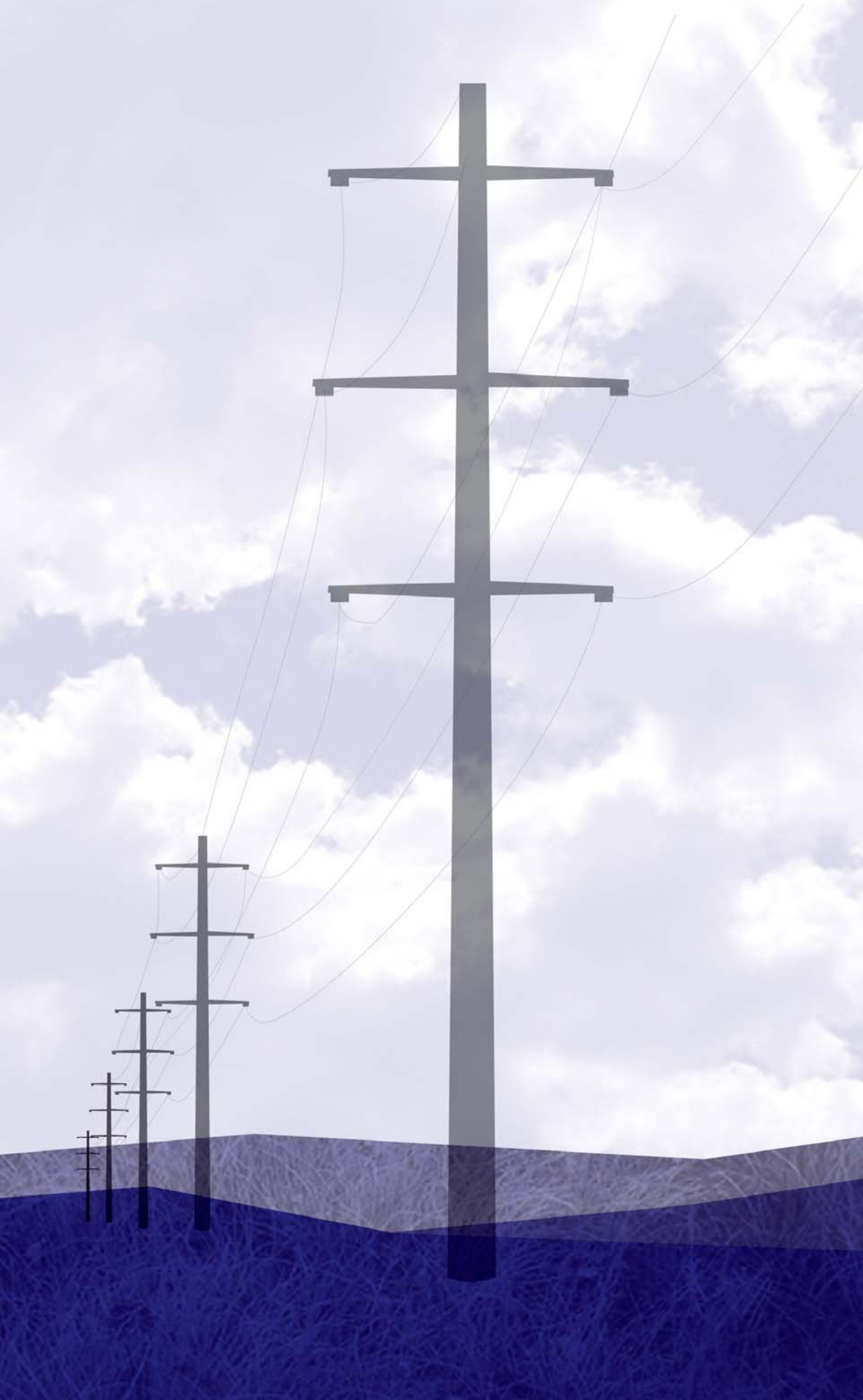
Powering Our FUTURE

Salt Lake County Electrical Plan
Local Planning Handbook

September 2010



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This document and the accompanying map can be found at:
www.cooperativeplan.slco.org
www.rockymountainpower.net/planning

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Executive summary

Planning, financing and building infrastructure to meet future growth in Salt Lake County poses major challenges. Essential facilities like water, sewer, roads and highways, public transportation, and schools are routinely considered by government and community leaders in planning for the future. Equally critical but typically given less attention by community planners, however, is electrical infrastructure.

Various projections put the county's population at approximately 1.7 million by 2040, an increase of nearly 70 percent over 2010. How much electrical capacity will Salt Lake County communities need and where will they need it are questions rarely considered in traditional growth scenarios and planning decisions--until now.

The Salt Lake County Electrical Plan is an unprecedented collaborative effort to keep pace with Salt Lake County's growth through 2040 by integrating local governments' long-term land-use development plans with future electrical network requirements. The effort recognizes that development decisions made by local government are a major driver of electricity requirements. The primary goal of this collaborative process is to develop a clear and documented plan to guide future infrastructure siting decisions to ensure adequate electrical capacity for local communities to achieve their goals.

The task force leading this effort includes a broad range of stakeholders including planning representatives from Salt Lake County and the municipalities in Salt Lake County served by Rocky Mountain Power, regional transportation and growth planners and other key stakeholders. An independent facilitator guided their deliberations while Rocky Mountain Power served as a technical adviser. As a group they share the goal of encouraging mutual understanding and cooperation with a county-wide perspective.

The task force utilized the Salt Lake Cooperative County Plan and Wasatch Front Regional Council's Wasatch Choices 2040 Vision as primary source documents for this effort. Estimates of future electrical power requirements are based on population and employment projections from the Governor's Office of Planning and Budget, while future substation locations correspond to areas expected to have high development potential under the Cooperative County Plan.

The product of the task force's year-long effort includes three elements:

1. A list of criteria for evaluating future substation and transmission sites
2. A map of approximate preferred locations of future substations and transmission lines
3. A tool kit that includes general plan language for use by local governments to implement the facility siting plan in their respective jurisdictions

The plan does not address "main grid" high-voltage facilities used for bulk power. It is limited to substations and transmission lines of 138,000 volts or less.

The task force members and Rocky Mountain Power support using the plan in future infrastructure planning within their respective jurisdictions. The commitment between Rocky Mountain Power and task force members means they will uphold the decisions reached through the process—or notify each other if circumstances change. Likewise, as representatives of their communities, task force members will also be able to rely on neighboring jurisdictions to follow the plan. Since an interconnected electrical network operates across jurisdictional boundaries, a change by one community could impact neighboring communities. (Communities may consider formalizing a mutual commitment with Rocky Mountain Power to observe the principles of collaborative planning outlined in the plan. A sample memorandum of understanding can be found in the Appendix.)

Max Johnson, Salt Lake County; Greg Scott, Wasatch Front Regional Council; Jerry Maio, Utah Department of Transportation; Jody Knapp, West Valley City

The Salt Lake County Electrical Plan is the first time the utility and community leaders have collaborated on a county-wide basis about the impacts of future growth and development on electrical infrastructure requirements. But it's not the first time this type of approach has been used in Utah to consider the impacts and challenges of growth. Rocky Mountain Power approached future infrastructure planning in the tradition of collaborative planning pioneered many years ago by Envision Utah to engage a broad cross-section of stakeholders to plan how to best meet the demands of growth in the Greater Wasatch area. Robert Grow, Envision Utah's first chairman, has described collaborative planning as "the best way to meet the challenges of tomorrow."

Going forward, task force members and Rocky Mountain Power will work together to incorporate the plan through a public process in each community's general plan. Identifying where electrical facilities are needed to support future growth will benefit local governments, transportation planners, developers, residents, businesses and Rocky Mountain Power. This type of clarity and predictability will not only help assure electrical capacity is available to meet communities' development needs, but also make more efficient use of limited financial resources and minimize potential conflict in the future.

David White, Salt Lake County; Jerry Bensen, Utah Transit Authority; Brenda Scheer, Univerity of Utah Architecture and Planning; Ana Paz, South Jordan; Jody Knapp, West Valley; Demi Corbett, The Planning Center; Mark McGrath, Taylorsville; Glen Graham, Herriman; Greg Mickolash, West Jordan; Alene Bentley, Rocky Mountain Power; Jim Byrne, Former Public Service Ccommission; Everett Joyce, Salt Lake City; Blair Squires, Rocky Mountain Power; Jani Gamble, Rocky Mountain Power; Ted Knowlton, The Planning Center; Steve Jensen, Rocky Mountain Power; Larry Gardner , South Salt Lake; Brad Baird, Economic Development Corporation of Utah; Jeremy Nielson, South Jordan; Alan Matheson, Envision Utah; Mickey Beaver, Rocky Mountain Power; Ken Shortt, Rocky Mountain Power

Task force members brainstormed potential infrastructure locations

1. Developing the Plan

"We can't solve today's problems by using the same kind of thinking we used when we created them."

- Albert Einstein

Background

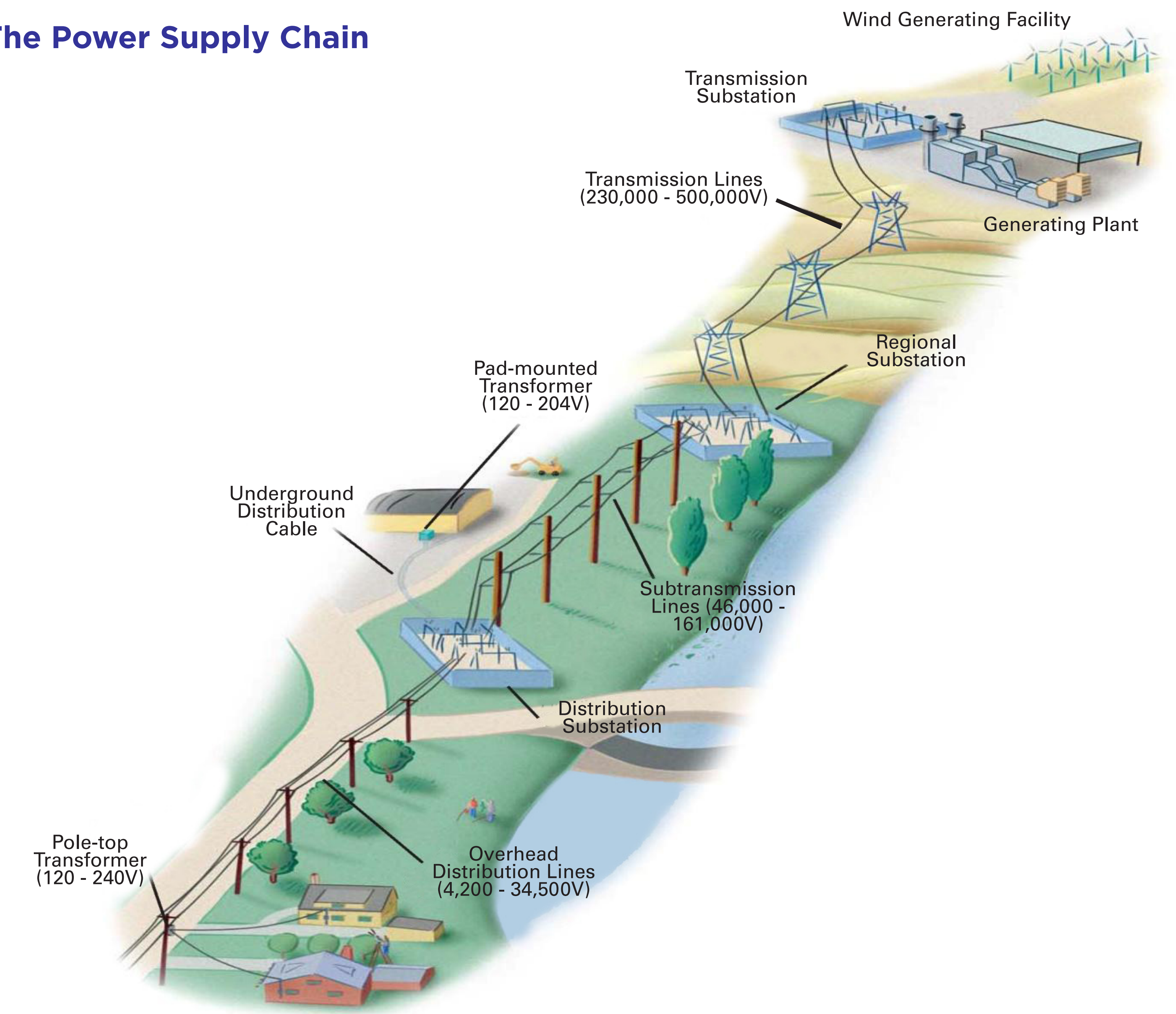
Like most utilities in the United States, Rocky Mountain Power operates as a regulated utility within a framework of regulatory, legal and financial requirements. The utility's prices and policies are regulated by the Utah Public Service Commission, which closely scrutinizes Rocky Mountain Power's resource portfolio, energy efficiency and peak reduction programs, customer services, capital expenses, and operations and administrative costs. The utility is also subject to rules and regulations of various federal agencies and national reliability standards and electrical safety codes.

A legal obligation to deliver a safe, adequate, reliable supply of electricity at the lowest reasonable cost guides utility decisions about timing and location of new substation and transmission capacity. Historically, system requirements were the primary driver of the utility infrastructure planning process with secondary consideration given to local government land-use plans. When customers' needs approached the capacity limits of existing substations and power lines, Rocky Mountain Power made plans to bring new projects on line to meet customers' growing needs.

Rocky Mountain Power's Utah residential customers use about 26 percent more electricity today than they did 20 years ago (see graph on page 5). In fact, usage among Utah households has grown at a higher rate since 1990 than the national average. Paradoxically, customers don't readily connect their dependence on electricity with the infrastructure needed to power their homes and businesses. At times, intense opposition to construction of new facilities or expansion of existing infrastructure to meet growing needs has resulted in project delays, reduced system reliability, costly mitigation measures, project cost overruns—and customers dissatisfied with their electric service.

As Rocky Mountain Power contemplated a 70 percent increase in Salt Lake County's population by 2040, it determined the time was right for a new approach to infrastructure planning. Working together with local government and key stakeholders gives communities and the utility an opportunity to jointly develop a mutually acceptable plan to meet customers' future electric energy needs.

The Power Supply Chain



MAGNITUDE OF THE CHALLENGE

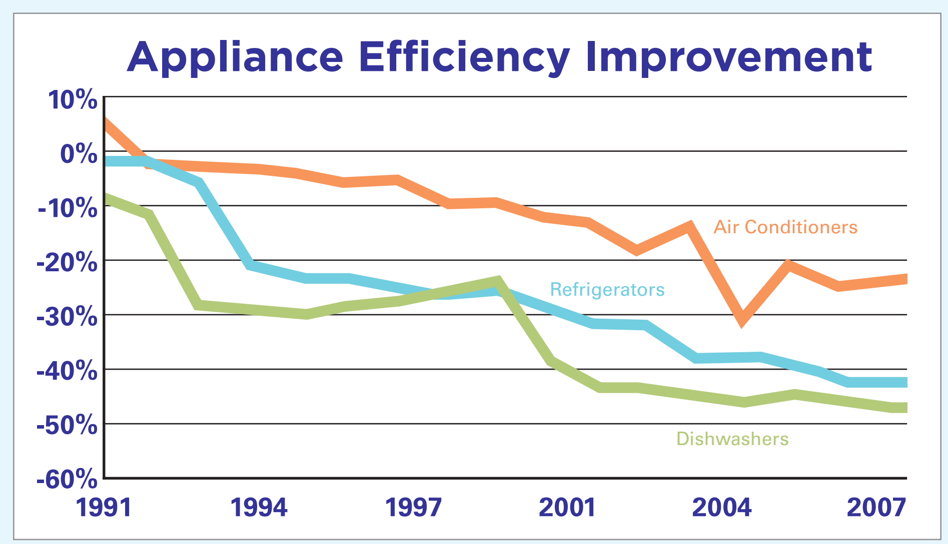
Electrical infrastructure systems are designed to meet customers' needs when usage is at the highest point during the year. Utilities refer to this point of maximum customer use as "peak demand." Peak demand on Rocky Mountain Power's system in Salt Lake County occurs in the heat of summer, typically in late afternoon and early evening. In 2010, peak customer use in Salt Lake County registered 2,082,000 kilowatts (kW) on Aug. 3 at 6 p.m.

A network of 92 substations and over 10,000 miles of high-voltage transmission lines and neighborhood distribution lines delivers electricity to approximately 1.05 million people in Salt Lake County. At present, the average per capita "demand" on the electric system in Salt Lake County is about 2 kilowatts per person. Although it is difficult to predict future per capita electrical demand, the task force agreed to apply this factor to a projected population of 1.7 million, bringing future customer requirements to approximately 3,540,000 kilowatts in 2040. System planners expect approximately 25 new substations will be needed throughout Salt Lake County in the next 30 years to satisfy communities' growing electricity needs.

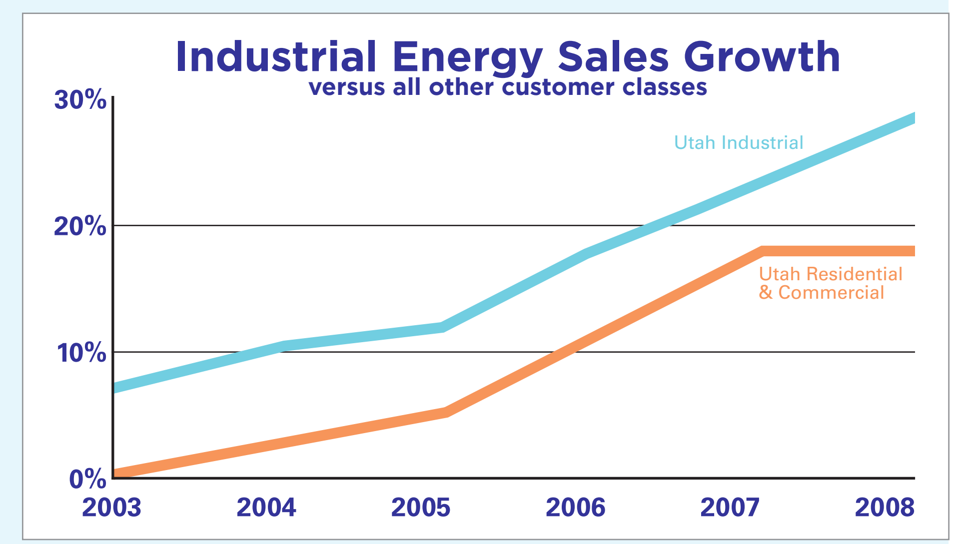
A significant challenge facing task force members and Rocky Mountain Power is, quite simply, the unknowable future. It is prudent to plan for tomorrow based on what we know today—realizing that a host of uncertainties will change many of the assumptions. For that reason, task force members and Rocky Mountain Power agree it is essential to update the plan at least every five years to account for changing circumstances. Some of the uncertainties include:

- Population projections, employment projections and development patterns are subject to economic, demographic and market conditions.
- The current economy is the most fragile it has been since the Great Depression. The speed and scope of economic recovery may alter customer demand projections.
- Climate change and carbon reduction strategies could impose higher energy costs on consumers. Utah is among the states where prices are expected to increase significantly due to gradual replacement of inexpensive coal-based generation with more costly alternatives.
- Residential usage continues to climb despite improved appliance efficiency. According to the International Energy Agency, the average household today owns 25 electronic consumer devices compared with three in 1980. Central air conditioning is also more prevalent today.
- Electric rates are projected to escalate. Price elasticity could reduce the growth rate of future customer demand.
- Technology advancements in "smart" homes and buildings could allow customers to view real-time usage and prices and change their usage habits. The technology could also allow utilities to control certain appliances to manage peak demand. Emerging technologies popularly known as "smart grid," which call for bidirectional meters, are not currently economically viable in many utility regulatory environments. Existing technologies, however, like Rocky Mountain Power's Cool Keeper program, are currently cost effective in managing peak system use.
- Industrial usage in Utah is rising faster than residential and commercial usage. If the trend continues, it may impact where substations and transmission lines are needed.
- Customer-owned wind and solar generation enjoys public support but it is not expected to appreciably reduce the need for future utility infrastructure. Peak generating periods of wind and solar seldom correlate with periods of peak customer use. Battery storage is expected to remain expensive.
- Electric vehicles may gain broader penetration with technology advancements and higher oil prices. How might widespread use affect peak demand? Utilities will offer off-peak charging incentives, but will consumers respond to price signals or re-charge at their own convenience? A handful of communities nationwide have already installed charging receptacles in public places.

Task force members recognize that barring any new technology developments that eliminate the need for substations and transmission lines, these facilities will continue to be necessary to supply future growth of Salt Lake County communities and industry. The foregoing uncertainties, and perhaps others that are unfathomable today, will alter the timing of new facilities. The plan provides for ongoing review of these uncertainties and other unforeseen changes.The plan represents the best efforts of local government, important stakeholders and Rocky Mountain Power to identify preferred locations for electrical infrastructure based on today's knowledge about Salt Lake County's future growth. It's the place where local government, stakeholders and the utility can begin the conversation when increased customer use calls for new facilities.



Source: Trends in Energy Efficiency 2008, Association of Home Appliance Manufacturers



Source: Rocky Mountain Power Customer Use Data

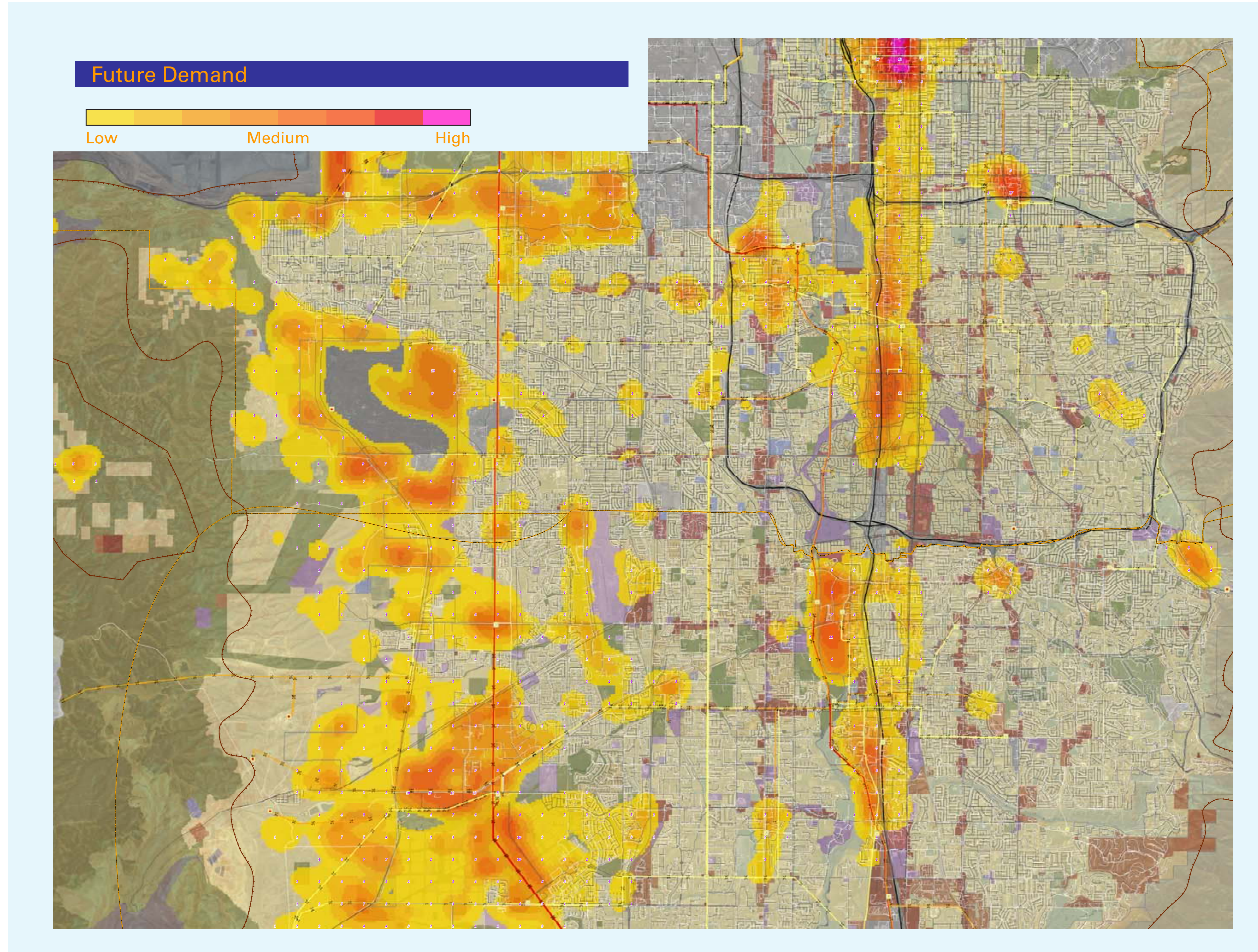
The task force process

The Salt Lake County Electrical Plan Task Force met monthly from October 2009 through May 2010. An independent facilitator guided their discussions, emphasizing from the outset that the task force would control the process within the overall scope of the effort and work towards consensus. Rocky Mountain Power participated with technical assistance and offered perspective on legal and regulatory requirements.

Throughout several months of meetings, members became more knowledgeable about the generation, transmission and distribution aspects of the electric utility industry as well as its legal and regulatory requirements. They discussed alternative energy resources, energy efficiency and peak reduction measures as potential means to offset future infrastructure needs. They also learned about utility operating requirements such as reliability standards required by the National Electric Regulatory Commission and Western Electricity Coordinating Council. They became familiar with transmission structure design and clearance requirements prescribed by the National Electric Safety Code.

The task force set 2040 as the planning horizon for the Salt Lake County Electrical Plan. Members reviewed population growth assumptions from the Governor's Office of Planning and Budget as well as maps developed through the Cooperative County Plan, which reflect future development potential according to each jurisdiction's general land-use plans. After comparing population assumptions and development patterns from the Cooperative County Plan with those from the Wasatch Choices 2040 Vision, members opted to use the Cooperative County Plan primarily because of data availability.

Task force members discussed and prioritized community issues and concerns during the course of several meetings. These discussions, which ultimately developed into a set of siting criteria, guided several mapping sessions to identify preferred locations for new substations in areas where future growth and development potential are expected to exceed existing electrical capacity. The plan does not address "main grid" high-voltage facilities used for bulk power. It is limited to substations and transmission lines of 138,000 volts or less.

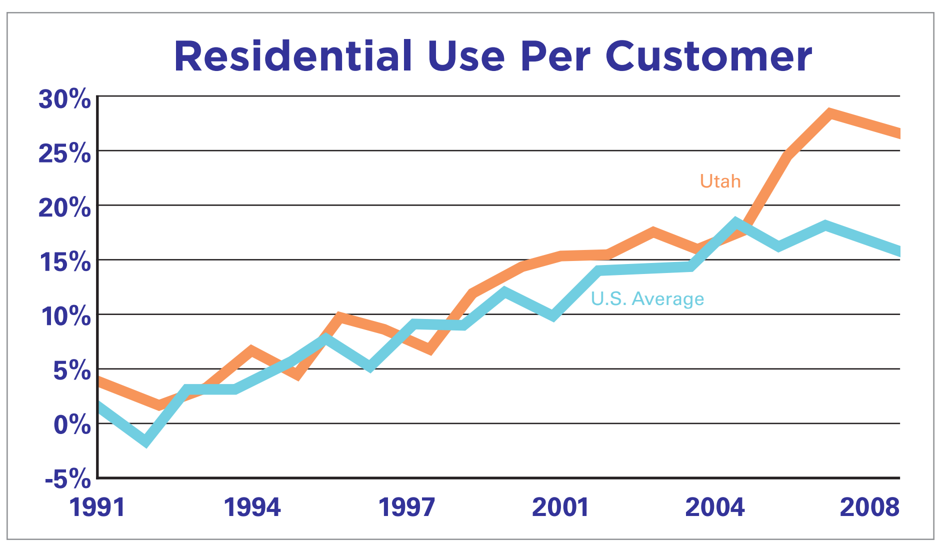


The Task Force utilized maps showing growth in electrical demand.

LOCATION EVALUATION SESSIONS

The Salt Lake County Electrical Plan map evolved over several months. Task Force members worked to identify preferred locations for new substations and transmission lines using electrical capacity requirements developed by Rocky Mountain Power. The electrical capacity projections are based on existing usage of various development types, which were applied to future population and employment projections from the County Cooperative Plan. The data was displayed as "hot spots" on a map to show growth of electricity-intensive areas. The map also included existing electrical infrastructure and general land-use patterns for reference.

Task force members worked in small groups representing their particular jurisdiction in the county or area of individual interest. They discussed local impacts and issues relevant to their own communities while designating suitable locations for new infrastructure with small place-markers (substations) and tape (transmission lines) on the map. Initially they worked from quadrant maps, which were later combined into a North County map and a South County map, and ultimately consolidated into a single map of Salt Lake County. Between mapping sessions they critiqued and refined their choices. Finally, Rocky Mountain Power reviewed the facility locations for engineering and operations feasibility and recommended minor changes.



Source: U.S. Energy Information Administration

DEVELOPMENT OF COMMUNITY SITING PRIORITIES

Community issues and concerns were at the center of the task force's discussions about facility siting. Members devoted several meetings to identifying and ranking factors that are important to the siting process from a community perspective. They ultimately created a set of "siting criteria," which reflect these community concerns, to guide future infrastructure planning decisions.

The siting criteria are an essential element of the plan. They are less likely than specific map locations to become outdated over time and can serve a broader application. The siting criteria represent the considerations which the task force believes should be taken into account when evaluating sites for new infrastructure.

The siting criteria capture the intent and goals of the task force in terms of important considerations and also their relative importance to site selection. Members refined and prioritized the criteria through online surveys and voting sessions during task force meetings. They discussed and refined many of the more difficult criteria in their regular meetings until the group could reach agreement. Finally, members ranked the order of importance among the various criteria. Thus, higher ranked criteria take precedence over lower ranked ones. Inherent conflicts may exist in some cases.

EVALUATION AND REFINEMENT OF PREFERRED LOCATIONS

During refinement of the map, task force members evaluated future infrastructure locations for potential environmental impacts and constraints. They took advantage of a tool developed by the Utah Department of Transportation, called UPlan, to view transmission line and substation locations in relation to natural conditions such as hillside slope, natural drainage and flood plains, earthquake potential, natural habitat, etc. The tool allowed task force members to magnify aerial imagery to a street-level view to see potential infrastructure sites at a more realistic scale than two-dimensional maps. Accordingly, they made some adjustments after seeing precise locations.

The siting criteria were essential to refining facility locations on the map. However, the scale of the map does not accommodate precise locations. At this point, new substation "markers" indicate approximate locations. When peak customer use increases to the point that new infrastructure is required in an area, the community and Rocky Mountain Power can use the siting criteria as a tool to evaluate alternate site options and select a specific location.

The task force refined the map in May 2010 using the siting criteria as well as feedback from Rocky Mountain Power following its technical review of facility locations for engineering and operations feasibility. The map represents the consensus of members' location choices for new substations and transmission lines to meet the county's projected growth in 2040. Rather than pinpointing precise locations, the map identifies the general vicinity where future infrastructure will be needed. It is intended to facilitate discussion about final site selection among local jurisdictions, the community and Rocky Mountain Power when it comes time to build additional electrical infrastructure to meet customers' needs.

The preferred scenario calls for about 25 new substations located throughout the Salt Lake County, provided that several existing substations can be expanded or upgraded to provide additional capacity in the future. These substations are shown on the map. Potential expansion of several existing substations reduced the number that was initially projected. The majority of new transmission capacity can be supplied by upgrading voltage of existing lines or adding second circuits where possible. Both courses of action will reduce community impacts by minimizing the total number of new facilities necessary to meet customer requirements.

The final product gives both local government and Rocky Mountain Power a degree of predictability that neither has previously enjoyed. New facilities will be built over a 30-year period as Salt Lake County's electrical needs grow. As a regulated utility, Rocky Mountain Power must provide electrical capacity to meet customers' needs but it cannot build new facilities until they are necessary. As that point approaches, the Salt Lake County Electrical Plan, including both the map and siting criteria, will serve as a blueprint for facility siting decisions.

Task force members agreed a commitment among all the communities, other stakeholders and Rocky Mountain is required to take the plan forward towards implementation and make it a reality.

2. The Plan

A. Principles of the Salt Lake County Electrical Plan

The Salt Lake County Electrical Plan Task Force defined principles that shaped the plan over the course of the nine-month dialogue. They are listed here.

1. Bring together a broad range of stakeholders with varied perspectives to jointly develop a long-range county-wide electrical plan.
2. Foster communication and broader understanding of all stakeholders' needs and concerns.
3. Improve predictability of electrical infrastructure improvements for communities, residents, property owners and Rocky Mountain Power.
4. Integrate community considerations into electrical infrastructure planning.
5. Develop and maintain a plan that works between jurisdictions and across the entire Salt Lake valley.
6. Establish and maintain a long-term basis for continuing collaboration.
7. Establish a logical relationship between electrical infrastructure and land use, both existing and future.
8. Integrate planning efforts for electrical infrastructure, transportation, and local and regional land use. In short, engage in cooperative planning.
9. Maintain communication among stakeholders and update the plan's elements over time.

The plan's final products and suggested 'next steps' are consistent with these principles. Future plan updates should address the final products and 'next steps' in a manner to advance the overarching principles.

B. Siting Criteria

Siting criteria were developed to guide the future facility siting process. The criteria represent the priorities established by the task force to optimize benefits and mitigate drawbacks to both the community and Rocky Mountain Power. They will be particularly useful in comparative evaluation of alternative sites.

Criteria are divided into five categories and listed in order of importance based on priorities established by the Salt Lake County Electrical Plan Task Force. The categories are as follows:

- General siting factors
- Desirable locations for substations
- Undesirable locations for substations
- Desirable locations for transmission lines
- Undesirable locations for transmission lines

Each criterion includes the following:

- Priority: An indication of the priority level or relative importance on a scale of 1 to 5, shown with compact fluorescent lamp icons
- Why: A statement of rationale and underlying logic
- Example Application: In some instances, an example explaining how the criterion should be applied in siting electrical infrastructure

There may be conflicts among the criteria at any given site. For example, one site may be in a residential area (a negative consideration), yet have few impacts on prominent views. The siting criteria must be considered as relative priorities among several others and adapted to community circumstances.

Berms and slopes are used to integrate a substation into the surrounding neighborhood

The area under a transmission line is used to create a path and greenway providing a needed amenity for the community

1. GENERAL SITING FACTORS

System capacity, reliability and cost considerations are inherent in utility system planning. Related considerations also have broad application to system design, operation and facility siting decisions. The following criteria are included as general factors that should be considered in future facility siting decisions. Given their general nature, they are not ranked and example applications are not provided.

1A. Provide adequate system capacity and reliability

1B. Work with local general plans and planning authorities

1C. Avoid inherently cost prohibitive locations and design elements

1D. Consider future generation options

1E. Consider mega-power users

1F. Consider small-scale renewable energy systems

1G. Consider energy storage

1H. Modify the plan to reflect technology advancements and changing circumstances

1I. Consider additional cost-effective energy efficiency, peak-reduction and smart grid opportunities

Rocky Mountain Power is the second largest utility-owner of wind generation in the United States

1A. Provide adequate system capacity and reliability

Rocky Mountain Power is required to provide adequate electrical capacity to meet customers' needs during peak use times and emergencies, i. e., loss of generation resource, main grid transmission line or substation transformer. Rocky Mountain Power transmission facilities are usually designed with alternate service capability, or redundancy, in order to maintain service from an alternate source if the main source is interrupted.

1B. Work with local general plans and planning organizations

Rocky Mountain Power, municipalities and Salt Lake County should combine planning efforts of the utility, local government and other planning organizations, such as transportation and regional land use, to include electrical infrastructure in general plans. Coordinated planning could address siting issues in advance of development and potentially avoid future conflicts.

1C. Avoid inherently cost prohibitive locations and design elements

While aesthetics is important to communities, it must be balanced with cost, electric service reliability and operational requirements. Careful consideration should be given to avoid sites or design elements that create operational issues and are not economically justifiable.

Communities may prefer siting infrastructure on public land rather than private property. In fact, in some instances it is necessary. However, the increased cost and lead time required to comply with the National Environmental Policy Act should also be considered.

1D. Consider future generation options

The scope of the Salt Lake County Electrical Plan does not encompass future generation resources or sites. When large generation facilities become necessary to meet customers' needs, Rocky Mountain Power will work with local authorities to select the best locations. In addition, technology advancements may create new generation options. Local authorities and Rocky Mountain Power should work together to facilitate capacity contributions from diverse generation resources, including wind, solar, biomass, etc.

1E. Consider mega-power users

"Mega-power" users like data centers or large manufacturing plants have large power needs. Some are large enough to require a dedicated substation. While it is difficult to know precisely where and when they might shop for development sites, it is important to plan for them. Local government and Rocky Mountain Power should work together closely when either becomes aware of a potential large customer.

The impact of a large power user will change infrastructure development plans. It is difficult to anticipate their needs.

1F. Consider small-scale renewable energy systems

Distributed solar and wind installations may achieve greater penetration as technology and costs improve, potentially offsetting electrical capacity supplied by the utility.

1G. Consider energy storage

Wind and solar are intermittent generation resources and do not typically correlate with the timing of customers' peak use. This means the utility must rely on other generation resources as well as transmission and distribution capacity to meet customers' needs during periods of peak demand because energy storage is not currently cost effective. Future commercialization of energy storage systems, like batteries, compressed air, flywheels, etc., will allow energy produced at low-use times to be "stored" for use during periods of peak demand. This could potentially offset the future needs for new generation, transmission and substation capacity.

1H. Modify the plan to reflect technology advancements and changing circumstances

Local government and Rocky Mountain Power should evaluate the plan periodically to account for changing circumstances that alter the supply and demand equation, like energy technology advancements and cost improvements, demographic changes, economic factors, etc. The siting criteria should be modified to incorporate changes. A dynamic planning process will ensure the plan moves forward as the task force intended and retains its validity to local government, other planning organizations and Rocky Mountain Power.

1I. Consider additional cost-effective energy efficiency, peak-reduction and smart grid opportunities

While customer energy efficiency and peak-reduction measures are outside the scope of the Salt Lake County Electrical Plan, Rocky Mountain Power relies on contributions from "demand-side" resources to satisfy customers' electricity needs in the same way as traditional generation resources. The utility currently plans to meet 25-30 percent of its future resource requirements with such measures. It offers financial incentives to residential, commercial and industrial customers to make energy efficiency improvements in their homes and businesses, including insulation and appliance rebates, lighting retrofits and controls, process improvements, etc.

Smart grid technologies have been utilized by the utility for many years to optimize operation of the distribution system, such as Supervisory Control and Data Acquisition, or SCADA. Interest is growing in interactive control measures at the customer level to reduce peak demand. A so-called 'smart grid' or 'smart meter' would enable customers to monitor usage in real-time and change their electrical use, while also giving the utility capability to control customer appliances to reduce peak load. Rocky Mountain Power's Cool Keeper program is an example of 'smart grid.'

Peak reduction measures will offset the need for new capacity requirements, thereby postponing the timing of new capacity additions. In view of increasing per capita energy use, however, they are unlikely to eliminate the need for new facilities.

Standard concrete wall with landscaping

Substations

2. DESIRABLE LOCATIONS FOR SUBSTATIONS

The following criteria pertain to important land characteristics or related considerations that are favorable to siting new substations.

2A. Maximize use of existing facilities and adjacent property before building new facilities

2B. Build aesthetically pleasing facilities

2C. Use topography to reduce visual impacts

2D. Use areas with high development potential

2E. Utilize land adjacent to other infrastructure

2F. Utilize green space

2A. Maximize use of existing facilities and adjacent property before building new facilities

Priority – High

It is preferable to expand existing facilities rather than build new ones whenever feasible. Voltage upgrades and/or expansion of existing facilities will minimize land disturbance by reducing the total number of new sites needed for new substations and also potentially reduce land acquisition costs. Maximizing use of existing facilities may also produce fewer conflicts with nearby buildings, land uses and environmental issues. A community already accustomed to existing facilities may prefer an upgrade or expansion over building a new facility at another location.

Rocky Mountain Power should consider customers' long-term needs when it acquires property for new substations to allow for future expansion. This way, there will be minimal impacts when new capacity is added.

Resolving conflicting criteria may require trade-offs with other considerations. For instance, upgrading an existing substation may be considered visually inappropriate (see Criterion 3D) or incompatible with existing land uses (see Criterion 3A). But it may be preferable to other alternatives.

2B. Build aesthetically pleasing facilities

Priority – High

Infrastructure will be better integrated into the area and find greater acceptance if it is built to be aesthetically pleasing and meet local noise ordinances. Landscaping and concrete walls can be used to improve aesthetics. The use of high quality materials will ensure facilities withstand years of operation without deterioration and costly maintenance. Wall/fence design should be complementary to the area. For instance, in some areas outside of highly urbanized settings or in light industrial areas, a simple fence may draw less attention than a solid concrete wall.

The standard design used by Rocky Mountain Power for new substation screening and landscaping in residential and commercial zones is pre-cast concrete walls and water-wise vegetation. Communities may select the color scheme of the concrete walls to harmonize with the neighborhood.

Capitol Substation, 46kV, ties into the quiet neighborhood with a fence and simple landscaping

At the time new substations are proposed, communities may explore cost-sharing arrangements with Rocky Mountain Power for design changes beyond the standard design.

2C. Use topography to reduce visual impacts

Priority – Medium

Topography, such as coves, raised berms or slopes, can be used to obscure a substation. This technique can lead to greater neighborhood integration, reduce adverse visual impacts and create greater cohesion.

A natural slope obscures the view of a substation to the surrounding neighborhood

Example Application

A new substation is sited in a cove. Drainage is not an issue. The site naturally reduces the visual impact of substation structures and incorporates the natural topography to screen the substation from view.

2D. Use areas with high development potential

Priority – Medium

Optimize use of land in projected growth areas, thus ensuring adequate electrical capacity is available to meet communities' growing needs. Where possible, it is valuable to plan infrastructure in advance of development to minimize conflicts with expanding uses. However, care should be taken to preserve prime real-estate parcels needed for economic development.

Casto Substation adjacent to Interstate 215

2E. Utilize land adjacent to other infrastructure

Priority – Medium

Where possible, substations should be sited adjacent to existing infrastructure and other complementary uses such as transportation corridors and other utilities. However, issues can arise from locating in or near freeway rights-of-way, including salt spray from snow plows, lack of access and insufficient clearance for in-coming transmission lines.

2F. Utilize green space

Priority – Low

Green space may be used for electrical infrastructure where the uses are compliant. Green space is a natural buffer between the substation and the urban form. For instance, nature parks, trails, greenways and other passive uses do not conflict with electrical facilities. Green space near "community centers" may present the best option for siting facilities without disturbing the intensity of the core. Communities may choose to utilize green space surrounding substations for pocket parks or other active uses. It is important to evaluate uses in the green space to ensure compatibility and to allow access for maintenance. While some active uses may be complementary to a substation, others may be problematic, such as stray baseballs from an adjacent ballpark.

3. UNDESIRABLE LOCATIONS FOR SUBSTATIONS

The following criteria pertain to land use characteristics or related considerations that should be avoided in siting new substations.

3A. Avoid residential neighborhoods, schools, and elderly populations

3B. Locate near but not within existing major development centers, transit-oriented development and transit stations

3C. Protect critical habitat, wetlands, rivers and stream corridors, and bird sanctuaries

3D. Protect significant viewsheds

3E. Avoid prime future development parcels

3F. Avoid areas of flood, landslide and earth movement potential

3G. Avoid discrimination based on income or ethnicity

3A. Avoid residential neighborhoods, schools, and elderly populations

Priority – High

Residential areas are the least desirable locations for new substations due to impacts to the character of the neighborhood and important community viewsheds. Avoiding these areas will reduce community concern about perceived reduction of property values and health effects.

3B. Locate near but not within existing major development centers, transit-oriented development and transit stations

Priority – Medium-High

High density centers create a unique situation. The dense residential, retail, commercial and office space drives electrical demand, yet a substation would disrupt the compact setting and pedestrian activity. Therefore, substations should be located near centers but not within the center itself so it won't disrupt the compact setting where density is crucial. The same is true of areas surrounding transit stations. These areas have potential to be developed with greater intensity as transit-oriented development (TOD) and should be avoided.

Wasatch Choices 2040 established areas such as "City Center, Metropolitan Center, Urban Center, Town Center, Main Street, Boulevard Community, Station Community or Village Center" according to density, walkability, and neighborhood character. Substations should be sited on the periphery of such areas where intensity diminishes.

3C. Protect critical habitat, wetlands, rivers and stream corridors, and bird sanctuaries

Priority – Medium

It is Rocky Mountain Power's policy to treat critical habitat, wetlands, river and stream corridors, and bird sanctuaries with extreme care and to avoid them where possible. Sites with potential for environmental issues should be evaluated for impacts and possible mitigation measures. Discussions with concerned parties should be held to identify locations with fewer adverse impacts.

3D. Protect significant viewsheds

Priority – Medium

Viewsheds are an essential element of community character and scenery. It is important to consider impacts to the neighborhood landscape as well as the view from surrounding areas. Avoid building facilities on ridge lines and undeveloped benches where they would disrupt residents' view of the mountains.

3E. Avoid prime future development parcels

Priority – Medium

Do not site substations where potential for prime development is high. These sites should be used for development to foster economic growth. For example avoid corner parcels, which typically have greater development potential than mid-block locations. Also consider siting substations on less traveled streets and roads.

3F. Avoid areas with flood, landslide and earth movement potential

Priority – Medium

Rocky Mountain Power seeks sites without potential for natural hazards that may damage the substation. Locations shown on the infrastructure maps were made without task force members' full knowledge of potential geological hazards. In accordance with its siting policy, Rocky Mountain Power analyzes future substation sites for landslide, flood, and earth movement potential.

3G. Avoid discrimination based on income or ethnicity

Priority – Medium

Whenever possible, work to ensure that demographic or ethnic groups are not impacted unfairly. New substations should be sited according to electrical supply needs and not within areas that may offer less public resistance. Be sensitive to low-income demographics in areas where property is cheaper and permitting requirements may be less restrictive.

Transmission Lines

4. DESIRABLE LOCATIONS FOR TRANSMISSION LINES

Criteria in this section pertain to important land characteristics or related considerations that are favorable to siting new transmission lines.

4A. Share rights-of-way with utilities, trails, railroads, canals, roads, etc.

4B. Upgrade existing facilities before building new facilities

4C. Build aesthetically pleasing facilities

4D. Use areas with high development potential

4E. Select sites that allow operations and maintenance access

4F. Co-locate multiple transmission lines in the same corridor

4G. Minimize the length of transmission corridors

4H. Utilize green space

4A. Share rights-of-way with utilities, trails, railroads, canals, roads, etc.

Priority – High

Where possible, co-locate transmission lines in existing major corridors and identified rights-of-way. The use of existing utility corridors and rights-of-way will minimize the cost of purchasing additional rights-of-way and mitigating potential impacts. Sharing corridors with complementary uses creates fewer disturbances to the aesthetic character of the area.

Transmission lines in a greenway serve as a buffer between major transportation corridors and other uses. Where transmission lines can be co-located with trails, railroads, and canals, they are more easily integrated into the neighborhood landscape. Communities may choose to convert areas under transmission lines into trails or greenways to utilize and beautify the existing right-of-way. This can benefit the community by adding green space and recreation.

Example Application

A new transmission corridor is co-located with Mountain View Corridor during the planning phase to combine similar uses. It results in reduced siting difficulty and provides a buffer between the roadway and the neighboring uses.

Transmission lines run adjacent to the Provo River Parkway Trail

4B. Upgrade existing facilities before building new facilities

Priority – High

Whenever possible, it is preferable to upgrade existing facilities rather than build new facilities. Voltage upgrades and/or addition of a second circuit will minimize land disturbance by reducing the total number of new corridors and also potentially reduce land acquisition and rights-of-way costs. Maximizing use of existing facilities may also produce fewer conflicts with nearby buildings, land uses and environmental issues. A community already accustomed to existing facilities may prefer an upgrade over building a new transmission line in another corridor.

Upgrading an existing transmission line may be considered visually inappropriate (see Criterion 4C) or incompatible with existing land uses (see Criterion 5B). Resolving conflicting criteria may require trade-offs with other considerations.

Example Application

A transmission line adjacent to commercial development is upgraded to a higher voltage to provide new capacity for a growing community. The taller structures required for the upgrade are preferable to building a new transmission line.

4C. Build aesthetically pleasing facilities

Priority – Medium-High

Infrastructure will be better integrated into the area and find greater acceptance if it is built to be aesthetically pleasing. In siting new facilities, seek locations with minimal adverse aesthetic impact, such as utility corridors, industrial areas and along freeways and major streets and highways. This may reduce impacts on surrounding areas such as residential viewsheds.

Communities may choose to create greenways, trails and pocket parks under transmission lines to beautify the corridor and enhance community amenities.

A greenway and trail enhance the area under a transmission corridor

Within accepted industry standards, communities may also work with Rocky Mountain Power to make poles more aesthetically pleasing. For example, community art could be placed near a pole base as long as it doesn't interfere with utility operations or create maintenance problems.

Example Application

The community may fund a landscaped trail in the transmission corridor.

4D. Use areas with high development potential

Priority – Medium

Optimize use of land in projected growth areas, thus ensuring adequate electrical capacity is available to meet communities' growing needs. It is valuable to plan electrical infrastructure in advance of development to minimize conflicts with developing uses. However, care should be taken to preserve prime real-estate parcels needed for economic development.

4E. Select sites that allow operations and maintenance access

Priority – Medium-Low

Access to transmission lines for emergency operations and regular maintenance is an important consideration and should be considered in conjunction with other siting criteria.

4F. Co-locate multiple transmission lines in the same corridor

Priority —Medium-Low

In some cases, more than one transmission line can be sited in a single corridor rather than separately. Co-location has the advantage of reduced land disturbance and impacts to surrounding areas. There are reliability risks, however, if service is interrupted by wind, lightning or other disturbances.

4G. Minimize the length of transmission corridors

Priority – Low

In balance with other criteria, electrical lines should be sited to minimize the length of corridors to reduce the aesthetic impact to the community and minimize construction costs.

4H. Utilize green space

Priority –Low

Green space may be used for electrical infrastructure where the uses are compliant. A transmission line in green space may serve as a buffer between transportation corridors and communities. Communities may choose to utilize green space under transmission lines for pocket parks or other active uses. It is important to evaluate uses in the green space to ensure compatibility. For instance, nature parks, trails, greenways and other passive uses do not conflict with electrical facilities. Green space near "community centers" may also present the best option for siting facilities without disturbing the intensity of the core.

Established conservation areas should be avoided in siting new infrastructure.

A transmission line utilizes natural green space in order to avoid areas with greater impact

5. UNDESIRABLE LOCATIONS FOR TRANSMISSION LINES

Criteria in this section pertain to important land characteristics or related considerations that are undesirable in siting new transmission lines.

5A. Avoid residential neighborhoods, schools, and elderly populations

5B. Locate near but avoid bisecting major development centers, transit-oriented development or transit stations

5C. Protect significant viewsheds

5D. Protect critical habitat, river and stream corridors and bird sanctuaries

5E. Avoid bisecting prime development parcels

5F. Avoid discrimination based on income or ethnicity

5G. Avoid areas with flood, landslide and earth movement potential

5A. Avoid residential neighborhoods, schools, and elderly populations

Priority – High

Residential areas are the least desirable locations for new transmission lines due to impacts to the character of the neighborhood and viewsheds. Avoiding these areas will reduce community concern about perceived reduction of property values and health effects.

5B. Locate near but avoid bisecting major development centers, transit-oriented development or transit stations

Priority – Medium-High

High density centers create a unique situation. The dense residential, retail, commercial and office space drives electrical demand, yet transmission lines or electrical facilities would disrupt the compact setting and pedestrian activity. Therefore, transmission lines should be located near centers but not within the center itself so they won't disrupt the compact setting where density is crucial. The same is true of areas surrounding transit stations. These areas have potential to be developed with greater intensity as transit-oriented development (TOD) and should be avoided.

Wasatch Choices 2040 established areas such as "City Center, Activity Center or Village Center," determined by density, walkability, and neighborhood character. Transmission lines should be sited on the periphery of such areas where intensity lessens. The community may also wish to have the transmission lines buried. State law provides that Rocky Mountain Power will build underground transmission lines if 1) reliability is not jeopardized and 2) the community pays the cost difference with overhead construction, in the case of new lines, or the full cost of converting existing overhead lines.

5C. Protect significant viewsheds

Priority – Medium-High

Viewsheds are an essential element of community character and scenery. It is important to consider impacts to the neighborhood as well as the view from surrounding areas. For example, ridge lines and undeveloped benches throughout Salt Lake County should be avoided. It is also preferable to use topography to make transmission lines less visible and blend in with the surroundings.

5D. Protect critical habitat, river and stream corridors, and bird sanctuaries

Priority - Medium

It is Rocky Mountain Power's policy to treat critical habitat, wetlands, river and stream corridors, and bird sanctuaries with extreme care and to avoid them where possible. Sites with potential for environmental issues should be evaluated for impacts and possible mitigation measures. Discussions with concerned parties should be held to identify locations with the fewer detrimental impacts.

5E. Avoid bisecting prime development parcels

Priority - Medium

Transmission lines should be sited to not bisect areas with prime development potential and interfere with economic development potential.

5F. Avoid discrimination based on income or ethnicity

Priority – Medium

Whenever possible, work to ensure that demographic or ethnic groups are not impacted unfairly. New transmission lines should be sited according to electrical supply needs and not within areas that may offer less public resistance. Be sensitive to low-income demographics in areas where property is cheaper and permitting requirements may be easier.

5G. Avoid areas with flood, landslide and earth movement potential

Priority – Medium-Low

Rocky Mountain Power seeks sites without potential for natural hazards that may damage electrical facilities. Locations shown on the infrastructure maps were made without task force members' full knowledge of potential geological hazards. In accordance with its siting policy, Rocky Mountain Power analyzes potential transmission corridors for land movement and flood potential.

C. Scorecard

A scorecard was developed as a tool for local jurisdictions and Rocky Mountain Power to use in evaluating alternative locations for new facilities. It provides a means to compare specific locations in terms of how well each site meets the siting criteria established by the task force. It is not intended to replace careful consideration and debate about the relative benefits or impacts of specific locations. Rather, it is a tool to be used in combination with other information to facilitate comparative evaluation.

INSTRUCTIONS FOR USE

The scorecard is separated into two sections, one for substations and one for transmission lines. To score the potential site, ask yourself how well the location meets each criterion, and enter an x in the corresponding line. Then multiply the score for each criterion by the corresponding criterion weight to produce a total score for that criterion. The weight assigned to each criterion corresponds to the priority it was given by the task force and shown in the Siting Criteria section of this document. Finally, sum the points in the last column to obtain a total score for the potential infrastructure location.

This example illustrates how to score a potential site. Blank scorecards can be found in appendix D and in spreadsheet form at:

www.rockymountainpower.net/planning

Salt Lake County Electrical Plan Example Scorecard

SUBSTATIONS				
Desirable Locations	SCORE how well the criterion is met	Enter X where appropriate	Criterion WEIGHT	Criterion TOTAL = score X weight
2A Maximize use of existing facilities and adjacent properties before building new facilities	Substantially (2 points)			
	Partially (1 point)	x	5	5
	Poorly (0 points)			
2B Build aesthetically pleasing facilities	Substantially (2 points)	x		10
	Partially (1 point)		5	
	Poorly (0 points)			
2C Use topography to reduce visual impacts	Substantially (2 points)			
	Partially (1 point)	x	3	3
	Poorly (0 points)			
2D Use areas with high development potential	Substantially (2 points)			
	Partially (1 point)	x	3	3
	Poorly (0 points)			
2E Utilize land adjacent to other infrastructure	Substantially (2 points)			
	Partially (1 point)		3	
	Poorly (0 points)	x		0
2F Utilize green space	Substantially (2 points)	x		2
	Partially (1 point)		1	
	Poorly (0 points)			
			Subtotal	**23**
Undesirable Locations	SCORE how well the criterion is met	Enter X where appropriate	Criterion WEIGHT	Criterion TOTAL = score X weight
3A Avoid residential neighborhoods, schools and elderly populations	Substantially (2 points)	x		10
	Partially (1 point)		5	
	Poorly (0 points)			
3B Locate near but not within existing major development centers, transit oriented development and transit stations	Substantially (2 points)			
	Partially (1 point)	x	4	4
	Poorly (0 points)			
3C Protect critical habitat, wetlands, rivers and stream corridors, and bird sanctuaries	Substantially (2 points)			
	Partially (1 point)	x	3	3
	Poorly (0 points)			
3D Protect significant viewsheds	Substantially (2 points)			
	Partially (1 point)		3	
	Poorly (0 points)	x		0
3E Avoid prime future development parcels	Substantially (2 points)			
	Partially (1 point)	x	3	3
	Poorly (0 points)			
3F Avoid areas with flood, landslide and earth movement potential	Substantially (2 points)	x		6
	Partially (1 point)		3	
	Poorly (0 points)			
3G Avoid discrimination based on income or ethnicity	Substantially (2 points)			
	Partially (1 point)		3	
	Poorly (0 points)	x		0
			Subtotal	**26**
			SUBSTATIONS GRAND TOTAL	**49**

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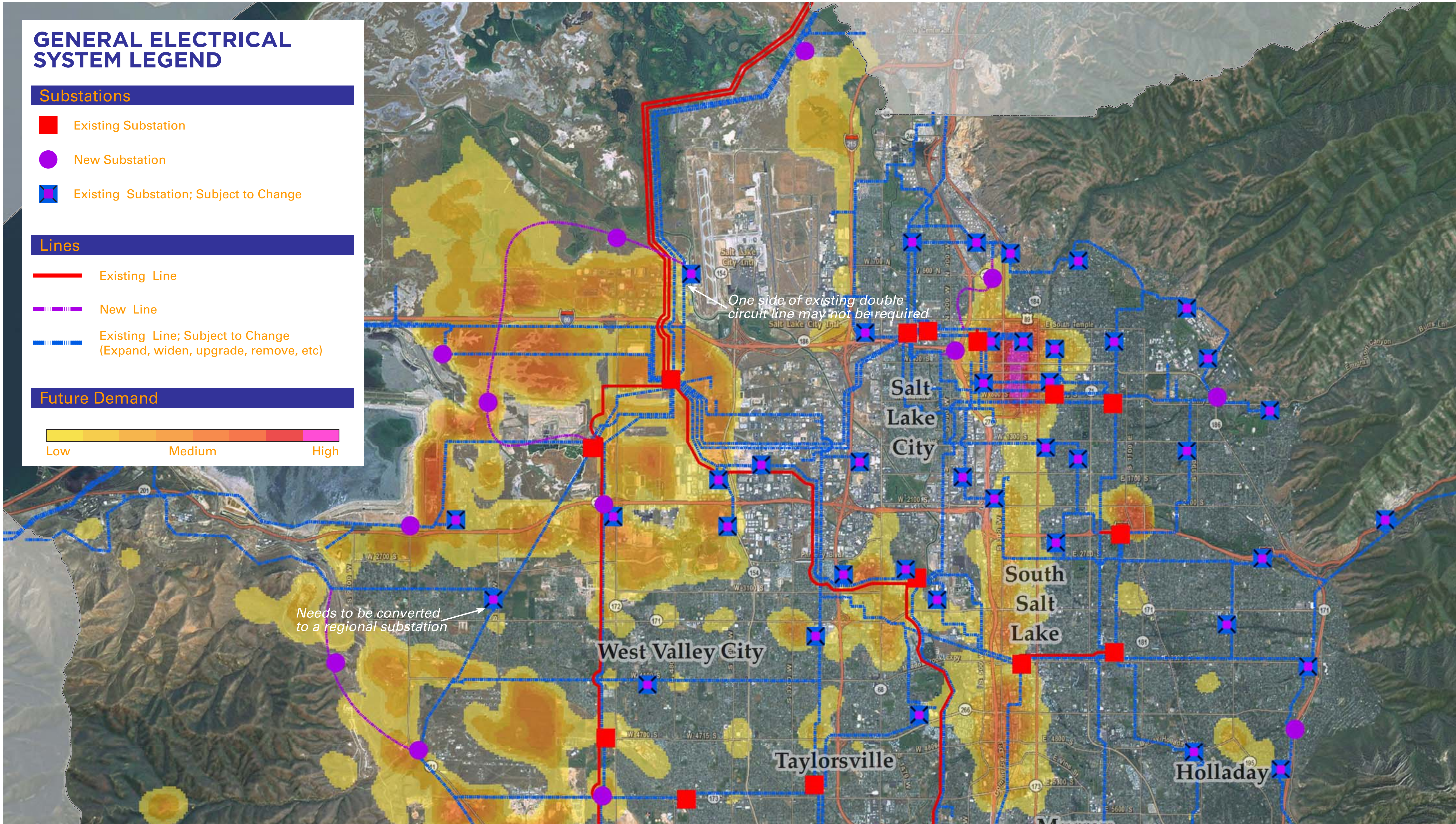
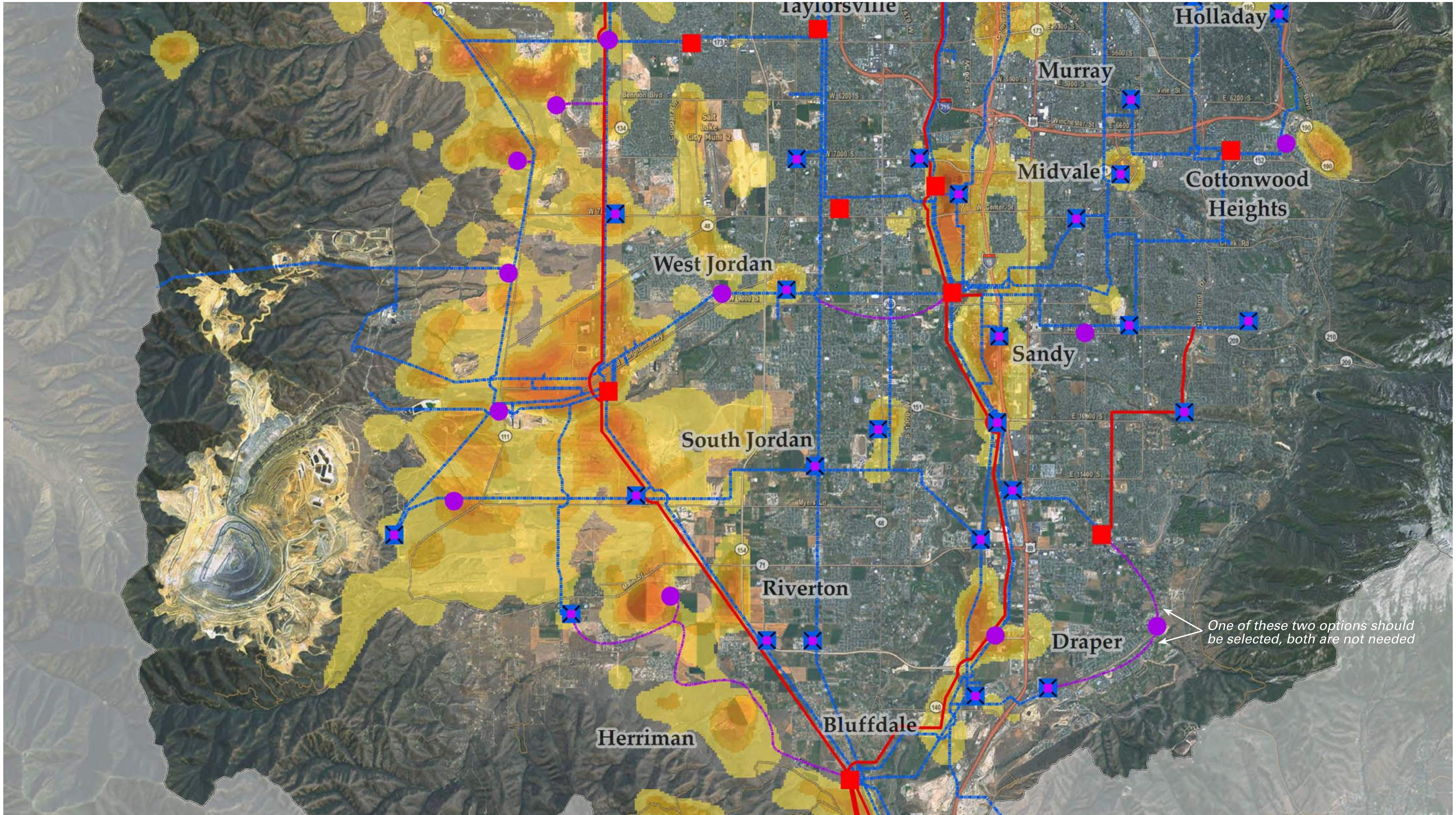
D. Map

NORTHERN SALT LAKE COUNTY



SOUTHERN SALT LAKE COUNTY



E. How to use the plan in the future

The goal of the Salt Lake County Electrical Plan is to facilitate cooperative planning by local government and Rocky Mountain Power for electrical infrastructure needed to supply growing communities. It represents a shared understanding of the preferred locations of new electrical infrastructure and the process they will follow in making future siting decisions. It has no force of law; however communities and the utility can realize measurable benefits over time if is implemented voluntarily.

The effort can fulfill three important goals of long-range planning:

- Ensure adequate electrical capacity to supply communities' future growth
- Define appropriate land uses and design characteristics for future electrical facilities
- Let residents and property owners know what to expect as the community changes over time

Cities and counties are accustomed to working towards these aims within the transportation or mobility components of their general plans. Further, community development considerations such as land use, parks and recreation are typically integrated into their transportation plans. But most cities do not address electrical infrastructure with the same long-range view. The Salt Lake County Electrical plan offers communities an opportunity to treat electrical infrastructure in a similar and thoughtful manner.

SALT LAKE COUNTY ELECTRICAL PLAN UPDATES

The plan will be incorporated into the Cooperative Salt Lake County Plan to ensure it is updated over time, easily accessible, and integrated with other cooperative county plan documents. Plan updates should reflect the changing geography of energy use, such as the location of a new data center, land-use changes, or to incorporate major local modifications.

Minor changes

Minor changes, those that affect only one jurisdiction and maintain the basic technical feasibility of the plan, should be shared with Rocky Mountain Power. The Rocky Mountain Power representative to contact with minor changes is:

Administrative Assistant
801-220-2660
rmpmasterelecplan@pacificorp.com

Major Changes

Major changes, those that affect more than one jurisdiction or affect basic technical considerations, should be addressed by affected parties (jurisdictions and Rocky Mountain Power) on an as-needed basis. These changes should be recorded in a modified Salt Lake County Electrical Plan by Salt Lake County staff as part of the Cooperative County Plan.

The Salt Lake County contact information is:

Salt Lake County Planning and Development Services
801-468-2000
khart@slco.org

Overall Updates

The County Cooperative Plan planning directors or subcommittee should meet at least every five years to develop an approach to update the Salt Lake County Electrical Plan. An update should include changes to the plan map, the shared siting criteria, and effective local implementation practices.

LOCAL IMPLEMENTATION CHECKLIST: SUGGESTED NEXT STEPS

- Present plan as an informational item to planning commission, city or county council.
  - Discuss concept and approaches to address electrical infrastructure in your locality.
- Review the siting criteria and the maps in the Salt Lake County Electrical Plan.
  - Identify compatibilities/incompatibilities with your existing general plan.
- Develop a planning approach and schedule to address electrical infrastructure that considers:
  - Input from your elected and appointed officials. Approaches to consider include:
    - Developing an electrical infrastructure general plan element
    - Adopt as a stand-alone plan, referenced in relevant general plan elements
    - Note the plan as a reference document within the general plan
  - Develop a schedule of anticipated general plan updates.
- Implement basic electrical infrastructure considerations in local plans and ordinances.
- Begin addressing substantive incompatibilities between local plans and ordinances and the Salt Lake County Electrical Plan.
- Inform Rocky Mountain Power, neighboring jurisdictions, and Salt Lake County (for the County Cooperative Plan) on an ongoing basis of any changes you make to plan elements to address incompatibilities.

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3. Local Planning Handbook

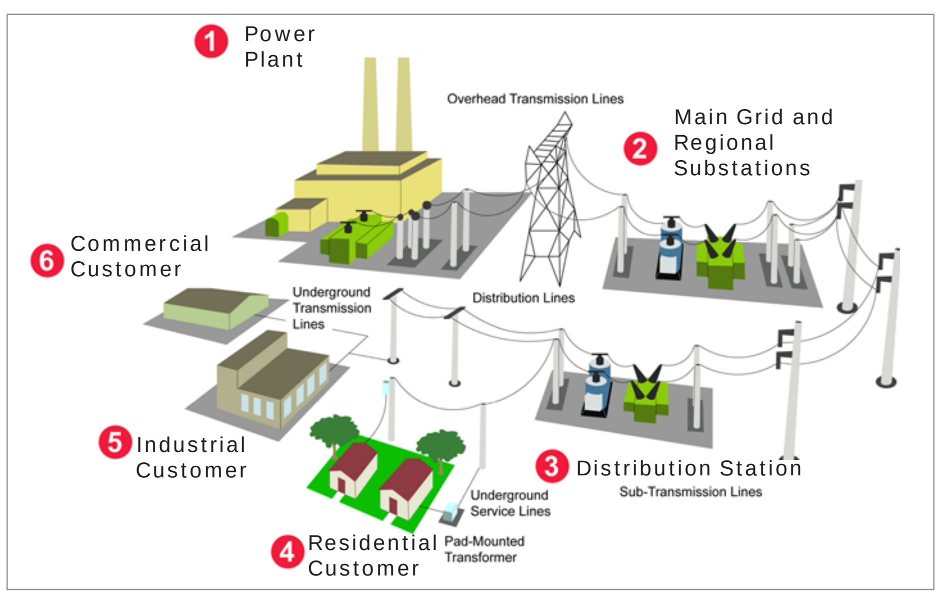
This handbook promotes a consistent ‘best practice’ approach to integrating electric substations and transmission lines into Utah’s communities. In doing so, it encourages citizens, community leaders, planners and utility representatives to actively participate in the utility siting process to improve the ability to efficiently coordinate future community growth, and recognizes the important role that electric utility service plays.

The electric utility transmission system is composed of electric power line corridors, which are linear routes through communities, and electric substations that are located on individual sites.

Electric power begins at power plants, transmitted through high voltage transmission lines, stepping down from higher to lower voltages through shorter-distance transmission lines and, ultimately, to distribution substations and distribution lines feeding residential and commercial users.

Electric substations and transmission lines should be sited in a way that is not only functional and cost-efficient, but also well-integrated into the community. Electric facilities should be part of a larger strategic plan that responds to community growth patterns and needs. Appropriate electric facility siting will ensure safe, reliable electric services can be provided that fits into the particular context. Each electric facility should consider impacts to natural systems like soils, drainage and habitat, and, with the aid of the community, address aesthetic considerations.

1. Proactive Planning
2. Best Management Practices
3. Sustainability
4. Communication
5. Multi-Purpose/Co-location
6. Neighborhood Integration



KEY QUESTIONS WHEN EVALUATING FACILITIES:

- Is this proposal consistent with the adopted electric service plan and corresponding siting criteria?
- Is this proposal compatible with existing land uses and the community's Comprehensive Plan?
- Can existing substations and transmission lines be utilized to meet the needs of the utility and the community?
- Does this proposal promote recreational use of utility corridors for trails, sports fields, and similar uses?
- Does this proposal limit the amount of site grading and vegetation, yet still meet adopted safety standards?
- Is proposed land development sited and screened in a manner that reduces the potential for conflicts with existing electrical facilities?
- Where feasible, are telecommunication facilities co-located with the proposal?
- Is the proposal screened with fences, walls, vegetation and/or topography or a combination thereof?
- Has the proposal included lighting designed to reduce impacts to the surrounding area yet meet safety and security requirements?
- Does this proposal's screening use color and materials minimizing aesthetic impacts?

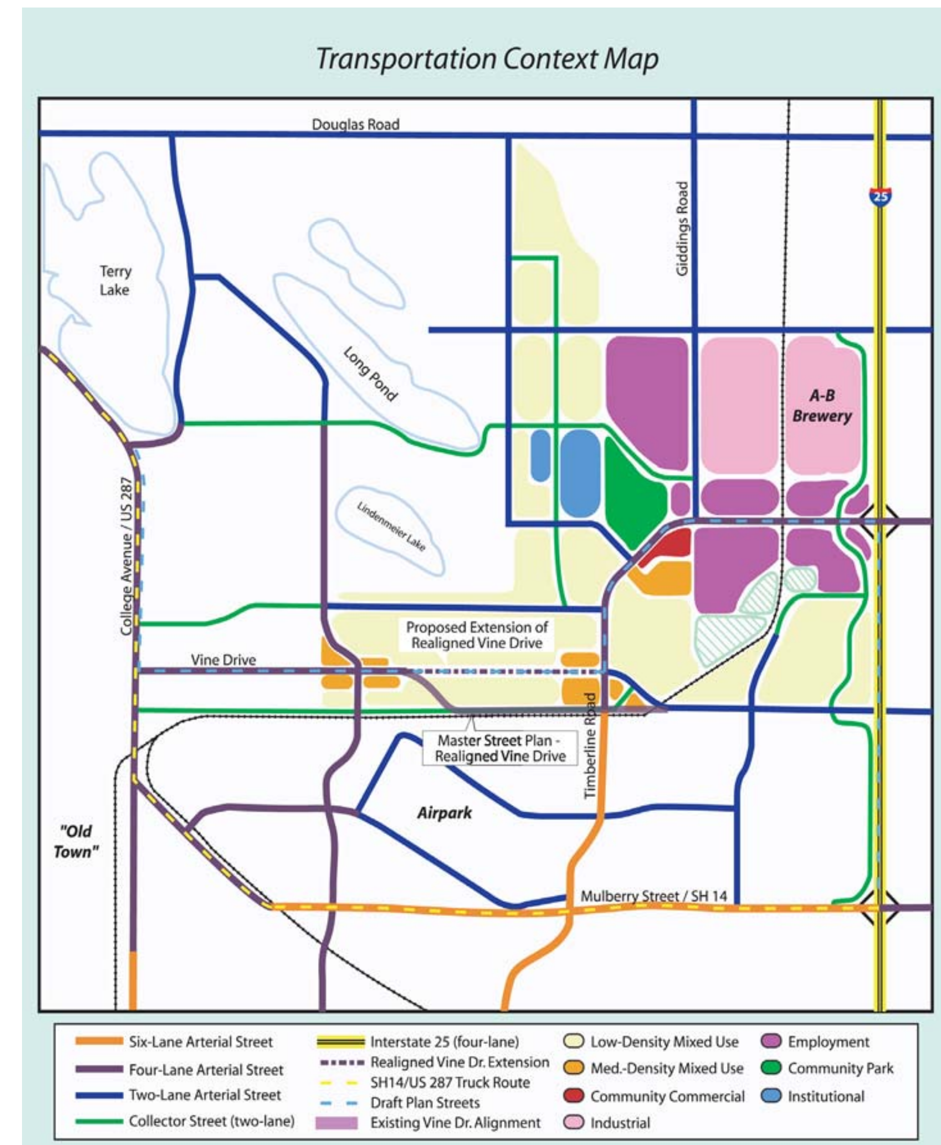
CORE CONCEPTS DISCUSSION

1. Proactive Planning

- Municipalities, counties, and utilities should work together to appropriately site new substation and transmission facilities to maintain a reliable level of service and accommodate growth. Data and population projections should be generated to assist utilities in their growth planning.

  Comprehensive plans should include the siting of electric facilities, much as is done for a water or sewer master plan, transportation plan, or a parks, recreation and open space plan.

The siting of new substation and transmission facilities should be taken into consideration during the comprehensive planning process, at the time the desired location of residential, commercial and industrial areas is determined. Data collected during the comprehensive planning process should include forecast energy demand and the location and timing of growth based on several factors such as, historical electric usage by market sector, density of development, and



Integrate utilities with future transportation corridors historic and forecasted market trends. Armed with this information, it will improve decision-making in forecasting electric demand relative to existing supply, predict facility need by general location, and determine transmission and distribution requirements. Once known, electric facilities can become an inclusive component of the planning process and adopted plan.

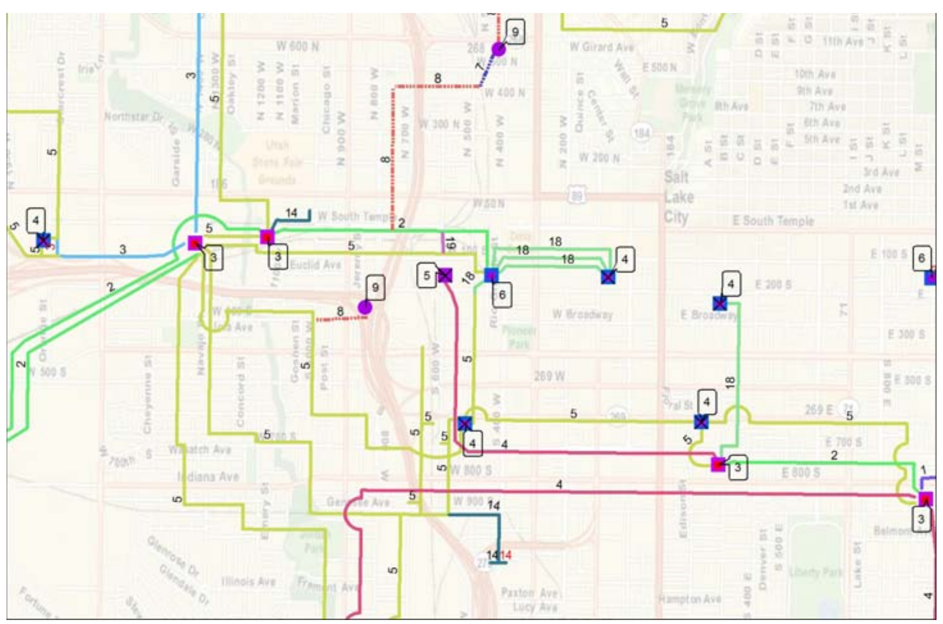
As with other Comprehensive Plan elements, communities should adopt utility policies that set a specific strategy to guide future decision-making. The following policies should be seen as a template for consideration by local municipalities:

- Develop siting and land use compatibility standards for electric facilities.
- Promote on-going coordination between municipalities and utility providers to ensure that electric transmission lines are provided in urban areas and can be coordinated with road right-of-way and other infrastructure.
- Consult the adopted Transportation Master Plan when designating new utility corridors.
- Consider utilizing new right-of-way corridors to minimize the need to tear up and replace existing roads.
- Secure new electric resources and transmission lines as necessary to meet projected demand levels.
- Require new development to dedicate sites and easements needed for substations, transmission, sub-transmission and distribution lines.
- Pursue reasonable and cost-effective energy efficiency, conservation, and load management programs.
- Develop and implement public education programs designed to increase the public's awareness of energy issues, including conservation measures and practices.

• Future facilities should follow the official electrical plan and corresponding siting criteria. The coordinated utilities plan suggests areas where expanded service may need to take place.

• Local jurisdictions should coordinate with the electrical provider when considering land use designations or new development in the vicinity of proposed transmission and substation facilities. Potential encroachments into proposed utility corridors and at substation sites should be evaluated during the land development review process. Some of the tools to preserve these areas include:
  - Identify future potential transmission corridors and substation sites in new developments and require utility integration into the development plan and/or subdivision plat.
  - Require dedication of a strip of land along existing transmission corridors for potential future right-of-way expansions.
  - Prescribe building set-backs or lot sizes for properties adjacent to transmission lines so that buildings don't constrain future rights-of-way.

• If property adjacent to an existing transmission line is to be developed, require the developer to dedicate land for a parkway, bike path, or buffer area.



Development Plans identifying utility easements

2. Best Management Practices

- Require the use of those proven methods or techniques that consistently produce positive results, i.e. - "best practices" for future substation and transmission facilities.
- Limit the disturbance to vegetation within major utility transmission corridors and substation sites to actions that are necessary for the safety, operation and maintenance of the facilities. Care should be exercised to preserve the natural landscape and conduct construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent construction and conductor clearances, approved construction roads, or excavation operations, all trees, native shrubbery, and vegetation should be preserved and shall be protected from damage by construction operations and equipment. The edges of clearings and cuts through tree, shrubbery or other vegetation might be irregularly shaped to alter the visual impact of straight lines.

3. Sustainability

- Encourage conservation of electric resources to delay the need for additional transmission and substation facilities for electricity. Citizens and businesses can take advantage of electric conservation opportunities. Many conservation actions such as interior motion sensor lights that control lighting in response to room occupancy have minimal associated costs, making payback immediate and significant. Providing educational resources is a positive way that electric providers can inform the public about ways to improve energy efficiency that is both practical and economical.
- Consider cost-effective energy conservation technologies including, but not limited to, site planning, construction methods, materials used, and landscaping and development regulations. Such technologies for methods and materials should also promote practices that do not compromise human health conditions when occupied or used, reduce the need for future additional utility distribution facilities, and leave options for increasing conservation technologies in the future.

  Local jurisdictions can incorporate sustainability features directly into zoning and building codes. Minimum zoning standards should allow various energy saving uses such as wind turbines, solar access, photovoltaic solar panels, geothermal heat, and green roofs. Since more efficient energy use in buildings decreases energy costs, then a major focus should be on implementing "green building" practices.

4. Communication

Utility providers should prepare a detailed communications plan that highlights how information about future substation and transmission improvements can be shared with public agencies and customers. The following communications program elements should include:

- Foster early and proactive communication between affected stakeholders.
- Meet periodically with representatives of utility providers to ensure coordination of substation and transmission line plans.
- Coordinate with other jurisdictions in the planning and implementation of multi-jurisdictional substation and transmission improvements.
- Add transmission and substation information to the jurisdiction's geographical information system (GIS), where feasible, and coordinate regularly with private utility providers to obtain up-to-date systems information.

Exercise care during construction to protect vegetation

5. Multi-Purpose /Co-location

- Where economically feasible and allowed by law, promote co-location of major transmission facilities. Many major transmission facilities such as electric transmission lines, water, and natural gas main pipe lines can share utility corridors. This will minimize the amount of land allocated for this purpose and the tendency of such corridors to divide neighborhoods or districts.
- Promote recreational use of utility corridors for trails, sports fields, and similar uses. Communities should be encouraged to utilize

Minimize disturbance to adjacent slopes electric transmission line rights-of-way for bicycle/pedestrian paths, equestrian trails and sports fields. The local Parks & Recreation Master Plan should be consulted when developing the utility system, and future corridors should be coordinated with greenway trails when possible.

- Promote the co-location of telecommunication facilities adjacent to electric substations without undue burden on any single utility provider. To the extent feasible antenna towers, and equipment structures should be co-located adjacent to substations and be designed to provide for the consolidation of future facilities to eliminate or minimize the visual clutter resulting from multiple communication structures.

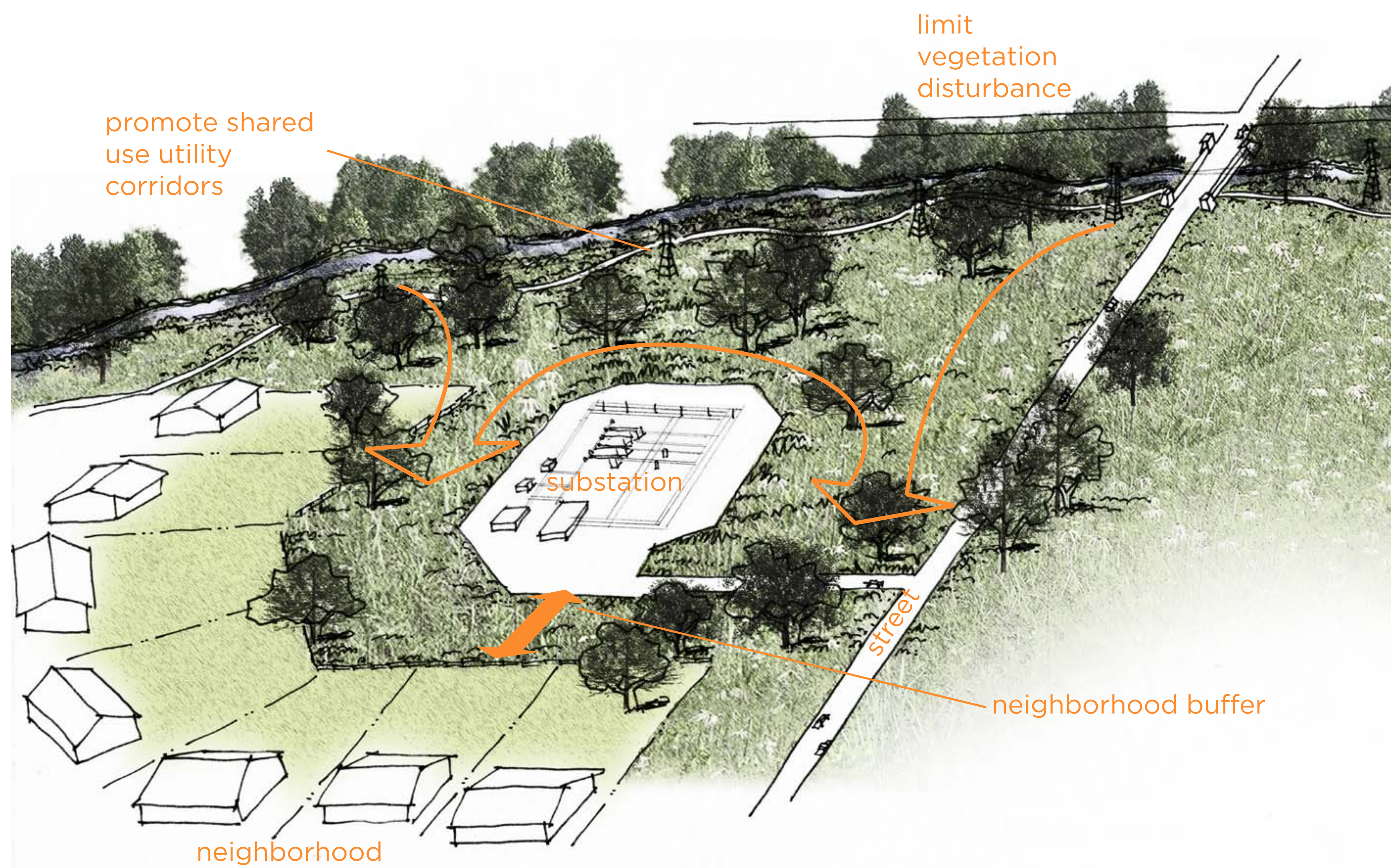
6. Neighborhood Integration

- Ensure that new transmission and substation facilities are designed in such a manner as to minimize adverse aesthetic impacts on the surrounding land uses.
- Utilize buffer zones to integrate substations with surrounding neighborhoods and districts. Buffer zones can be defined through distance, land forms and plant material. Three types of landscaping options are currently available:
    1. **Hardscape** - Gravel, asphalt, decorative rock, paving etc.
    2. **Softscape** - Non-native trees, shrubs, grass, continual irrigation and maintenance required
    3. **Xeriscape** - Low watering intensity (waterwise), self sustaining shrubs and trees, native trees, shrubs and grasses
- If possible, move facilities behind natural landforms or vegetation to help screen them from view.
- Permanent exterior lighting must provide lighting adequate to meet safety and security needs, but should not be excessive. Dark sky practices should be utilized minimizing the impact of lighting to the adjacent properties.
- Encourage the use of design guidelines to address the location and screening of electric substations.
- New development approved adjacent to existing substation facilities should provide vegetative screening or buffers. Buffer yards, including vegetative screening and/or berms should be created that separate new residential land uses from existing substations and similar electrical equipment in order to eliminate or minimize potential nuisances, or to provide spacing to reduce visual impacts.
- Use color and material finishes to blend into the surroundings. The colors and finishes should be based on the following considerations:
    - Utilize uniform and non-contrasting colors for substation walls to blend with the immediate natural environment.
    - Selected on the basis of their ability to blend with both the sky and the environment in which they are being used.
    - Transmission line conductors should, over time, be non-reflective, and the insulators non-reflective and non-refractive.

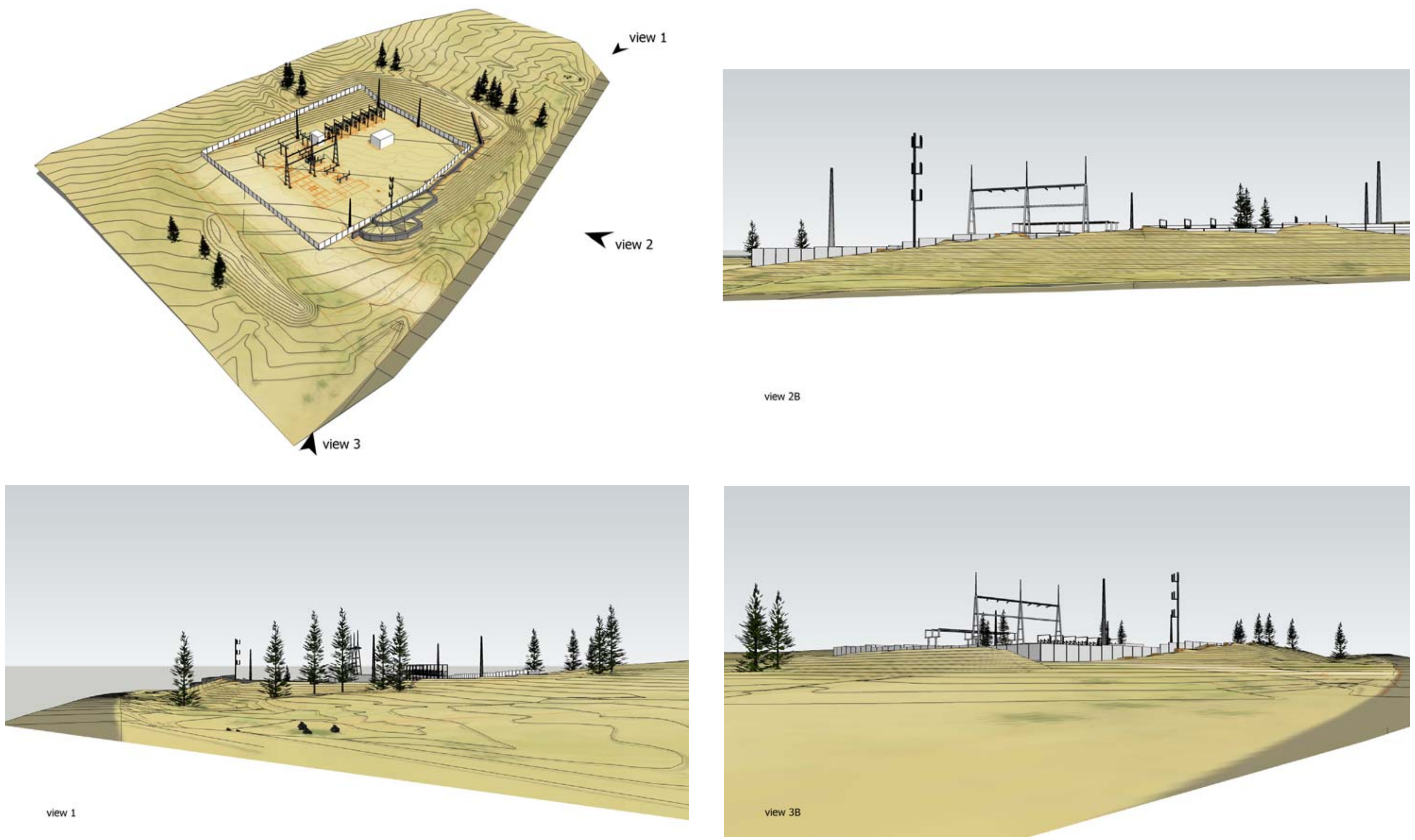
Co-location of telecommunication towers with substations

Minimize disturbance of existing vegetation

Vegetation acts as a buffer between a substation and the surrounding neighborhood



Techniques used to integrate substation into surrounding neighborhood



Example berming used to integrate substation into surrounding neighborhood

Resources

1. *The Case for New Electricity Transmission and Siting New Electricity Transmission Lines, Roger W. Gale, Mary O'Driscoll, GR Energy LLC, September, 2001, http://oharas.com/ET/Transmission_Case.pdf*

2. *The Neighborly Substation-Electricity, Zoning and Urban Design, Hope Cohen, Deputy Director, Center for Rethinking Development, December, 2008. http://www.manhattan-institute.org/html/crd_neighborly_substation.htm*

3. *Visual Impact Analysis Methodology for Transmission Line Planning Corridors, EDAW, February 1977.*

4. Appendices

Appendix A: Glossary of terms

A

Alternating Current (AC) – An electrical current which alternates direction repeatedly due to a change in voltage. With power companies the alternating current creates a sinusoidal waveform.

Ampacity – The current-carrying capacity, expressed in amperes, of an electric conductor under stated thermal conditions. As ambient temperatures decrease the ampacity increases.

Ampere – A unit of measurement for electrical current produced by one volt applied across a resistance of one ohm. See Current.

B

Breaker –See Circuit Breaker.

Bus – An electrical connection that connects multiple electrical devices which is sometimes referred to as a bus bar.

Bushing – An insulated connection between the internal and external components of electrical equipment.

C

Capacitor – A device to store an electrical charge. In the field of electric power transmission and distribution, capacitors are devices used for power factor correction and voltage regulation. Power factor correction improves the ability to deliver useful power (real power) to loads and voltage regulation helps to maintain constant service voltage.

Capacity – The maximum amount of electrical power which a device can utilize at one time without causing damage to the device. Also, the amount of electric power that can be delivered at one time by a generating unit, generating station, or all the plants on an electric system.

Circuit – A conductor or system of conductors through which an electric current is intended to flow

Circuit Breaker – A device to open (de-energize) or close (energize) a circuit either during normal power system operation or during abnormal conditions. During abnormal conditions, when excessive current develops, a circuit breaker opens to protect equipment and surroundings from possible damage due to excess current.

Conductor – A material, usually in the form of a wire, cable, or bus bar capable of carrying an electric current, which allows an electric current to pass continuously along it.

Continuous Load – A sustained electrical load.

Current –The flow of electricity commonly measured in amperes. See also Ampere.

Cycles-per-Second – See Hertz.

D

Direct Current (DC) – Electrical current that normally flows in one direction only.

Demand –The rate at which electric energy is delivered to or by a system, expressed in kilowatts, or other suitable units at a given instant or averaged over a designated period of time. Demand varies from hour to hour, day to day, and season to season.

Distribution Substation – A substation where one or more transformers reduces the line voltage from a local transmission level between 46,000 volts and 161,000 volts (46 kV – 161 kV) to a distribution level (4.2 kV – 34.5 kV) in order to distribute power to customers.

Distribution Line – A combination of conductors connected together to deliver power to customers at distribution voltages (4.2 kV – 34.5 kV). Each distribution line can be composed of overhead or underground conductors and can serve hundreds of customers.

Distribution System –The distribution system includes all lines energized at voltages 34,500 volts (34.5 kV) and below.

DSM (Demand Side Management) –The planning and implementation of strategies designed to encourage consumers to improve energy efficiency, reduce energy costs, change the time of usage, or promote the use of a different energy source.

E

Easement – An easement is a right given to a person or entity to trespass upon land that the person or entity does not own. Easements are used for roads, for example or given to utility companies for the right to construct and access power lines

Energy – Energy is a measure of the amount of power usage over time and is measured in kilowatt-hours or megawatt-hours.

F

Fault – A problem on a power line that interrupts the normal flow of power, which usually causes a protective device (see circuit breaker and fuse) to operate.

Feeder – See distribution line

FERC (Federal Energy Regulatory Commission) – An independent U.S. government agency that regulates the interstate transmission of natural gas, oil, and electricity.

Franchise – A license or similar legal authority, granted to a utility by a jurisdiction, to provide service at retail in a given geographic area. An exclusive franchise is a monopoly to provide service in that area.

Frequency –The number of complete alternations or cycles per second of an alternating current measured in Hertz.

Fuse – A protective device that is designed to and de-energize a circuit when there is a fault on the circuit. The fuse can only operate once and must be replaced when it has operated.

G

Generator – A unit that converts thermal, mechanical, hydro, wind, chemical or nuclear energy into electric energy.

Generation Mix – A term used to describe the types of electrical generation a utility uses, or presently has on line – coal, wind, hydro, etc.

Giga-watt (GW) – 1,000 mega-watts, or 1,000,000 kilo-watts, or 1,000,000,000 watts.

Ground – The reference point in an electrical circuit from which other voltages are measured. Electric utilities use the earth or ground as the reference point. The potential or voltage of ground or earth is assumed to be zero volts.

Grounded – Connected to or in contact with earth or connected to some extended conductive body in place of the earth.

Guy Wire – A cable fastened to the pole to keep it in position.

H

Hertz (Hz) – A unit of frequency. One Hertz equals one complete cycle per second of an AC source. This unit replaces the former "cycles-per-second." The standard frequency in the US is 60 Hz. However, in some other countries the standard is 50 Hz

Horsepower – A measure of power used to define electric motors. For electricity one horsepower = 746 watts.

Hot – Energized (i.e., the line is hot or live).

I

IEEE (Institute of Electrical and Electronics Engineers) – A non-profit organization that is the world's leading professional association for the advancement of electrical technology. The IEEE promotes the engineering process of creating, developing, integrating, sharing and applying knowledge about electro and information technologies and sciences for the benefit of humanity and the profession. The IEEE sponsors the National Electrical Safety Code (NESC)

Insulator – Hardware or equipment made of porcelain, glass, or polymer used to isolate conductors from distribution poles or transmission structures that support them.

IOU (Investor Owned Utility) – A utility that is structured as a tax-paying business financed through sales of common stock. Rocky Mountain Power is an Investor Owned Utility.

IPP (Independent Power Producer) – A company that generates power but is not affiliated with an electric utility.

IRP (Integrated Resource Plan) – A method for looking ahead using environmental, engineering, social, financial and economic considerations; includes using the same criteria to evaluate both supply and demand options while involving customers and other stakeholders in the process. The IRP is the product of the process many utility companies and utility commissions use to select the generation resources needed to meet future demand for electricity.

J

Junction Box – An electrical junction box is a container for electrical connections, usually intended to conceal them from sight and deter public tampering

K

Kilovolt (kV) – A measurement of voltage. One kilovolt = 1,000 volts. This unit of measurement is most commonly used when describing transmission and distribution lines.

Kilowatt (kW) – A measurement of electric power. Ten 100 watt bulbs would use one kilowatt or 1,000 watts.

Kilowatt-Hour (kWh) – A measurement of electric energy equal to one kilowatt of power supplied for one hour. A kilowatt-hour could be used to light a 100-watt bulb for 10 hours.

L

Line Loss – The electrical energy lost in the process of transporting power over transmission and distribution lines. For a fixed amount of power going into a system:

The greater the line length the greater the line loss

The higher the voltage the less the line loss.

Load – The demand for power at a given point in time. The peak load is the highest amount of power drawn down at any time, or the utility's maximum demand. Load can be divided into three major classes – industrial load, commercial load, and residential load.

Load Curve – A graph showing power or demand against time

Load Factor – Load factor is the average power divided by the peak power, over a period of time. A high load factor is electricity used at a more constant rate without having peaks and valleys. A large business with a high load factor typically experiences a lower average cost per kWh and has a lower cost of service by the utility.

Load Forecasting – An estimate of future consumption of electricity. The estimates are used in planning for generation, transmission, and distribution facilities; in calculating future revenue from the sales of electricity; in determining cost allocations for the various rate classes; and in assessing the impact on load of changes in policies or underlying conditions such as the level of employment in the region.

M

Megawatt (MW) – 1,000 kilowatts or 1,000,000 watts.

Megawatt-hour (MWh) – 1,000 kilowatt-hours or 1,000,000 watt-hours.

Municipal Utility – An electric utility system owned by a municipality that serves retail customers generally within the boundaries of the municipality.

N

NEC (National Electrical Code) – A code for the safeguarding of people and property from hazards related to the use of electricity. Compliance with this code along with proper maintenance will result in an installation essentially free from hazard. The NEC does not cover installations under the exclusive control of an electric utility. The NEC is sponsored and updated by the National Fire Protection Association.

NERC (North American Electric Reliability Council) – An independent organization that works to ensure that the bulk electric system in North America is reliable, adequate, and secure.

NESC (National Electric Safety Code) – Rules published by the Institute of Electrical and Electronics Engineers (IEEE) applying to grounding, installation, maintenance and operation of electric supply, communication, utilization equipment, lines and facilities which have been adopted as standard by the American National Standards Institute. By law or statute electrical utilities are required to conform to the NESC.

Net Metering – A method of measuring the difference between the electricity the customer uses from the power company and the excess electricity given back by generating their own power. The net meter keeps track of power usage taken from the company and customer power provided back to the company.

Neutral Conductor – A system conductor other than a phase conductor that provides a return path for current to the source. It is intended to have approximately a zero voltage potential relative to earth or ground and such that the voltage differences between it and each of the phase conductors are approximately equal in magnitude.

O

Off-Peak – All times not identified as on-peak. See On-Peak.

Ohm – A unit of electrical resistance. A circuit resistance of one ohm will pass a current of one ampere with a voltage difference of one volt. Abbreviated using the Greek letter omega (Ω).

Ohm's Law – An equation that defines the relationship between voltage, resistance, and current. In 1828 the German physicist George Simon Ohm showed by experiment that the current in a conductor is equal to the difference of potential or voltage between any two points divided by the resistance between them. This may be written as $I = V / R$ where V is the voltage difference in volts, R is the resistance in ohms, and I is the current in amperes.

On-Peak – Those periods of time at which power is being delivered near the utility's maximum demand. Rocky Mountain Power's on-peak periods are:

- October through April inclusive – 7:00 a.m. – 11:00 p.m., Monday through Friday except holidays
- May through September inclusive – 7:00 a.m. – 9:00 p.m., Monday through Friday except holidays

Outage – Interruption in the delivery of electric service.

Overhead Service – Electric service supplied to the customer from the power company utilizing overhead conductors.

Overload – Operation of electrical equipment above its normal full-load rating, or of a conductor above its rated ampacity, that when it persists for a sufficient length of time, would cause damage to the equipment or conductor.

P

Partial Power – The loss of one or two energized conductors of a three-phase service or one energized conductor of a single phase service.

Peak Demand – The maximum demand imposed on a power system or component thereof.

Peak Load – See peak demand.

Phase – One wire or conductor of a two, three or four wire system.

Point of Delivery – The point where the electrical utility's circuit connects to the customer's system.

Potential – See voltage.

Power – The rate at which work is performed or that electric energy is converted to other forms of energy. Electric power is the product of voltage and current ($P = VI$) and is commonly measured in watts, kilowatts, or megawatts.

Power Grid – A network of power lines, transformers, generators, and associated equipment employed in distributing electricity over a geographical area. Rocky Mountain Power is part of a power grid that encompasses the western United States and parts of Canada and Mexico.

Power Plant – A complex of structures, machinery, and associated equipment for generating electric energy from another source of energy, such as nuclear reactions, coal, gas, wind, water, or sun.

PPE (Personal Protective Equipment) – Refers to protective clothing, helmets, goggles, or other garment designed to protect the wearer's body from injury by blunt impacts, electrical hazards, heat, chemicals, and infection, for job-related occupational safety and health purposes.

Primary – The high voltage part of the distribution system. In Rocky Mountain Power service territory the primary distribution power is between 4,160 volts (4.2 kV) and 34,500 volts (34.5 kV) with the majority at 12,500 volts (12.5 kV).

PSC (Public Service Commission) – A utility regulating authority.

PURPA (Public Utility Regulatory Policies Act) – A law passed in 1978 by the United States Congress as part of the National Energy Act, meant to promote greater use of renewable energy. This law created a market for non-utility electric power producers forcing electric utilities to buy power from these producers at the "avoided cost" rate, which was the cost the electric utility would incur were it to generate or purchase from another source. Generally, this is considered to be the fuel costs incurred in the operation of a traditional power plant.

Q

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R

Recloser – A switch that will automatically open a circuit if it detects electrical problems such as a fault, and then attempts to close the circuit at timed intervals. If the electrical problem falls to correct itself, the switch will remain open after a certain number of attempts to close the circuit.

RMP (Rocky Mountain Power) – An investor owned electric utility which serves customers in Utah, Idaho and Wyoming. A division of PacifiCorp which is a subsidiary of Mid-American Energy Holding Company (MEHC).

ROW (Right of Way) – Right-of-way is an interest in property either owned in fee or as an easement transferred through grant, prescription, dedication, or the right of Eminent Domain. Public utilities (regulated by the Public Utility Commission) have the right by State Statue to use a portion of the road right-of-way for installation and maintenance of their facilities.

S

SCADA (Supervisory Control & Data Acquisition) System – Rocky Mountain Power's SCADA system is a complex computer system that:

- Monitors frequency, generation, power, current, voltage and controlling device status on the utility's transmission and distribution systems.
- Controls (either automatically or via manual control) breakers, reclosers, and other controlling devices to maintain the integrity of the transmission and distribution systems.

Secondary – The low voltage part of the distribution system. In Rocky Mountain Power service territory the secondary distribution power is between 120 volts and 480 volts.

Sectionalize – To isolate a problem and restore as many customers to service as possible.

Single-phase – One phase of a three phase system. Single phase power is typically used to serve customers whose load characteristics are primarily lighting, heating, and small motors (typically residential and small commercial customers).

Single Phase Service – An overhead or underground service consisting of two "hot" wires and a neutral.

Smart Grid – A term used for an ever widening palette of utility applications that enhance and automate the monitoring and control of electrical use at the consumer level.

Structures – The poles or towers used to support transmission and distribution conductors.

Substation – An assembly of equipment in an electric power system through which electrical energy is passed for transmission, distribution, interconnection, voltage transformation, or switching. Substations can range in size from one acre to several hundred acres. A typical distribution substation whose primary purpose is to convert power from 138 kV to 12.5 kV is one acre inside the fence or wall. However, a main grid substation whose primary purpose is to convert power from 500 kV to 345 kV and connect to several 345 kV transmission lines may be 200 acres.

Sub-transmission – Lines that are typically energized between the voltages of 46,000 volts (46 kV) and 161,000 volts (161 kV). Sub-transmission lines are used to transfer power from transmission substations to regional and distribution substations.

Switch – A device that open or closes a circuit.

Switchyard – A substation that does not include voltage transformation.

T

Three - phase – The most common method used by electrical utilities worldwide to distribute power. In a three-phase system, three circuit conductors carry three alternating currents which reach their instantaneous peak values at different times. Three phase power is typically used to serve customers whose load characteristics include large motors, (typically industrial customers and large commercial customers).

Three Phase Service – An overhead or underground service usually consisting of three "hot" wires and a neutral.

Transformer – A transformer is an electrical device that takes electricity of one voltage and transforms it into another voltage.

Transmission System – An interconnected group of high voltage electric lines and associated equipment for transfer of electric energy between points of supply and points at which it is delivered to other utilities or transformed one or more times to lower voltages for delivery to consumers. Typically, at Rocky Mountain Power, transmission lines are energized at 230,000 volts (230 kV) and above.

Trip – A sudden shutdown of a piece of equipment or line. A trip is generally caused when a protective device (breaker, recloser) operates to isolate a portion of the system in order to protect the equipment or line.

U

Undergrounding – The act of converting the overhead transmission or distribution system to underground.

Underground Service – Electric service supplied to the customer from the power company utilizing underground cable.

V

Volt – A unit of measurement for voltage. The voltage difference across a one ohm resistance carrying a current of one ampere.

Voltage – The driving force, or "electrical pressure," that causes current to flow through a closed circuit. The force can be compared to the pressure of water in a pipe. Voltage is measured in volts (V) or kilovolts (kV).

Voltage Drop – Voltage drop is defined as the amount of voltage loss that occurs through all or part of a circuit due to the impedance of the lines and equipment on the circuit.

W

Watt – A unit of measurement of power. One watt equals the power dissipated by a current of 1 ampere flowing across a resistance of 1 ohm

X

- - -

Y

- - -

Z

- - -

Appendix B: Facility diagrams and requirements

ELECTRICITY 101

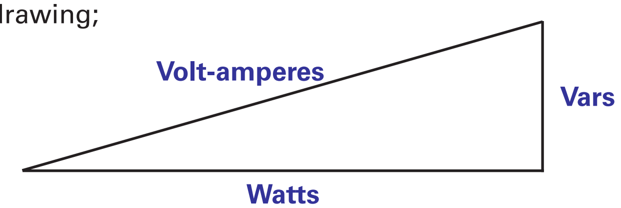
V = IR or Voltage (volts) = Current (amperes) X Resistance (ohms)

Voltage is a measure of electrical "pressure" (similar to water pressure in a hose).

Current is the movement of electrons through a conductor, (similar to water flow in a hose) measured in amperes or amps.

P = IV or Power (volt-amperes) = Current (amperes) X Voltage (volts)

Power (volt-amperes) has two components: Watts and Vars, as shown in the follow drawing;



Typically vars are not considered except with large customers and utility engineers. The remainder of this document will ignore vars and assume power only has one component, watts.

- 1,000 watts = 1 kilowatt = 1 kW
- 1,000,000 watts = 1 megawatt = 1 MW

The maximum amount of power a transmission line can carry is referred to as **capacity**.

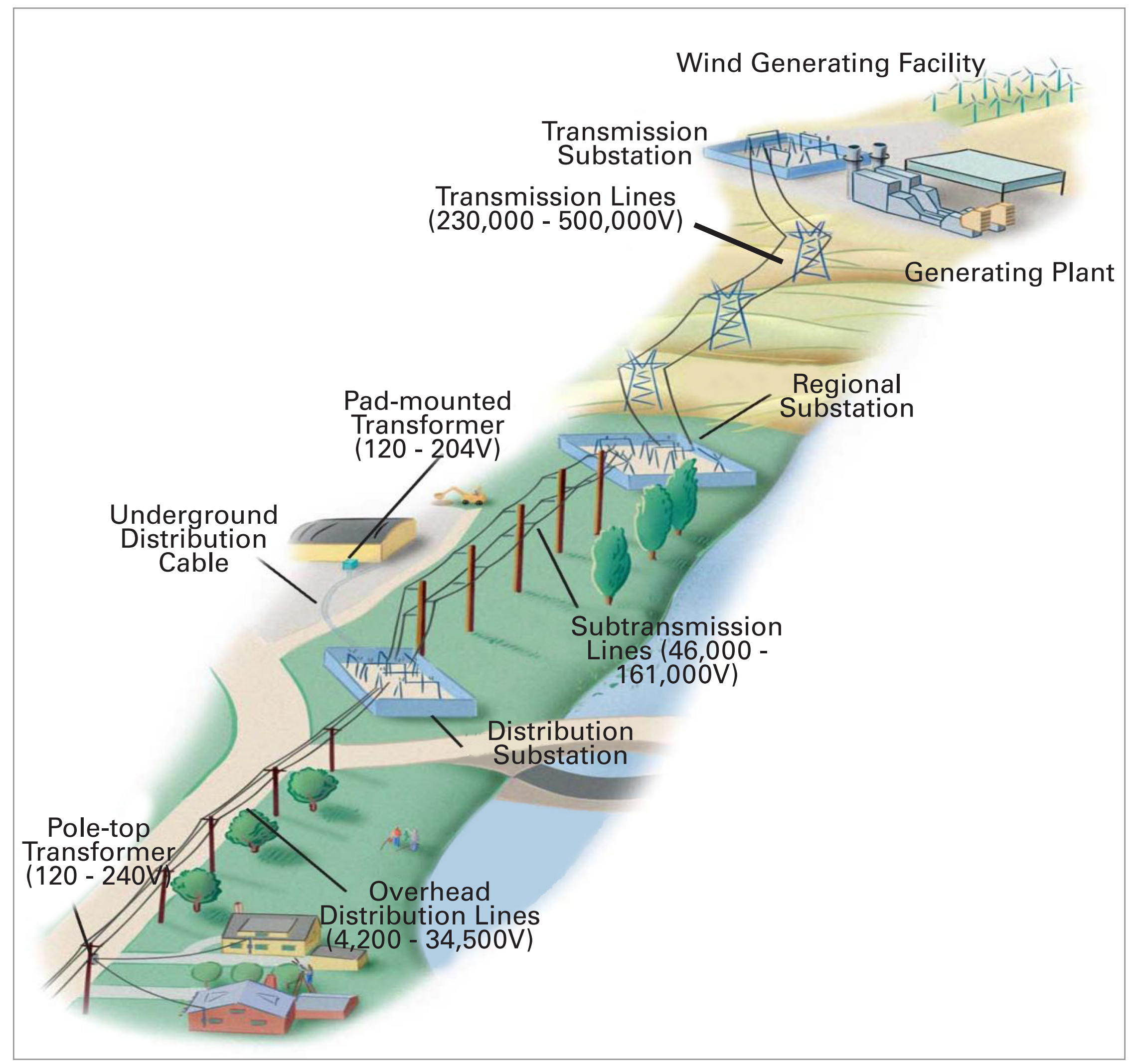
Energy represents the amount of power used or transmitted over a given period of time (energy = power x time). The basic unit of measure for electrical energy is the watt-hour.

- 1,000 watt-hours = 1 kilowatt-hour = 1 kWh
- 1,000,000 watt-hours = 1 megawatt-hour = 1 MWh

An electrical system is designed to accommodate Capacity (Demand (MW)) and Energy (MWh). Since capacity can be accommodated then Energy (Mwh) will also be accommodated.

Load is power being used by customers. Instantaneous load represents capacity used. If customer load is greater than the electrical system capacity then load must be reduced or one or more components of the electrical system will fail.

Power System



Electricity moves from generation plants to transmission substations and distribution substation before being delivered to our homes

TRANSMISSION

Clearance

Minimum vertical and horizontal clearance is established by the National Electrical Safety Code (NESC). When a utility designs a transmission or distribution line they consider the maximum sag of the conductor (vertical component) and the maximum deflection of the conductor (horizontal component).

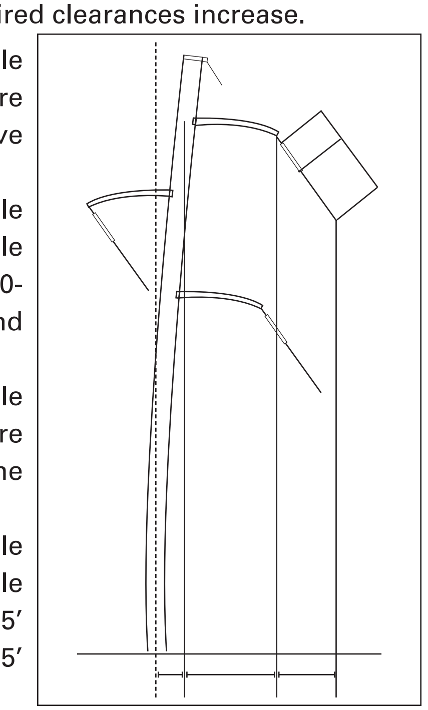
Vertical Clearance

Items that influence conductor sag include: (line loading, conductor capacity, line tension, ambient temperature, conductor weight, and conductor composition). The clearance required by code considers what the conductor crosses (roads, railroads, trails, water, structures, etc.) and the operating voltage of the line.

Clearance requirements are dependent on transmission line voltage.

As voltages increase, required clearances increase.

- Typical 345 kV single circuit H-frame structure will be 90-120' above the ground.
- Typical 345 kV double circuit single pole structure will be 130-170' above the ground (200' in some cases).
- Typical 138 kV single circuit H-frame structure will be 60-90' above the ground.
- Typical 138 kV double circuit single pole structure will be 70-95' above the ground (115' in some cases).

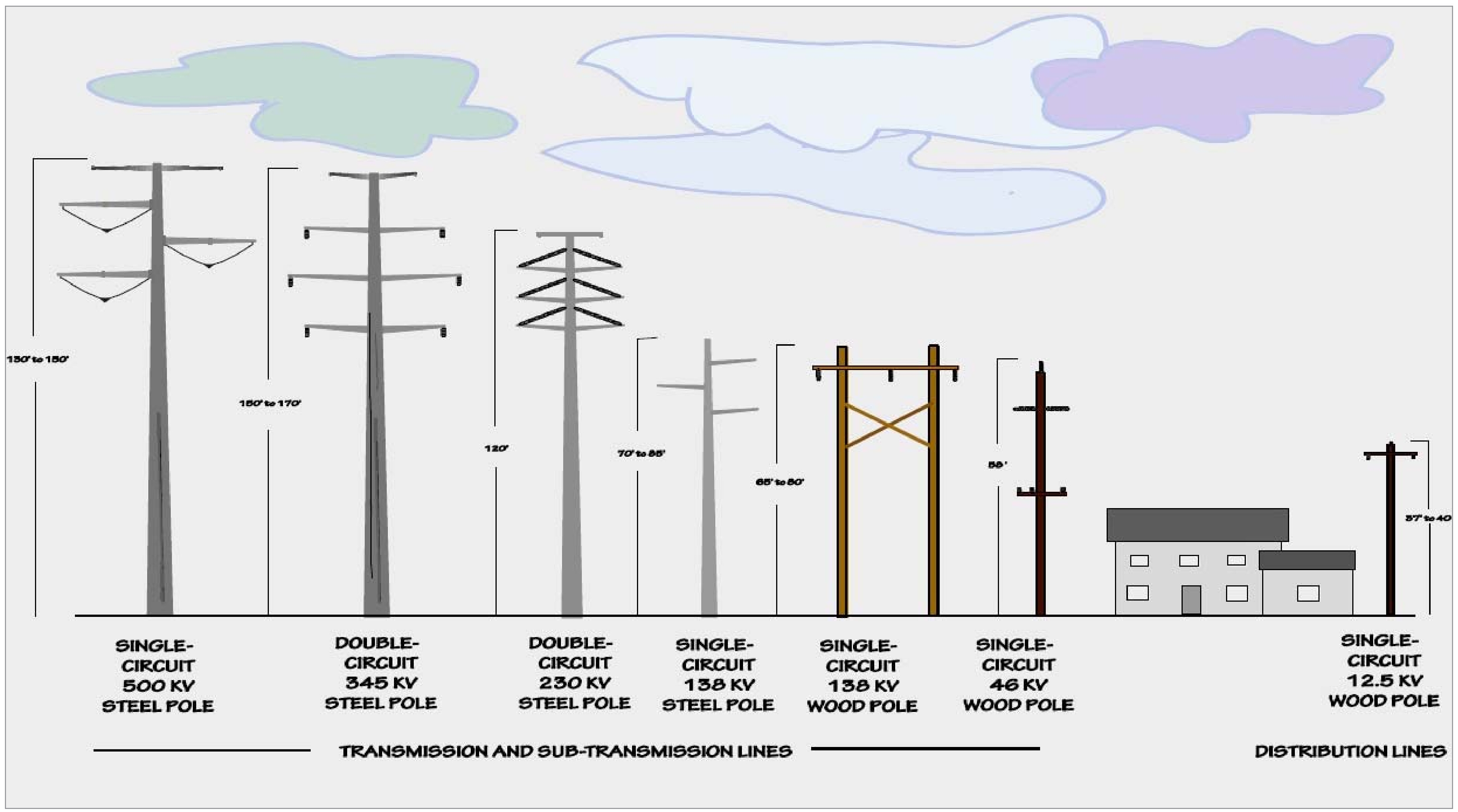


Horizontal Clearance and Right of Way

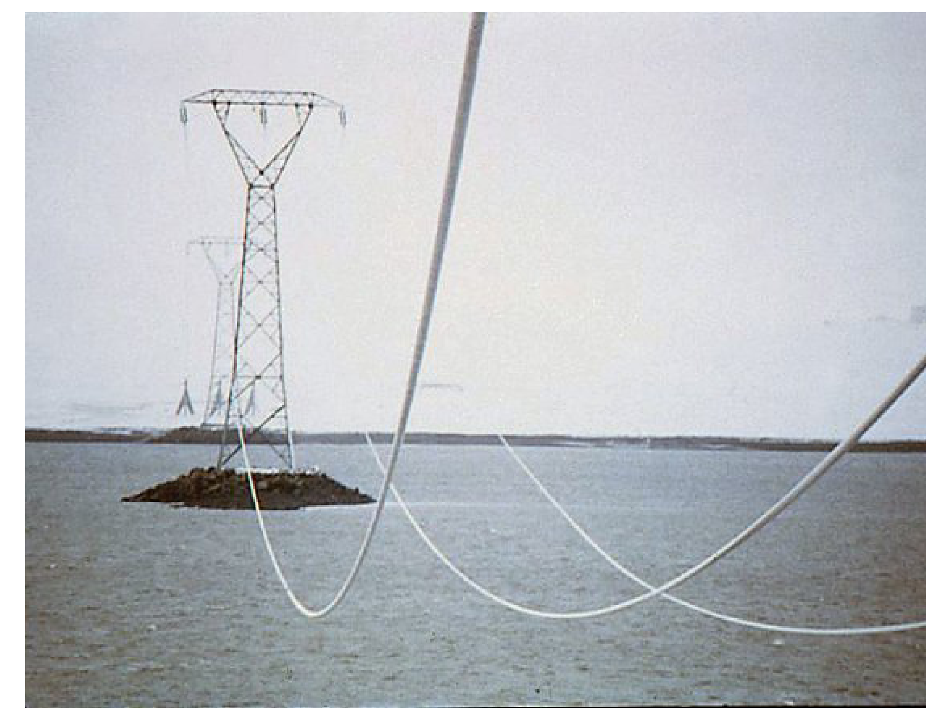
Horizontal clearance, like vertical clearance, increases as the voltage increases. As illustrated in the adjacent drawing, items that influence deflection include: pole structure design, pole material, wire size and span length, and maximum wind speed where the line is constructed. The horizontal clearance required by code considers what the conductor is passing by: tress, signs, buildings, etc.

Right of way width is determined by combining the maximum conductor deflection, the no wind conductor position (pole width and insulator length, and the minimum clearance required by code.

Single pole structures typically require less ROW width than lattice or multiple pole structures. Right of way can be shared with other infrastructure such as roads and pipelines.



Transmission and distribution line poles

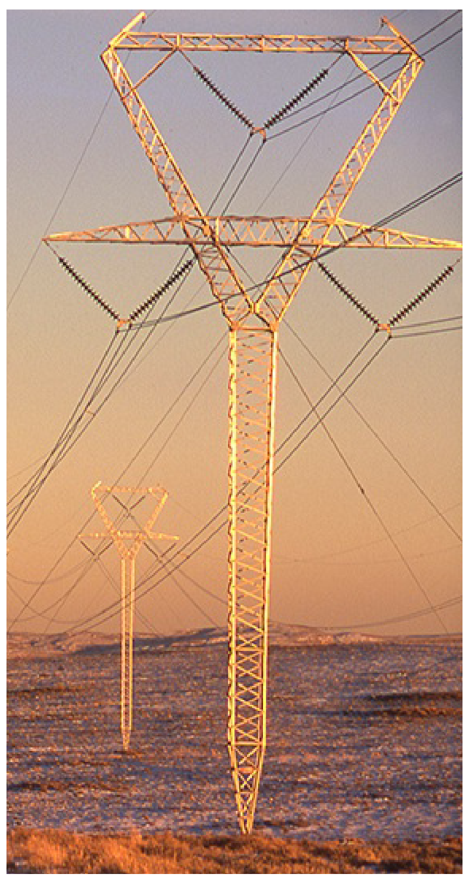


Conductor sag caused by extreme weather conditions

MAIN GRID

Main Grid lines typically operate at 230 kV and 345 kV

Energy is transmitted via high voltage lines (230kV, 345kV) from the power plants to major substations.



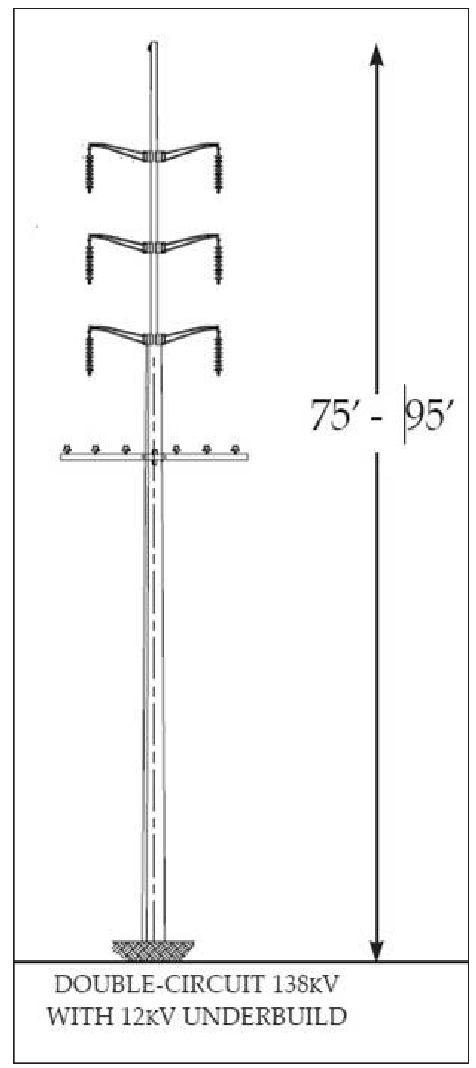
Left: Double circuit 345 kV line in a power line corridor with other lines. Monopole structure is the current typical design. Right: Single circuit 345 kV line in a power corridor with other lines.

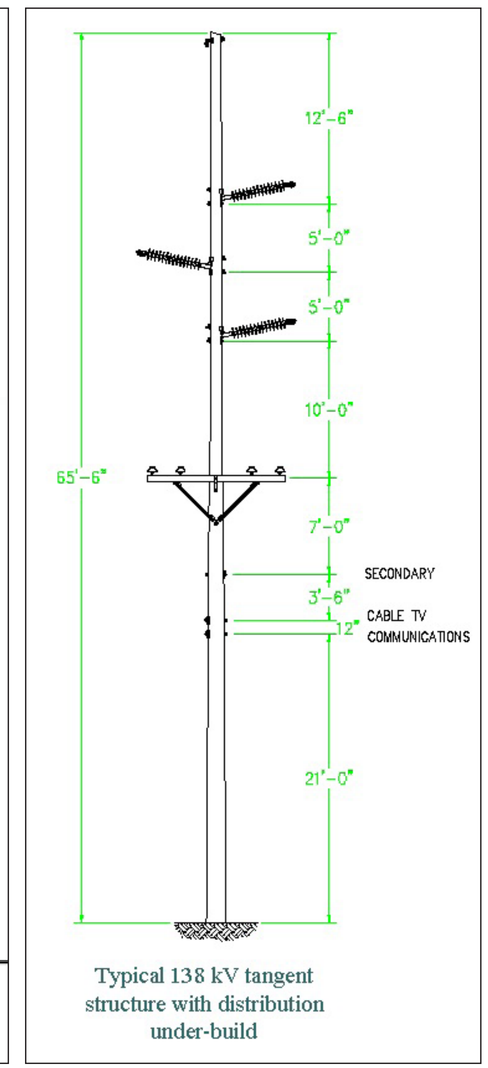
Sub-transmission Lines (Local Transmission)

46 kV and 138 kV – Used to transmit energy from main grid substations to regional and local substations.

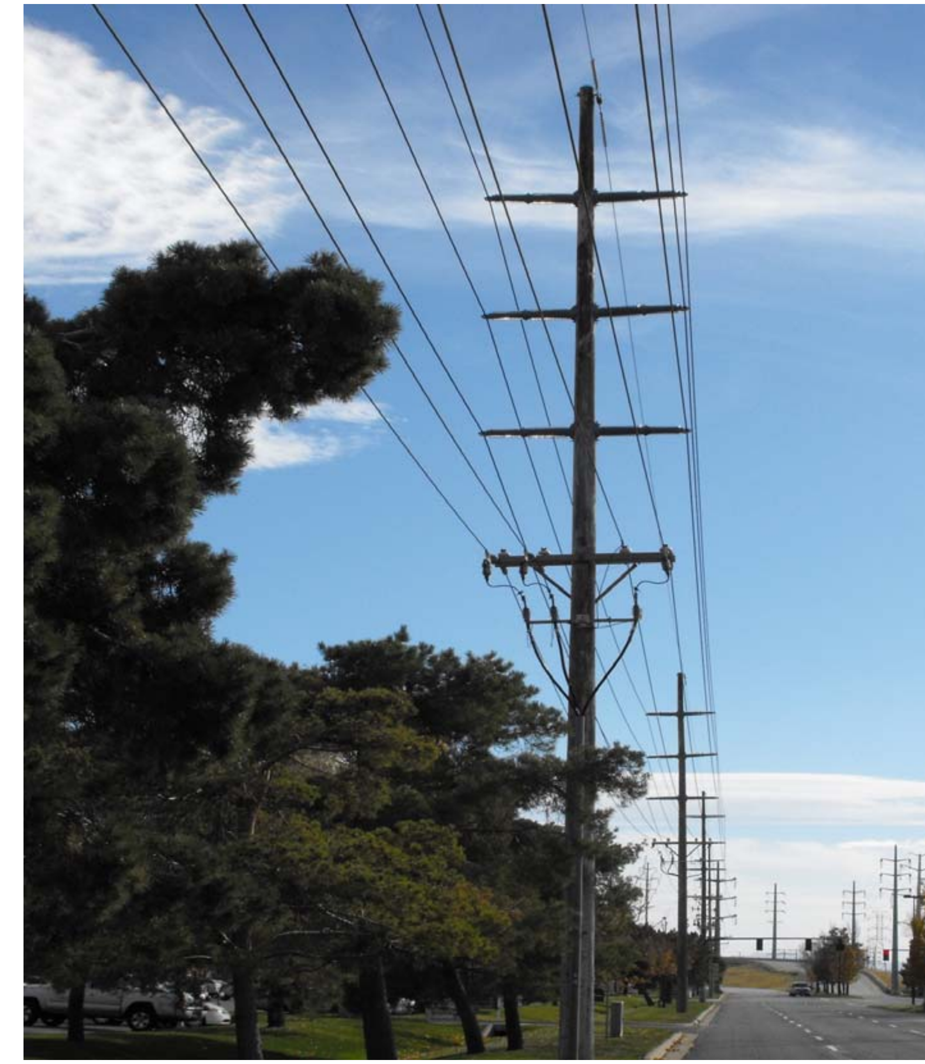
Double Circuit and Single Circuit 138 kV

Right-of-way is typically around 60 ft. with distances between structures around 300 ft.





138 kV line with 12.5 kV distribution underbuild. Monopole structures.



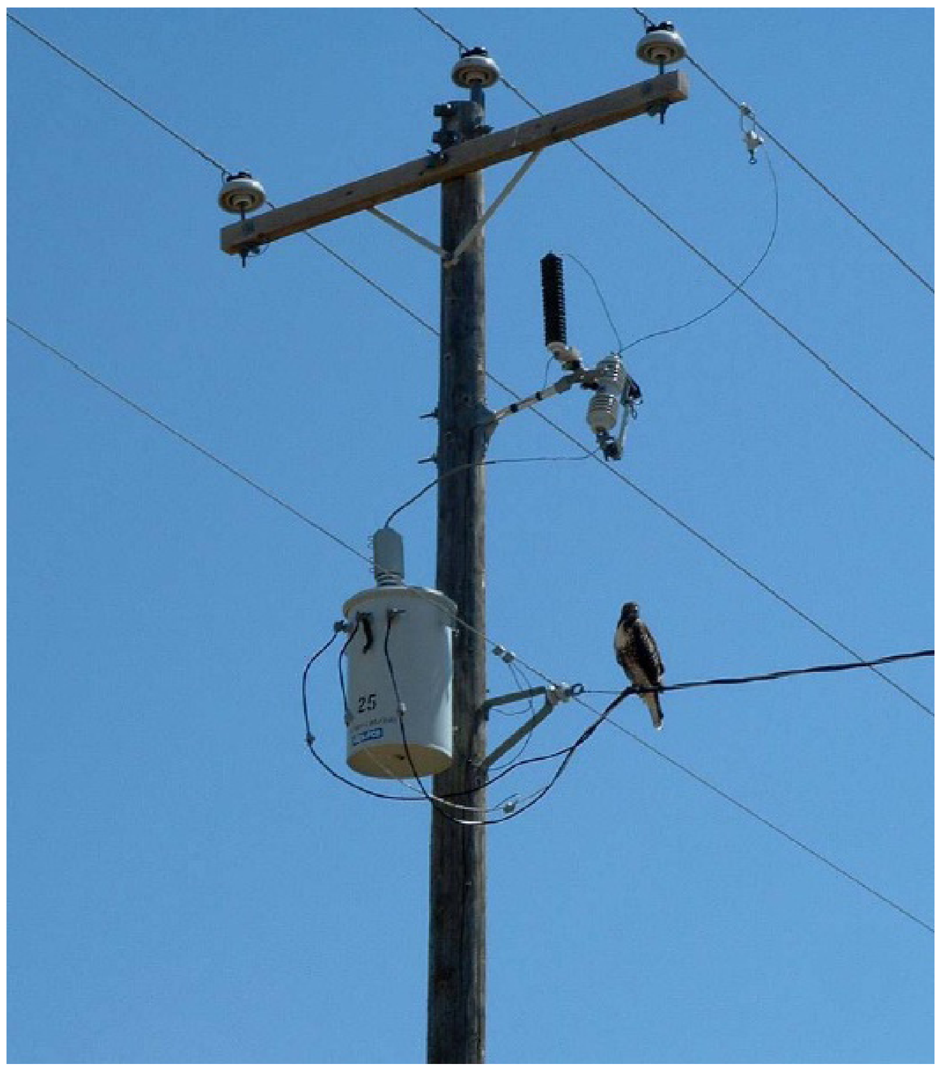
Double circuit 138 kV with 12 kV distribution underbuild

Double Circuit and Single Circuit 46 kV

46 kV lines are similar to 138 kV lines. Older 46 kV lines are usually shorter, however, the current practice is to replace failing 46 kV structures with structures designed to accommodate future 138 kV conversion.

Distribution

4.16 kV to 12.47 kV



Typical distribution pole

SUBSTATIONS

A substation is used to transform or change voltage levels and contain equipment to protect power lines and substation equipment. Substations can contain the following: transformers, switches, capacitors, reactors, and circuit breakers. Generally power flows from a high voltage substation to a regional substation; then to a distribution substation.

Main Grid Transmission

Major substations (main grid): Convert power from high voltage transmission lines (230 kV, 345 kV) to sub-transmission voltages (46 kV, 138 kV)

Midvalley Substation. 345 kV to 138 kV

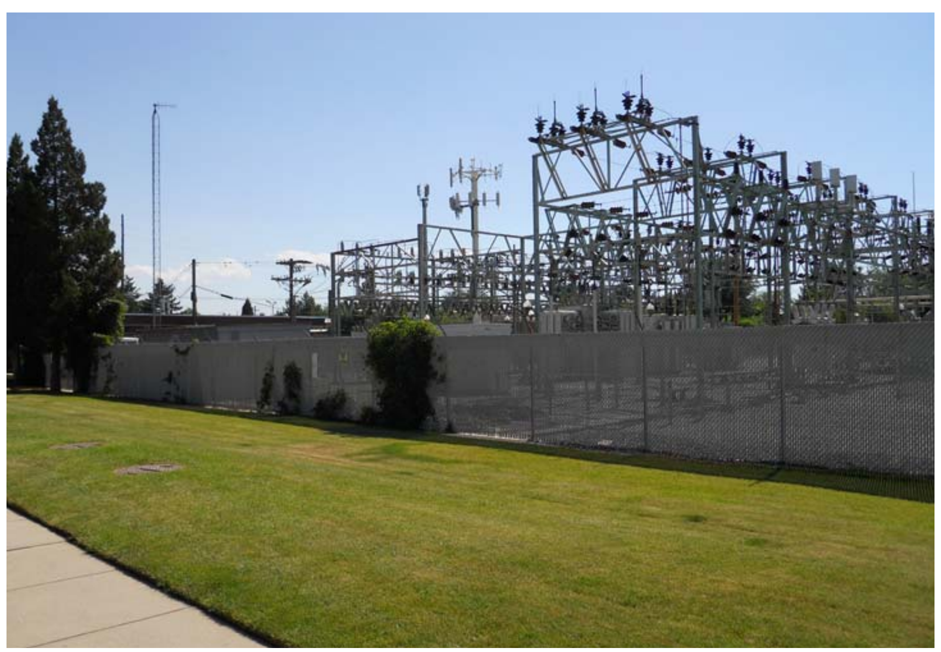
Main Grid collocated with Sub-Transmission and Distribution

Major substations (main grid): Convert power from high voltage transmission lines (230 kV, 345 kV) to sub-transmission voltages (46 kV, 138 kV) and distribution voltages (12.5 kV, 25 kV).

Above: Camp Williams Substation. 345 kV to 138 kV, 138 kV to 46 kV, 138 kV to 12.5 kV. Below: 90th South Substation 345 kV to 138 kV, 138 kV to 46 kV, 138 kV to 12.5 kV.

Regional Transmission collocated with Distribution

Regional substations (sub-transmission): Convert power from sub-transmission lines (46 kV, 138 kV) to other sub-transmission voltages and distribution voltages (12.5 kV, 25 kV)



Above: Southeast Substation Regional with Distribution 138kV to 125.5 kV. Below: Cottonwood Substation 138 kV to 46 kV, 138 kV to 12.5 kV, 46 kV to 12.5 kV.

Distribution

Local substations convert power from sub-transmission lines (46 kV, 138 kV) to distribution voltages (12.5 kV, 25 kV).

Ultimately serves up to 80 MW of load or:

- 1-3 square miles for industrial load
- 2-5 square miles for commercial load
- 6-8 square miles for typical urban residential load (8000 homes)

Above: Meadowbrook Substation aerial view. Below: Meadowbrook Substation street view. 138 kV to 12.5 kV.

Above: Hammer Substation aerial view. Below: Hammer Substation street view. 138 kV to 12.5 kV.

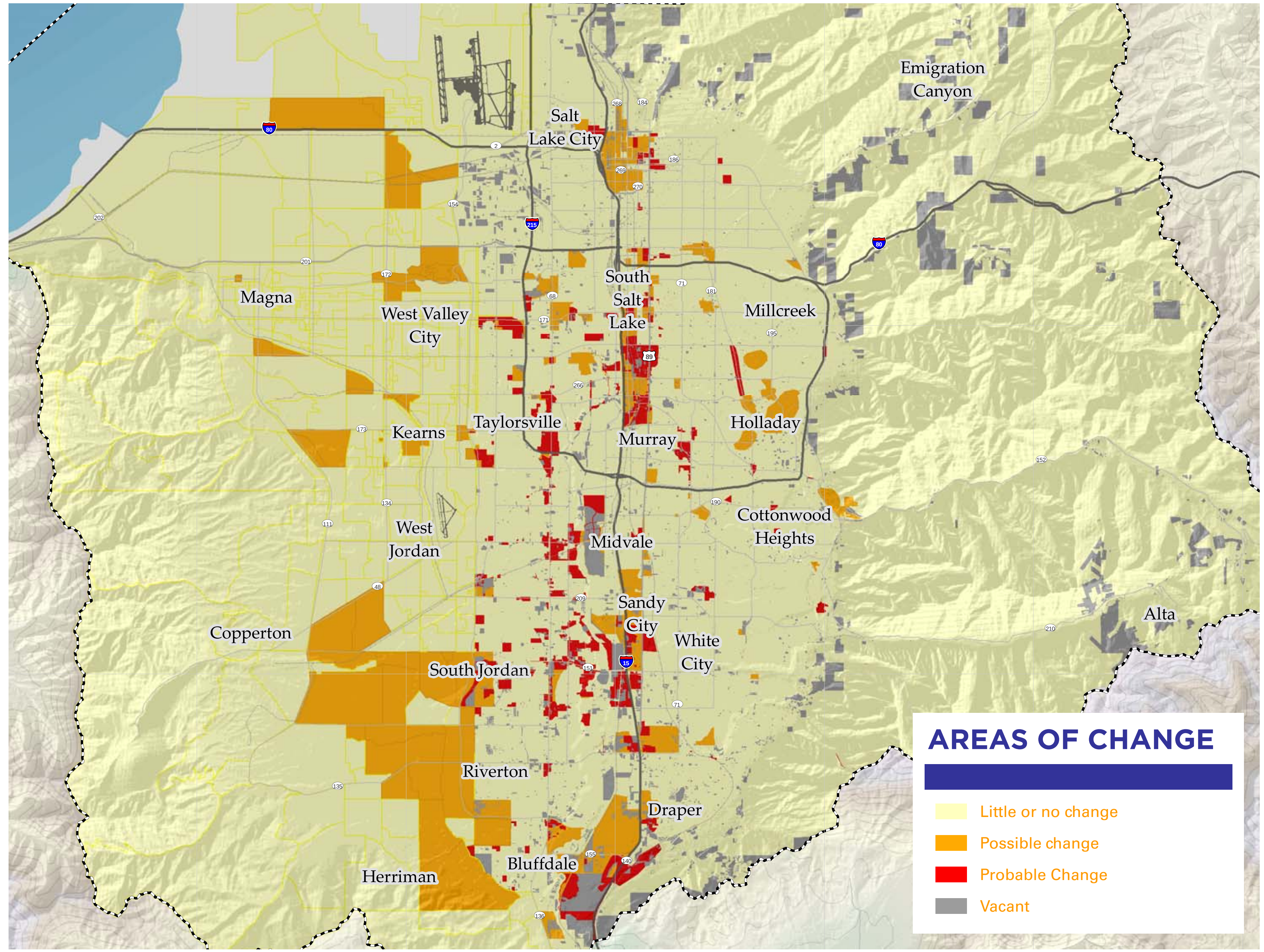
Above: West Jordan Substation 138 kV to 12.5 kV. Below: 106th Substation. 138 kV to 12.5 kV.

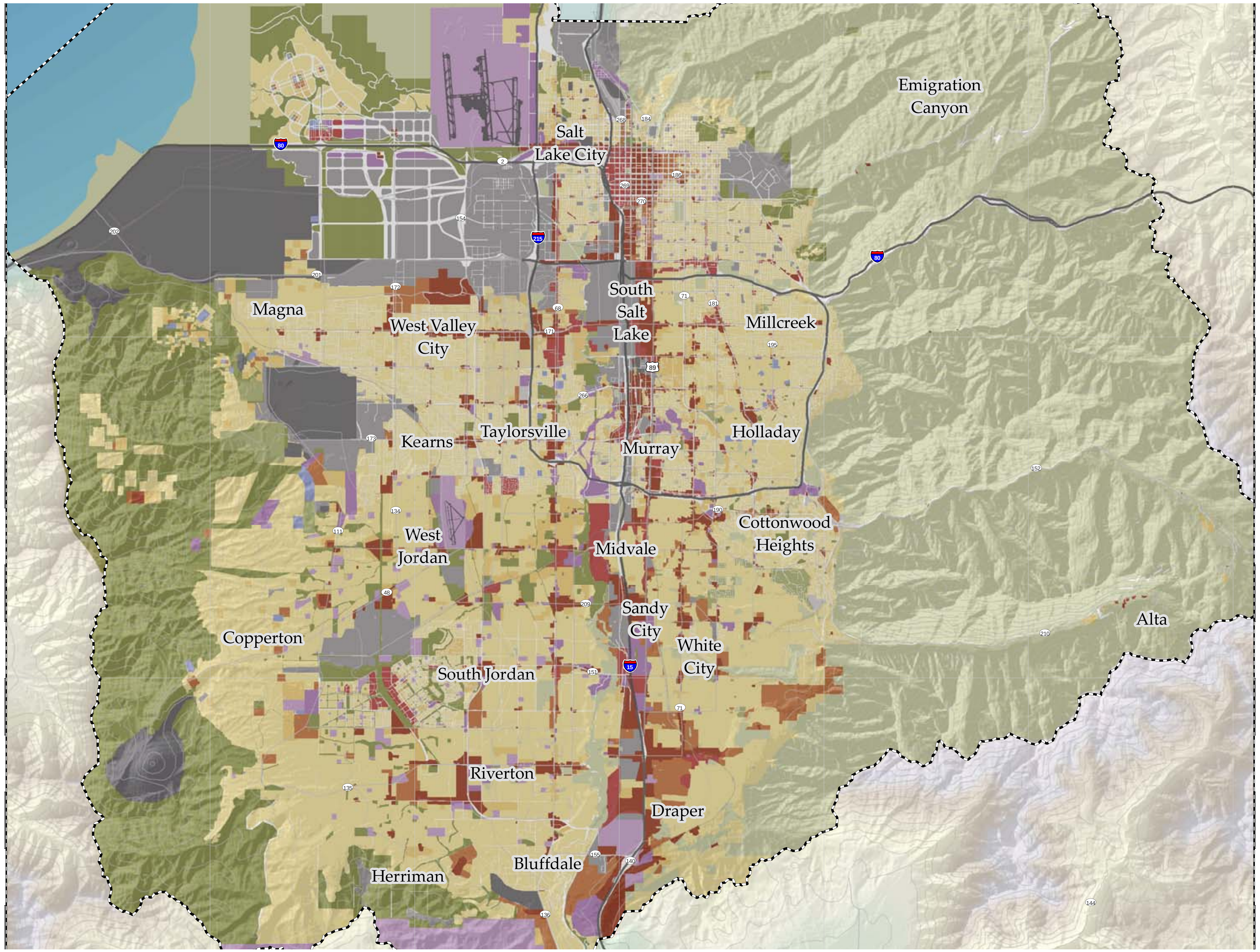
Above: Capitol Substation 46kV to 12.5 kV. Below: East Millcreek Substation street view. 46 kV to 12.5 kV.

Above: Rose Park Substation 46 kV to 12.5 kV. Below: Sandy Substation 138 kV to 12.5 kV.

Appendix C: Growth assumptions

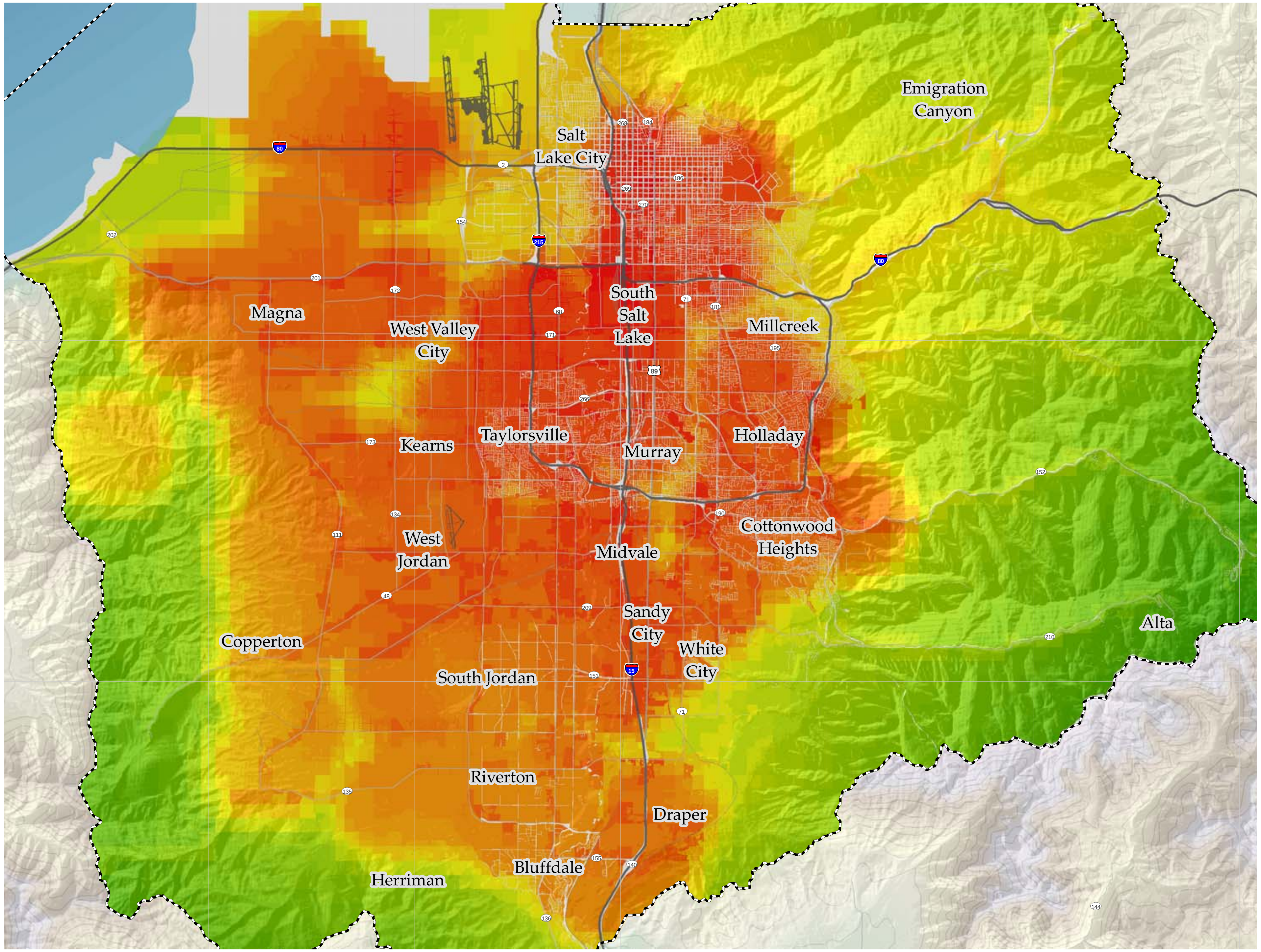
In order to establish a planning horizon year the task force was given population projection by geographic area for total dwelling units and total jobs, land-use and areas of change at build-out. In addition, maps were provided to show the attraction level for homes and jobs. The data was provided by the Salt Lake Cooperative County Plan and based on population data from the Governor's Office of Planning and Budget. The County Cooperative Plan represents population projections allocated geographically by using local general plans and zoning districts.





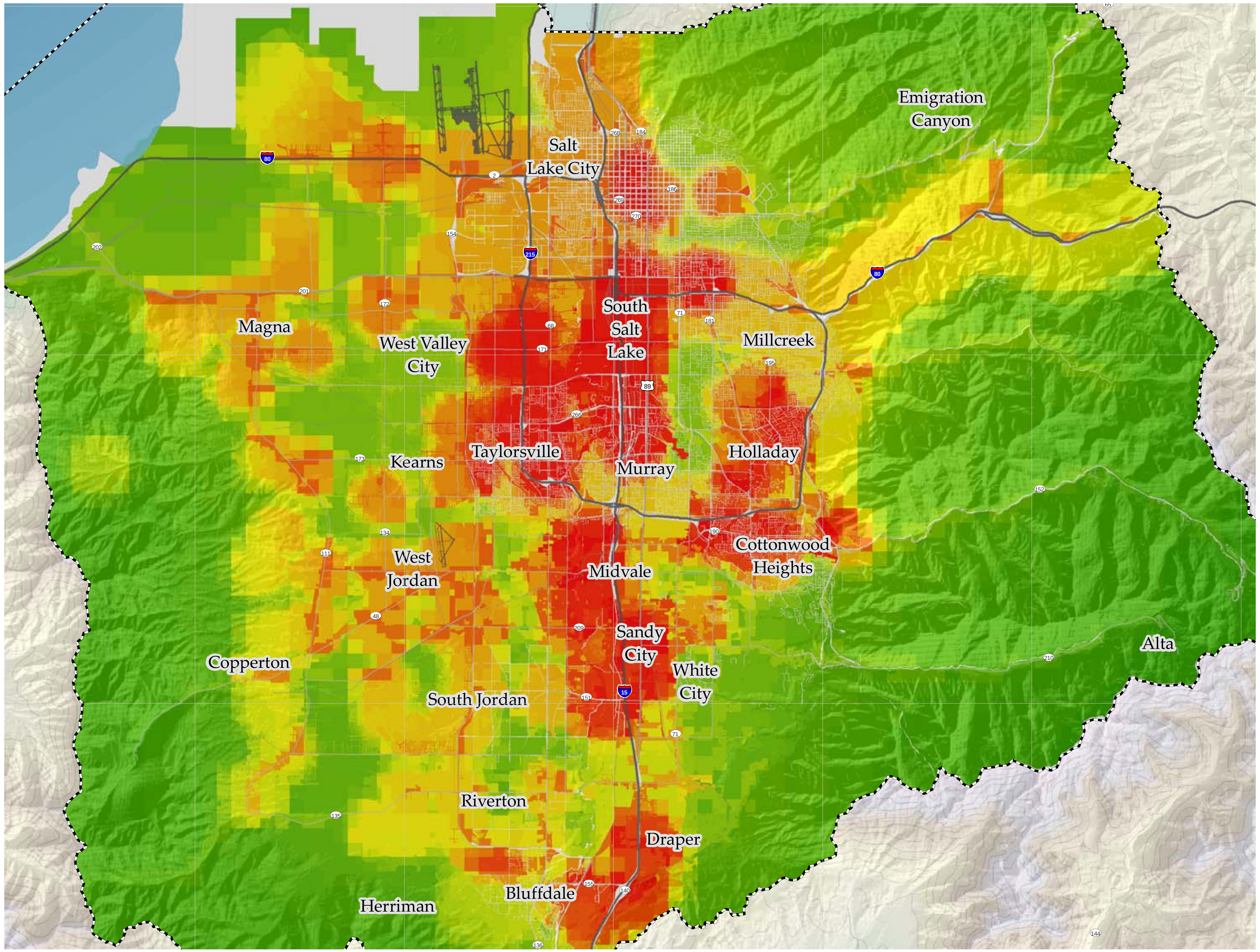
COUNTY LAND-USE

- Single-family
- Multi-family
- Residential Mixed Use
- Retail/Services
- Employment Mixed Use
- Heavy Industrial
- Light Industrial
- Office
- Government Employment
- Campus K-12
- Recreation, Public/Civic, Parks
- Open Space, Other Undeveloped
- National Forest, Other Undeveloped
- Utilities/Other ROW



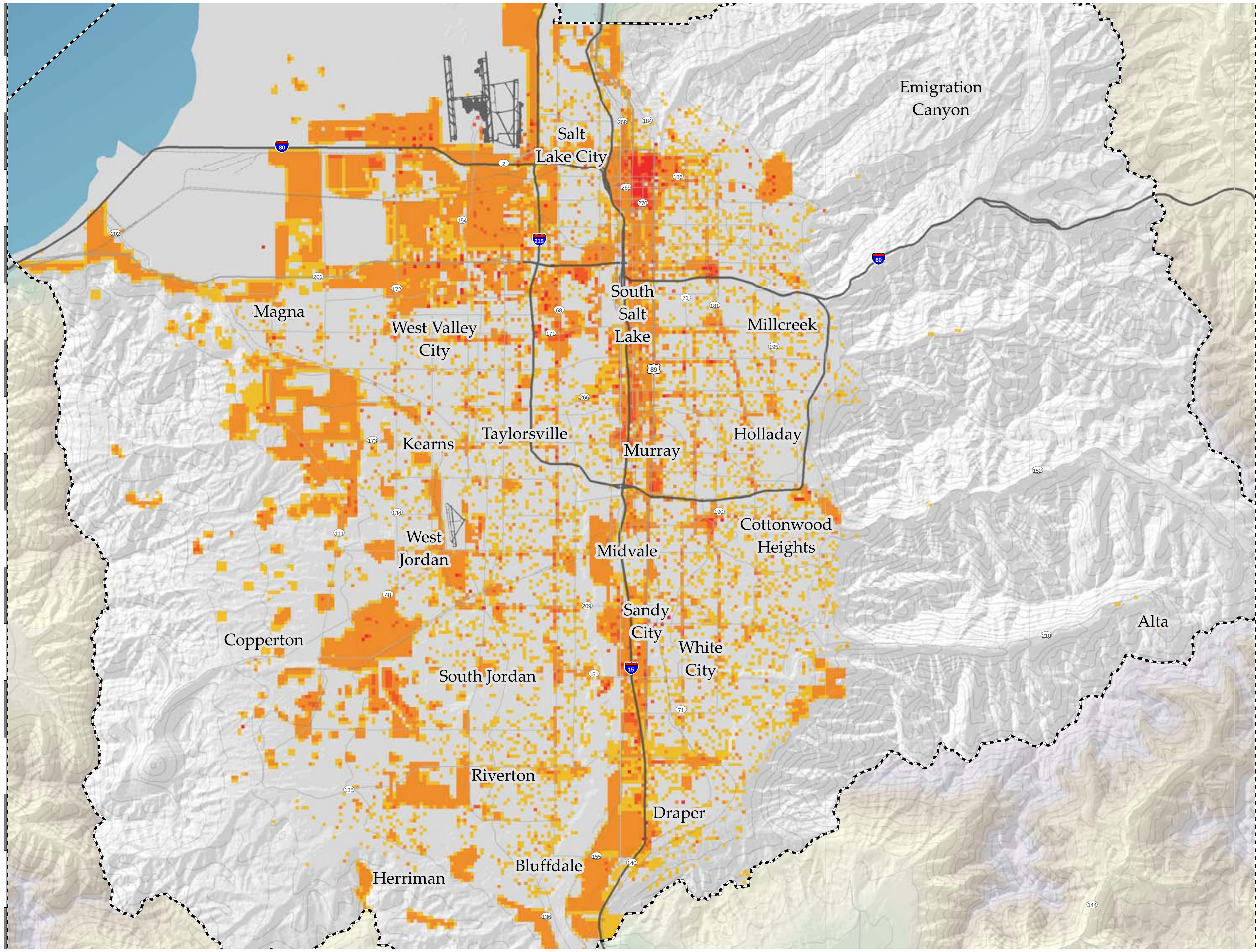
ATTRACTIVENESS FOR HOMES

Low Medium High



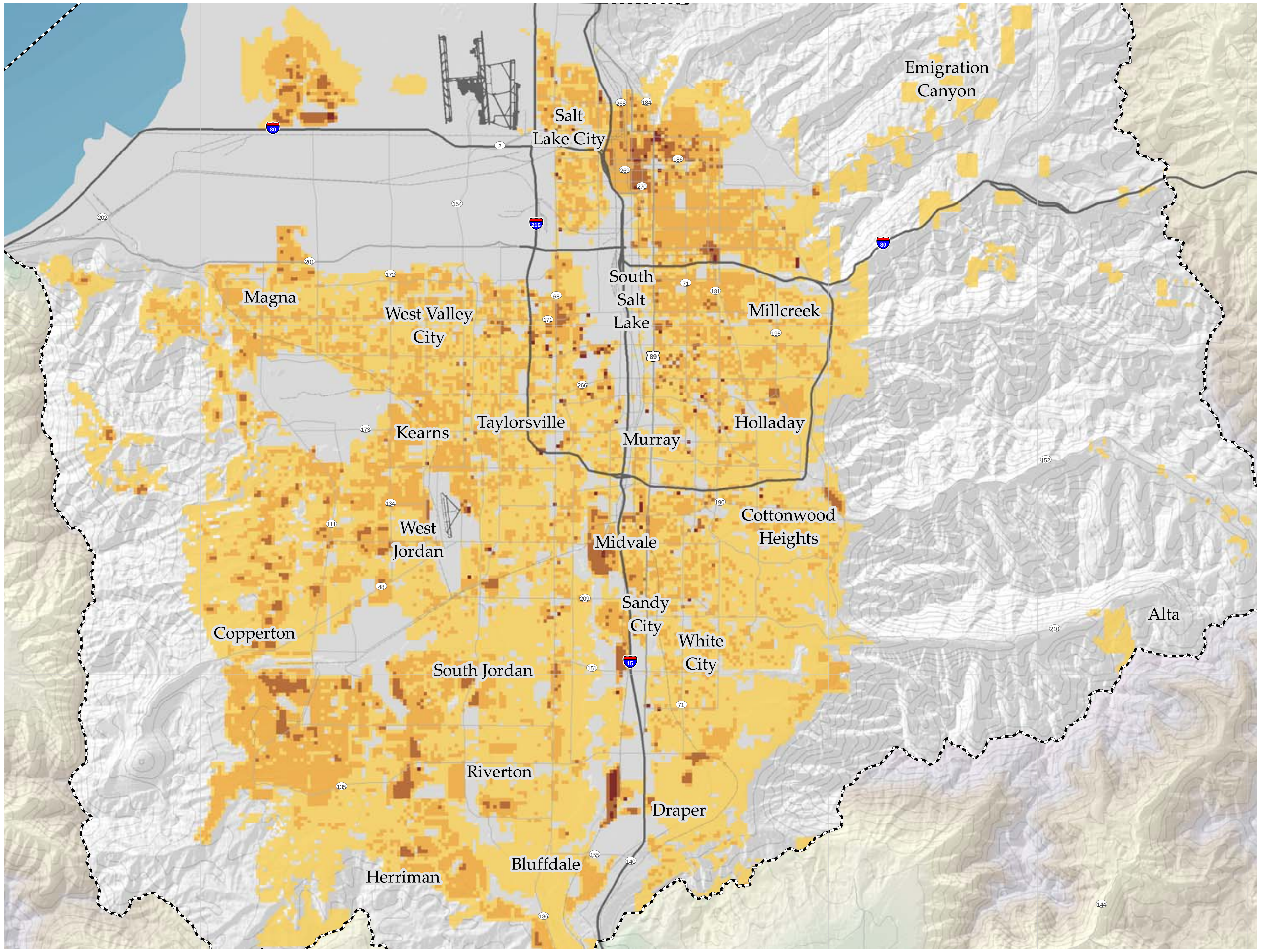
ATTRACTIVENESS FOR JOBS

Low Medium High



TOTAL JOBS AT BUILDOUT

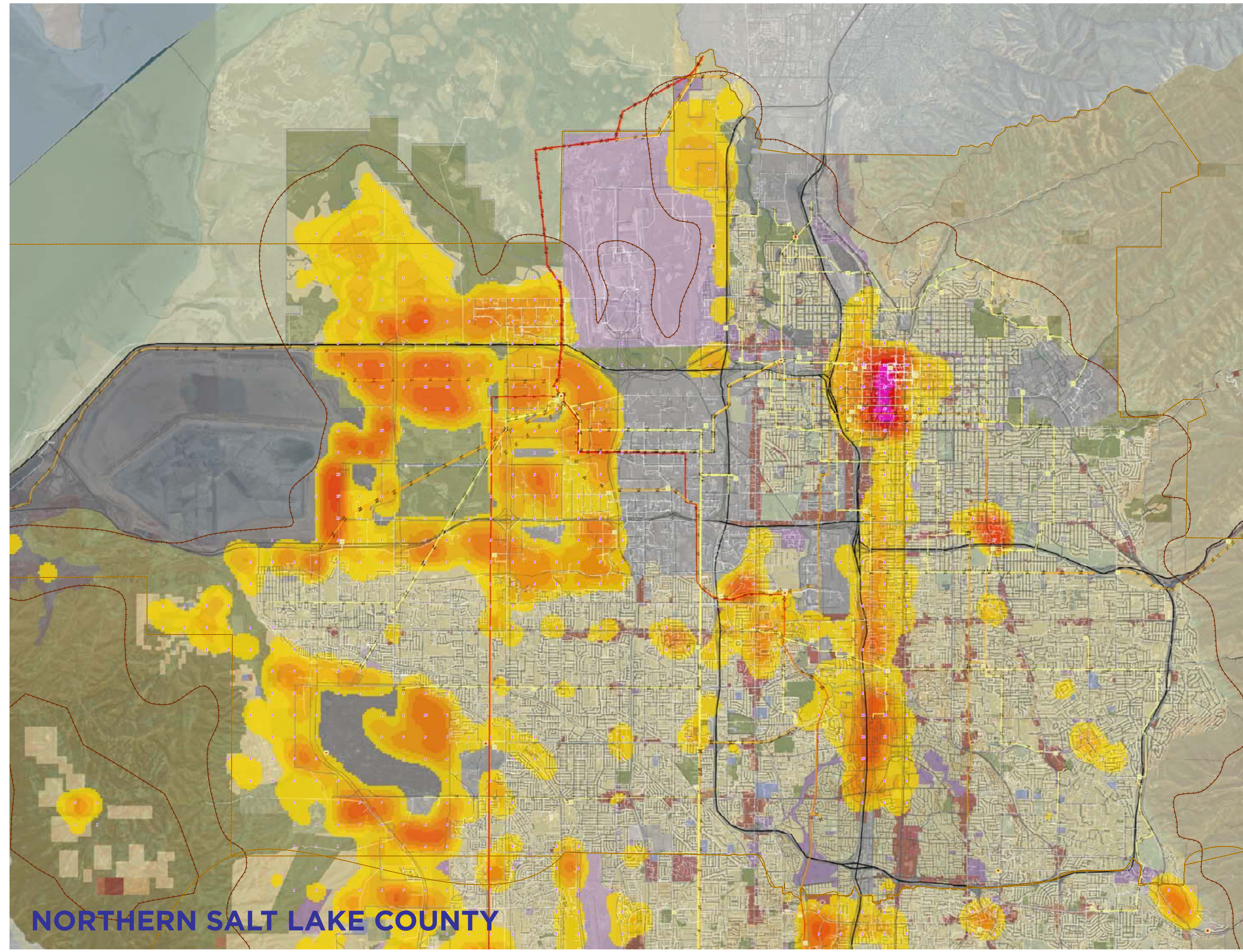
0	1-20	20-200	200-500	500-3425

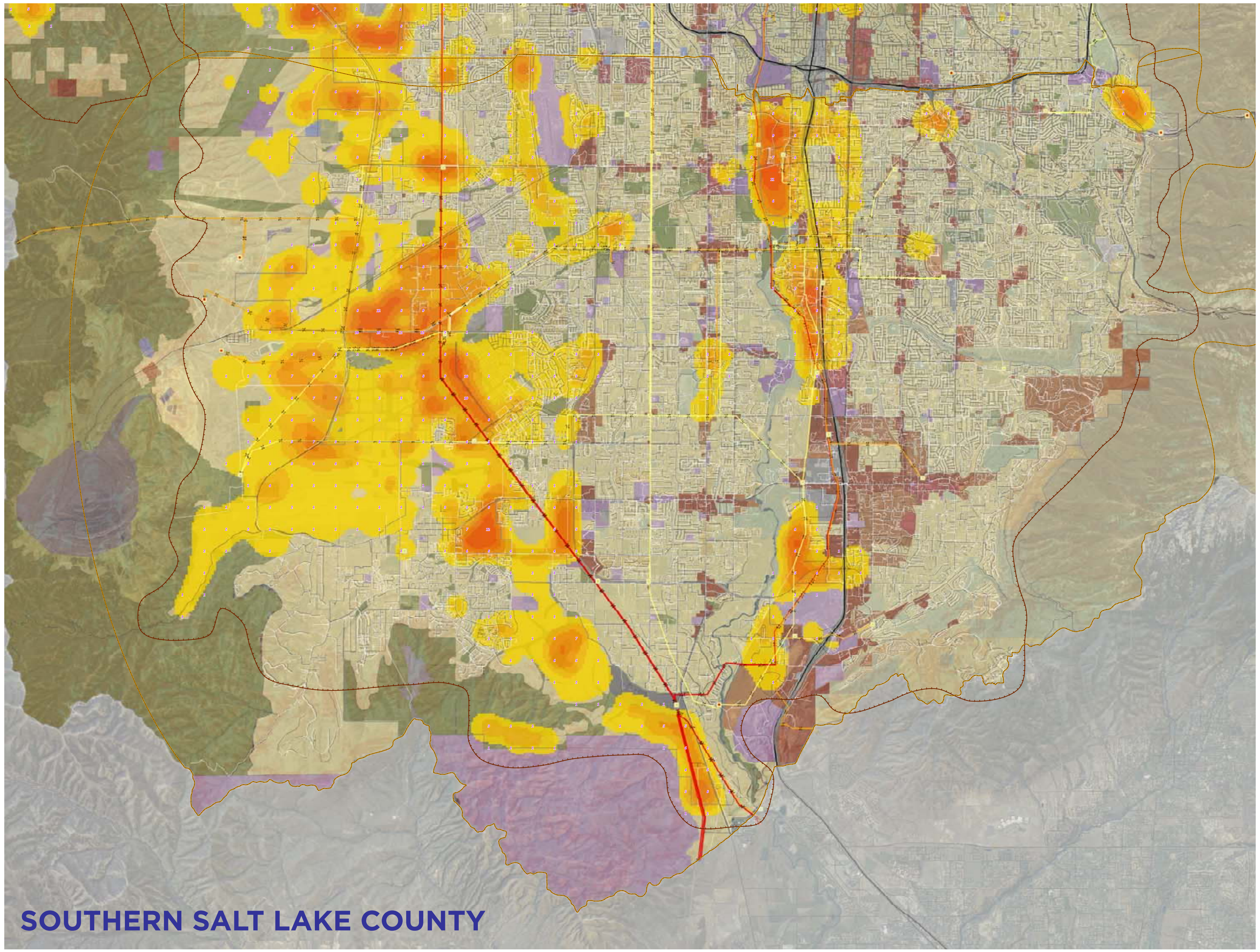


TOTAL DWELLING UNITS AT BUILDOUT

Appendix D: Load density based on zoning

Load growth "hot spots" show energy-intensive areas. These were developed by applying existing usage of various development types to future population and employment projections from the County Cooperative Plan.





FUTURE DEMAND

Crosswalked Land-Use

- Single-family
- Multi-family
- Residential Mixed Use
- Retail/Services
- Employment Mixed Use
- Heavy Industrial
- Light Industrial
- Office
- Government Employment
- Campus K-12
- Recreation, Public/Civic, Parks
- Open Space, Other Undeveloped
- National Forest, Other Undeveloped
- Utilities/Other ROW

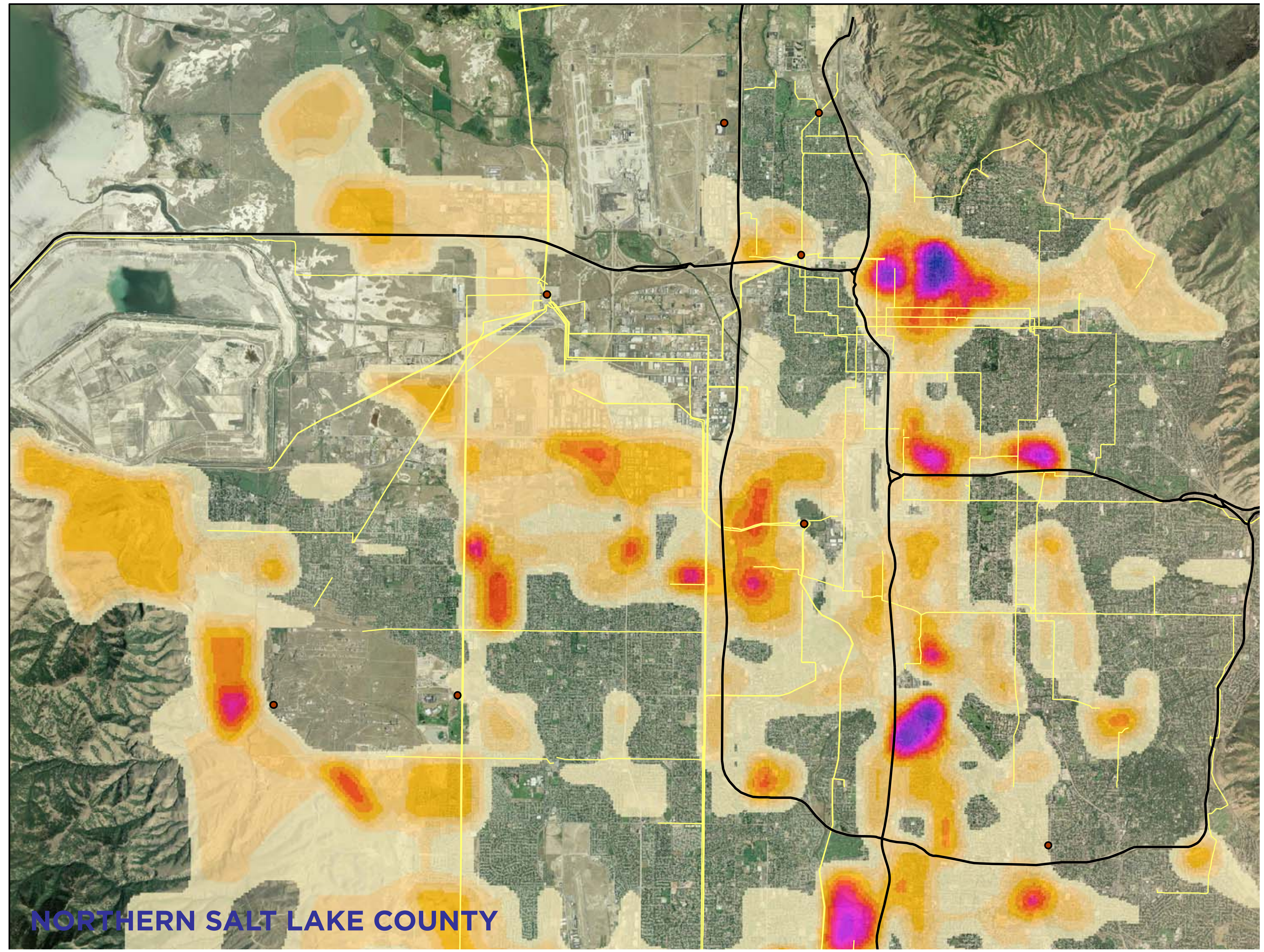
Transmission Voltage

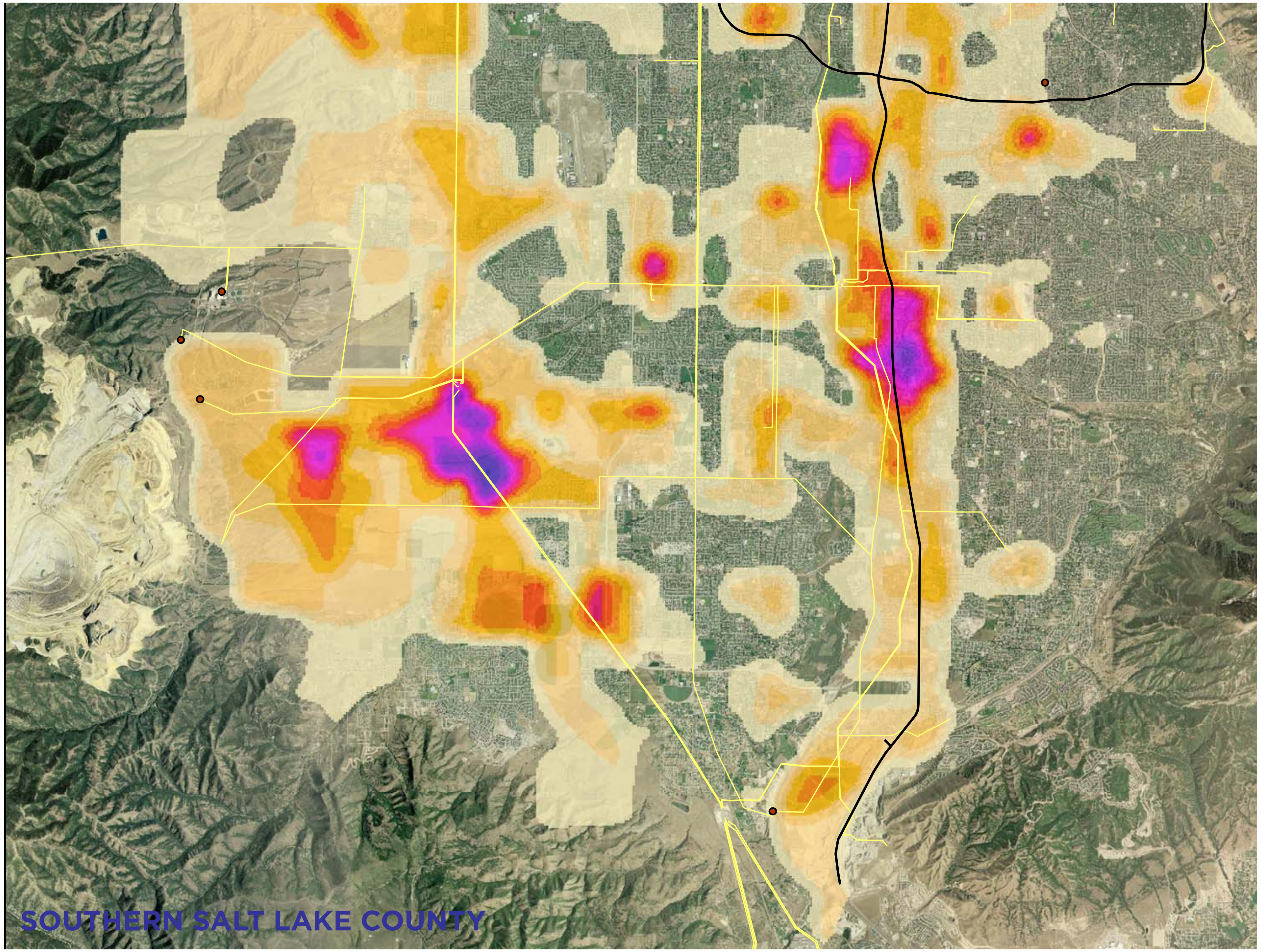
- 46
- 138
- 230
- 345
- Distribution
- Transmission Substation
- Distribution Substation

Future Demand

Low Medium High

Similar maps were created using Wasatch Choices 2040 visioning process data. These maps were used for comparison only as the group felt that the County Cooperative data was better suited to the purposes of this process.





WFRC LOAD GROWTH

Load Growth From Wasatch Choices 2040

Low Medium High

Transmission

Transmission Lines

Transmission Substation

Appendix E: Local government memorandum of understanding

Individual communities may consider entering into a Memorandum of Understanding with Rocky Mountain Power to formalize their mutual commitment to observe the principles of collaborative planning outlined in the Salt Lake County Electrical Plan. Sample language is provided below.

Whereas, a broad and diverse group of city, county and regional land-use and transportation planners, community stakeholders, and economic development representatives worked collaboratively to develop a shared electrical infrastructure plan for Salt Lake County; and

Whereas, the location of an electrical transmission network is multi-jurisdictional, crossing through multiple local government boundaries; and

Whereas, one jurisdiction may have authority to modify the alignment of transmission infrastructure in the shared plan;

Now, Therefore,

We, as a local government jurisdiction of Salt Lake County served by Rocky Mountain Power, will consider the following Principles of Agreement once an Electrical Infrastructure element is adopted as part of our local General Plan, or we have taken other actions to incorporate electrical infrastructure considerations into local planning:

PRINCIPLES OF AGREEMENT

1. RECOGNITION OF VALID PROCESS: We recognize the Salt Lake County Electrical Plan process is a good-faith collaborative effort to integrate community and local government considerations into an electrical infrastructure plan.

- Diverse involvement
- Developed from a county-wide perspective
- Open process

2. A COMMITMENT BETWEEN OUR JURISDICTION AND ROCKY MOUNTAIN POWER: Having adopted the plan as part of our General Plan, we commit to use the Map and Siting Criteria to plan appropriate land uses near future electrical infrastructure locations and will work to preserve locations for potential future infrastructure. By doing so, we expect a similar commitment from Rocky Mountain Power to utilize the Plan Map and Siting Criteria in cooperation with local governments and affected parties when specific site options are considered for new or expanded infrastructure. If we determine an element of the plan is no longer in our jurisdiction's best interest, we will inform Rocky Mountain Power of our intention to modify our general plan. Conversely, Rocky Mountain Power will inform our jurisdiction if customers' electrical needs require alterations to the plan.

3. A COMMITMENT BETWEEN OUR JURISDICTION AND ADJACENT JURISDICTIONS: Once the plan is adopted as part of our General Plan or electrical infrastructure considerations are incorporated into our local planning process and when any of our contiguous neighboring governmental jurisdictions also signs this Memorandum of Understanding, we will commit to either maintain shared boundary locations of infrastructure elements consistent with this plan or to notify and discuss modifications with the adjacent jurisdiction and Rocky Mountain Power.

4. PLAN FINDINGS WILL BE SHARED WITH STAKEHOLDERS: We will utilize our adopted General Plan Electrical Infrastructure Element to help stakeholders understand the basis for potential locations of electrical infrastructure in advance of construction. The elements of the plan will be made available on the Internet for easy access and will be referenced in staff reports as applicable.

5. UTILIZATION AND UPDATING THE COUNTY COOPERATIVE PLAN: We will utilize the Salt Lake County Electrical Plan to understand the geographic interactions between this electrical plan and other infrastructure plans. We will share geographic data with Salt Lake County to ensure the County Cooperative Plan continues to be accurate and reflect local plans.

6. COORDINATE PLAN UPDATES: As necessary, we will work with Rocky Mountain Power and adjacent jurisdictions, if applicable, through the County Cooperative Plan, to clarify or refine mapped locations of infrastructure elements.

7. PRO-ACTIVE COMMUNICATION: Once an adjacent local government jurisdiction signs this Memorandum of Understanding, participating local governments and Rocky Mountain Power will commit to 1) either follow the plan element or 2) notify participating adjacent jurisdictions, Rocky Mountain Power, and Salt Lake County (for the County Cooperative Plan) of its intent and reasons to not follow an element of the electrical plan.

8. COORDINATE INTER-CITY IMPLEMENTATION: Participating local governments and Rocky Mountain Power will seek to maintain boundary locations of infrastructure elements consistent with this plan unless there is notification or discussion with adjacent jurisdictions and Rocky Mountain Power.

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Appendix F: Scorecard

A scorecard was developed as a tool for local jurisdictions and Rocky Mountain Power to use in evaluating alternative locations for new facilities. It provides a means to compare specific locations in terms of how well each site meets the siting criteria established by the task force. It is not intended to replace careful consideration and debate about the relative benefits or impacts of specific locations. Rather, it is a tool to be used in combination with other information to facilitate comparative evaluation.

INSTRUCTIONS FOR USE

The scorecard is separated into two sections, one for substations and one for transmission lines. To score the potential site, ask yourself how well the location meets each criterion, and enter an x in the corresponding line. Then multiply the score for each criterion by the corresponding criterion weight to produce a total score for that criterion. The weight assigned to each criterion corresponds to the priority it was given by the task force and shown in the Siting Criteria section of this document. Finally, sum the points in the last column to obtain a total score for the potential infrastructure location.

The scorecard spreadsheet can also be found at:

www.rockymountainpower.net/planning

Salt Lake County Electrical Plan Example Scorecard

SUBSTATIONS				
Desirable Locations	SCORE how well the criterion is met	Enter X where appropriate	Criterion WEIGHT	Criterion TOTAL = score X weight
2A Maximize use of existing facilities and adjacent properties before building new facilities	Substantially (2 points)			
	Partially (1 point)	x	5	5
	Poorly (0 points)			
2B Build aesthetically pleasing facilities	Substantially (2 points)	x		10
	Partially (1 point)		5	
	Poorly (0 points)			
2C Use topography to reduce visual impacts	Substantially (2 points)			
	Partially (1 point)	x	3	3
	Poorly (0 points)			
2D Use areas with high development potential	Substantially (2 points)			
	Partially (1 point)	x	3	3
	Poorly (0 points)			
2E Utilize land adjacent to other infrastructure	Substantially (2 points)			
	Partially (1 point)		3	
	Poorly (0 points)	x		0
2F Utilize green space	Substantially (2 points)	x		2
	Partially (1 point)		1	
	Poorly (0 points)			
			Subtotal	**23**
Undesirable Locations	SCORE how well the criterion is met	Enter X where appropriate	Criterion WEIGHT	Criterion TOTAL = score X weight
3A Avoid residential neighborhoods, schools and elderly populations	Substantially (2 points)	x		10
	Partially (1 point)		5	
	Poorly (0 points)			
3B Locate near but not within existing major development centers, transit oriented development and transit stations	Substantially (2 points)			
	Partially (1 point)	x	4	4
	Poorly (0 points)			
3C Protect critical habitat, wetlands, rivers and stream corridors, and bird sanctuaries	Substantially (2 points)			
	Partially (1 point)	x	3	3
	Poorly (0 points)			
3D Protect significant viewsheds	Substantially (2 points)			
	Partially (1 point)		3	
	Poorly (0 points)	x		0
3E Avoid prime future development parcels	Substantially (2 points)			
	Partially (1 point)	x	3	3
	Poorly (0 points)			
3F Avoid areas with flood, landslide and earth movement potential	Substantially (2 points)	x		6
	Partially (1 point)		3	
	Poorly (0 points)			
3G Avoid discrimination based on income or ethnicity	Substantially (2 points)			
	Partially (1 point)		3	
	Poorly (0 points)	x		0
			Subtotal	**26**
			SUBSTATIONS GRAND TOTAL	**49**

Salt Lake County Electrical Plan Scorecard

SUBSTATIONS

Desirable Locations	SCORE how well the criterion is met	Enter X where appropriate	Criterion WEIGHT	Criterion TOTAL = score X weight
2A Maximize use of existing facilities and adjacent properties before building new facilities	Substantially (2 points)		5	
	Partially (1 point)			
	Poorly (0 points)			
2B Build aesthetically pleasing facilities	Substantially (2 points)		5	
	Partially (1 point)			
	Poorly (0 points)			
2C Use topography to reduce visual impacts	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
2D Use areas with high development potential	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
2E Utilize land adjacent to other infrastructure	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
2F Utilize green space	Substantially (2 points)		1	
	Partially (1 point)			
	Poorly (0 points)			
			Subtotal	0

Undesirable Locations	SCORE how well the criterion is met	Enter X where appropriate	Criterion WEIGHT	Criterion TOTAL = score X weight
3A Avoid residential neighborhoods, schools and elderly populations	Substantially (2 points)		5	
	Partially (1 point)			
	Poorly (0 points)			
3B Locate near but not within existing major development centers, transit oriented development and transit stations	Substantially (2 points)		4	
	Partially (1 point)			
	Poorly (0 points)			
3C Protect critical habitat, wetlands, rivers and stream corridors, and bird sanctuaries	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
3D Protect significant viewsheds	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
3E Avoid prime future development parcels	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
3F Avoid areas with flood, landslide and earth movement potential	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
3G Avoid discrimination based on income or ethnicity	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
			Subtotal	0

SUBSTATIONS GRAND TOTAL 0

Salt Lake County Electrical Plan Scorecard

TRANSMISSION LINES

Desirable Locations	SCORE how well the criterion is met	Enter X where appropriate	Criterion WEIGHT	Criterion TOTAL = score X weight
4A Share rights-of-way with utilities, trails, railroads, canals, roads, etc.	Substantially (2 points)		5	
	Partially (1 point)			
	Poorly (0 points)			
4B Upgrade existing facilities before building new facilities	Substantially (2 points)		5	
	Partially (1 point)			
	Poorly (0 points)			
4C Build aesthetically pleasing facilities	Substantially (2 points)		4	
	Partially (1 point)			
	Poorly (0 points)			
4D Use areas with high development potential	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
4E Select sites that allow operations and maintenance access	Substantially (2 points)		2	
	Partially (1 point)			
	Poorly (0 points)			
4F Co-locate multiple transmission lines in the same corridor	Substantially (2 points)		2	
	Partially (1 point)			
	Poorly (0 points)			
4G Minimize the length of transmission corridors	Substantially (2 points)		1	
	Partially (1 point)			
	Poorly (0 points)			
4H Utilize green space	Substantially (2 points)		1	
	Partially (1 point)			
	Poorly (0 points)			
			Subtotal	0

Undesirable Locations	SCORE how well the criterion is met	Enter X where appropriate	Criterion WEIGHT	Criterion TOTAL = score X weight
5A Avoid residential neighborhoods, schools, and elderly populations	Substantially (2 points)		5	
	Partially (1 point)			
	Poorly (0 points)			
5B Locate near but avoid bisecting major development centers, transit-oriented development or transit stations	Substantially (2 points)		4	
	Partially (1 point)			
	Poorly (0 points)			
5C Protect significant viewsheds	Substantially (2 points)		4	
	Partially (1 point)			
	Poorly (0 points)			
5D Protect critical habitat, river and stream corridors, and bird sanctuaries	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
5E Avoid bisecting prime development parcels	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
5F Avoid discrimination based on income or ethnicity	Substantially (2 points)		3	
	Partially (1 point)			
	Poorly (0 points)			
5G Avoid areas with flood, landslide and earth movement potential	Substantially (2 points)		2	
	Partially (1 point)			
	Poorly (0 points)			
			Subtotal	0

TRANSMISSION LINES GRAND TOTAL 0