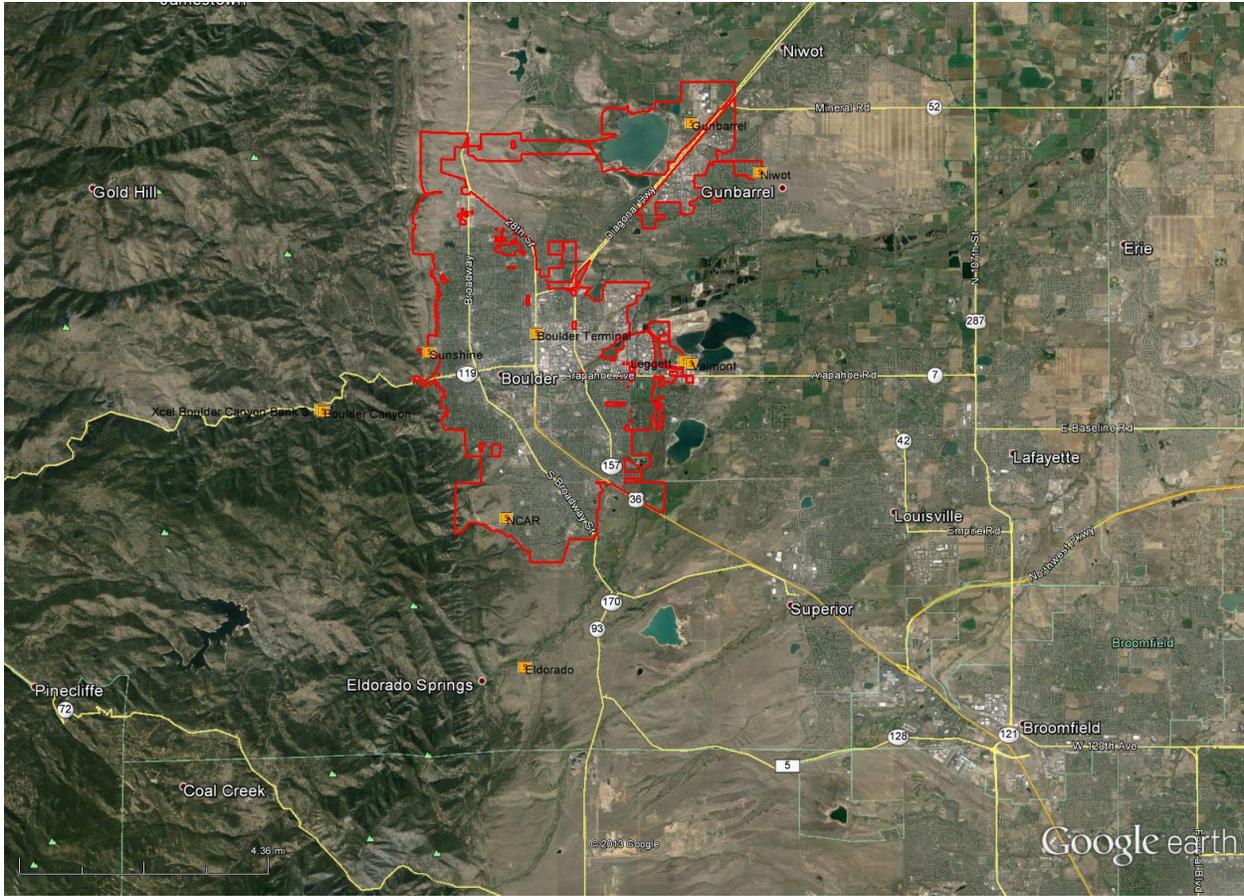
I am Tom Ghidossi, President of Exponential Engineering Company. This presentation covers the concepts behind the utility acquisition area that was created, some of the interconnections, and how the whole system would go together.



In the slide above, the utility system in Boulder is represented by the roads in the city, and outside the city boundaries (the green lines). This is illustrating that there is a great concentration of the distribution system within the city proper. We have used the road maps rather than the actual utility lines in order to avoid showing detail of critical electric infrastructure. In general, the distribution facilities follows roads and alleys.



The slide above shows the existing municipal boundary in red. There are county enclaves inside the city boundaries as shown by some of the small red shapes. You can also see that the majority of the electric system, especially the most dense portion of the electric system, is within the existing municipal boundaries.



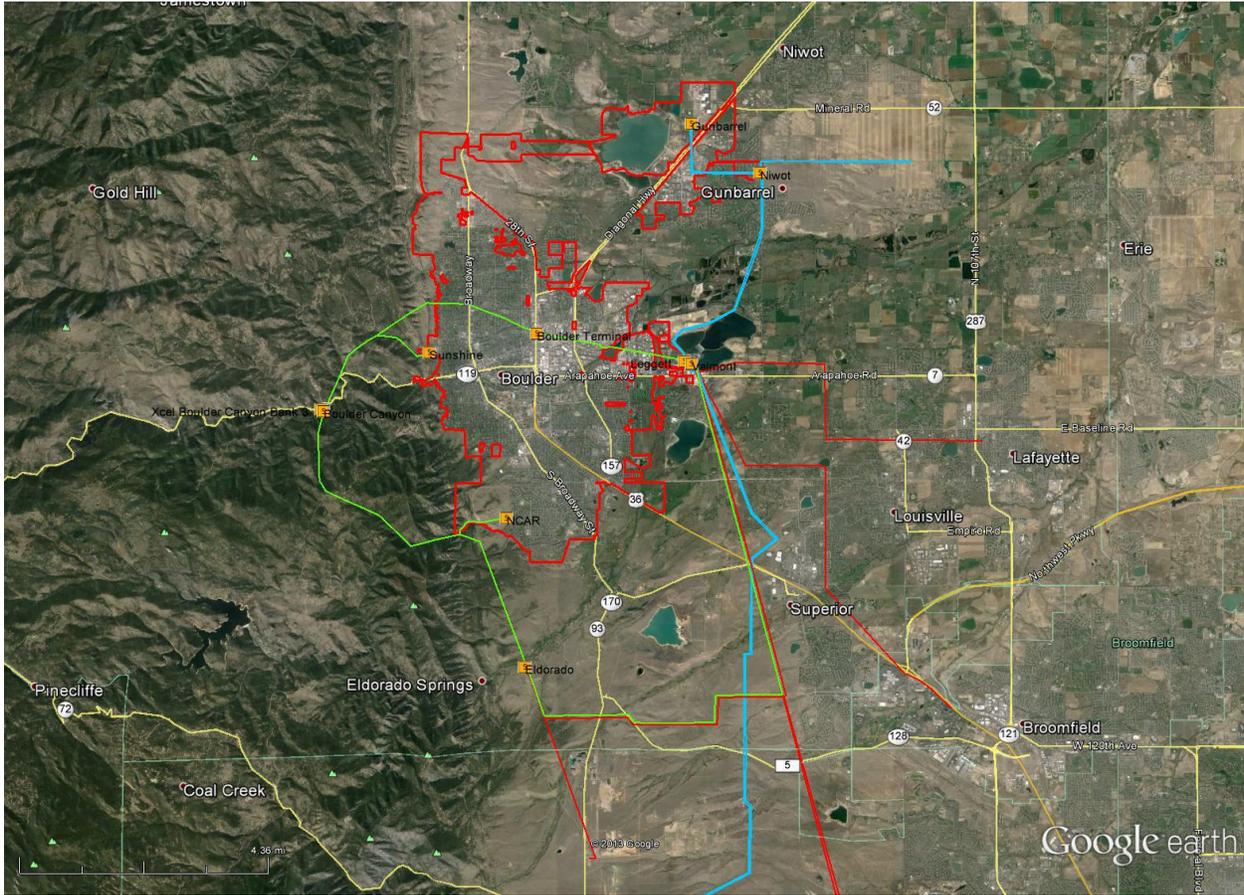
Substations

The orange shapes on this slide show the nine substations that feed Boulder customers and the surroundings around Boulder. The first substation on the south end is Eldorado substation. It is an existing Xcel substation that feeds the areas south of the city and to the eastside of the city. Moving straight north is the NCAR substation within the city boundaries. NCAR serves a lot of the neighborhoods and areas around Table Mesa and some of the southern parts of Boulder itself. Heading to the west up Boulder Canyon is Boulder Canyon Hydro substation and a substation called Boulder Canyon Bank 3 that is across Boulder Creek from the Boulder Canyon Hydro substation. The city owns the Boulder Canyon Hydro plant and recently upgraded the generation there to a new five MW hydrogenerator that uses the city’s water rights as they are legally and physically available to generate power. That power is sold on the grid as a wholesale power sale to other customers.

Moving back to the east, and slightly north, is the Sunshine substation, again within the city limits. Sunshine is one of the older substations and feeds the neighborhoods north and west of Broadway and Canyon and a lot of the downtown area. Moving straight east is Boulder Terminal substation in the heart of Boulder. It is the largest substation in the system with the most installed capacity. In general, it feeds the central area of Boulder. It also feeds into the mountains to the west of Boulder and to the north, towards Lyons. Moving further east, there is the Leggett substation, which is a 230kV substation. That substation feeds a lot of the distribution system to the east side of Boulder and northeast toward the Niwot area and to the

south of Arapahoe road and then adjacent to the Valmont switch yard. The switchyard is adjacent to the Valmont power plant and has 115kV and 230kV facilities. The 115kV transmission loop serving Boulder ties into the Valmont switch yard.

Heading north out toward the Gunbarrel area, the substation to the east side is the Niwot substation that feeds the Gunbarrel area, up into Niwot, and also feeds to the south of Gunbarrel. Then, the final substation in terms of feeding the area, is the Gunbarrel substation which is to the north and slightly west of the diagonal. Gunbarrel substation is dedicated to the IBM service. IBM is served at transmission level voltage by Xcel. That substation and IBM are within the existing municipal boundaries. The substations are the hubs for the distribution system to be able to bring power in via transmission and then disperse it using the transformers and the equipment in those substations.

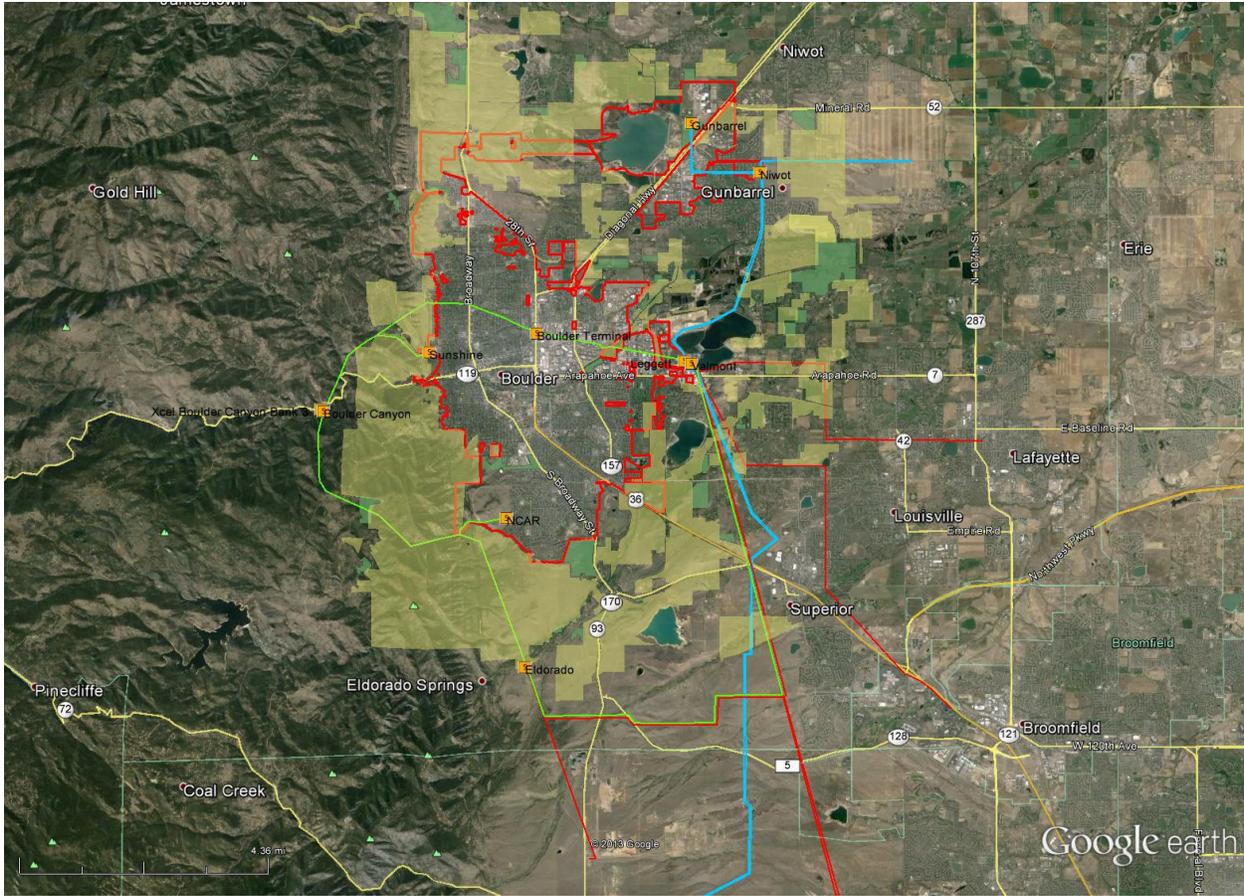


Transmission Loop

Looking at the transmission system that feeds this area, the green line, runs from Valmont switch yard to Boulder Terminal, then into Sunshine, then into Boulder Canyon Hydro, then NCAR, Eldorado, and back around to Valmont. That 115kV loop is the transmission loop that serves the majority of the Boulder substations and is critical to reliability for the city and to make sure that we have the ability to connect local generation and to have distributed generation going around the city and to tie into Boulder Canyon Hydro directly.

The blue lines are the 230kV (230,000 volts) system which is not being acquired by the city. The 230kV transmission feeds the Niwot, Gunbarrel, and Leggett substations. It runs through Valmont and then heads on south to a station south of Boulder. There is also a 115kV transmission line in red on the east side that is shown leaving Valmont and 115kV transmission lines south and east that the city would not be acquiring.

The distribution system is fed by transmission. The transmission loop is on the edge of Xcel’s system and feeds primarily Boulder. There is one substation in Boulder Canyon, near the Boulder Hydro Substation, which Xcel uses to feed the mountain area – 25kV- that is feeding Nederland and Eldora and other mountain areas.

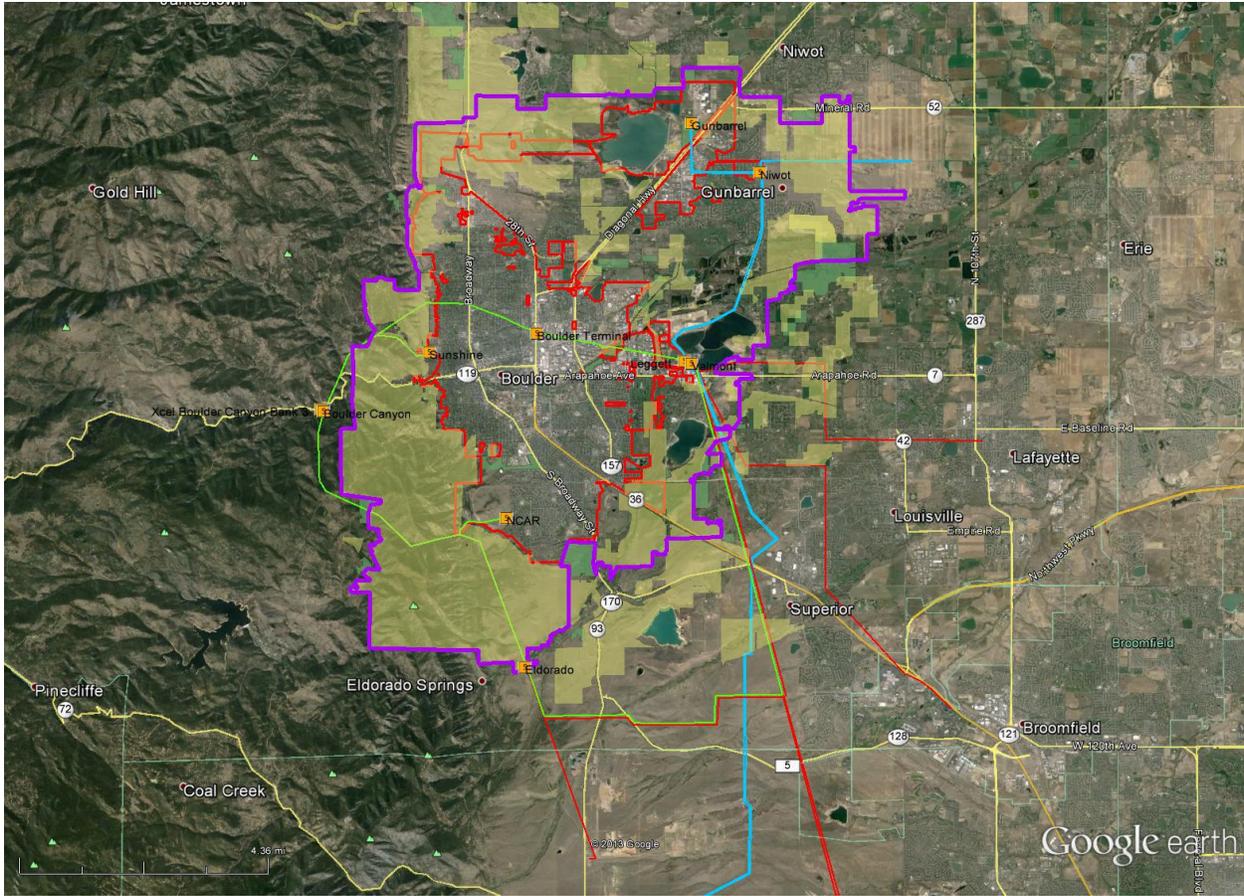


Criteria Given by City – Developing Acquisition Area

We started with certain guidelines:

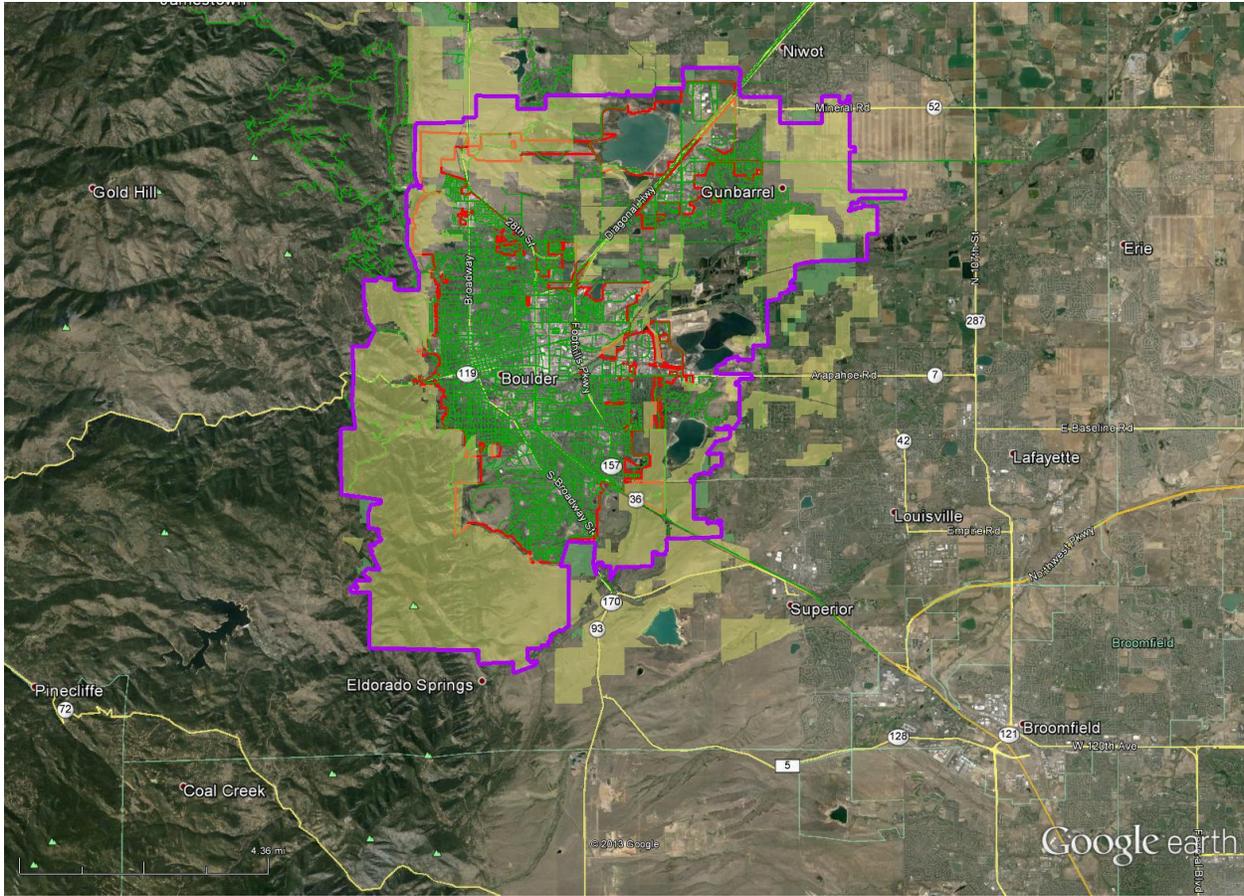
- 1) to serve all the municipal customers within the municipal boundaries,
- 2) to maintain reliability at the same or better level, and
- 3) to minimize the interconnections and the impact to customers outside the purposed municipal service territory.

As we were reviewing the existing system in light of these guidelines, one of the things that came to light was that there is a significant amount of property owned by the city of Boulder outside the municipal boundaries. Those properties are indicated in the green/yellow color on the above map. In addition there are some conservation easements or areas that cannot be developed which are shown in green. Looking at the municipal boundaries, and the city’s open space and properties that cannot be developed, shows that the system is somewhat isolated by nature in that there will be no customers in these boundary areas. The location of customers and areas that are planned for development make a big difference in being able to determine where to separate ownership of the system.

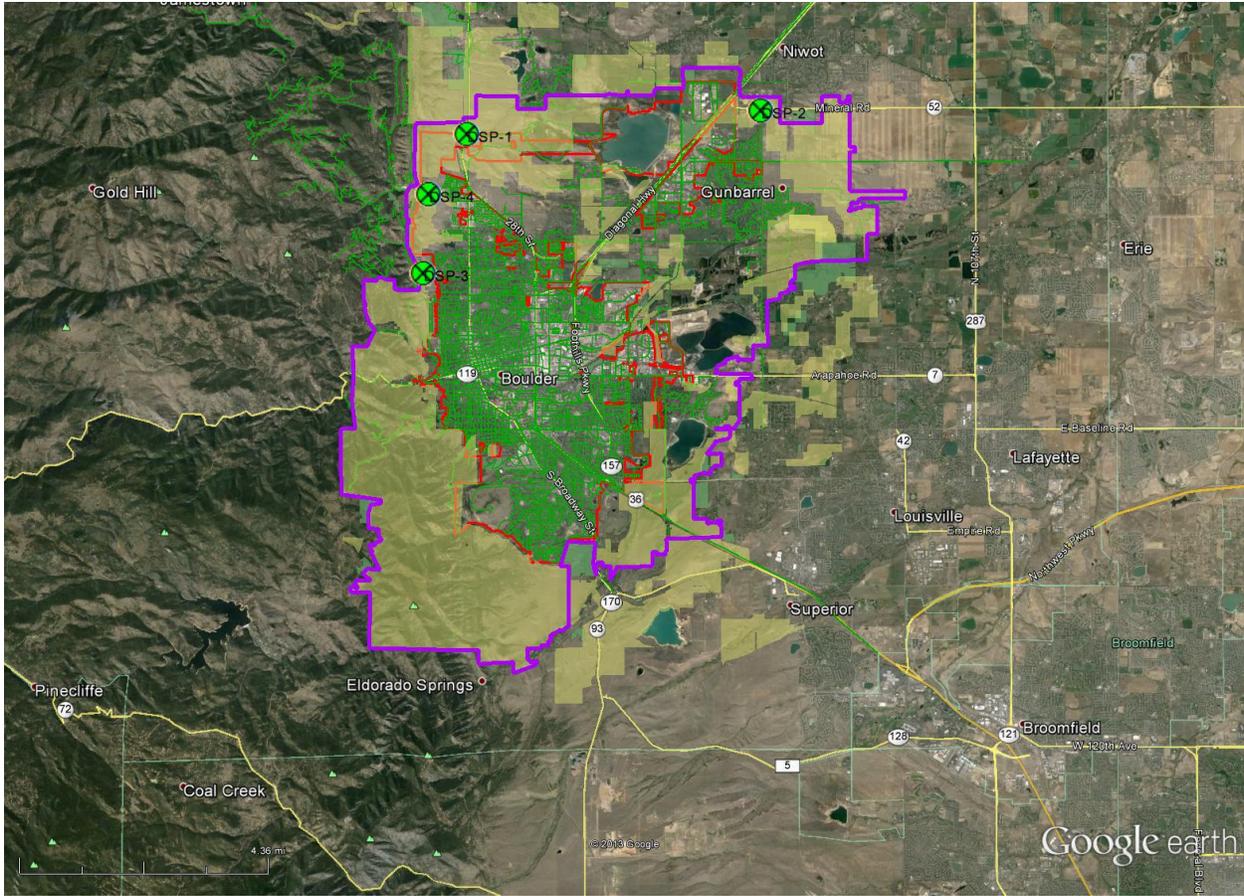


Acquisition Boundary

To include the city-owned property, the purple line was used to show the boundary of the acquisition area. The area includes facilities outside the city’s municipal boundaries, but for the most part the areas outside the municipal boundaries are areas that don’t have customers. The purple line follows parcel boundaries which are the normal way for utility areas to be defined. This area then is what constitutes the area in which Boulder would be acquiring facilities from Xcel’s existing system.

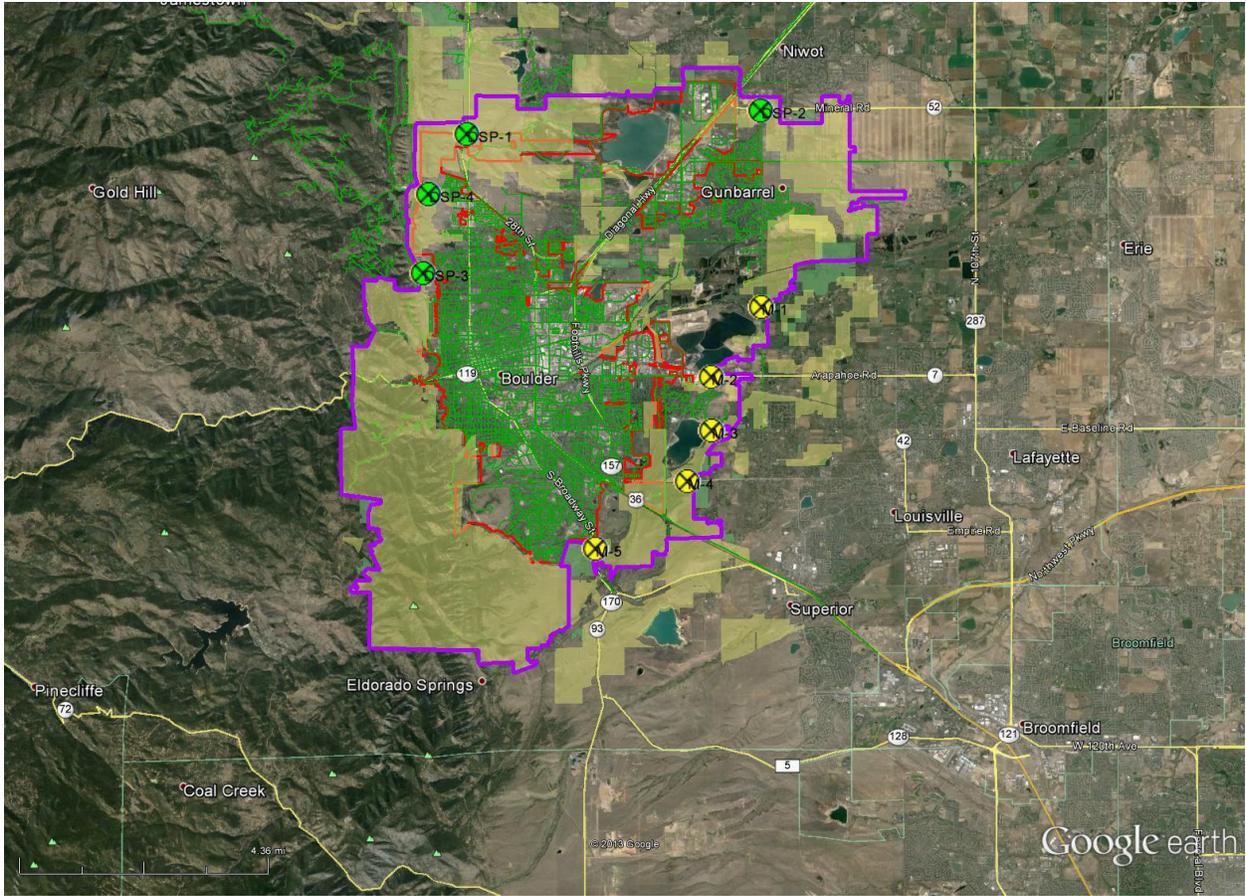


This picture adds the distribution facilities in green and shows that the most dense portion of the distribution facilities are within this acquisition boundary. There are not many Xcel facilities crossing the boundary. This meets one of the original guidelines of minimizing the number of interconnections and reducing any impact to Xcel customers outside the municipal boundary.

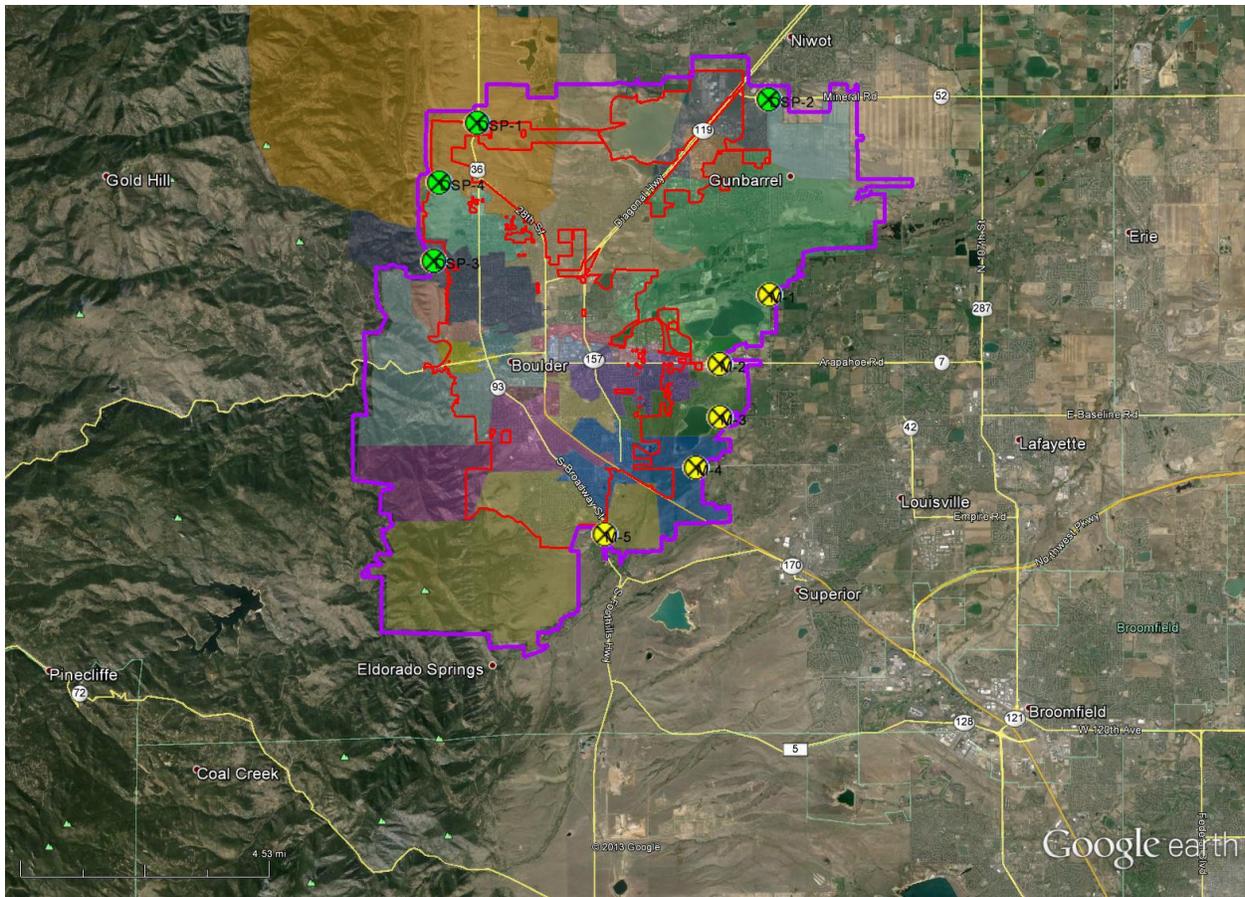


Interconnections

In order to maintain the existing flow of power, there will need to be interconnection points between the facilities that will remain with Xcel and those that will be owned by Boulder. Some of these points match up with current interconnection points that Xcel uses between substations. Others are at the purple boundary. On the slide above, the four interconnections that are shown as green circles with an “x” are called “distribution service provider” points or “DSPs.” These interconnection points would be a metering point to be able to determine how much power flows between Boulder’s system and Xcel’s system to serve customers that are outside the Acquisition Area. Each of the interconnection points would be operated to maintain reliability to the Xcel customers; to provide the amount of power desired or required by Xcel’s customers in those areas and within the existing capacity restraints. There are three of these DSPs along the northwest corner of the city and one that is located at the north east, east of the Diagonal. These interconnections would continue existing operation of the system. There would be power flowing over these four points at all times. The only switching would be done to isolate feeders if desired by Xcel or if there became a system problem.

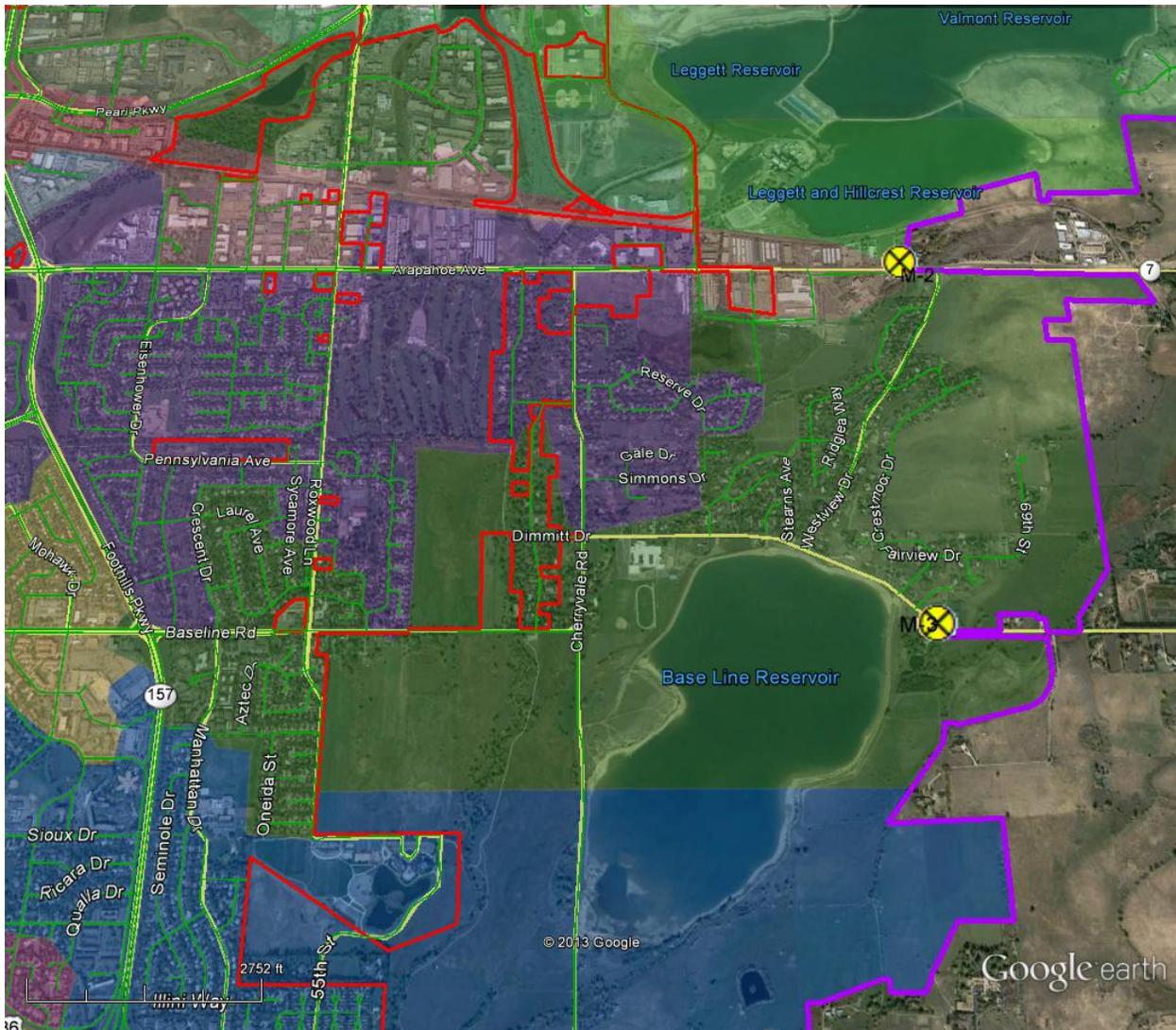


In addition to the four normal feeds shown in green, there are five “M” or mutual aid and support type feeds, which are indicated by the yellow circles with the “X” in them. These are areas where there are existing interconnection points on the system. Xcel uses them to provide support to areas outside of Boulder. If there was a problem in Lafayette, the mutual aid interconnection allows Boulder to provide support toward Lafayette. These mutual aid points would also allow a Lafayette substation to provide support to circuits in Boulder. These five points are existing sets of connection points that Xcel typically operates normally open. If any of the mutual aid points need to be closed for mutual aid and support, the meters allow each utility to know how much power was transferred across the boundary and would enable them to be compensated for the use of their system.



Feeder Lines

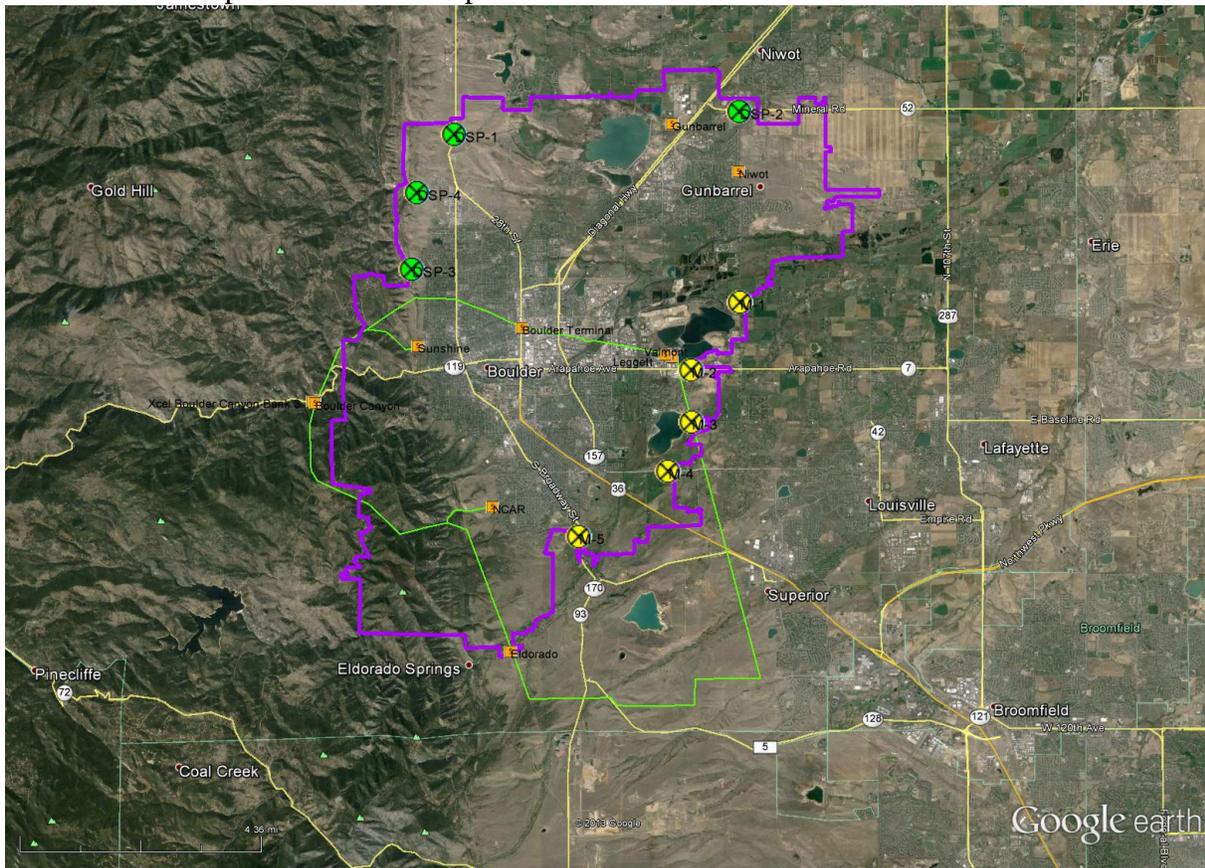
One of the key issues in separating ownership of an existing electrical system is that feeders and distribution systems are not designed to respect political boundaries. Feeders and distribution systems are built to serve customers wherever the customers are located. Municipal boundaries change whenever the city annexes property. The shaded areas in different colors on this map illustrate an area covered by a feeder and how the coverage of various feeders is within Boulder. As you can see the same color covers areas both inside and outside of the municipal boundaries. The colors are also intended to show these feeder boundaries are somewhat amorphous. They serve the properties in the area whether or not the properties are in enclaves or whether the feeder moves in and out of the city boundaries several times.



This picture shows more details of a feeder on the east side of Boulder, south of Valmont plant where the feeder coverage is quite scattered. The feeds run back and forth in different places and cross over the enclave boundaries several times. While it may be physically possible to have some of the facilities owned by Xcel and some by Boulder, in practice that is not feasible and would increase the number of interconnection points exponentially. Each piece of additional equipment statistically reduces reliability of the system. The additional equipment also leads to issues with potential delays in outage response and confusion as to which entity is responsible for the precise location where a fault may be. However the ownership of the feeders does not determine who serves the customers outside of the municipal boundaries. Xcel can still acquire the power and bill those customers over lines owned by the city.

Summary of Area

The definition of an acquisition area boundary was to identify the location to separate ownership between Xcel and Boulder while maintaining a system that meets the reliability needs of customers inside and outside of the city. The locations of the interconnections were determined to be at the technically optimal location from an engineering perspective to provide reliability to customers outside the municipal boundary and to provide mutual aid and support between Xcel and Boulder as part of the integrated electric grid system. As a result the system will continue to operate after municipalization as it does now.



This last slide is an overall summary of the facilities and areas the city will acquire. The green continuous line is the 115kV transmission loop being acquired, the purple lines show the boundaries within which the city will acquire facilities, and the yellow and green spots show the substations where facilities and land will be acquired.

Questions:

Following are a few questions which I have been asked to answer:

Q: How much of the electric load inside the Acquisition Area is outside the municipal boundaries?

A: Approximately 3% of the total load within the purple boundary is outside of the city limits. Of that 3%, probably at least a 1/4 is the city of Boulder's wastewater treatment plant to the north and east of the Valmont substation.

Q: Where are the out of city customers that will continue to be served by Xcel?

A: Most of them are in the Gunbarrel region and in areas where the municipal boundary has a strange shape. There are a number of customers in enclaves that have not yet become a part of the municipal boundary. Enclaves are those red areas within the perimeter boundaries of the city on the second slide.

Q: Is the city acquiring generation?

A: No, the city is not acquiring generation facilities from Xcel. The city does have generation facilities at its hydroelectric plants. The only hydroelectric plant directly connected to the system would be Boulder Canyon Hydro. The city also has smaller generation facilities, including the distribution system at the various fresh water treatment plants and the reservoirs.

Q: Is Boulder acquiring a transmission system that serves adjacent areas?

A: In the general sense, the transmission system is part of the bulk electric system with load flow as part of the interconnected network. However, the electrical system serving Boulder is operated like a piece off to the side of the main bulk transmission system. The 115kV transmission loop does not go any further west than Boulder and it serves substations throughout the city. As a result it makes sense to look at the 115kV system as a critical piece of the city's reliability. It does also serve areas towards the mountains that would become a network interconnection at transmission much like the city's interconnections at Eldorado or Valmont would be network interconnection to the Xcel transmission system.

Where there are Xcel customers served through the four distribution service provider interconnection points, the city is committed to deliver power over those distribution lines based on existing load projections and loads that Xcel would provide. As a distribution service provider, the city would be obligated to maintain a level of reliability to Xcel so that they can maintain a level of reliability to their customers and to maintain a level of capacity sufficient to serve those customers. Much like any utility would be serving via transmission, the capacity has to be there. As capacity needs increase, there would be discussions and negotiation regarding construction of additional capacity. At this point with the system that Xcel has in place, our understanding is that the capacity is sufficient and allows for future growth and the city would continue to provide that capacity in the future.

Q: Are there other Power Providers than Xcel in the Area?

A: Yes. On the north of Boulder is the Poudre Valley REA service area, just north of IBM. The United Powers service areas are south toward Coal Creek Canyon and on the east side of the city.

End of Text Prepared March 2015