Eastern Treasure Valley Electrical Plan

Final Report

Final report prepared by
Delivery Planning Department

In cooperation with the
Eastern Treasure Valley Electrical Plan Community Advisory Committee

December 2012

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Table of Contents

Table of Figures

Acronyms/Definitions

BLM – U.S. Bureau of Land Management.

Buildout – The point when all available land is developed in accordance with zoning ordinances.

CAC – Community Advisory Committee, referred to herein as the "Committee."

Distribution Substation – A relatively small substation located near its electrical load that transforms (reduces) sub-transmission voltages to distribution voltages. In the eastern Treasure Valley, the sub-transmission voltage is either 138,000 or 69,000 volts and the distribution voltage is either 34,500 volts or 12,470 volts.

Hub Substation – Acts as the supply point for the 138,000 volt sub-transmission. Power arrives at a Hub substation at 230,000 volts and is stepped-down by transformers to 138,000 volts.

IPC – Idaho Power Company.

kV – kilovolts (thousands of volts). 1,000 volts = 1 kV.

kW – kilowatts (thousands of watts). 1,000 watts = 1 kW.

MW – megawatt (millions of watts). 1,000,000 watts = 1 MW.

The Plan – The Eastern Treasure Valley Electrical Plan.

Source Substation – Typically, a large substation that is used to transform (reduce) main grid transmission voltages to a lower voltage level for delivery to Hub substations. In the eastern Treasure Valley, a typical source substation will transform 500,000 volts to 230,000 volt transmission or will receive 230,000 volt power from distant generation and then send it on at 230,000 volts to Hub substations.

Substation – A facility that provides transmission line switching *with* electrical transformation (voltage reduction) to distribution voltages that serve local area loads.

TVEP – Treasure Valley Electrical Plan

WTVEP – Western Treasure Valley Electrical Plan

Relationship between Power and Voltage – There are two quantities referred to in this report when describing the electrical system: Power and Voltage.

> **Power**: The amount of work performed in one second. The term is used to express the electrical workload of the eastern Treasure Valley and the capability of a transmission line to move electricity. Power is measured in watts (kilowatts and megawatts).
>
> **Voltage:** A component of power that enables the power to flow on a transmission line. It is the "push" behind the power. In general, a higher voltage line can carry more power than a lower voltage line. Voltage is measured in volts at your household (110 and 220 V) and kilovolts on the transmission network (138 kV).

Executive Summary

Electricity: it lights our homes, runs our computers, cooks our food and entertains our kids. It can be used to save a life and it can ease our work. But we don't often think about how much effort is put in every day to keep the electricity flowing and how much planning must take place to ensure electrical facilities are built when they are needed. And the cost for electrical facilities is tremendous. The electric utility industry is one of the most, perhaps *the* most, capital-intensive industries in the United States.

The eastern Treasure Valley's population and industrial base have grown significantly over the past 20 years and Idaho Power (IPC) continually adds new infrastructure to meet the electricity needs resulting from this growth. Even with the economic recession that began in 2007, IPC's existing customers continue to purchase devices that consume more and more energy on a per capita basis. Even though these devices are becoming more energy-efficient, customers seem to have more of them. And industry, businesses, farms, and residences are becoming more dependent on a reliable supply of electricity with every passing year. Now in 2012, growth is picking up in this region and new facilities will be needed to supply the energy the new businesses and homes will need. It is important that IPC takes a long-term view of the future and plan new generation, transmission, and substation facilities so they not only serve their electrical need, but also fit the desires of the communities within which they reside.

Even though electricity has become a necessity to modern life, to many people, electrical facilities are visually and environmentally intrusive. Each new facility location needs to address safety, property owner concerns, jurisdictional siting requirements, environmental laws and regulations and federal reliability standards. A long-term plan is necessary to ensure the transmission lines and substations are there when they are needed and it is important to locate the facilities so they fit into a larger strategy to serve the area. This larger strategy or plan should accommodate the vision and perspective of local communities.

In October, 2011, IPC invited members of the eastern Treasure Valley to participate in a Community Advisory Committee (the Committee) to help plan for the new electrical facilities that will provide for growth. The Committee, made up of local elected officials, city and county planning representatives, agricultural interests, developers, industrial representatives, community members, and representatives from the Bureau of Land Management and the Idaho Department of Fish and Game, met monthly for a year. The inside cover of this report shows a complete list of the Committee members. Developed in concert with the Community Advisory Committee, the Eastern Treasure Valley Electrical Plan (the Plan) describes infrastructure improvements and additions that will be needed to provide an adequate and dependable power supply far into the future. It provides a long-range – buildout – strategy to serve the electrical power needs of IPC's customers in a region consisting of Ada and Elmore counties and the Grand View area of Owyhee County. It must be noted that the new 500 kV transmission lines planned for the area in the next few years were beyond the scope of this Committee. Additionally, the Committee did not address any transmission external to the eastern Treasure Valley that might be used to deliver energy to the area.

From 2005 through 2006, Idaho Power convened a community advisory committee to site buildout facilities for the Treasure Valley and named the plan the Treasure Valley Electrical Plan (TVEP).

The TVEP laid out 230 kV and 500 kV substation locations and transmission line routes in Ada, Canyon and Owyhee counties in Idaho and Malheur County in Oregon. The TVEP did not consider 138 kV facilities. The Eastern Treasure Valley Electrical Plan uses the TVEP 230 kV substation locations and 230 kV transmission line routes as a starting point to plan 230 kV hub substation locations and transmission line routes with the Committee confirming nearly all locations sited in the TVEP.

From 2010 through 2011, Idaho Power convened another community advisory committee to site 138 kV and 230 kV facilities in the western part of the Treasure Valley (including Canyon, Gem, Owyhee, Payette and Washington counties in Idaho and Malheur County in Oregon). Like the ETVEP, the Western Treasure Valley Electrical Plan (WTVEP) used the TVEP 230 kV substation locations and transmission line routes as a starting point in planning their 230 kV hub substation locations and transmission line routes and also the WTVEP committee confirmed nearly all the locations sited in the TVEP. Taken together, the ETVEP and the WTVEP form the basis of a Treasure Valley encompassing plan that ties the power systems between the two plans together.

The Committee started its work in October, 2011 with a general education session followed in November with a bus tour of generation and transmission facilities. The following two months were also devoted to providing the Committee a good background relating to electrical power systems. Through these educational sessions, the Committee was introduced to the concepts of electrical power generation, transmission, substations, energy efficiency, and regulatory affairs. Additionally, the Committee was introduced to IPC's electrical system from production to delivery.

Guiding Principles and Community Criteria

As a first step in determining the feasibility of individual transmission line routes and substation locations, the Committee members created a *Guiding Principles and Community Criteria* document. The guiding principles are key themes that serve as a foundation for making decisions concerning the eastern Treasure Valley electrical system while the community criteria are used more specifically for locating future transmission lines and substations.

The final guiding principles are divided into 9 categories:

1. **Promote economic development**
    - Plan for potential growth (residential, commercial and industrial)
    - Recognize and promote the benefits of a healthy electric system
    - Encourage prosperity by working to ensure that our electrical system is ready to meet requests for future growth
    - Balance costs and rewards of economic development opportunities (i.e., the number of jobs provided versus amount of power needed for facility)
2. **Support existing businesses, property rights and land uses (e.g. historic sites, industries, Air Force Base)**
    - Accommodate existing growth
    - Plan for change in existing growth areas
    - Support future community development
    - Consider what would be impacted if a disaster were to occur
3. **Be sensitive to agriculture**
    - Take into account irrigation practices
    - Take precautions to minimize stray voltage at dairies and feedlot operations

4. **Encourage positive interaction between communities**
    - Foster inter-jurisdictional communication regarding future electrical infrastructure needs to make the siting process easier and more successful
    - Be aware of neighboring communities' growth plans
5. **Comply with comprehensive plans**
    - Be flexible for future unplanned changes
    - Site infrastructure consistent with local agency plans
    - Actively participate in updates of comprehensive plans
6. **Be aware of environmentally sensitive areas**
    - Consider the Birds of Prey area
7. **Consider community character**
    - Take urban visual impacts into account
    - Avoid cutting communities in half
    - Be sensitive to each community's unique environment
    - Be sensitive to downtown areas
8. **Continue to meet power needs and prepare for future unknowns**
    - Ensure all future electrical infrastructure is operational and reliable
    - Keep construction realistic
9. **Be as efficient as possible**
    - Consider monetary costs to all stakeholders
    - Take into account the impact of the line or substation
    - Consider upgrading existing infrastructure as much as possible

The Community Criteria are divided into two lists that provide guidance for the specific placement of substations and transmission lines. The first list includes areas that can be deemed favorable to electrical infrastructure placement while the second list includes areas that should be avoided. The combined lists are shown in Table 1.

Table 1: Community Criteria

Areas to Site Electrical Infrastructure	Areas to Avoid Siting Electrical Infrastructure
Industrial areas	Parks
Public lands	Schools
Near areas where energy is generated	Highly populated areas
Areas that need (or will need) more power	Irrigated farmland
Vacant areas	Airport approach zones
Upgrade existing electrical infrastructure	City corners
Along existing and/or planned electrical corridors	Near natural waterways and existing canals
Along transportation corridors and roadways	Sensitive wildlife habitats
Along rail corridors	The Air Force Base and Base flight corridors
Areas where transmission and/or substations will be of the highest and best use	Military training areas (e.g. Gowen Field, Owyhee County bombing ranges)
Along irrigation and/or drainage facilities, where practical	Viewsheds
Underground where possible	Pedestrian areas
Buffer around military installations	Historically sensitive areas (e.g. intact sections of the Oregon Trail)
Plan for change within existing growth areas	Already approved uses
Canals (decisions will be made at the local level for this criterion)	Ridgelines
Subdivision areas (decisions will be made at the local level for this criterion)	Preserved foothills property
	Foothills open space (both owned and anticipated)
	Gateway corridors
	Zoos
	Cemeteries
	Historic properties, structures and buildings
	Low-lying areas that could be prone to flood every few years (for substation)
	Canals (decisions will be made at the local level for this criterion)
	Subdivision areas (decision will be made at the local level for this criterion)

Mapping Exercise

Using the information it gained from the first four meetings as well as from the guiding principles and community criteria it developed, the Committee laid out proposed substation locations and transmission line routes to serve the eastern Treasure Valley through buildout. The Committee identified many different alternatives for evaluation. IPC staff provided technical analysis for each alternative to help the Committee further refine its choices. In the end, the Committee reached consensus on preferred and acceptable secondary alternatives. A preferred alternative represents the committee's first choice for a substation location or transmission line route while a secondary alternative represents the committee's recommendations for substation sites or transmission line routes if a preferred alternative cannot be obtained.

For the purposes of this report, the eastern Treasure Valley area is broken down into two sub-areas:

- Ada County – Includes the cities of Boise, Eagle, Garden City, Kuna, Meridian and Star
- Elmore and Owyhee Counties – Includes the cities of Mountain Home, Glenns Ferry, Hammett and Grand View. It also includes Mountain Home Air Force Base

In addition to the city areas described above, each sub-area includes a substantial amount of public lands that were evaluated by the Committee.

Preferred Alternatives

The Committee's preferred alternatives to serve the eastern Treasure Valley service area at buildout are shown in the following figures. Instead of narrowing the facility locations down to one alternative, the Committee preferred to eliminate "no go" alternatives and indicate if the remaining alternatives were preferred over others. The Committee generally recommended that IPC refer to their *Guiding Principles and Community Criteria* when siting any new facilities in the eastern Treasure Valley.

For clarity, the eastern Treasure Valley in the following drawings is split between Ada County and Elmore/Owyhee counties. Further subdivisions are shown in the *Committee's Preferred Alternatives* section of this report and in Appendix D.

Ada County Area: (See Figure 1 for 230 kV facilities and Figure 2 for 138 kV facilities). Because proposed locations for 230 kV Hub substations were already determined by the TVEP Community Advisory Committee in 2006, the ETVEP Committee was asked to validate their locations and make changes if they found it necessary. Only the Highway 16 (hub) Substation location was changed by the Committee and then only slightly. The Committee was also asked to validate the 230 kV transmission routes designated in the TVEP. The only change made by the Committee was the route of the 230 kV transmission line from the Highway 16 (hub) Substation heading south, changing it to match the planned Highway 16 road alignment as planned by the Idaho Transportation Department.

The Committee's preferred alternative for the Ada County area includes 19 new distribution substations and the associated 138 kV transmission to interconnect them. It is noted that because of the high growth rate of commercial properties in and around Meridian, committee members representing the City of Meridian recommend that Idaho Power obtain substation properties as soon as possible before they are purchased for commercial development.

Elmore and Owyhee Counties Area: (See Figure 3 for 230 kV facilities and Figure 4 for 138 kV facilities).
The Committee's preferred alternatives for the Elmore and Owyhee counties area includes expansion of the existing Danskin (hub) Substation in Mountain Home and two new distribution substations: one in Elmore County and one in Owyhee County. The Committee also recommended upgrading most 69 kV transmission lines in Elmore County to 138 kV when conditions warrant.

The Committee sited an additional hub substation east of Mountain Home for the stated purpose of providing capacity should load growth warrant it. The location was not specific but was only a general area located near the existing 230 kV transmission lines east of Mountain Home. Based on comments received from the Elmore County Growth and Development Department relating to its proximity to land designated as agricultural ground, the second hub substation location has been removed from the map. If load growth warrants it, siting of an additional hub substation will be pursued in future Eastern Treasure Valley Electrical Plan committee processes. It is noted that the Danskin (hub) Substation location is forecast to be adequate for future load growth and an additional hub substation location is not needed unless growth greatly exceeds Idaho Power's forecasts.

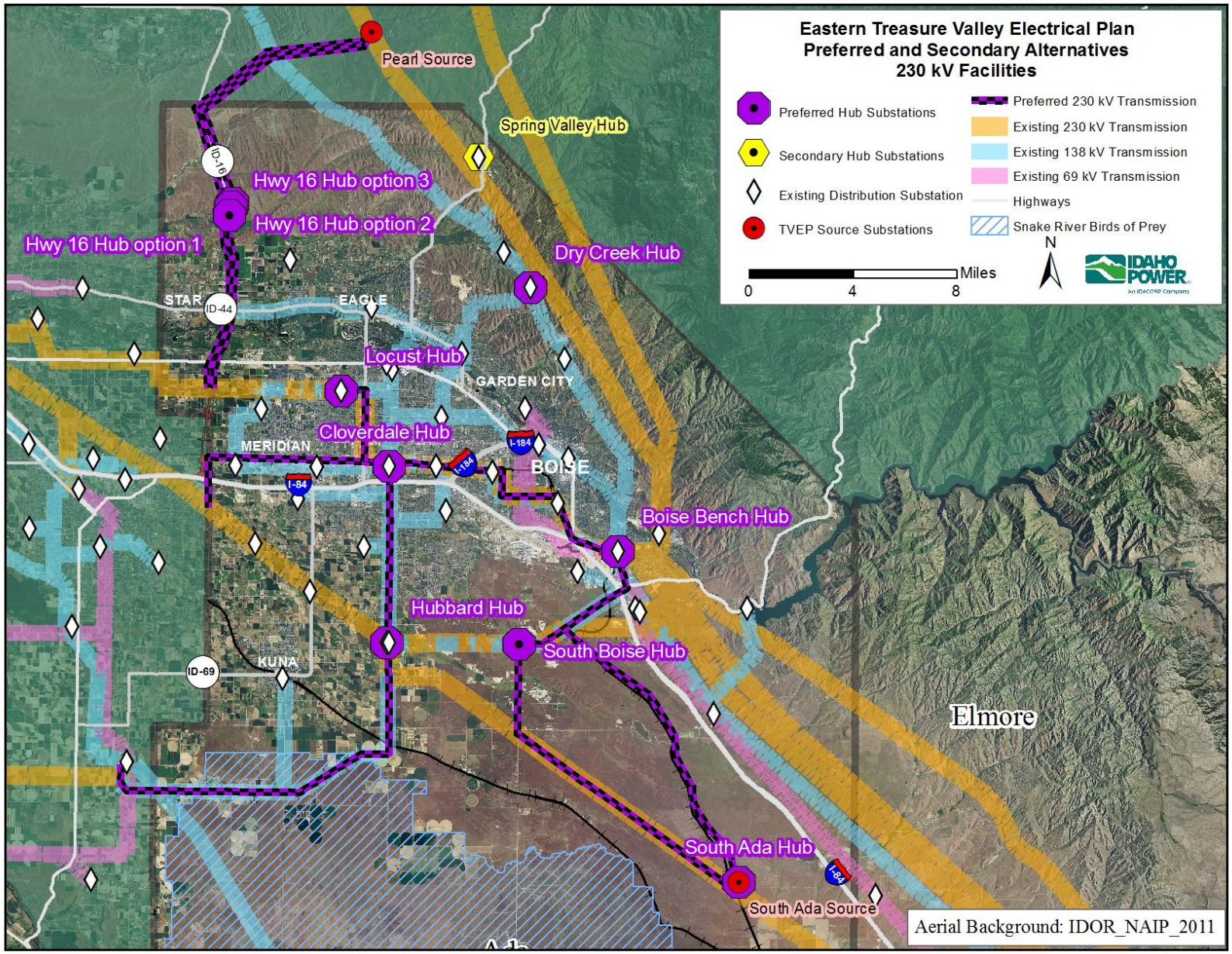

Figure 1: Ada County Preferred and Secondary 230 kV Alternatives

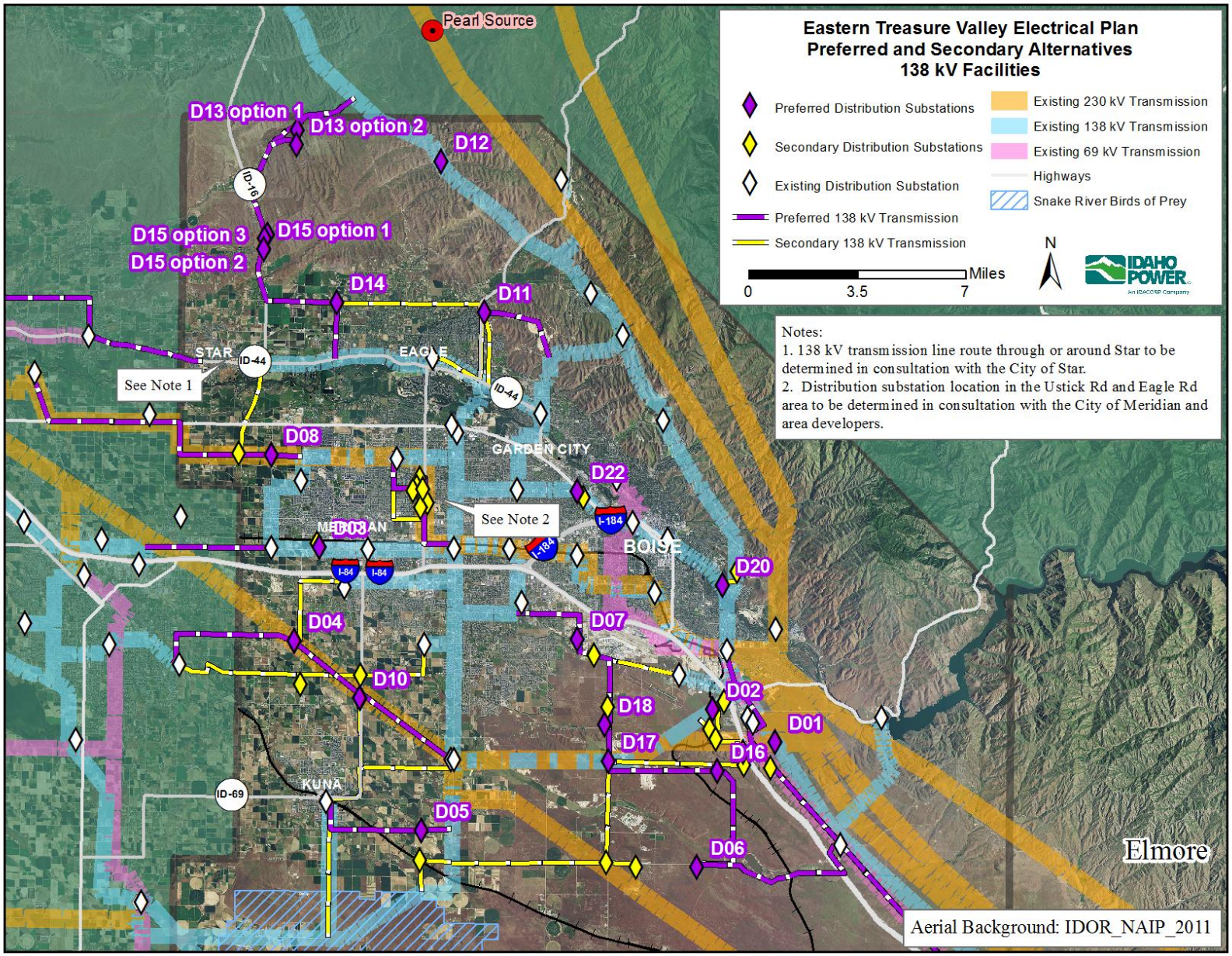

Figure 2: Ada County Preferred and Secondary 138 kV Alternatives

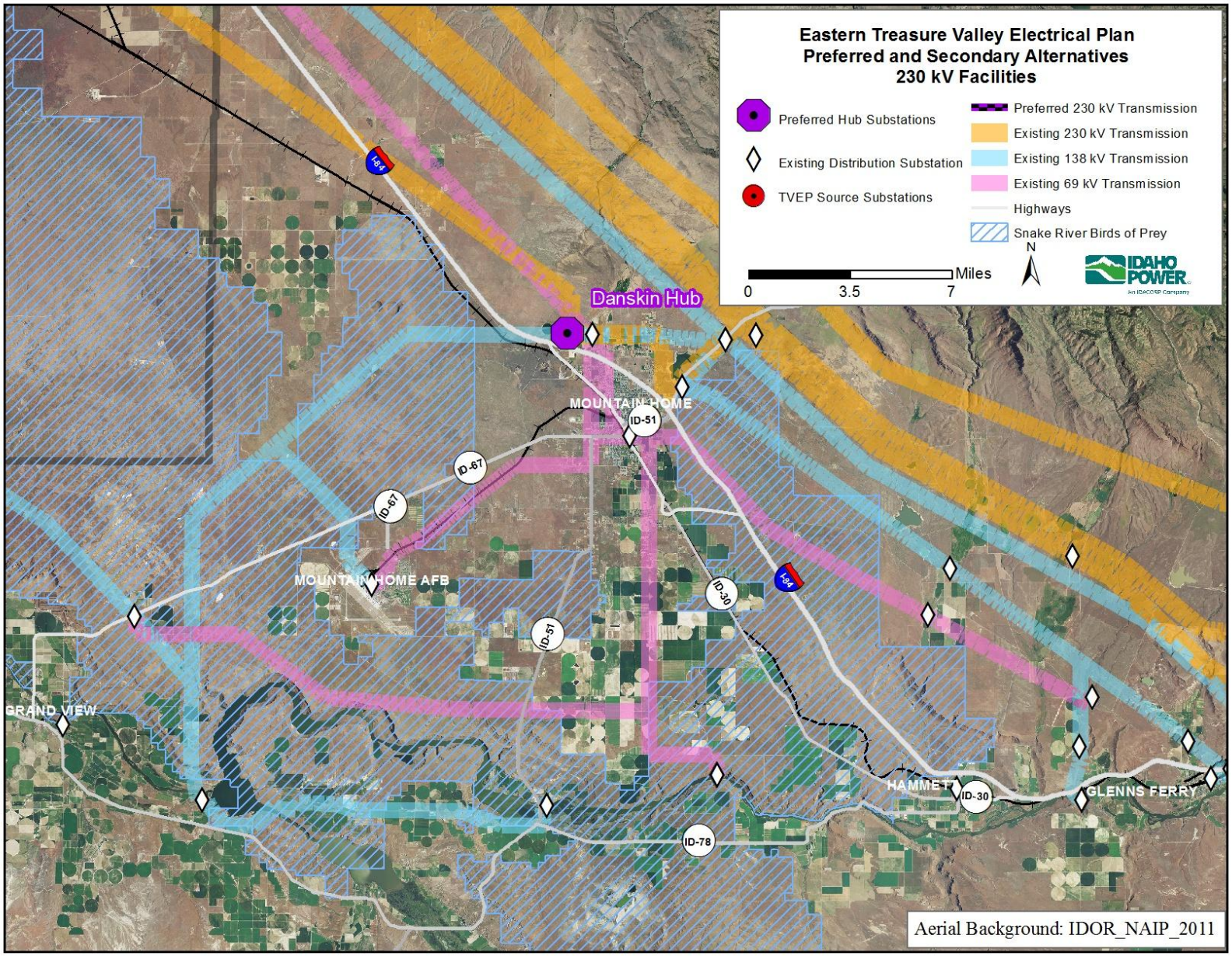

Figure 3: Elmore and Owyhee Counties Preferred and Secondary 230 kV Alternatives

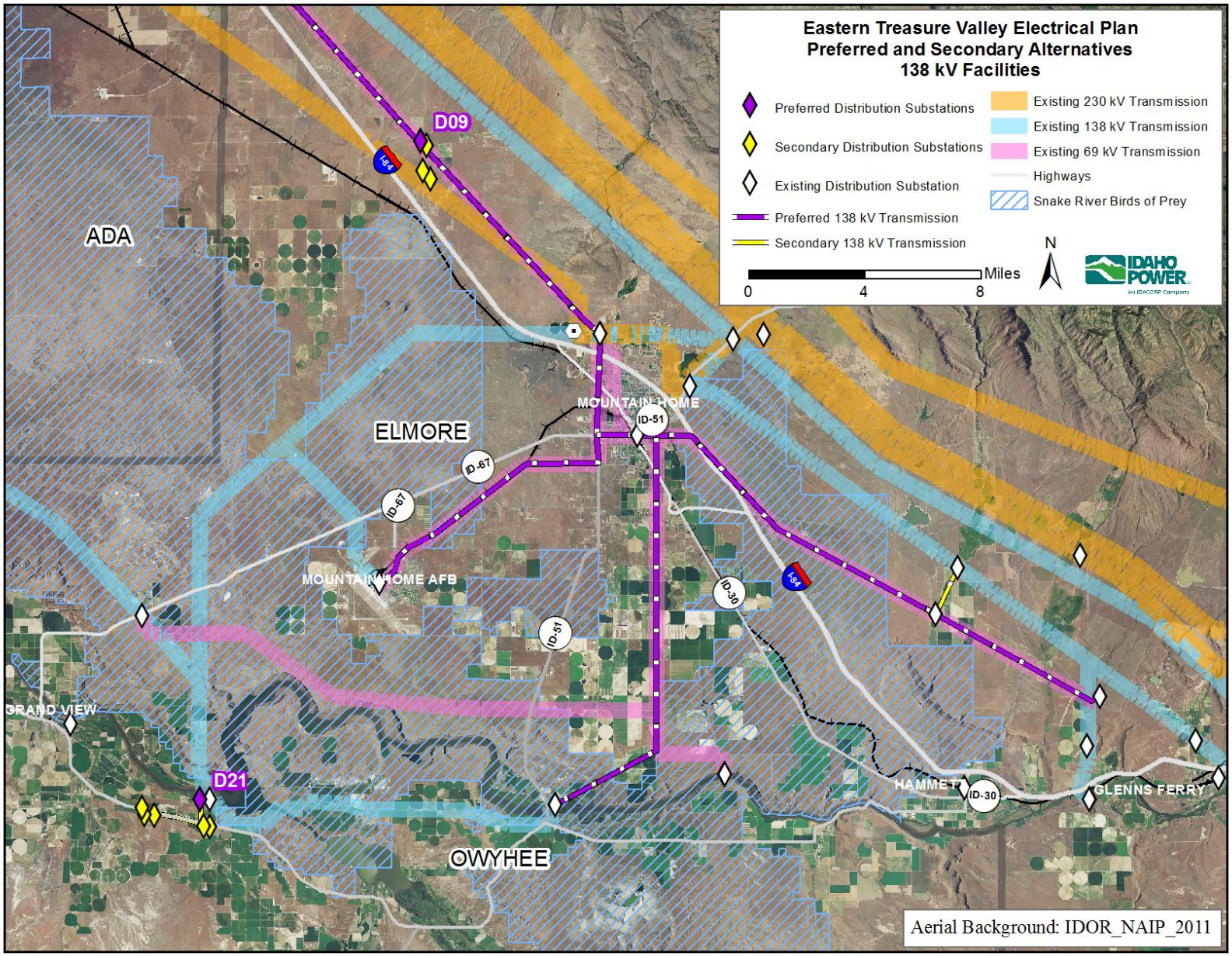

Figure 4: Elmore and Owyhee Counties Preferred and Secondary 138 kV Alternatives

Not all the facilities proposed by the Committee will be needed in the near term; facilities will be phased in based on load growth, reliability, system capacity, available budget, and Committee recommendations. If all or some parts of the preferred alternatives become unbuildable or unfeasible because of future constraints, the Committee identified some secondary alternatives that are also acceptable. Idaho Power will pursue the secondary alternatives as necessary to meet future electrical service requirements. Additionally, Idaho Power will make every effort to honor the Committee's *Guiding Principles and Community Criteria* when siting new infrastructure. Details for the preferred and secondary options are found in the body of this report in the *Committee's Preferred Alternative* section.

The Eastern Treasure Valley Electrical Plan is conceptual, and is the first step in planning for new and upgraded transmission lines and substations. Individual projects resulting from this plan will still require jurisdictional approval and will be subject to the public siting process. Before IPC does any siting or places infrastructure, open houses and perhaps community meetings (for projects that have significant local impact) will be held to provide information and gather input on specific proposed projects. Substations and transmission lines associated with this plan are subject to change due to land availability, jurisdictional objections, or other needs discovered during the project development phase. This first step, however, will give the jurisdictions and citizens advance notice as to where high-voltage transmission facilities may be located, and will allow the jurisdictions and citizens to plan accordingly. It is also IPC's request that this plan be incorporated into jurisdictional comprehensive plans.

In preparing the Eastern Treasure Valley Electrical Plan, IPC has accounted for the anticipated effect that energy efficiency will have on future electrical load in the eastern Treasure Valley. Idaho Power is committed to reducing electrical load through the use of energy efficiency at all customer levels. In conjunction with activities outside Idaho Power's control — such as expected improvements in local building standards, customer involvement, distributed generation, and energy efficiency technology advancements — Idaho Power expects *new* electrical load will be significantly reduced between now and the time the area is built out. That is, on a per capita basis, the rate of electrical load growth will be much slower when compared to today's load growth. Appendix B of this report discusses the various energy efficiency programs offered by Idaho Power.

The minimum estimated cost in 2012 dollars for the infrastructure identified in the preferred alternatives in this plan to serve the projected buildout load is approximately $300 million. Future changes in technology may make some of these improvements unnecessary or, at least, delay their need. These types of shifts, however, are difficult to predict. Idaho Power will monitor these potential shifts, recognizing that external forces can force change in even the best plans. The Eastern Treasure Valley Electrical Plan is a flexible plan that will be maintained and kept viable through continued public involvement.

Idaho Power sincerely thanks every member of the Community Advisory Committee. The time and effort the Committee gave to this project will enable IPC to go forward with plans to serve the eastern Treasure Valley and gain public acceptance of the specific pieces that must, through further public collaboration, be put in place to make this plan a reality. This Plan is a result of the Committee's efforts and will serve as the basis for further studies to refine, stage, and request permitting for future infrastructure improvements in the eastern Treasure Valley.

Introduction

The eastern Treasure Valley, as defined in this Plan, is the Idaho Power service area contained within Ada and Elmore counties and the Grand View area of Owyhee County. The Idaho Power electrical facilities serving these counties are part of an interconnected system that relies on a diversity of sources to provide a reliable source of electricity. This diversity comes in the form of multiple generation resources, multiple substations, and redundant transmission lines that deliver power from the generators and between the substations.

Population growth has slowed in the past few years due to the economic downturn resulting in a slowing in electrical load growth. However, growth is picking up with commercial building leading the way. Along with a renewed growth, the eastern Treasure Valley is becoming more and more dependent on a reliable electric supply as is happening across the United States. It is important that the electrical system keeps pace with growth and increasing reliability demands and does not deter the growth this region depends upon.

The electrical needs of the eastern Treasure Valley can be described using two separate though interrelated concepts: *reliability* and *capacity*.

- The first concept is *reliability*. If the power goes out, the inconvenience the outage causes increases more and more every year. To maximize its reliability, an electrical system must be redundant; that is, more than one transmission line must serve an area so that if one line is damaged, the other can still provide the electricity.

- The second concept is *capacity.* Capacity describes the maximum amount of power an electrical system can carry. An electrical system must have adequate capacity to serve the maximum electrical load, which, in the eastern Treasure Valley, occurs early to mid-summer. The maximum or peak electrical demand occurs when irrigation load is greatest, when the weather is hot and when air conditioner usage is also high. Today, Idaho Power's energy supply feeding into the eastern Treasure Valley is adequate to serve the peak load. As load continues to grow, reinforcements and additions will be required to serve the increasing load.

To plan the future transmission and substation infrastructure for the eastern Treasure Valley and to ensure a reliable and adequate electrical supply, Idaho Power invited members of the eastern Treasure Valley community to be involved in a Community Advisory Committee (Committee) to develop the Eastern Treasure Valley Electrical Plan (ETVEP). The ETVEP outlines the electrical infrastructure needs of the area from today through the area's population and load buildout. The Committee included local elected officials, city and county planning representatives, agricultural interests, Idaho Department of Fish and Game and BLM representatives, economic development representatives, developers, industrial representatives, and community members. The inside cover of this report lists the complete roster of Committee members. This report documents the study process and the Committee's consensus recommendations pertaining to the power system serving the eastern Treasure Valley.

From 2005 through 2006, Idaho Power convened a community advisory committee to site buildout facilities for the Treasure Valley and named the plan the Treasure Valley Electrical Plan (TVEP). The TVEP laid out 230 kV and 500 kV substation locations and transmission line routes in Ada, Canyon and Owyhee counties in Idaho and Malheur County in Oregon. The TVEP did not consider 138 kV facilities. The Eastern Treasure Valley Electrical Plan uses the TVEP 230 kV substation locations and 230 kV transmission line routes as a starting point to plan 230 kV hub substation and transmission line routes with the Committee confirming nearly all locations sited in the TVEP.

From 2010 through 2011, Idaho Power convened another community advisory committee to site 138 kV and 230 kV facilities in the western part of the Treasure Valley (including Canyon, Gem, Owyhee, Payette and Washington counties in Idaho and Malheur County in Oregon). Like the ETVEP, the Western Treasure Valley Electrical Plan (WTVEP) used the TVEP 230 kV substation locations and transmission line routes as a starting point in planning their 230 kV hub substation locations and transmission line routes and also the WTVEP committee confirmed nearly all the locations sited in the TVEP. Taken together, the ETVEP and the WTVEP form the basis of a Treasure Valley encompassing plan that ties the power systems between the two plans together.

Background

Existing Population and Electrical Load

Idaho Power Company (IPC) currently serves a population of 439,450 people in the three-county eastern Treasure Valley area (2011 numbers).

The highest power demands in the eastern Treasure Valley area occur in the summer, and the peak historic electrical load consumed by this population is 1,078 MW. The electrical system must be designed to supply summer peak loading because of the added stress on electrical equipment caused by high ambient temperatures and higher demand. Therefore, all studies, projections, and requirements described in this plan are designed to meet the projected summer peak buildout demands. The population and electrical load (MW) breakdown by county is shown in Table 2 below.

Table 2: 2011 Eastern Treasure Valley Population and Electrical Demand served by Idaho Power Company

County	2011 Population	Peak Summer Electrical Demand (MW)
Ada	400,680	915
Elmore	27,270	132
Owyhee*	1,150	31
Total	**429,100**	**1078**

* Only the portion of Owyhee County included in the defined eastern Treasure Valley Area (Grandview Area)

Eastern Treasure Valley Growth

Electrical load growth calculations for the Eastern Treasure Valley Electrical Plan were performed using a spatial load forecasting approach, and then a time frame was added to project when buildout would be achieved. The spatial growth approach was based on the comprehensive plans and current zoning and land use maps for the three counties (Ada, Elmore, and Owyhee counties). Current zoning for the cities of Boise, Eagle, Garden City, Glenns Ferry, Kuna, Meridian, Mountain Home, and Star were also used in the study. The projected timeframe for buildout used a population growth approach based on county economic development growth projections developed by Idaho Economics, and then extended those by assuming a uniform growth rate.

Spatial Growth Approach

The spatial growth method involved accessing the jurisdictional comprehensive plans, reviewing the existing zoning laws, and assigning a load density in megawatts per square mile (MW/mi^2) to each zoning area. "Buildout" is defined as the point in time when all available land is developed according to the land use ordinances. Modifications were made to existing land use maps to better approximate the buildout of the three counties. These modifications were based on the following assumptions:

- Agriculture zones within any city area of impact will be developed into a mix of residential and commercial loads.
- Commercial development will concentrate along transportation corridors.
- Development occurs to the maximum allowed load density per zone. That is, complete fill-in is assumed.

Zoning load densities were estimated based on existing built-out areas in the Idaho Power service area. For residential zones, 2 to 10 kW per lot was used to calculate residential load density, depending on the zoning. Table 3 shows the specific kW per dwelling (zones values) assigned to each. It is noted that Boise City's zoning designations are different than other jurisdictions for single family residential zones and Idaho Power planners took these differences into account during the study process. However, it has been determined that load densities in the Boise foothills may not be as high as originally estimated, though the overall affects on the study are minimal.

Table 3: Load Density Assignments for Residential Zoning

Zone	kW/lot
Large Estate Residential	10
Single Family Residential	4.5
Multi-family Residential	2

Much of the land in the eastern Treasure Valley area is publicly owned (mostly BLM) and it was assumed that there would be no development on these publicly-owned lands.

Multiplying the load density (MW/mi^2) for each zoning class by the total area associated with each zoning class (private land only) results in an estimate of the total load in megawatts (MW) for each zoning class. Finally, the total IPC eastern Treasure Valley buildout load was calculated by summing the total load for all the zoning classes. This approach resulted in a total buildout load of 3,995 MW. For general purposes, 4,000 MW is the assumed buildout load. Table 4 details the projected buildout electric load by county. Appendix F contains the detailed load density numbers used in the calculations.

Table 4: Projected Eastern Treasure Valley Electrical Demand

County	Projected Buildout Electrical Demand (MW)
Ada	3,500
Elmore	360
Owyhee*	135
Total MW	**3,995**

* Only the portion of Owyhee County included in the defined eastern Treasure Valley Area (Grandview Area)

Projected Buildout Timeframe

The projected buildout timeframe utilizes county population and household growth projection numbers developed by John Church, President of Idaho Economics, which projects population

out to the year 2041. Historic and projected population and household growth rates are shown in Table 5. Population and electric load growth will continue throughout the eastern Treasure Valley service area. It is expected that buildout growth will eventually be limited by the amount of private, buildable land and the availability of water. Therefore, it is assumed that for the near future, growth rates will be similar to the growth rate of the past 25 years. Over the long run, growth rates will gradually slow down as the amount of developable land and available water diminish. A conservative constant average annual growth rate after the year 2041 of 1.0% was used to estimate the buildout population values.

Table 5: Eastern Treasure Valley Population Growth

County	Previous 10 Year Annual Population Growth Rate	Previous 25 Year Annual Population Growth Rate	Next 25 Year Annual Population Growth Rate	Growth Rate to Buildout Population
Ada	2.46%	3.01%	1.49%	1.18%
Elmore	-0.61%	0.94%	-0.18%	0.82%
Owyhee*	0.56%	1.27%	0.50%	0.72%
Eastern Treasure Valley Total	2.23%	2.83%	1.40%	1.00%

*Only the portion of Owyhee County included in the defined eastern Treasure Valley Area (Grandview Area)

The population of the eastern Treasure Valley is projected by Idaho Economics to be about 607,000 people by the year 2036. For the eastern Treasure Valley area, the current average power demand is about 2.5 kW per person. As more and more irrigated farm land is developed into residential and commercial subdivisions, the total electric demand will increase, but the average electric demand per person will tend to decline. On the other hand, as large industrial users of electricity expand or locate into the region, the average power use per person tends to increase. Therefore, assuming a relatively constant average power use per person in each of the three counties in the study area is reasonable. Using an average demand of 2.5 kW per person, the 4,000 MW projected buildout load would support a population of approximately 1.6 million people. It is projected, using present and future growth rates, that the eastern Treasure Valley will reach this population value in approximately 120 years (from 2011) or in the year 2131. Table 6 shows 2011 and projected buildout population and power use per person by county.

Table 6: Eastern Treasure Valley Population by County, Current and at Buildout

County	2011 Population	2011 kW/person	Buildout Population
Ada	400,680	2.3	1,500,000
Elmore	27,270	4.8	75,000
Owyhee	1,150	27.0	5,000
Eastern Treasure Valley Total	429,100	2.5	1,600,000*

*Approximation

Potential variations in the spatial growth approach could result from future zoning changes, and developers choosing to develop at a lower density rather than at the maximum density allowed by the zoning laws. The population growth results will vary because of economic and political changes in the area and other potential limits such as limited water, limited developable land or limited transportation. The Committee's work and this report assume an eastern Treasure Valley buildout power demand value of 4,000 MW.

Existing Eastern Treasure Valley Electrical Supply System

The power supplied to the eastern Treasure Valley electrical system is provided primarily by high-voltage transmission lines connected to generation located outside the area. The only significant generation facilities located within the study area are the Evander Andrews (Danskin) and Bennett Mountain generation plants; both located in Mountain Home. There are other small, privately-owned power plants in the region including generation located at Lucky Peak Reservoir. These generators can supply only a small portion of the electric demands in the eastern Treasure Valley and most of the power that serves the area must be transported in via high-voltage transmission lines. The generation within the area also requires transmission to transport the electrical energy to the load.

Figure 5 (on Page 19) shows existing transmission and substation facilities in the eastern Treasure Valley. Idaho Power serves this area via 230 kV transmission from three source substations: Boise Bench, Danskin, and Hemingway substations.

- *Boise Bench Substation* – Located in southeast Boise, Boise Bench is served by seven 230 kV transmission lines. Four 230 kV transmission lines feed in from the Hells Canyon generation complex and three 230 kV transmission lines feed in from Idaho Power generation to the east.
- *Danskin Substation* – Located in Elmore County, Danskin Substation is connected to the Midpoint and Boise Bench substations on one side and the Hubbard Substation on the other. It is also connected to natural gas combustion turbine generators.
- *Hemingway Substation* – Located in Owyhee County, Hemingway Substation is connected to the PacifiCorp 500 kV transmission line and primarily receives power from Idaho Power's eastern generation.

From these three source substations power is fed into hub substations where the voltage is stepped down for further delivery into the Treasure Valley via 138 kV and 69 kV sub-transmission lines. The four hub substations in the eastern Treasure Valley area are Boise Bench, Locust, Bowmont, and Danskin substations.

- *Boise Bench Substation* – This substation acts as both a source and a hub substation. Five 138 kV and three 69 kV sub-transmission lines originate from Boise Bench Substation and carry power to numerous distribution substations.
    - It is rated at 896 MW capacity.
    - It provides about 510 MW to the eastern Treasure Valley on a summer peak day.

- *Locust Substation* –Two 230 kV transmission lines carry power to the Locust Substation with three 138 kV sub-transmission lines delivering power to numerous distribution substations.
    - It is rated at 600 MW capacity.
    - It provides about 260 MW to the eastern Treasure Valley on a summer peak day.
- *Bowmont Substation* – Located near Melba, power is fed into Bowmont Substation by a single 230 kV transmission line that originates from Hemingway Substation. From Bowmont Substation, power is fed to eastern Treasure Valley distribution substations via two 138 kV sub-transmission lines.
    - It is rated at 300 MW capacity.
    - It provides about 140 MW to the eastern Treasure Valley on a summer peak day
- *Danskin Substation* – Located in Mountain Home, power is fed into Danskin Substation via two 230 kV transmission line to the Midpoint, Boise Bench, and other substations from the west. From Danskin Substation, power is fed to numerous distribution substations on two 138 kV sub-transmission lines.
    - It is rated at 300 MW capacity.
    - It provides about 73 MW to the eastern Treasure Valley on a summer peak day.

There are 53 existing distribution substations in the eastern Treasure Valley serving the 12.5 kV and 34.5 kV distribution lines feeding power to customers. Of these 53 substations, 44 are fed from the 138 kV system and 9 are served from the 69 kV system.

Existing System Reliability

Idaho Power strives to provide reliable, responsible, fair-priced energy services to its customers. Beyond Idaho Power's desire to provide reliable energy, it must also comply with regulations set forth by the North American Electrical Reliability Council (NERC) which is tasked by the federal government with developing and enforcing reliability requirements.

The 230 kV transmission lines serving the eastern Treasure Valley area must provide a high level of reliability and must adhere to N-1 reliability criteria for main grid transmission. This means that for multiple transmission lines delivering power to the same point, if one of the lines goes out of service, the remaining line or lines must be able to carry both the load they were carrying before the event as well as the load carried by the line that is out of service. See Appendix G for a more detailed explanation and example of the N-1 criteria.

The sub-transmission (138 kV, 69 kV and 46 kV) system located within the eastern Treasure Valley is not generally required to perform to the same federal standards as is the main grid transmission. IPC does, however, endeavor to maintain the system in a state that maximizes its reliability while keeping power rates reasonable to all customers. Currently, the 138 kV sub-transmission system in the eastern Treasure Valley area provides redundant service to most of the substations connected to the 138 kV system. The 69 kV sub-transmission tends to serve more remote, outlying areas and is not as redundant as the 138 kV system. The 69 kV system has capacity to serve all the existing customers when all lines and stations are operating normally, even under peak load conditions. However, if there is a failure of a 69 kV sub-transmission line that has no redundant feed, customers will be without power until repairs can be made.

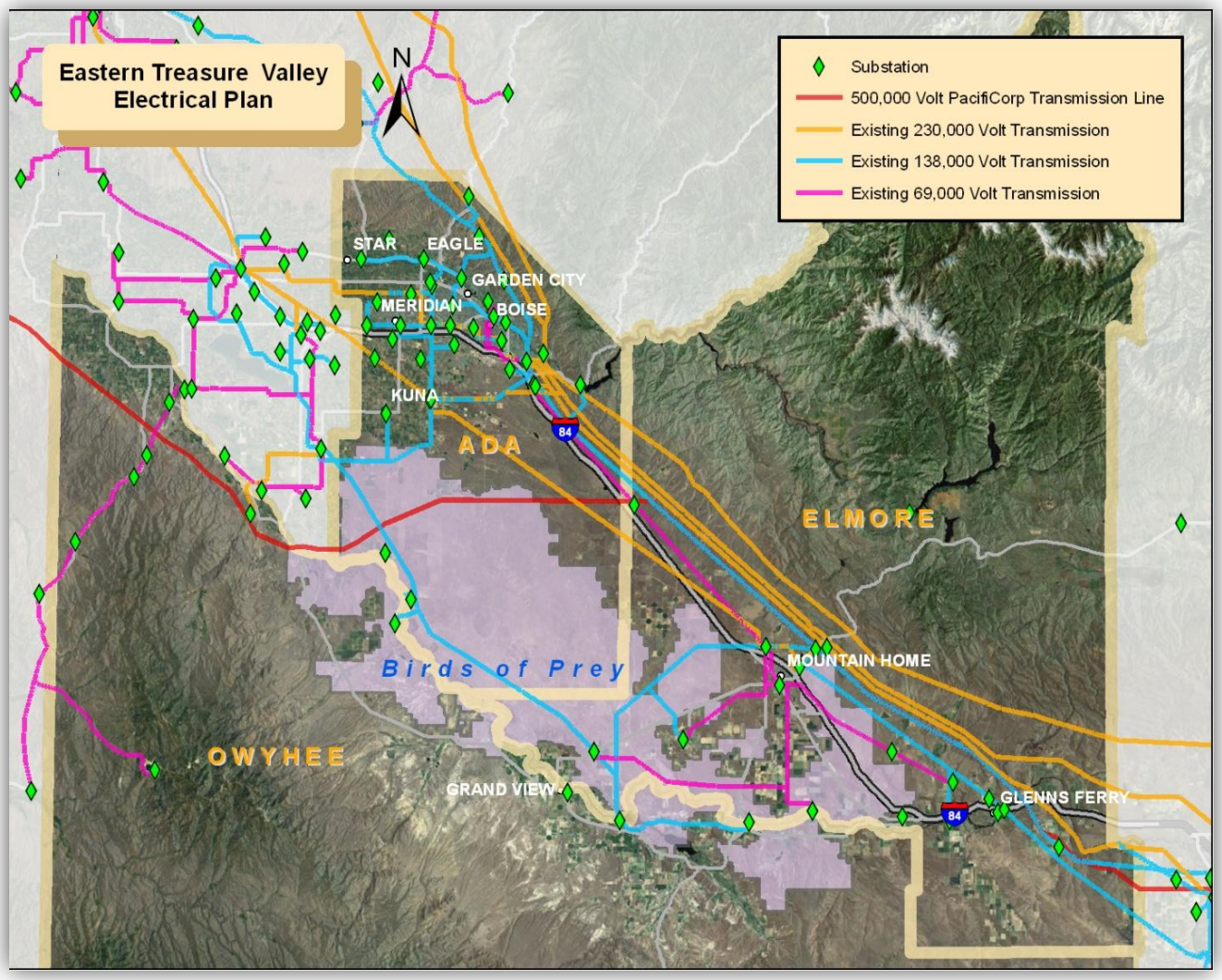

Figure 5: Eastern Treasure Valley Electrical Supply Overview Map

Committee Process and Input

Idaho Power engaged RBCI of Boise, a public process consulting firm, to facilitate the Community Advisory Committee meetings. The meetings began in October, 2011, with a general education session followed in November with a bus tour of generation and transmission facilities. The following two months were also devoted to providing the Committee a good background as relates to electrical power systems. Through these educational sessions, the Committee was introduced to the concepts of electrical power generation, transmission, substations, energy efficiency, and regulatory affairs. Additionally, the Committee was introduced to IPC's electrical system from production to delivery. Using the information gained from the first four meetings, the Committee set out in February, 2012, to lay out proposed 230 kV and 138 kV substation locations and transmission line routes to serve the eastern Treasure Valley through buildout.

- *Meeting 1 (October 2011):* This first meeting provided an orientation to the project and an education session concerning basic electrical concepts, an overview of IPC's electrical system, electrical power generation, transmission lines and substations.
- *Meeting 2 (November 2011):* This full-day meeting consisted of tours of the Bennett Creek/Hot Springs wind turbine facility and the Danskin combustion turbine power plant, both located near Mountain Home. Additionally, the Committee was shown the Mountain Home Substation in Mountain Home. While in-transit between the electrical facilities, the Committee discussed the various electrical transmission lines and substations passed along the way.
- *Meeting 3 (December 2011):* Continuing the education series begun in Meeting 1, the Committee learned about IPC's pricing and regulatory process as well as IPC's energy efficiency programs. The Committee was also presented information concerning the existing population and electrical conditions in the eastern Treasure Valley. A group discussion was held to begin creating a set of guiding principles and community criteria to be used in the future mapping sessions after which the Committee separated into smaller groups to discuss specific Committee issues and concerns to further refine the guiding principles and community criteria.
- *Meeting 4 (January 2012):* During this session, the Committee reviewed and modified the draft list of the guiding principles and community criteria it began in Meeting 3. IPC gave presentations concerning planning for the eastern Treasure Valley electrical needs, the projected buildout of the area, and the transmission and substation components needed to meet the buildout needs.
- *Meeting 5 (February 2012):* The Committee continued to modify its guiding principles and community criteria it developed in Meetings 3 and 4. After an orientation, the Committee separated into small groups to begin mapping alternatives for substation and transmission line placement in the eastern Treasure Valley. The small groups ended the session by reporting to the entire Committee the alternatives they had begun to develop.
- *Meeting 6 (March 2012):* The Committee continued the mapping work begun in Meeting 5. Once the mapping was complete, the individual groups reported their results to the full Committee.
- *Meeting 7 (April 2012):* The Committee completed its small group mapping exercises. Each small group reported to the entire Committee the alternatives they had developed.

- *Meeting 8 (May 2012):* IPC provided technical feedback to the initial set of alternatives developed by the small group mapping sessions in Meetings 5 through 7. The Committee then began the process of identifying preferred and secondary alternatives for each substation and transmission line to be used in the buildout plan.
- *Meeting 9 (June 2012):* Continuing the process that began in Meeting 8, the Committee further refined the list of preferred and secondary alternatives. A list of preferred alternatives for all areas was developed and finalized.
- *Meeting 10 (September 2012):* The Committee was convened for a final meeting to present the draft plan developed by IPC and to give the Committee an opportunity to make changes to the report. The Committee and IPC discussed how to implement the Eastern Treasure Valley Electrical Plan as well as how to integrate the Plan into jurisdictional comprehensive plans.

Alternative Energy Generating Technologies

During the generation education session in October, 2011, the Committee received information regarding alternative generation technologies. This presentation, and the discussion that followed, outlined various alternative energy generating technologies that could possibly be used to meet the energy needs of the eastern Treasure Valley or to reduce the need for future transmission lines. The technologies discussed included wind turbines, solar (photovoltaic and thermal), geothermal generators, combustion turbines, and fuel cells. A more detailed description and discussion concerning alternative energy generating technologies can be found in Appendix A.

IPC currently purchases the output of many alternative energy generators in its service area. The amount of energy produced by renewable resources and delivered onto the IPC system is rapidly increasing. IPC currently contracts for the entire output of wind generation projects in Idaho near Hagerman and Mountain Home as well as wind generation projects in northeastern Oregon near North Powder. The output of the Raft River geothermal project in eastern Idaho is also purchased by IPC as is the output from the Neil Hot Springs geothermal project near Vale, Oregon. Additionally, new wind turbine facilities are being brought on-line near Hagerman and Burley, with more planned in other areas in the next few years.

One large scale solar-generation project is also planned in the IPC service area in the next couple of years. Two methane digester generation projects at large dairies in the Magic Valley are currently operating and several more digesters are planned at other large dairies and feedlots in the region.

IPC, in a joint venture with PacifiCorp, is planning to build 500 kV transmission lines into Idaho from Wyoming that will enable the wind resources in Wyoming to be developed and transported to the region. Additionally, the Boardman to Hemingway 500 kV transmission line will transport energy into the eastern Treasure Valley, much of which will be produced by wind turbines along the Columbia River. It should be noted that all of the above technologies will still require that more transmission lines and substations be built in the eastern Treasure Valley to deliver the energy within the area.

Distributed Generation
Small-scale solar (roof-mounted photovoltaic), small wind turbines, and residential-sized fuel cells could reduce the need for, or serve as an alternative to, new transmission and substation facilities in the eastern Treasure Valley. In this respect, these technologies could be referred to as distributed generation because they distribute the generation so it is nearer to the load and thus reduce the need for more transmission. Idaho Power currently has a generous Net Metering tariff (Schedule 84) in place that allows residential customers to connect a small generator, up to 25 kilowatts, and commercial customers up to 100 kilowatts, to the customer side of the meter that can serve to reduce the customer's metered energy use and can even result in credits back to the customer if the generated energy exceeds the energy used. Dozens of small-scale wind and photovoltaic projects at homes and businesses are currently operating under this tariff. Continued growth in the numbers of these systems could reduce or delay the need for additional transmission lines and substations.

Energy Efficiency

The aggressive implementation of energy efficiency technologies in the eastern Treasure Valley could reduce or delay the need for additional transmission. IPC is currently providing many programs to promote energy efficiency and reduce electricity usage. These programs are funded by a Customer Conservation Charge added to customer bills. The number and scope of these programs continues to grow. For example, in 2010, the IPC system-wide energy savings from energy efficiency was over 180,000 megawatt-hours (MWh) compared to under 20,000 MWh in 2002; a nine-fold increase. Energy efficiency programs from both the existing portfolio and new program opportunities included in the 2011 Integrated Resource Plan (IRP) are forecast to reduce average load by 233 MW by 2030.

Demand response is a subcategory of energy efficiency and is designed to reduce the peak demand on the power system during summer peak hours. Examples of demand response programs include the residential A/C Cool Credit program and the agricultural Irrigation Peak Rewards program. In 2012, Idaho Power's demand response programs are expected to reduce peak-hour load by 330MW. Table 7 shows the current IPC programs. A complete description of the various energy efficiency programs offered by Idaho Power can be found in Appendix B.

Table 7: Idaho Power Energy Efficiency Programs

Residential	Commercial/Industrial/Irrigation
A/C Cool Credit	Irrigation Peak Rewards
Weatherization Assistance	Irrigation Efficiency
Rebate Advantage	Building Efficiency
Energy Star® Homes	Easy Upgrades
Energy Efficiency Lighting	Custom Efficiency
Energy House Calls	Flex Peak Management
Heating and Cooling Efficiency	
Home Improvement	
Home Products	
See Ya Later Refrigerator	
Energy Efficiency Education	

Additionally, Idaho Power has rates that vary by season in Idaho, with summer electricity rates being higher than winter rates, to encourage lower energy use in the summer when the overall electricity usage on the IPC system is greatest. In both Idaho and Oregon, IPC has tiered rates that increase as energy use increases.

Idaho Power is now offering a Time Of Day rate plan (on a limited basis) that encourages, through price incentives, customers to use less energy during peak times such as afternoon and early evening.

Transmission Characteristics

The Committee was provided construction cost estimates for the various types of transmission lines, by voltage, that are typical to the IPC system. Table 8 shows these costs. Note that the right-of-way widths shown in Table 8 are for total right-of-way requirements, not width from center line. The transmission line cost on a per mile basis does not include costs for rights-of-way.

Table 8: Estimated Overhead Transmission Costs for Various Voltage Levels

Voltage	Type	$/mi	ROW (ft)
230 kV	Overhead, H-Frame	400k to 500k	120
230 kV	Overhead, Single Pole	500k to 600k	70
138 kV	Overhead, H-Frame	300k to 400k	100
138 kV	Overhead Single Pole	400k to 500k	50

Underground transmission characteristics were also discussed. Costs for underground 138 kV transmission lines are generally 10 times the costs of overhead 138 kV transmission lines or about $3,000,000 per mile. While IPC does have an extensive underground distribution system, it has no underground transmission within its service area. IPC uses the most cost-effective method for transmission construction, and should any entity desire a transmission line be underground, they will be required to pay the difference between the overhead line costs and underground line costs. This practice is supported by the Idaho Public Utilities Commission. Figure 6 shows a comparison of various typical transmission tower and distribution pole heights used by IPC. These heights are representative of various tower and pole designs, but do not include all possible designs. Using different designs, the towers and poles can be shorter or taller than shown. Additionally, if a tower or a pole is placed in hilly terrain, it will sometimes be taller than shown to ensure adequate ground clearance for the lines. For example, a 500 kV transmission tower might go as high as 190 feet if it is located in hilly or mountainous terrain.

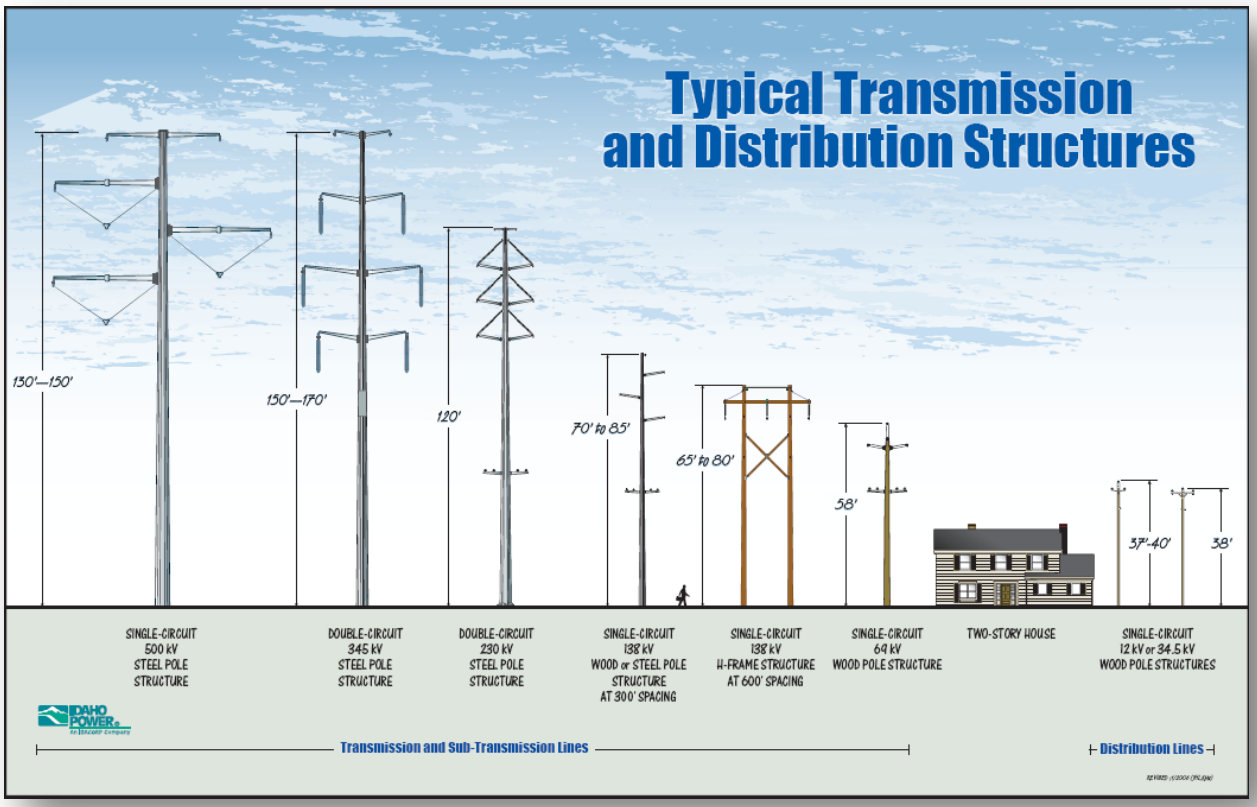

Figure 6: Typical Transmission and Distribution Structures

Substation Characteristics

In addition to transmission characteristics, the Committee was presented information concerning distribution substations and hub substations. A *distribution* substation is a relatively small substation located near the electrical load it serves that transforms (reduces) sub-transmission voltages to distribution voltages. In the eastern Treasure Valley, the sub-transmission voltage is either 138 kV or 69 kV and the distribution voltage is either 34.5 kV or 12.47 kV. A *hub* substation acts as the supply point for the 138 kV sub-transmission system. Power arrives at a hub substation at 230 kV and is stepped-down by transformers to 69 kV or 138 kV. Table 9 shows a comparison of distribution and hub substation characteristics.

Table 9: Substation Characteristics

Characteristic	Hub Substation	Distribution Substation
Supply Voltage	230 kV	69 kV or 138 kV
Land Required	5 to 10 acres	2 to 3 acres
Load Served	400 to 600 MW	40 to 80 MW
Cost	$7M to $10M	$2.5M to $4M

Guiding Principles and Community Criteria

As a first step in determining the feasibility of individual transmission line routes and substation locations, the Committee members created a *Guiding Principles and Community Criteria* document that set forth various measureable and non-measureable principles to guide their choices for the alternatives they would develop.

- **Guiding Principles** are key themes that serve as a foundation for making decisions concerning the eastern Treasure Valley electrical system.

- **Community Criteria** were used more specifically for locating transmission lines and substations by providing land use characteristics that are either more favorable or less favorable to electrical infrastructure siting.

The effort to define guiding principles and community criteria began in December, 2011, when the Committee separated into small groups facilitated by RBCI to discuss issues that are important to Committee members when planning to meet the eastern Treasure Valley's future energy needs. The small groups were asked to discuss the following questions:

- What are the principles important to you when siting future transmission lines and substations?

- Where should future transmission lines and substations be sited in your community?

- Are there areas in your community to avoid when siting future transmission lines and substations?

The issues recorded during the small groups' discussions were refined and synthesized by RBCI staff and were then formatted to fit into the "Guiding Principles" and "Community Criteria" format. The Committee used the *Guiding Principles and Community Criteria* when they developed the proposed siting alternatives. Both the Guiding Principles and Community Criteria represent the Committee's instructions and desires for IPC in implementing the plan and serving the communities in the eastern Treasure Valley area.

If the Committee's preferred substation and transmission line locations as shown in the Committee's Preferred Alternatives section of this report cannot be obtained, Idaho Power will use the Committee's *guiding principles and community criteria* for siting transmission lines and substations in the eastern Treasure Valley.

The final guiding principles were divided into 9 categories (listed in no particular order):

1. **Promote economic development**
    - Plan for potential growth (residential, commercial and industrial)
    - Recognize and promote the benefits of a healthy electric system
    - Encourage prosperity by working to ensure that our electrical system is ready to meet requests for future growth
    - Balance costs and rewards of economic development opportunities (i.e., the number of jobs provided versus amount of power needed for facility)

2. **Support existing businesses, property rights and land uses (e.g. historic sites, industries, Air Force Base)**
    - Accommodate existing growth
    - Plan for change in existing growth areas
    - Support future community development
    - Consider what would be impacted if a disaster were to occur
3. **Be sensitive to agriculture**
    - Take into account irrigation practices
    - Take precautions to minimize stray voltage at dairies and feedlot operations.
4. **Encourage positive interaction between communities**
    - Foster inter-jurisdictional communication regarding future electrical infrastructure needs to make the siting process easier and more successful
    - Be aware of neighboring communities' growth plans
5. **Comply with comprehensive plans**
    - Be flexible for future unplanned changes
    - Site infrastructure consistent with local agency plans
    - Actively participate in updates of comprehensive plans
6. **Be aware of environmentally sensitive areas**
    - Consider the Birds of Prey area
7. **Consider community character**
    - Take urban visual impacts into account
    - Avoid cutting communities in half
    - Be sensitive to each community's unique environment
    - Be sensitive to downtowns areas
8. **Continue to meet power needs and prepare for future unknowns**
    - Ensure all future electrical infrastructure is operational and reliable
    - Keep construction realistic
9. **Be as efficient as possible**
    - Consider monetary costs to all stakeholders
    - Take into account the impact of the line or substation
    - Consider upgrading existing infrastructure as much as possible

The Community Criteria were divided into two lists that provide guidance for the specific placement of substations and transmission lines. The first list shows areas that can be deemed favorable to electrical infrastructure placement (Table 10) while the second list includes areas that should be avoided (Table 11).

Table 10: Areas Where Future Infrastructure should be Sited

Industrial areas	Along rail corridors
Public lands	Areas where transmission and/or substations will be of the highest and best use
Near areas where energy is generated	Along irrigation and/or drainage facilities, where practical
Areas that need (or will need) more power	Underground where possible
Vacant areas	Buffer around military installations
Upgrade existing electrical infrastructure	Plan for change within existing growth areas
Along existing and/or planned electrical corridors	Canals (decisions will be made at the local level for this criterion)
Along transportation corridors and roadways	Subdivision areas (decisions will be made at the local level for this criterion)

Table 11: Areas to Avoid when Siting Future Infrastructure

Parks	Historically sensitive areas (e.g. intact sections of the Oregon Trail)
Schools	Already approved uses
High populated areas	Ridgelines
Irrigated farmland	Preserved foothills property
Airport approach zones	Foothills open space (both owned and anticipated
City corners	Gateway corridors
Near natural waterways and existing canals	Zoos
Sensitive wildlife habitats	Cemeteries
The Air Force Base and Base flight corridors	Historic properties, structures and buildings
Military training areas (e.g. Gowen Field, Owyhee County bombing ranges)	Low-lying areas that could be prone to flood every few years (for substation)
View sheds	Canals (decisions will be made at the local level for this criterion)
Pedestrian areas	Subdivision areas (decision will be made at the local level for this criterion)

Mapping Exercise

Building upon the information provided in the first four committee meetings, and using the *Guiding Principles and Community Criteria* document as a guide, the Committee was divided into four smaller teams at the February meeting to map out recommended substation sites and transmission line routes. The teams were given large aerial maps on which to place stickers (representing substations) and colored tape (representing transmission lines). Additionally, each team had access to computer-generated Geographic Information System (GIS) maps that were projected on the wall at each group's substation. The GIS data included:

- Facilities – IPC facilities located in the eastern Treasure Valley.
- Environmental – Habitat information on plants and animals plus land-use information such as agricultural land.
- Base Layers – Data included cities, roads, railroads and general land ownership.
- Zoning – Data included zoning designations from each major jurisdiction.
- Aerial – Data included aerial photographs of the entire region.

A complete list of the GIS data provided for the Committee use can be found in Appendix C.

IPC provided estimates of the electrical infrastructure required to meet the eastern Treasure Valley's buildout needs. The region was divided into three areas; north Ada, south Ada, and Elmore/Owyhee County. All three geographical areas — north Ada, south Ada, and Elmore/Owyhee — required additional hub substation capacity to meet the expected buildout demand. Also, to be able to deliver power to customers, the Committee was asked to locate 22 new distribution substations as well as the accompanying interconnecting transmission lines. The following details concerning substations were provided:

- Hub Substation
    - Requires 5 to 10 acres of land.
    - Serves 400 to 600 MW of load from each hub substation.
    - Costs between $7M and $10M to construct.
    - Requires a minimum of two high voltage lines (230 kV) for each hub substation.
    - Two to four sub-transmission lines (138 kV) will feed out of each hub substation to deliver power to distribution substations.
- Distribution Substation
    - Requires 2 to 3 acres of land.
    - Serves 40 to 80 MW of load from each distribution substation.
    - Costs between $2.5M to $4M to construct.
    - Generally, distribution substations are placed near the center of their assigned service area so as to improve the efficiency of the distribution system coming out of the substation.

To help show where the load growth is expected to occur, maps were provided showing the electric load densities in the eastern Treasure Valley. Figure 7 shows the current electric load densities for the eastern Treasure Valley area (summer 2011). The higher load densities are found in and around the cities as shown by the darker coloring. The total existing eastern Treasure Valley area load total was 1,078 MW for the summer of 2011 with most of the load located in the darker areas around the cities. Figure 8 shows the corresponding load density map

for buildout and shows how the total expected 4,000 MW buildout load would be distributed throughout the area. While load growth is expected throughout the eastern Treasure Valley area, a quick comparison of these maps shows that the bulk of the load growth will still be near the cities. These maps begin to indicate to the Committee where they would need to site new substations and corresponding transmission lines.

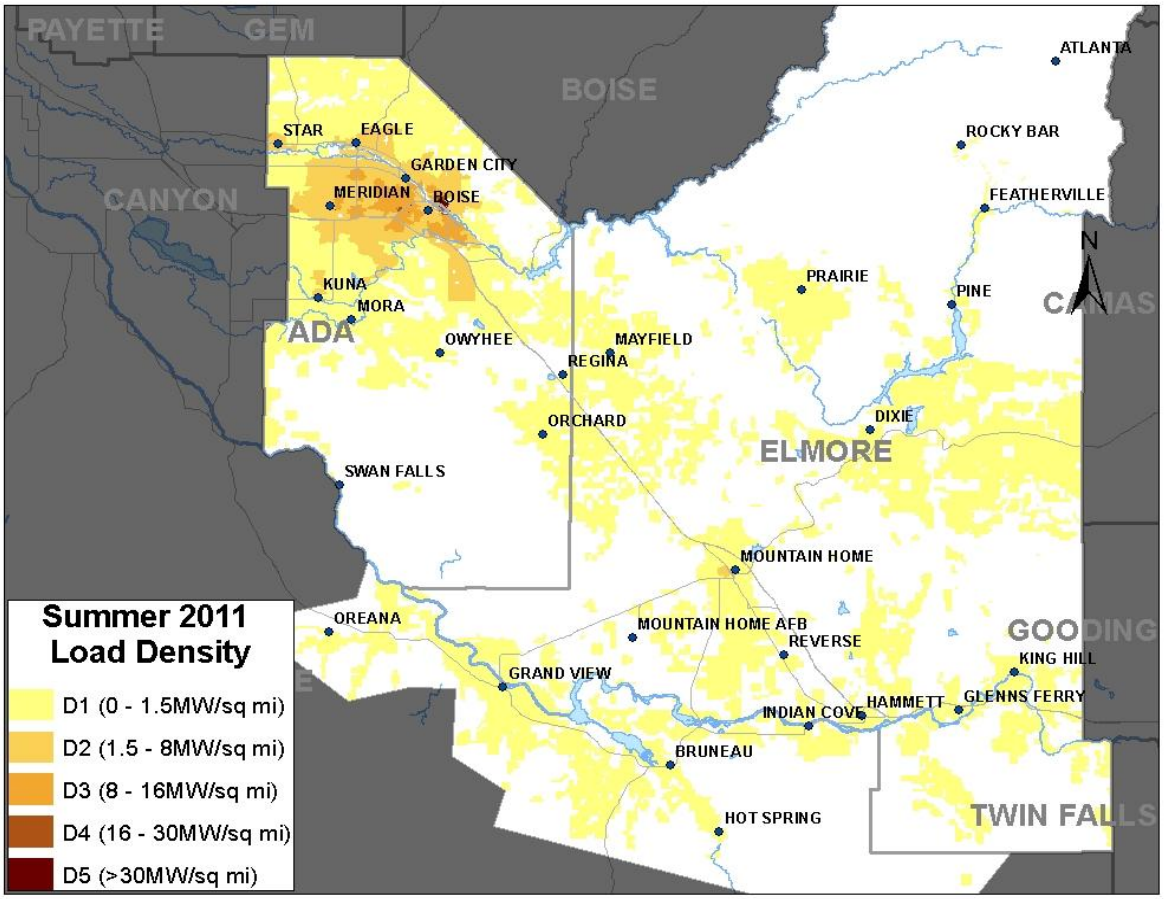

Figure 7: Summer 2011 Eastern Treasure Valley Load Densities – 1078 MW Total Summer Peak

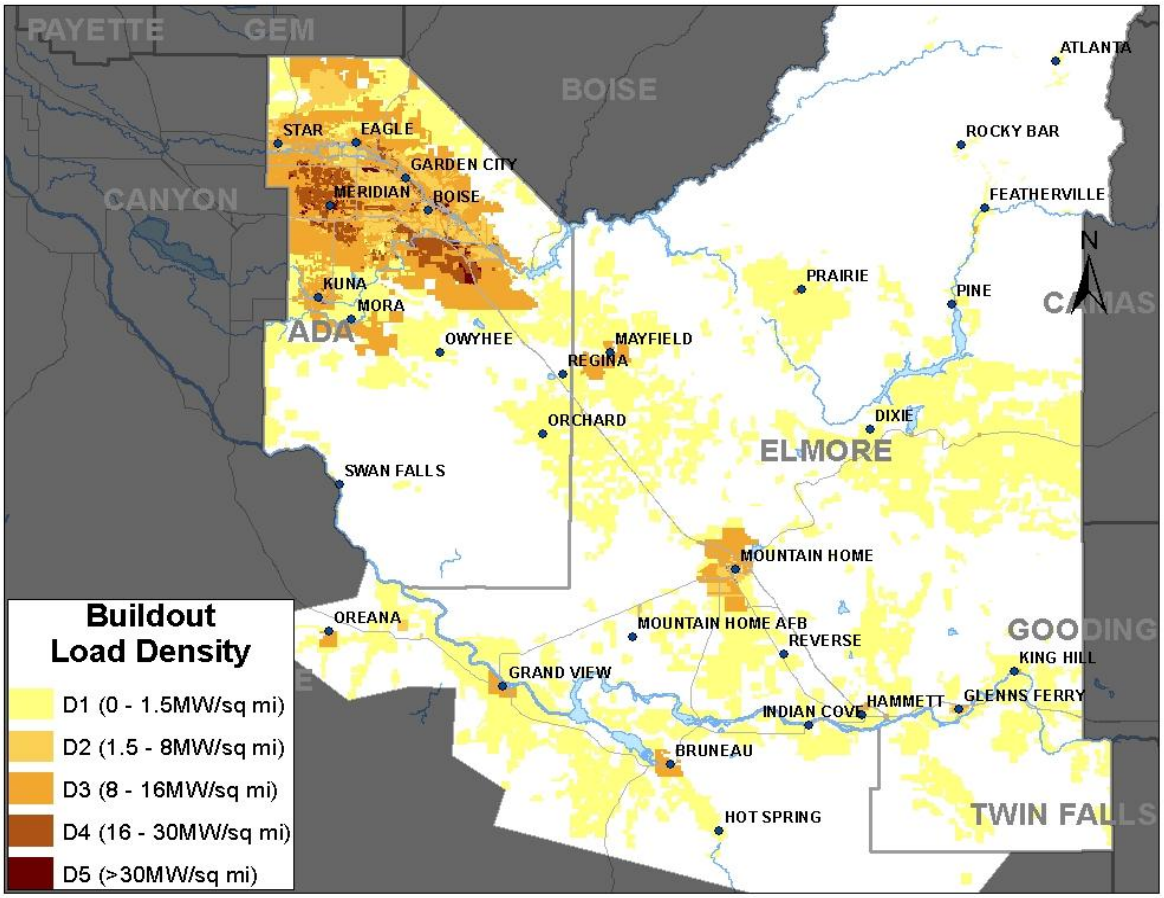

Figure 8: Eastern Treasure Valley Buildout Load Densities – 4,000 MW Total Summer Peak

To prepare for the mapping sessions, the Committee needed to understand the size and location of the electrical load anticipated at buildout. Then, they needed to know where and how the existing electrical system would be deficient in serving the buildout load. This information helped the Committee determine the amount and general locations of new and/or upgraded electrical infrastructure. It was then the Committee's responsibility to specifically determine new substation locations and transmission line routes. They were asked to specify which of the existing electrical facilities would be upgraded to handle the buildout demand.

In general, each of the small mapping teams followed a four-step process in designing their buildout system options.

1. Confirm hub substation locations specified in the Treasure Valley Electrical Plan conducted in 2006 or site new hub substation locations.
2. Confirm 230 kV transmission line routes specified in the Treasure Valley Electrical Plan or determine new 230 kV transmission line routes in and out of the hub substations.
3. Site 22 distribution substations:
    a. Eight in the north Ada area.
    b. Twelve in the south Ada area.

c. Two in the Elmore/Owyhee area.

4. Determine 138 kV sub-transmission line routes required to connect distribution stations to hub substations and to each other as necessary.

The first step to create a power system to serve the buildout electrical demand was to determine the location of the hub substations.

Figure 9 shows the existing hub substation capacity and buildout load requirement. The eastern Treasure Valley area needed additional hub substation capacity to cover the anticipated 1,904 MW deficit and meet the expected buildout demand. Each of the four small mapping groups then determined how they would reliably meet the hub substation capacity requirements, either confirming the results of the Treasure Valley Electrical Plan, siting new hub substations, or upgrading existing hub substations.

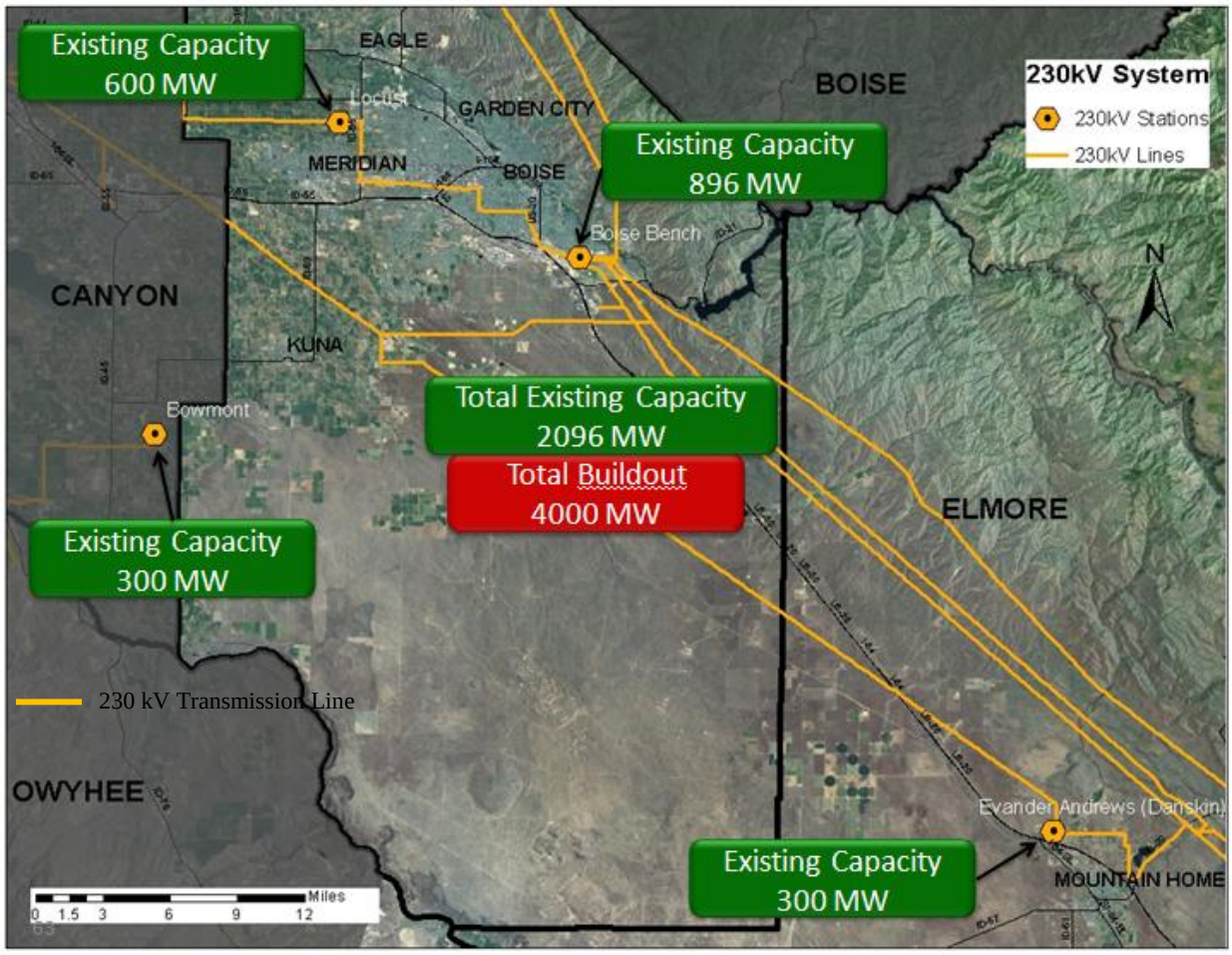

Figure 9: Existing Hub Substation Capacities and Buildout Load Requirements

Once the hub substations were placed, each group was tasked with confirming the 230 kV transmission line routes defined in the Treasure Valley Electrical Plan or siting new 230 kV transmission line routes to serve the hub substations. Each hub substation is required to have at least two high voltage transmission lines to provide a reliable, redundant source to the substation.

The next step in the mapping process was to place new distribution substations within the areas. Again, maps were provided to help the Committee understand where the existing distribution stations would be deficient in meeting buildout electrical demand. The eastern Treasure Valley study area was divided into three areas for this discussion as shown in Figure 10. Maps for each area were provided that showed the existing capacity and buildout load requirements for each distribution substation. In areas where a new substation will be required at buildout, the expected buildout load requirement for that substation was also provided. Figures 11, 12, and 13 show the diagrams for the north Ada, south Ada, and Elmore/Owyhee areas, respectively. In these figures, yellow circles indicate IPC-recommended general locations for distribution substations.

Figure 10: Eastern Treasure Valley Area

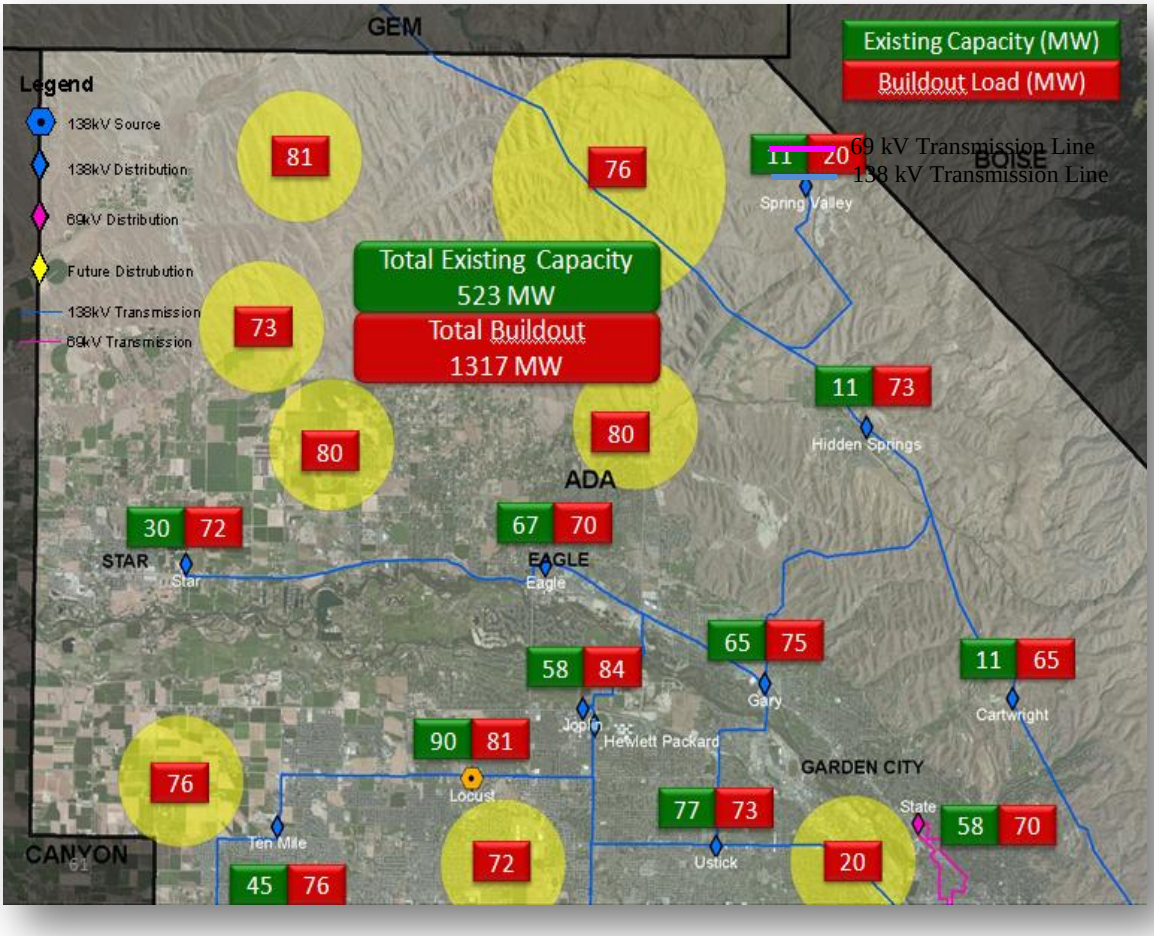

Figure 11: North Ada Area Buildout Distribution Substation Requirements

The total existing distribution substation capacity in the north Ada area is 523 MW. The total buildout distribution substation capacity needed at buildout is projected to be 1,317 MW.

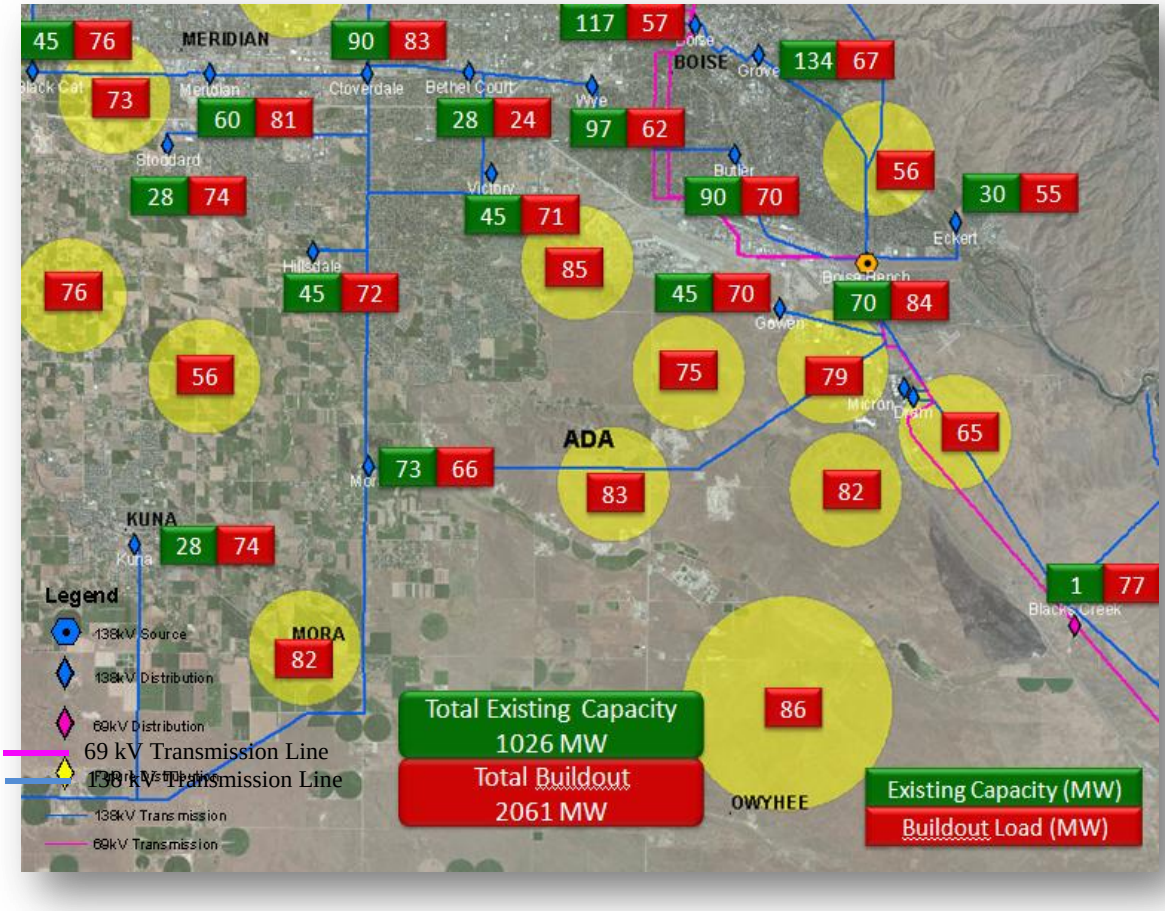

Figure 12: South Ada Area Buildout Distribution Substation Requirements

The total existing distribution substation capacity in the south Ada area is 1,026 MW. The total buildout distribution substation capacity needed at buildout is projected to be 2,061 MW.

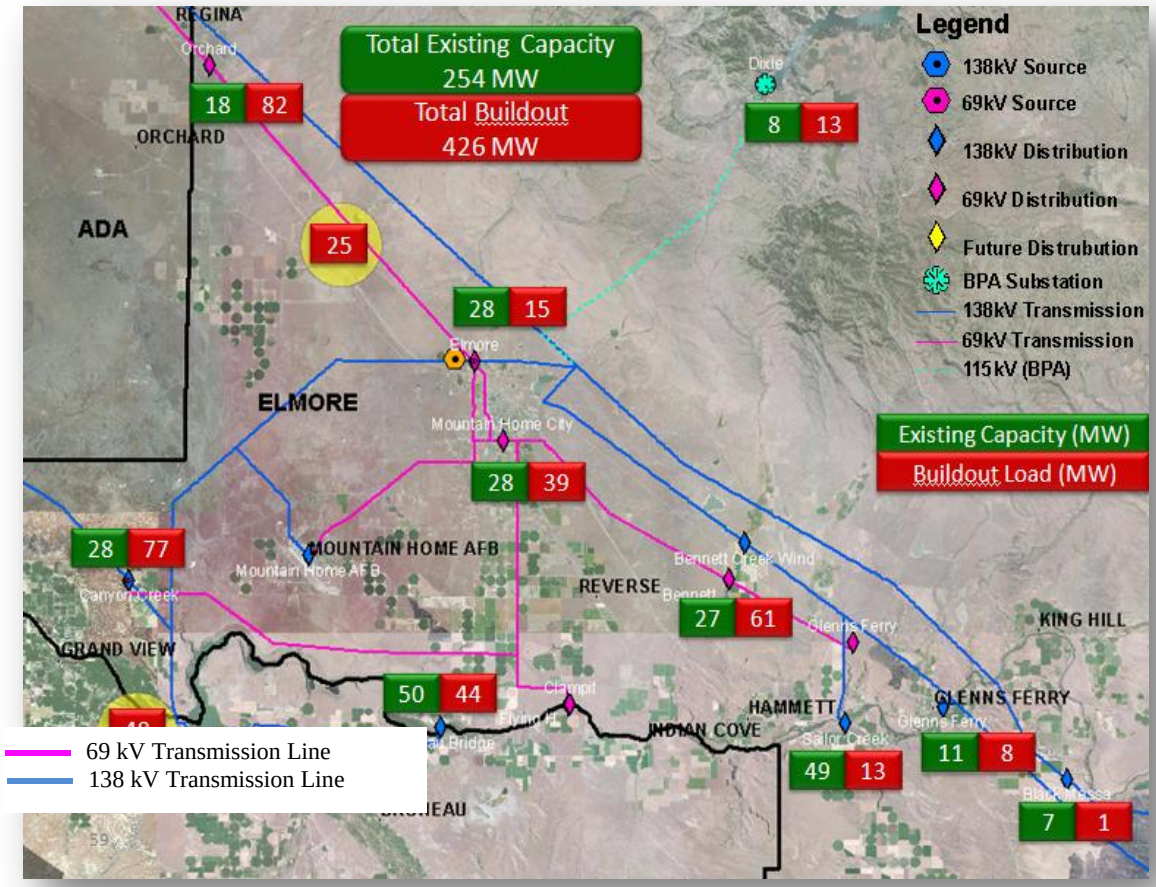

Figure 13: Elmore/Owyhee Area Buildout Distribution Substation Requirements

The total existing distribution substation capacity in the Elmore/Owyhee area is 254 MW. The total buildout distribution substation capacity needed at buildout is projected to be 426 MW.

The final mapping step was to site new or upgraded sub-transmission lines to connect the distribution substations to the source stations as well as to other distribution substations.

IPC provided the Committee information regarding the Treasure Valley Electrical Plan (TVEP) that was completed in 2006. The TVEP was a buildout planning effort similar to the Eastern Treasure Valley Electrical Plan that covered Ada and Canyon counties and focused on 500 kV and 230 kV facilities to serve the major population centers of the Treasure Valley. A community advisory committee developed a 500 kV transmission ring around the valley and located major substations to transform the 500 kV power transmitted from distant generators to 230 kV for delivery into the valley. The TVEP committee also designated numerous locations for hub substations and 230 kV transmission lines to interconnect the hub substations. The Committee members were asked to review the hub substation locations in the eastern Treasure Valley as determined by the TVEP committee and to change locations if present-day reasons could be given. That is, the Committee was asked to evaluate the TVEP hub substation locations to

determine if those locations still made sense recognizing present conditions. Figure 14 shows hub substation locations designated in the Treasure Valley Electrical Plan.

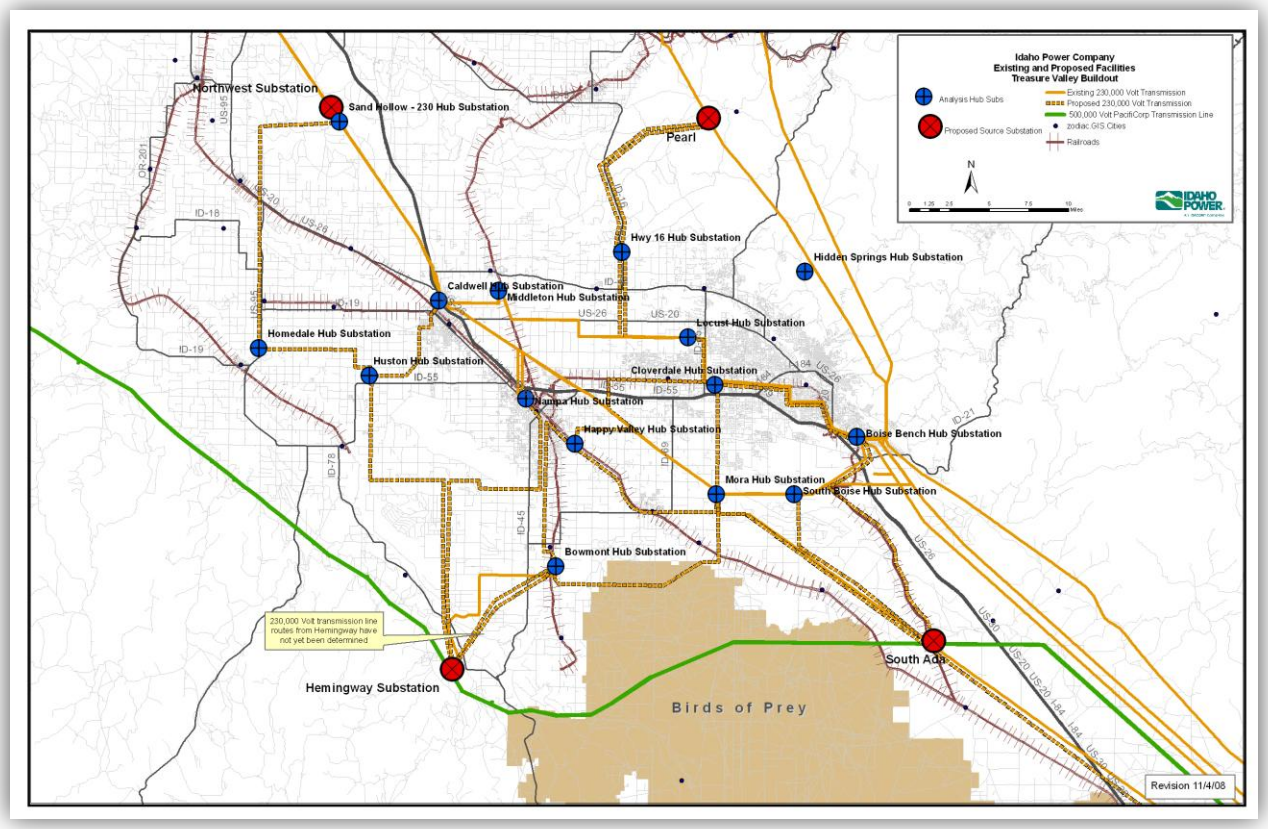

Figure 14: Treasure Valley Electrical Plan 230 kV Facilities

Using the information provided in the September through December 2011 meetings as well as the goals developed in November and December 2011, the Committee began, in January, 2012, to lay out the proposed eastern Treasure Valley transmission line routes and substation locations. The Committee separated into four teams. Each team was given a large aerial photograph showing terrain, cities, and roads. Also included on the aerial map were yellow circles showing recommended distribution substation locations based upon IPC's estimated future electrical load locations. The suggested substation location circles represented the buildout load centers that would need new distribution substations. The mapping teams were free to choose to site new substations inside or outside of the circles. They were encouraged to site the substations in areas that would best meet the local needs as well as conform to the *Guiding Principles and Community Criteria* developed in previous meetings.

In addition to the printed maps, each team was provided with geographical information system (GIS) data projected on the wall along with Idaho Power GIS staff to operate the software and record the substation locations and transmission line routes developed by the team.

Committee Small Group Mapping Results

Using the *Guiding Principles and Community Criteria* document previously developed as a guide, each group developed feasible alternatives to meet the area's buildout requirements. The following guidelines were used to form the small groups:

- Groups (Teams) were designated by color — Red, Orange, Green and Blue — for alternative discussion and identification purposes.
- Each team included Committee members from throughout the planning area.
- Each team included an IPC planning engineer to provide technical support and a facilitator to capture the details for each of the alternatives.
- Each team included an IPC GIS operator, computer, and computer projector to project the GIS mapping representations on the wall.

After the mapping teams completed their work, IPC engineers evaluated each alternative to ensure it worked electrically and met reliability standards. Power flow analysis was performed using PowerWorld Simulator software which is one of the standard software packages IPC uses to perform planning and design of its transmission network.

The power flow analysis found that each team's alternative contained some minor deficiencies, so IPC's engineers made some adjustments to each alternative so that each would perform to IPC standards. This is to be expected with a system as large as the eastern Treasure Valley. IPC engineers normally perform many iterations of analysis before an optimum design or configuration is found. The adjustments made to each alternative were presented to the Committee at the May, 2011, meeting for its information and concurrence. In all cases, the Committee agreed to these changes.

The following descriptions and maps show each team's alternative as it was developed in the small group mapping sessions and also include the changes made by IPC engineers as a result of the power flow analysis. For clarity, the mapping results are broken down into six smaller areas: Eagle, Meridian, Kuna, south Boise, Boise/Garden City and Mountain Home/Grand View. Pictorially, the results are shown as Ada County and Elmore/Owyhee counties.

Red Team Mapping Results

The Red Team created a map showing the locations for three new hub substations and confirming all but one hub substation location sited in the TVEP. They also provided the locations for 22 new distribution substations. The Red Team's Ada County alternatives are shown in Figure 15 and their Elmore and Owyhee County alternatives are shown in Figure 16. Specific highlights are as follows:

Eagle Area:

- Hub Substations:
  - New Highway 16 (hub) Substation located on ID-16 northeast of Star near West Deep Canyon Drive. The Red Team commented that the present location for Highway 16

Substation as designated by the TVEP is in the middle of a winery so needs a new location.
    - New Spring Valley (hub) Substation co-located with the existing Spring Valley distribution substation. This is an alternate substation should Idaho Power's planned Dry Creek (hub) Substation be difficult to build.
- 230 kV Transmission Lines:
    - New 2/3 mile long 230 kV transmission line from Dry Creek (hub) Substation to existing Boise Bench Substation to Brownlee Substation 230 kV transmission line. The line follows ridgeline cross-country though an exact location wasn't proposed.
    - Second new 2/3 mile long 230 kV transmission line from Dry Creek (hub) Substation to existing Boise Bench Substation to Brownlee Substation 230 kV transmission line. This line follows the ridgeline cross-country and is 1/3 mile further south than other new line though an exact location wasn't proposed.
    - New 1/2 mile long 230 kV transmission line from Spring Valley (hub) Substation to existing Boise Bench Substation to Brownlee Substation 230 kV transmission line. The line heads cross-country with no determined route until it reaches existing 230 kV line.
    - Second new 1/2 mile long 230 kV transmission line from Spring Valley (hub) Substation to existing Boise Bench Substation to Brownlee Substation 230 kV transmission line. The line heads cross-country with no determined route until it reaches existing 230 kV line. The line runs very close to the other new 230 kV transmission line. Perhaps double circuit.
- Distribution Substations:
    - D11 – Northeast of Eagle, along ID-55 near West Dry Creek Road intersection.
    - D12 – North of Eagle, near where the existing 138 kV transmission line crosses Aerie Lane. The Red Team stated that the exact location is to be determined in the future according to the best use of future development. Substation located near center of IPC Recommended Substation Location circle for reference.
    - D13 – North of Eagle and southeast of West Chaparral Road, build near future road. Location to be determined depending on future planned community development.
    - D14 – In East Eagle at the corner of North Linder Road and West Beacon Light Road on existing Idaho Power owned land.
    - D15 – Co-locate with Hwy 16 (hub) Substation on Highway 16 northeast of Star near West Deep Canyon Drive.
- 138 kV Transmission Lines:
    - New 138 kV transmission line from Substation D11 to Substation D14. The line follows ID-55 to E. Beacon Light Road then heads west on Beacon Light to Substation D14.
    - New 138 kV transmission line from Substation D13 to existing Hidden Springs Substation to Emmett Substation 138 kV transmission line. From the existing transmission line, the new line generally follows Aerie Lane west then heads north along W. Willow Creek Road. It then heads west cross-country until it reaches Substation D13.
    - New 138 kV transmission line from Spring Valley (hub) Substation to Substation D11. The line runs double circuit with another new line for the first mile out of

Spring Valley Substation, following ID-55. It then runs single circuit along ID-55 until Substation D11.
- New 138 kV transmission line from Highway 16 (hub) Substation to Substation D13. The exact routing for this line was not determined because of the lack of existing development in the area the transmission line must traverse.
- New 138 kV transmission line from Highway 16 (hub) Substation to Star Substation. The line generally follows ID-16 south from Highway 16 (hub) Substation then heads west 1/4 mile to Star Substation.
- New 138 kV transmission line from Highway 16 (hub) Substation to Substation D14. The line follows ID-16 south from Highway 16 (hub) Substation then heads east on W. Beacon Light to Substation D14.
- New 1/10 mile 138 kV transmission line from Substation D12 existing Hidden Springs Substation to Emmett Substation 138 kV transmission line.
- New 138 kV transmission line from Spring Valley (hub) Substation to existing Hidden Springs Substation to Emmett Substation 138 kV transmission line. The line to be run double circuit with existing 138 kV transmission line.

Meridian Area:

- Distribution Substations:
  - D03 – In Meridian, just off Franklin Road west of the school bus lot.
  - D08 – In Meridian, at the corner of West McMillan Road and North Black Cat Road.
  - D19 – In Meridian along East Ustick Road, 1/4 mile west of North Eagle Road (behind Kohl's).
- 138 kV Transmission Lines
  - New 138 kV transmission line from Locust Substation to Substation D19. From Locust Substation, the line runs south along N. Locust Grove Road then turns east along E. Ustick Road until it reaches Substation D19.
  - New 138 kV transmission line from Cloverdale Substation to Substation D19. From Cloverdale Substation, the new line is run double circuit along railroad tracks with the existing Boise Bench to Locust 230 kV transmission line then heads north along Eagle Road, still double circuit with existing 230 kV transmission line. The line heads west along E. Ustick Road until it reaches Substation D19.
  - New 138 kV transmission line from Star Substation to Substation D08. From Star Substation, the new line follows the new ID-16 alignment until McMillan Road. It turns east and follows McMillan Road to Substation D08. The line also continues east until connecting to the existing 138 kV transmission line between Locust Substation and Ten Mile Substation.

Kuna Area:

- Distribution Substations:
  - D04 – On Amity Road west of South Ten Mile Road, on existing Idaho Power owned land.
  - D05 – At corner of South Eagle Road and West Barker Road, southeast of Kuna. Prefer to place on BLM land.
  - D10 – North of Kuna along South Meridian Road north of East Columbia Road, on existing Idaho Power owned land.

- 138 kV Transmission Lines
  - New 138 kV transmission line from Hubbard Substation to Substation D10. From Hubbard Substation, the line follows the same route northwest as the existing 230 kV transmission line between Hubbard Substation and Nampa Substation then heads south on S. Meridian Road until it reaches Substation D10.
  - New 138 kV transmission line from Substation D10 to Substation D04. The line follows the same route northwest as the existing 230 kV transmission line between Hubbard Substation and Nampa Substation.
  - New 138 kV transmission line from Substation D04 to Happy Valley Substation. From Substation D04, the line follows the proposed TVEP 230 kV transmission line route, paralleling W. Amity Road then turns south on S. Happy Valley Road until it reaches Happy Valley Substation.
  - New 138 kV transmission line run double circuit from existing Bowmont Substation to the existing 138 kV transmission line between Hubbard Substation and Kuna Substation. This line provides a second power source to Kuna Substation.

South Boise Area

- Hub Substations:
  - New South Boise (hub) Substation near where the existing 230 kV transmission line crosses South Pleasant Valley Road in south Boise.
- Distribution Substations:
  - D01 – East of Micron where existing 138 kV transmission line crosses existing 69 kV transmission line. The Red Team didn't precisely locate this substation. The actual site should be determined as the area develops.
  - D02 – In south Boise, near southwest corner of Winco Distribution Center and under existing 230 kV transmission line.
  - D06 – At northwest corner of South Pleasant Valley Road and West Kuna Mora Road, south of Boise. The Red Team stated that it might be advantageous to locate the substation on county owned property.
  - D07 – On decommissioned sewer pond land near South Orchard Street and West Gowen Road, west of the Boise Airport.
  - D16 – In south Boise just west of the Eisenman Road interchange though the Red Team didn't precisely locate this substation.
  - D17 – Co-locate with South Boise (hub).
  - D18 – One mile north of South Boise (hub) Substation on northwest corner of West Holly Drive and South Pleasant Valley Road.
- 138 kV Transmission Lines
  - New 138 kV transmission line from South Boise (hub) Substation to Substation D06. The line follows S. Pleasant Valley Road.
  - New 138 kV transmission line from South Boise (hub) Substation to Substation D18. On the map, the line heads directly north from South Boise (hub) Substation cross-country to Substation D18. Team comments indicate that the line should follow S. Pleasant Valley Road.
  - New 138 kV transmission line from Substation D18 to Substation D07. From Substation D18, the line heads north along S. Pleasant Valley Road then west along W. Gowen Road until it reaches Substation D07.

- New 138 kV transmission line from Substation D07 to the existing 138 kV transmission line between Victory Substation and Hillsdale Substation. The line heads directly south cross-country from Substation D07 then turns west until it reaches W. Lake Hazel Road. It then heads north along S. Maple Grove Road until it ties into the existing 138 kV transmission line at the corner of S. Maple Grove Road and W. Victory Road. Note, as the transmission line is heading west, it crosses some densely populated areas and the line route is to be determined during siting through this area.
- New 138 kV transmission line from South Boise (hub) Substation to Substation D16. The line follows the existing 230 kV transmission line heading east from the South Boise (hub) Substation then heads cross-country to Substation D16. Because of the existing undeveloped characteristics of this area, the route is to be determined during siting.
- New 138 kV transmission line from Substation D02 to Substation D16. The line heads directly east from Substation D02 until it reaches S. Eisenman Road. It then follows S. Eisenman Road until it reaches Substation D16.
- New 138 kV transmission line from Substation D02 to the existing138 kV transmission line between Boise Bench and Mora. From Substation D02 the line heads west along same route as existing 230 kV transmission line until the new line ties into the existing 138 kV transmission line.

Boise/Garden City Area

- Distribution Substations:
  - D20 – In southeast Boise, along East Warm Springs Avenue just southeast of Warm Springs Golf Course. Try to locate back up against hill to no void viewsheds from big houses.
  - D22 – In Garden City at northeast corner of E. Veterans Memorial Parkway and Adams Street. Stay off of Chinden Blvd.
- 138 kV Transmission Lines
  - New 138 kV transmission line run double circuit from the existing 138 kV transmission line between Boise Bench Substation and Cartwright Substation into and out of Substation D20. The line route heads northeast cross-country from Substation D20 then turns west until it ties into the existing 138 kV transmission line.

Mountain Home/Grand View Area

- Distribution Substations:
  - D09 – Northwest of Mountain Home at the intersection of Ditto Creek Road and West Martha Avenue on BLM land.
  - D21 – ½ mile west of CJ Strike Dam on Idaho Power owned land off River Road.
- 138 kV Transmission Lines
  - Upgrade existing 69 kV transmission line from Elmore Substation to Substation D09 to 138 kV.
  - New set of 138 kV transmission lines that run in and out of Substation D21 from the existing Canyon Creek to Raft River 138 kV transmission line. The lines are run double circuit cross-country for 1/5 miles.

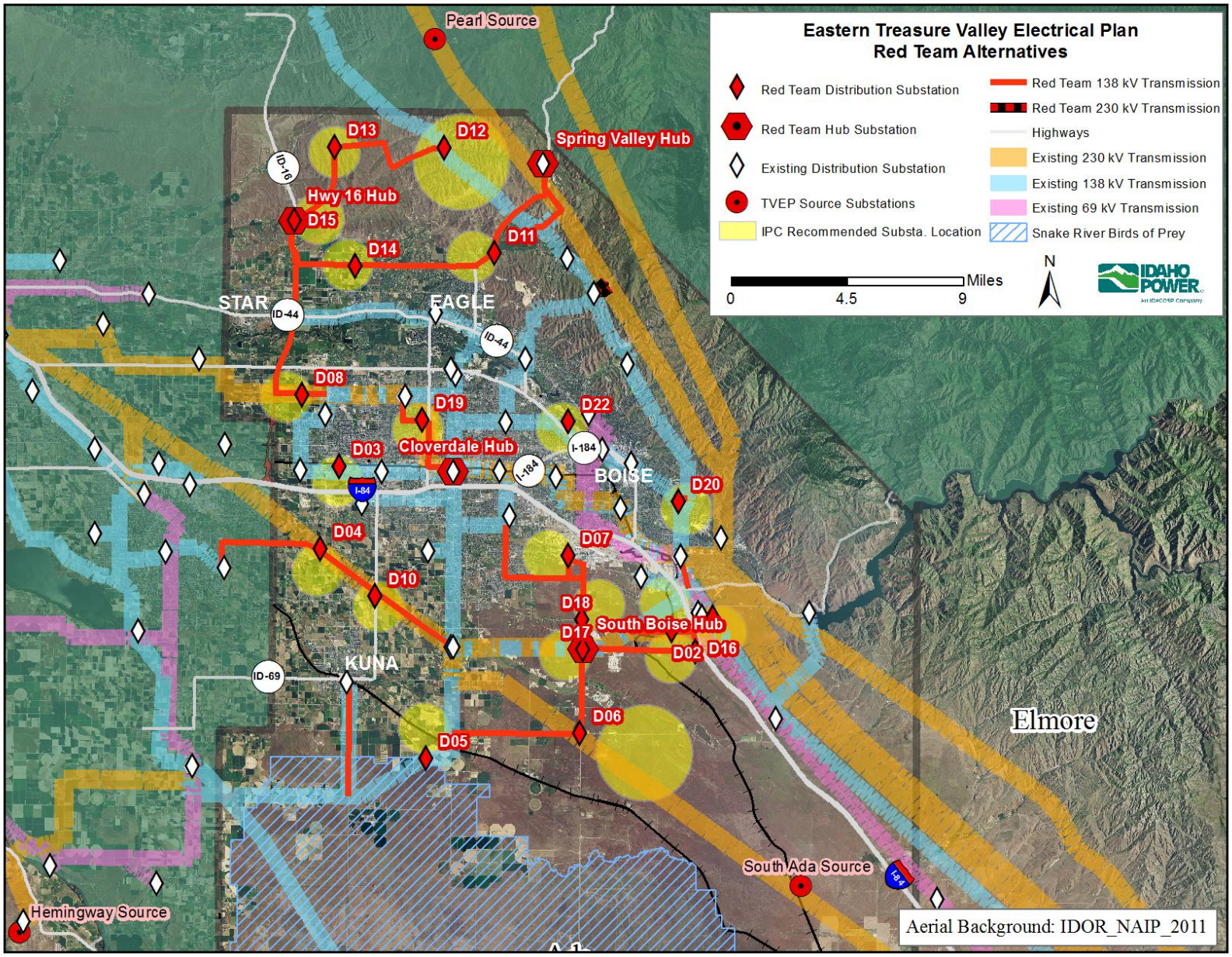

Figure 15: Red Team Ada County Mapping Results

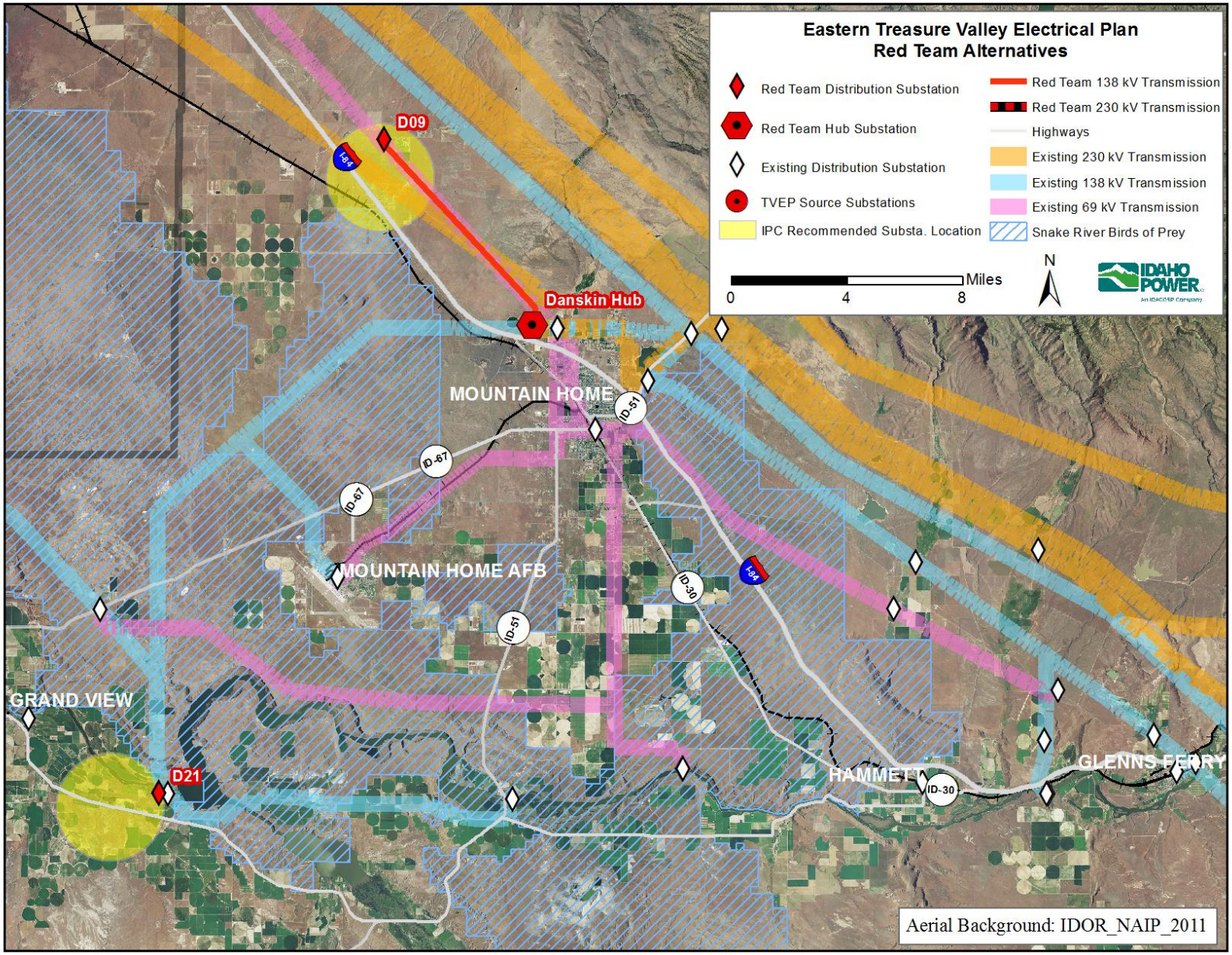

Figure 16: Red Team Elmore and Owyhee Counties Mapping Results

Orange Team Mapping Results

The Orange Team created a map showing the locations for four new hub substations, two expanded hub substations and confirming all but one hub substation locations sited in the TVEP. They provided the locations for 25 new distribution substations, some of which are alternative locations. The Orange Team's Ada County alternatives are shown in Figure 17 and their Elmore and Owyhee County alternatives are shown in Figure 18. Specific highlights are as follows:

Eagle Area:

- Hub Substations:
  - New Highway 16 (hub) Substation located north of Star, just west of Firebird Raceway.
  - New Spring Valley (hub) Substation co-located with the existing Spring Valley distribution substation. This is an alternate substation should Idaho Power's planned Dry Creek (hub) Substation prove difficult to build.
- 230 kV Transmission Lines:
  - New 0.6 mile long 230 kV transmission line from Dry Creek (hub) Substation to existing 230kV transmission line between Boise Bench Substation and Brownlee Substation. The line heads northeast from Dry Creek Substation cross-country with no identified route.
  - Second new 0.6 mile long 230 kV transmission line from Dry Creek (hub) Substation to existing 230kV transmission line between Boise Bench Substation and Brownlee Substation. The line heads northeast from Dry Creek Substation cross-country with no identified route.
  - New 3/4 mile long 230 kV transmission line from Spring Valley (hub) Substation to existing 230 kV transmission line between Boise Bench Substation and Brownlee Substation. The new line follows the existing 138 kV transmission line route.
  - Second new 0.9 mile long 230 kV transmission line from Spring Valley (hub) Substation to existing 230 kV transmission line between Boise Bench Substation and Brownlee Substation. The new line approximately follows ID-55.
- Distribution Substations:
  - D11 – Northeast of Eagle, along N. Horseshoe Bend Road and W. Goose Creek Road.
  - D12 – North of Eagle, near wear Aerie Lane crosses the existing 138 kV transmission line.
  - D13 – North of Eagle and southeast of West Chaparral Road. The team chose a site close to the middle of the IPC Recommended Substation Location circle. There are not roads presently in-place so this is an approximate location.
  - D14 – In East Eagle at the corner of North Linder Road and West Beacon Light Road on existing Idaho Power owned land.
  - D15 – North of Eagle, approximately 3/4 mile east of ID-16 and 1 mile south of W. Roseway lane.

- 138 kV Transmission Lines:
  - New 138 kV transmission line from Substation D11 to tap into existing 138 kV transmission line between Gary Substation and Eagle Substation. The line follows N. Horseshoe Bend Road for nearly its entire length.
  - New 138 kV transmission line from Substation D11 to existing 138 kV transmission line between Hidden Springs Substation and Spring Valley Substation. The line follows ID-55 for nearly its entire length.
  - New 138 kV transmission line from Spring Valley Substation to Substation D12. From Spring Valley Substation, the line heads northwest cross-country. After about 1.6 miles, the line then follows an unnamed dirt road to Substation D12. The dirt road appears to be an extension of Aerie Lane.
  - New 138 kV transmission line from Substation D13 to existing 138 kV transmission line between Hidden Springs Substation and Emmett Substation. From Substation D13, the line heads northeast cross-country until it connects into the existing 138 kV transmission line.
  - New 138 kV transmission line from Substation D13 to Substation D15. From Substation D13, the line heads southwest cross-country to Substation D15.
  - New 138 kV transmission line from Highway 16 (hub) Substation to Substation D15. From Highway 16 Substation, the line head southeast cross-country to Substation D15.
  - New 138 kV transmission line from Highway 16 (hub) Substation to Substation D14. The line heads southeast from Highway 16 Substation, cross-country and then follows ID-55 until it turns east along W. Beacon Light Road. It terminates at Substation D14.
  - New 138 kV transmission line from Substation D14 to existing 138 kV transmission line between Eagle Substation and Star Substation. The line follows N. Linder Road its entire length.
  - New 138 kV transmission line from Substation D10 to Hubbard Substation. The line follows S. Meridian Road heading south from Substation D10, turning west on E. Deer Flat Road then angling the last 1/2 mile to Hubbard Substation.

Meridian Area:

- Hub Substations:
  - Expand existing Cloverdale distribution Substation to make it a hub substation. This confirms TVEP.
- Distribution Substations:
  - D03 – In Meridian near the corner of W. Franklin Road an N. Ten Mile Road and near the existing 138 kV transmission line.
  - D08 – In Meridian, at the corner of West McMillan Road and North Black Cat Road.
  - D19 – In Meridian at the southwest corner of E. Ustick Road and N. Eagle Road.
- 138 kV Transmission Lines:
  - New 138 kV transmission line from Locust Substation to Substation D19. From Locust Substation, the line heads east along W. McMillan Road then turns south along N. Eagle Road until it reaches Substation D19.
  - New 138 kV Transmission line from Locust Substation to Substation D08. The line follows W. McMillan Road its entire length.

- New 138 kV transmission line from Star Substation to Substation D08. The team showed the line following the same route as a previously identified TVEP 230 kV transmission line. The 230 kV transmission line route has since changed.

Kuna Area:

- Distribution Substations:
  - D04 – Between Kuna and Meridian near northwest corner of W. Lake Hazel Road and S. Ten Mile Road.
  - D05 – East of Kuna, along railroad line near corner of E. Kuna Mora Road and S. Eagle Road.
  - D10 – North of Kuna along South Meridian Road north of East Columbia Road, on existing Idaho Power owned land.
- 138 kV Transmission Lines:
  - New 138 kV transmission line from Substation D05 to the existing 138 kV transmission line between Bowmont Substation and Mora Substation. From Substation D05, the line heads directly east until it connects into the existing transmission line.
  - New 138 kV transmission line from Substation D04 to Substation D10. The line follows W. Lake Hazel Road east until it reaches an existing 230 kV transmission line. It then follows the same route as the 230 kV line until it turns south along S. Meridian Road, terminating in Substation D10.
  - New 138 kV transmission line from Hubbard Substation to Kuna Substation. From Hubbard Substation, the line angles to the southwest for 1/2 mile then follows E. Deer Flat Road until it turns south on S. Meridian Road. The line then turns west along Avalon Street then south on S. Swan Falls Road until it reaches Kuna Substation.
  - New 138 kV transmission line from Substation D05 to the existing 138 kV transmission line between Bowmont Substation and Mora Substation. From Substation D05, the line heads directly south until it connects into the existing transmission line.

South Boise Area

- Hub Substations:
  - New South Boise (hub) Substation Co-locate with Substation D17, 1/3 mile west from where the existing 230 kV transmission line crosses South Pleasant Valley Road.
  - New South Ada (hub) Substation located south of Boise, northeast of where rail line crosses under existing Danskin to Hubbard 230 kV transmission line. Co-located with TVEP designated South Ada Source Substation.
- Distribution Substations:
  - D01 – In southeast Boise, southeast of Micron where existing Boise Bench Substation to Hubbard Substation 230 kV transmission line crosses existing 138 kV transmission line.
  - D02 – In southeast Boise, approximately 3/4 mile northwest of Winco Distribution Center near existing Boise Bench Substation to Mora Substation 138 kV transmission line.

- D06 – Along Kuna Mora Road, 3 miles east of S. Pleasant Valley Road on southwest corner of state endowment land.
- D07 – Near South Orchard Street and West Gowen Road, southwest of the Boise Airport on state land.
- D16 – In south Boise, 0.9 miles southwest of the Eisenman Road interchange.
- D17 – Co-locate with South Boise (hub) Substation 1/3 miles west from where the existing 230 kV transmission line crosses South Pleasant Valley Road.
- D18 – 1.75 mile north of South Boise (hub) Substation along South Pleasant Valley Road on State owned land.

- 138 kV Transmission Lines:
  - New 138 kV transmission line that replaces existing 69 kV transmission. The line heads east cross-country from South Ada (hub) Substation until it turns southeast and follows the existing 69 kV right-of-way to Ditto Creek Road where it turns south to connect into Substation D09.
  - New 138 kV transmission line from Substation D06 to Blacks Creek Substation. The line follows Kuna Mora Road east from Substation D06, leaving the road where it turns north and instead continues east until it crosses I-84. It then follows I-84 northwest until it turns west on E. Blacks Creek Road then reaches Blacks Creek Substation.
  - New 138 kV transmission line from Substation D06 to Substation D16. From Substation D06 line follows Kuna Mora Road east for 1 mile then turns north and then terminates in Substation D16.
  - New 138 kV transmission line from Substation D16 to South Boise (hub) Substation. From Substation D16 the line heads west along W Amyx Lane then turns north on S. Pleasant Valley Road. The line turns west when it is even with South Boise (hub) Substation then terminates at the hub substation.
  - New 138 kV transmission line from Substation D18 to Gowen Substation. From Substation D18, the line follows S. Pleasant Valley Road north until it turns east on W. Gowen Road. It follows W. Gowen Road to Gowen Substation.
  - New Transmission line from Substation D18 to South Boise (hub) Substation. The line heads east from South Boise (hub) Substation for 1/3 mile then turns north until it reaches Substation D18.
  - New 138 kV transmission line from Substation D07 to the existing 138 kV transmission line between Victory Substation and Hillsdale Substation. The line heads directly west cross-country from Substation D07 then turns north along S. Cole Road until it reaches W. Victory Road. It then heads west along W. Victory Road until it ties into the existing 138 kV transmission line at the corner of S. Maple Grove Road and W. Victory Road.
  - New 138 kV transmission line from Substation D18 to Substation D07. The line follows S. Pleasant Valley Road north from Substation D18. When it is nearly even with Substation D07, the line turns west, cross-country to tie into Substation D07.
  - New 138 kV transmission line replacing existing 69 kV transmission line. The line heads east cross-country from South Ada (hub) Substation until it turns northwest and follows the existing 69 kV right-of-way to Blacks Creek Substation.

- Rebuild the existing 138 kV transmission line from Substation D02 heading northeast to where it taps off the 138 kV transmission line between Boise Bench Substation and Mora Substation. Higher capacity required because of greater electrical load on line.

Boise/Garden City Area

- Distribution Substations:
  - D20 – In southeast Boise, near existing Boise Bench to Cartwright 138 kV transmission line, 1/4 mile west of Table Rock.
  - D22 – In Garden City, along N. Curtis Road near W. Ustick Road, near existing 138 kV transmission line. The team designated that this is not a specific site because the area is very built out with development.

Mountain Home/Grand View Area

- Hub Substations
  - Expand the existing Danskin (hub) Substation.
- Distribution Substations:
  - D09 – Northwest of Mountain Home along Ditto Creek Road, 1 mile south of Martha Avenue.
  - D21 Alternative – East of Grand View Alternative 1 - 2.25 miles southwest of CJ Strike Dam, south of ID-78, 1.6 miles west of River Road.
  - D21 Alternative – East of Grand View Alternative 2 - 2.5 miles southwest of CJ Strike Dam, north of ID-78, 2 miles west of River Road.
  - D21 Alternative – East of Grand View Alternative 3 - south of ID-78, .2 miles east of River Road on Owyhee County land.
  - D21 Preferred Location – East of Grand View Alternative 4, Preferred Alternative - .6 miles southeast of CJ Strike Dam, at intersection of Black Sands Road and River Road.
- 138 kV Transmission Lines:
  - New 138 kV Transmission from Raft River Substation to Substation D21. From Raft River Substation the line follows Black Sands road west then turns south along River Road. It follows River Road until it reaches ID-78, turns west along ID-73 and follows it to Substation D21. Note, this is only one of the D21 alternatives provided by the Orange Team. The other alternatives are sourced in a similar manner along the same roads.
  - New 138 kV transmission line that replaces existing 69 kV transmission. The line heads northeast cross-country from Substation D09 then follows the existing 69 kV right of way to Elmore Substation.

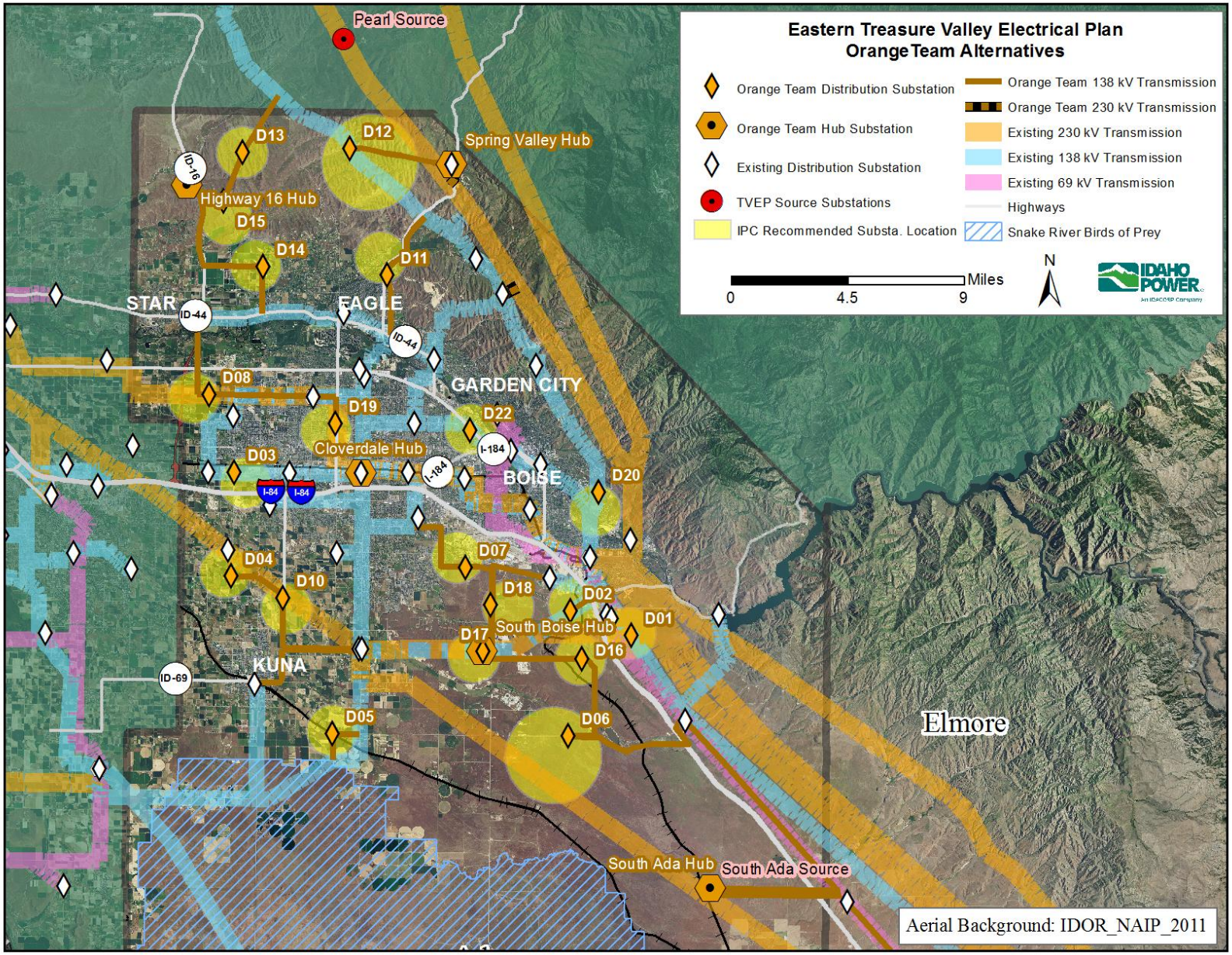

Figure 17: Orange Team Ada County Mapping Results

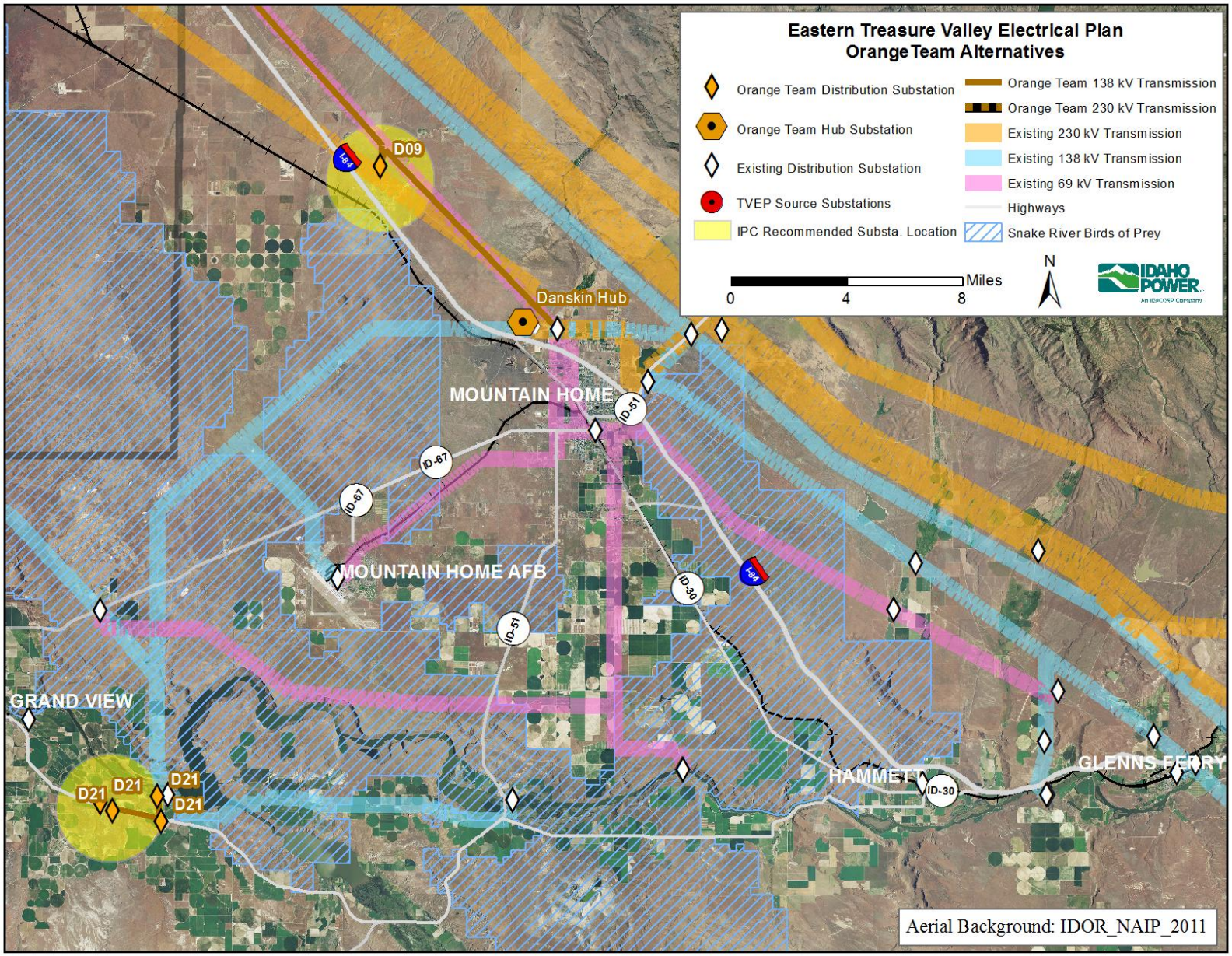

Figure 18: Orange Team Elmore and Owyhee Counties Mapping Results

Green Team Mapping Results

The Green Team created a map showing the locations for four new hub substations, one expanded hub substation and confirming all but one hub substation locations sited in the TVEP. They provided the locations for 22 new distribution substations. The Green Team's Ada County alternatives are shown in Figure 19 and their Elmore and Owyhee County alternatives are shown in Figure 20. Specific highlights are as follows:

Eagle Area:

- Hub Substations:
  - New Highway 16 (hub) Substation co-locate with Substation D15 on Highway 16 northeast of Star 0.8 miles north of West Deep Canyon Drive. Same location as designated by TVEP.
  - New Dry Creek (hub) Substation located at the future Dry Creek Substation site. This is in agreement with the TVEP.
- 230 kV Transmission Lines:
  - New 0.6 mile long 230 kV transmission line from Dry Creek (hub) Substation to existing 230 kV transmission line between Boise Bench Substation and Brownlee Substation. The line heads northeast from Dry Creek Substation cross-country with no identified route. The team commented that historic structures should be avoided.
  - Second new 0.6 mile long 230 kV transmission line from Dry Creek (hub) Substation to existing 230 kV transmission line between Boise Bench Substation and Brownlee Substation. The line heads northeast from Dry Creek Substation cross-country with no identified route. The team commented that historic structures should be avoided.
- Distribution Substations:
  - D11 – Northeast of Eagle, along N. Horseshoe Bend Road and W. Goose Creek Road (northwest corner – Ada County Solid Waste ownership)
  - D12 – North of Eagle, near where Aerie Lane crosses the existing 138 kV transmission line.
  - D13 – North of Eagle, 2 miles east of ID-16, 0.6 miles south of W. Chaparral Road. Actual location to be determined when M3 plans are further refined.
  - D14 – In East Eagle at the corner of North Linder Road and West Beacon Light Road on existing Idaho Power owned land.
  - D15 – Co-locate with Hwy 16 (hub) Substation on Highway 16 northeast of Star 0.8 miles north of West Deep Canyon Drive.
- 138 kV Transmission Lines:
  - New 138 kV transmission line from Highway 16 (hub) Substation to Substation D14. The line heads south from Highway 16 (hub) Substation along ID-16 then turns east on W. Beacon Light Road, following it to Substation D14.
  - New 138 kV transmission line from Highway 16 (hub) Substation to Substation D13. The line follows ID-16 north from Highway 16 (hub) Substation then turns east on W. Chaparral Road. It follows W. Chaparral Road for about 1.4 miles then turns southeast until it reaches Substation D13.

- New 138 kV transmission line from Substation D13 to the existing 138 kV transmission line between Hidden Springs Substation and Emmett Substation. The line heads northwest from Substation D13 then follows Chaparral Road until it reaches the existing 138 kV transmission line.
- New 138 kV transmission line from Substation D14 to Substation D11. The line follows W. Beacon Light Road heading east from Substation D14, crosses ID-55 then turns southeast until it reaches Substation D11.
- New 138 kV transmission line from Substation D11 to existing 138 kV transmission line between Hidden Springs Substation and Emmett Substation. The line heads northwest from Substation D11 then follows ID-55 to the existing transmission line.

Meridian Area:

- Hub Substations:
  - Expand existing Cloverdale distribution Substation to make it a hub substation. This confirms TVEP.
- Distribution Substations:
  - D03 – In Meridian 0.16 miles east of W. Franklin Road an N. Ten Mile Road on south side of road. This substation is connected to the existing Meridian Substation to Black Cat Substation 138 kV transmission line.
  - D08 – In Meridian, at the corner of West McMillan Road and North Black Cat Road.
  - D19 – In Meridian, 1/3 mile west of E. Ustick Road and N. Eagle Road intersection, on south side of Ustick Road.
- 138 kV Transmission Lines:
  - New 138 kV transmission line from the existing 138 kV transmission line between Locust Substation and Ten Mile Substation to Substation D08. The line follows W. McMillan Road. It is expected in the future this line will continue on into Canyon County to connect with the 138 kV transmission.
  - New 138 kV transmission line from Locust Substation to Substation D19. The line follows N. Locust Grove Road heading south from Locust Substation then turns east on W. Ustick Road until it reaches Substation D19.
  - New 138 kV transmission line from Cloverdale Substation to Substation D19. From Cloverdale Substation, the new line is run double circuit along railroad tracks with the existing Boise Bench to Locust 230 kV transmission line then heads north along Eagle Road, still double circuit with existing 230 kV transmission line. The line heads west along E. Ustick Road until it reaches Substation D19.

Kuna Area:

- Distribution Substations:
  - D04 – On Amity Road west of South Ten Mile Road, on existing Idaho Power owned land.
  - D05 – Southeast of Kuna at S. Eagle Road and E. King Road.
  - D10 – North of Kuna along South Meridian Road north of East Columbia Road, on existing Idaho Power owned land.
- 138 kV Transmission Lines:
  - New set of 138 kV transmission lines feeding Substation D05 southeast of Kuna. The lines connect into the existing 138 kV transmission line between Bowmont Substation

and Mora Substation to serve Substation D05. From the existing 138 kV transmission line, the new lines follow E. King Road for 1 mile west until reaching the new substation.

- New 138 kV transmission line from Hubbard Substation to Substation D10. From Hubbard Substation, the line follows the same route northwest as the existing Hubbard to Nampa 230 kV transmission line then heads south on S. Meridian Road until it reaches Substation D10.
- New 138 kV transmission line from Substation D10 to Substation D04. The line follows the same route northwest from Substation D10 as the existing Hubbard Substation to Nampa Substation 230 kV transmission line.
- New 138 kV transmission line from Stoddard Substation to Substation D04. The new line follows W. Overland Road heading west from Stoddard Substation until it reaches S. Ten Mile Road. Note, the line does not follow Overland as it curves toward S. Ten Mile but takes a straight line route to S. Ten Mile Road. The line then turns south along S. Ten Mile Road and then heads west along W. Amity Road until it reaches Substation D04. This line completes a loop between Mora Substation and Stoddard Substation.
- New 138 kV transmission line from the existing 138 kV transmission line between Bowmont Substation and Mora Substation to Kuna Substation. This is a second circuit on an existing 138 kV transmission line. The line runs along S. Swan Falls Road.

South Boise Area

- Hub Substations:
  - New South Boise (hub) Substation Co-locate with Substation D17, 1/3 mile west from where the existing 230 kV transmission line crosses South Pleasant Valley Road.
- Distribution Substations:
  - D01 – In southeast Boise, 1.4 miles southeast of Micron along existing 69 kV transmission line.
  - D02 – In south Boise, 0.4 miles northwest of Winco Distribution Center.
  - D06 – East of Kuna at W. Kuna Mora Road and S. Vista Ave.
  - D07 – West of Boise Airport near intersection of S. Curtis Road and Albatross Street.
  - D16 – In south Boise, along S. Eisenman Road, 0.25 miles east of I-84 exit.
  - D17 – Co-locate with South Boise (hub) Substation 1/3 mile west from where the existing 230 kV transmission line crosses South Pleasant Valley Road
  - D18 – In south Boise, .15 miles west of S. Pleasant Valley Road, .12 miles north of W. Hollilynn Drive.
- 138 kV Transmission Lines:
  - New 138 kV transmission line from South Boise (hub) Substation to Substation D18. The line heads east for 1/3 mile from South Boise (hub) Substation then follows S. Pleasant Valley Road until it reaches Substation D18.
  - New 138 kV transmission line from Substation D18 to Substation D07. From Substation D18, the line follows S. Pleasant Valley Road heading north then turns west and runs along W. Gowen Road. The line follows W. Gowen Road then turns

north and runs along S. Curtis Road until W. Albatross St. It then turns west until it reaches Substation D07.
- New 138 kV transmission line from Substation D07 to Victory Substation. The line follows S. Curtis Road heading north from Substation D07 then turns west along W. Victory Road. The line then follows the existing 138 kV transmission line along S. Maple Grove Road north until it reaches Victory Substation.
- New 138 kV transmission line from existing 138 kV transmission line between DRAM Substation and Elmore Substation to Substation D01. The new line taps into the existing transmission line 1.9 miles southeast of Micron then heads approximately 0.6 miles southwest to Substation D01.
- New 138 kV transmission line from South Boise (hub) Substation to Substation D06. The new line heads east from South Boise (hub) Substation then follows S. Pleasant Valley Road south. It turns east on Kuna Mora Road until reaching Substation D06. This is a set of two lines run double circuit between substations.
- New 138 kV transmission line from South Boise (hub) Substation to Substation D16. The new line heads east from South Boise (hub) Substation cross-country then turns north and follows S. Eisenman Road to Substation D16.
- New 138 kV transmission line from Substation D16 to Substation D02. The new line approximately follows S. Eisenman Road north from Substation D16 then turns west along E. Freight Street for 0.9 miles (double circuit with existing 230 kV transmission line). It then turns north 0.4 miles cross-country to Substation D02.
- New 138 kV transmission line from Substation D02 to existing 138 kV transmission line between Boise Bench Substation and Mora Substation. The new line heads northwest from Substation D02 cross-country until it connects into the existing transmission line.

Boise/Garden City Area

- Distribution Substations:
  - D20 – In southeast Boise, along East Warm Springs Avenue just southeast of Warm Springs Golf Course and along existing Boise Bench Substation to Grove Substation 138 kV transmission line. Former Gate City Steel site.
  - D22 – In Garden City, at southwest end of W. 44th St. next to existing 138 kV transmission line.

Mountain Home/Grand View Area

- Hub Substations
  - Expand the existing Danskin (hub) Substation.
- Distribution Substations:
  - D09 – Northwest of Mountain Home at northeast corner of W. Dessert Duck Road and Ditto Creek Road. Note, after mapping it was noted there is a house at this corner.
  - D21 – East of Grand View - south of ID-78, 1.9 miles east of River Road on Owyhee County land.
- 138 kV Transmission Lines:
  - New 138 kV Transmission from Raft River Substation to Substation D21. From Raft River Substation the line follows Black Sands road west then turns south along River

Road. It follows River Road until it reaches ID-78, turns west along ID-73 and follows it to Substation D21. The team designated this as a double circuit, in-and-out 138 kV transmission line serving Substation D21. They also noted that if cost is an issue, make this a single circuit radial feed substation.

- New in-and-out, set of 138 kV transmission lines connecting to Substation D09 served from the existing Elmore Substation to Orchard Substation 69 kV transmission line. It is assumed the team intended to also upgrade the existing 69 kV transmission line to 138 kV.

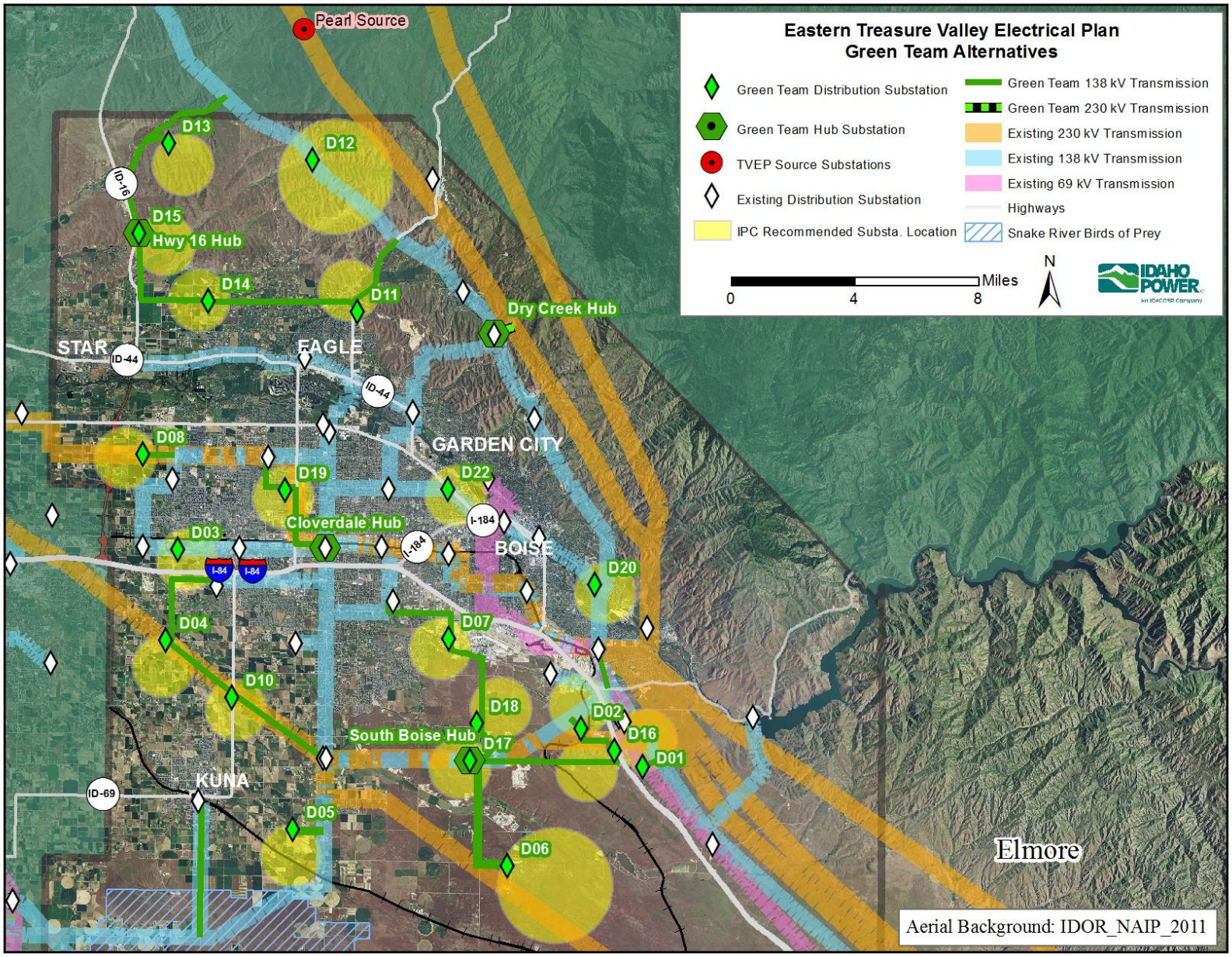

Figure 19: Green Team Ada County Mapping Results

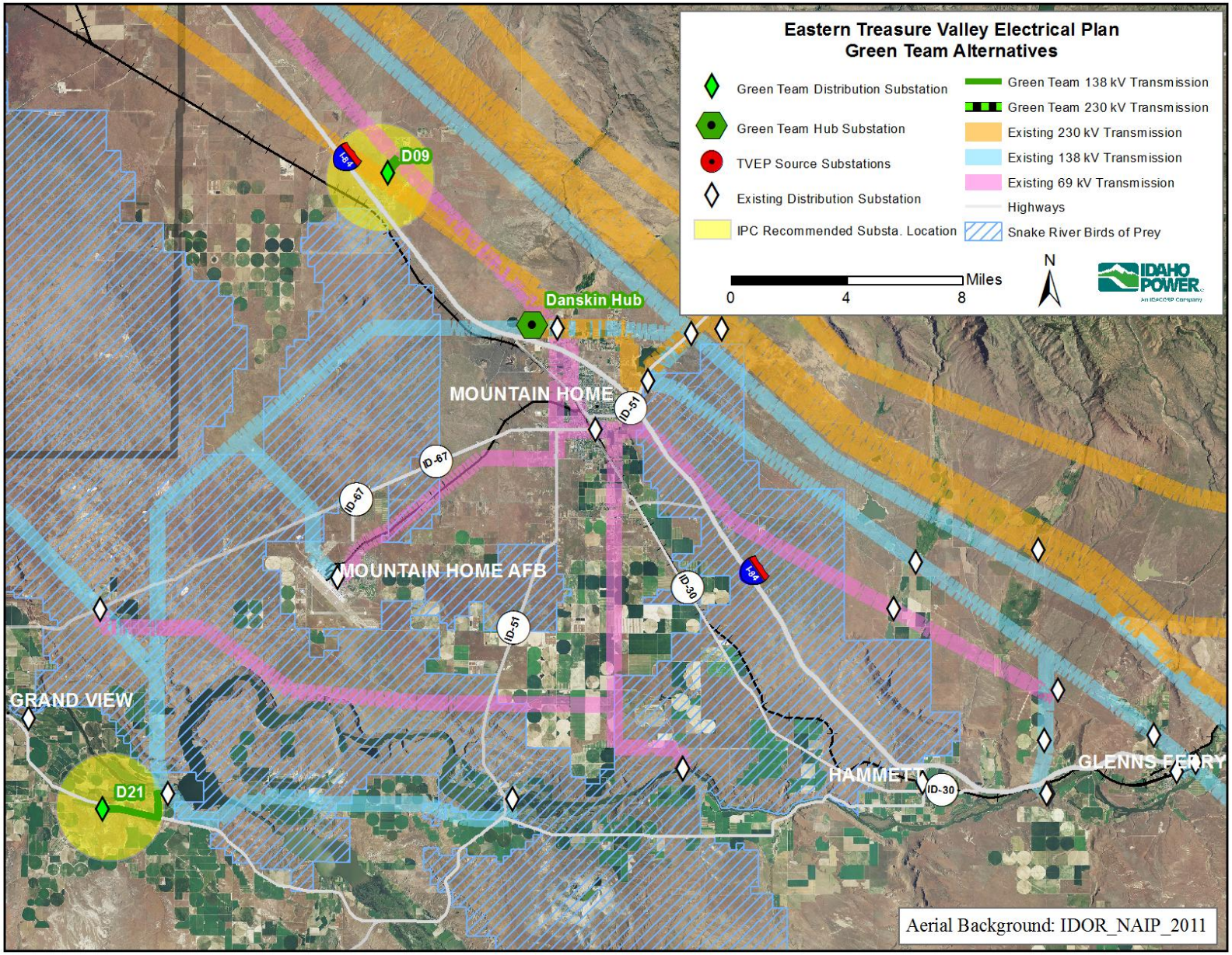

Figure 20: Green Team Elmore and Owyhee Counties Mapping Results

Blue Team Mapping Results

The Blue Team created a map showing the locations for four new hub substations and confirming all but one hub substation locations sited in the TVEP. They provided the locations for 27 new distribution substations, some of which are alternative locations. The Blue Team's map of their Ada County 138 kV alternatives is shown in Figure 21 and their 230 kV alternatives for Ada County are shown in Figure 22. Elmore and Owyhee counties alternatives (Both 230 kV and 138 kV) are shown in Figure 23. Specific highlights are as follows:

Eagle Area:

- Hub Substations:
  - New Highway 16 (hub) Substation co-located with Substation D15 on Highway 16 northeast of Star 0.7 miles north of West Deep Canyon Drive.
  - New Dry Creek (hub) Substation located at the future Dry Creek Substation site. This is in agreement with the TVEP.
- 230 kV Transmission Lines:
  - Follow the TVEP 230 kV route between Pearl Source Substation and Highway 16 (hub) Substation continuing south to tie into existing Locust Substation to Caldwell Substation 230 kV transmission line. The Blue Team modified this route saying the line should follow the new Highway 16 road extension alignment as determined by the Idaho Transportation Department as it heads south, crosses the Boise River and heads towards McMillan Road.
- Distribution Substations:
  - D11 – Northeast of Eagle, along N. Horseshoe Bend Road and W. Goose Creek Road.
  - D12 – North of Eagle, near wear Aerie Lane crosses the existing 138 kV transmission line.
  - D13 – North of Eagle, 2.1 miles east of ID-16, 0.15 miles south of W. Chaparral Road.
  - D14 – In East Eagle at the corner of North Linder Road and West Beacon Light Road on existing Idaho Power owned land.
  - D15 – Co-locate with Hwy 16 (hub) Substation on Highway 16 northeast of Star 0.7 miles north of West Deep Canyon Drive.
- 138 kV Transmission Lines:
  - New 138 kV transmission line from Highway 16 (hub) Substation to Substation D13. The line follows ID-16 north from Highway 16 (hub) Substation then turns east on W. Chaparral Road. The team showed a straight line route for about 2 miles approximately along W. Chaparral Road. The line then turns southeast until it reaches Substation D13.
  - New 138 kV transmission line from Substation D13 to the existing 138 kV transmission line between Hidden Springs Substation and Emmett Substation. The line heads northwest from Substation D13 then approximates Chaparral Road until it reaches the existing 138 kV transmission line.
  - New 138 kV transmission line from Highway 16 (hub) Substation to Substation D14. The line heads south following ID-16 from Highway 16 (hub) Substation then turns east on W. Beacon Light Road, following it to Substation D14.

- New 138 kV transmission line from Substation D14 to Substation D11. From Substation D14, the line heads east along W. Beacon Light Road until it reaches ID-55. It then heads southeast cross-country until it reaches Substation D11.
- New 138 kV transmission line from the existing 138 kV transmission line between Dry Creek (future) Substation and Gary Substation to Substation D11. The new line connects into the existing transmission line approximately 2 miles north of Gary Substation. It heads northwest across the Ada County landfill then angles west on the ridgeline above the landfill until it reaches Substation D11.
- Alternate new 138 kV transmission line serving Substation D11 from the east. This line connects into the existing 138 kV transmission line at the future Dry Creek Substation site. It heads northwest, cross-country until it reaches Substation D11.
- Alternate new 138 kV transmission line serving Substation D11 from the north. This line ties into the existing Hidden Springs Substation to Emmett Substation 138 kV transmission line where the line crosses ID-55. It approximately follows ID-55 its entire route.
- Alternate new 138 kV transmission line serving Substation D14. The new line is connected to the existing Eagle Substation to Star Substation 138 kV transmission line where the line crosses N. Linder Road. The line follows N. Linder Road its entire route.
- Alternate new 138 kV transmission line serving Substation D11. The new line follows ID-55 south from Substation D11 then is run double circuit on the existing Gary Substation to Eagle Substation 138 kV transmission line until it reaches Eagle Substation.
- New 138 kV transmission line from Star Substation to Lansing Substation. The new line heads west along ID-44 from Star Substation and follows ID-44 until it reaches Lansing Substation.

Meridian Area:

- Distribution Substations:
  - D03 – In Meridian, just off Franklin Road west of the school bus lot.
  - D08 – In Meridian at intersection of N. McDermott Road and W. McMillan Road.
  - D19 Preferred Alternative 1 – 1/3 miles north of E. Fairview Ave and N. Eagle Road intersection on west side of road.
  - D19 Preferred Alternative 2 – 1/3 miles north of E. Ustick Road and N. Eagle Road intersection in field west of Eagle Road.
  - D19 Alternative – Just east of N. Eagle Road near E. River Valley Road.
- 138 kV Transmission Lines:
  - New 138 kV transmission line to serve Substation D03 in Meridian. The new line ties into the existing 138 kV transmission line between Meridian Substation and Black Cat Substation along W. Franklin Road just west of the transfer substation then connects in and out (double circuit) of Substation D03.
  - New 138 kV transmission line from Black Cat Substation west of Meridian to the existing 138 kV transmission line between Karcher Substation and Zilog Substation. The new line runs west along E. Franklin Road until Ridgecrest Golf Course. It crosses the golf course still heading west until it ties into the existing transmission line.

- New 138 kV transmission line serving Substation D08 in Meridian. The new line ties into the existing Locust Substation to Ten Mile Substation 138 kV transmission line at W. McMillan Road and N. Ten Mile Road. The line follows W. McMillan Road until it reaches Substation D08. The line then continues on for 2 miles, dead-ending at N. Can Ada Road.
- New 138 kV transmission line from Cloverdale Substation to Locust Substation. The line follows the existing 230 kV transmission line between Cloverdale Substation and Locust Substation. Along the way, the line is connected to Substation D19, whichever alternative for D19 is chosen.
- New 138 kV transmission line from Cloverdale Substation to Meridian Substation along the same route of the existing 138 kV transmission line that connects these two substations.
- New 138 kV transmission line from Locust Substation to Ten Mile Substation along same route as the existing 138 kV transmission line that connects these two substations.

Kuna Area:

- Distribution Substations:
  - D04 – Between Kuna and Meridian, at southeast corner of W. Lake Hazel Road and S. Ten Mile Road.
  - D04 Alternative – Alternative - between Kuna and Meridian, south of W. Lake Hazel Road and S. Ten Mile Road intersection, south of Kuna water treatment plant.
  - D05 – Southeast of Kuna at S. Eagle Road and E. King Road.
  - D10 Preferred Alternative – North of Kuna along South Meridian Road north of East Columbia Road, on existing Idaho Power owned land.
  - D10 Secondary Alternative – Between Kuna and Meridian, at intersection of W. Lake Hazel Road and S. Meridian Road on Idaho Power owned land.
- 138 kV Transmission Lines:
  - New 138 kV transmission line from Kuna Substation to Substation D05. The line heads south from Kuna Substation following S. Swan Falls Road. It turns east along E. King Road and follows it until the line reaches Substation D05.
  - New 138 kV transmission line from existing 138 kV transmission line between Bowmont Substation and Mora Substation to Substation D05. The line follows E. King Road its entire route.
  - New 138 kV transmission line from Happy Valley Substation to Substation D04. The new line heads southeast cross-country until it reaches Cruse Lane. It follows Cruse Lane then heads north on Robinson Road until W. Lake Hazel Road. It follows W. Lake Hazel Road until it reaches Substation D04.
  - New 138 kV transmission line from Substation D10 to Substation D04. The new line follows W. Lake Hazel Road its entire route.
  - New 138 kV transmission line from Hillsdale Substation in Meridian to Substation D10. The new line heads south along S. Eagle Road from Hillsdale Substation then turns west on E. Lake Hazel Road until it reaches Substation D10.

South Boise Area

- Hub Substations:
  - New South Boise (hub) Substation Co-locate with Substation D17, 0.15 miles east from where the existing 230 kV transmission line crosses South Pleasant Valley Road. Locate in or next to gravel pit.

- Distribution Substations:
  - D01 – In southeast Boise, southeast of Micron where existing Boise Bench Substation to Hubbard Substation 230 kV transmission line crosses existing 138 kV transmission line.
  - D02 – In southeast Boise, along S. Eisenman Road just south of Boise Factory Outlet mall, near existing Boise Bench to Mora 138 kV transmission line.
  - D06 – Along Kuna Mora Road, 2.8 miles east of S. Pleasant Valley Road.
  - D07 – West end of Boise airport, south of South Orchard Street and West Gowen Road intersection, located on Boise airport land.
  - D16 – In south Boise, near southwest corner of Winco Distribution Center and just south of existing 230 kV transmission line (intersection of E. Freight St and S. Warehouse Way).
  - D17 – Co-locate with South Boise (hub) Substation 1/3 mile west from where the existing 230 kV transmission line crosses South Pleasant Valley Road.
  - D18 – 1 mile north of South Boise (hub) Substation on northwest corner of West Holly Drive and South Pleasant Valley Road
- 138 kV Transmission Lines:
  - New 138 kV transmission line from Gowen Substation to Substation D07. The line follows W. Gowen Road heading west from Gowen Substation then continues cross-country when W. Gowen Road turns into S. Orchard Street until it reaches Substation D07.
  - New 138 kV transmission line serving Substation D16. The new line ties into the existing 138 kV transmission line between Boise Bench Substation and Mora Substation about 1/4 mile southwest of S. Eisenman Road. It follows the railroad line south until it's approximately 1/4 mile from Substation D16. It then heads directly south, cross-country until it reaches Substation D16.
  - New 138 kV transmission line from South Boise (hub) Substation to Substation D07. The line heads directly north from South Boise (hub) Substation then follows S. Pleasant Valley Road until W. Gowen Road. It follows W. Gowen Road heading west then continues cross-country when W. Gowen Road turns into S. Orchard Street until it reaches Substation D07.

Boise/Garden City Area

- Distribution Substations:
  - D20 – In southeast Boise, along East Warm Springs Avenue just southeast of Warm Springs Golf Course and along existing Boise Bench Substation to Grove Substation 138 kV transmission line (near intersection of W. Windsong Dr. and E. Warm Springs Ave.).
  - D22 – In Garden City, at southwest end of W. 44th St. next to existing 138 kV transmission line (W. 44th ST and Stockton St.).

Mountain Home/Grand View Area

- Hub Substations
  - New Elmore (hub) Substation location in Elmore County. Approximate location: near eastern 230 kV transmission line, 13. 5 miles southeast of Mountain Home. This is an alternative hub substation location to recognize that growth could occur someday in this part of Elmore County. The location wasn't precisely determined.
- Distribution Substations:
  - D09 – Northwest of Mountain Home at the intersection of Ditto Creek Road and West Martha Avenue on private land.
  - D21 Preferred Alternative – 0.6 miles southeast of CJ Strike Dam, along Black Sands Road on Idaho Power owned land.
  - D21 Alternative – South of ID-78, 1/3 miles east of River Road on Owyhee County land.
- 138 kV Transmission Lines:
  - Upgrade the existing 69 kV transmission from Elmore Substation in Mountain Home to Mountain Home Air Force Base Substation to 138 kV.
  - New 138 kV transmission line from Mountain Home Junction #2 Substation to existing 138 kV transmission line between Mountain Home City Substation and Bennett Creek Wind Substation. The new line heads directly south from Mountain Home Junction #2 Substation to the existing transmission line.
  - New 138 kV transmission line serving Bruneau Bridge Substation south of Mountain Home. The new line is run double circuit south from Mountain Home with the existing 69 kV transmission line until the line turns east (connecting to Flying H Substation). The new line then runs single circuit, southwest and cross-country until it reaches Bruneau Bridge Substation.
  - Upgrade the existing 69 kV transmission from Mountain Home City Substation to Bennett Substation to Glenns Ferry Pipeline Substation to 138 kV.
  - Upgrade existing 69 kV transmission line from Boise Bench Substation to Elmore Substation to 138 kV. Along the way, the upgraded transmission line connects to Substation D09.
  - Upgrade the existing 69 kV transmission line to 138 kV from Mountain Home City Substation to where it ties into the Elmore Substation to Mountain Home Air Force Base Substation 69 kV transmission line.

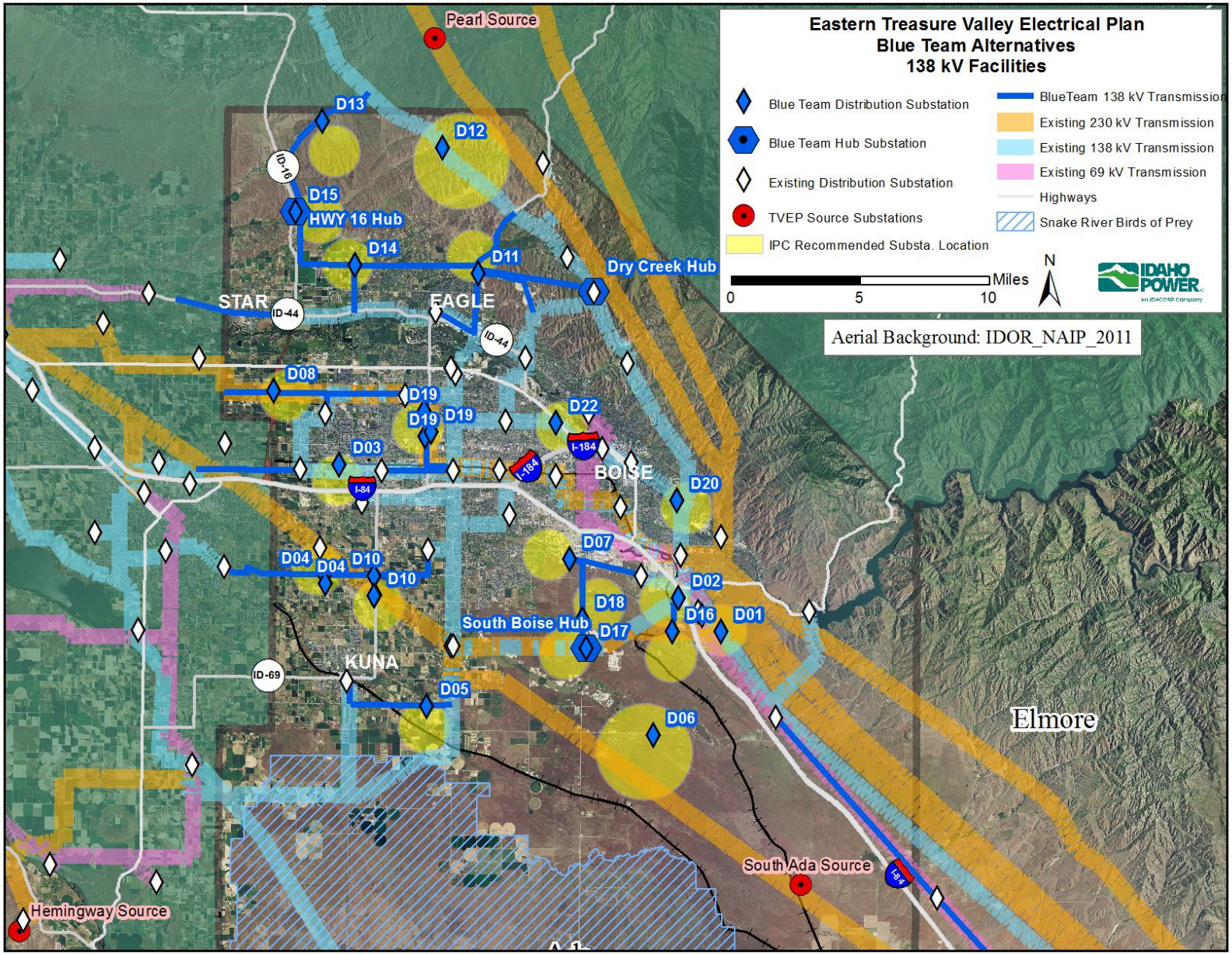

Figure 21: Blue Team Ada County 138 kV Mapping Results

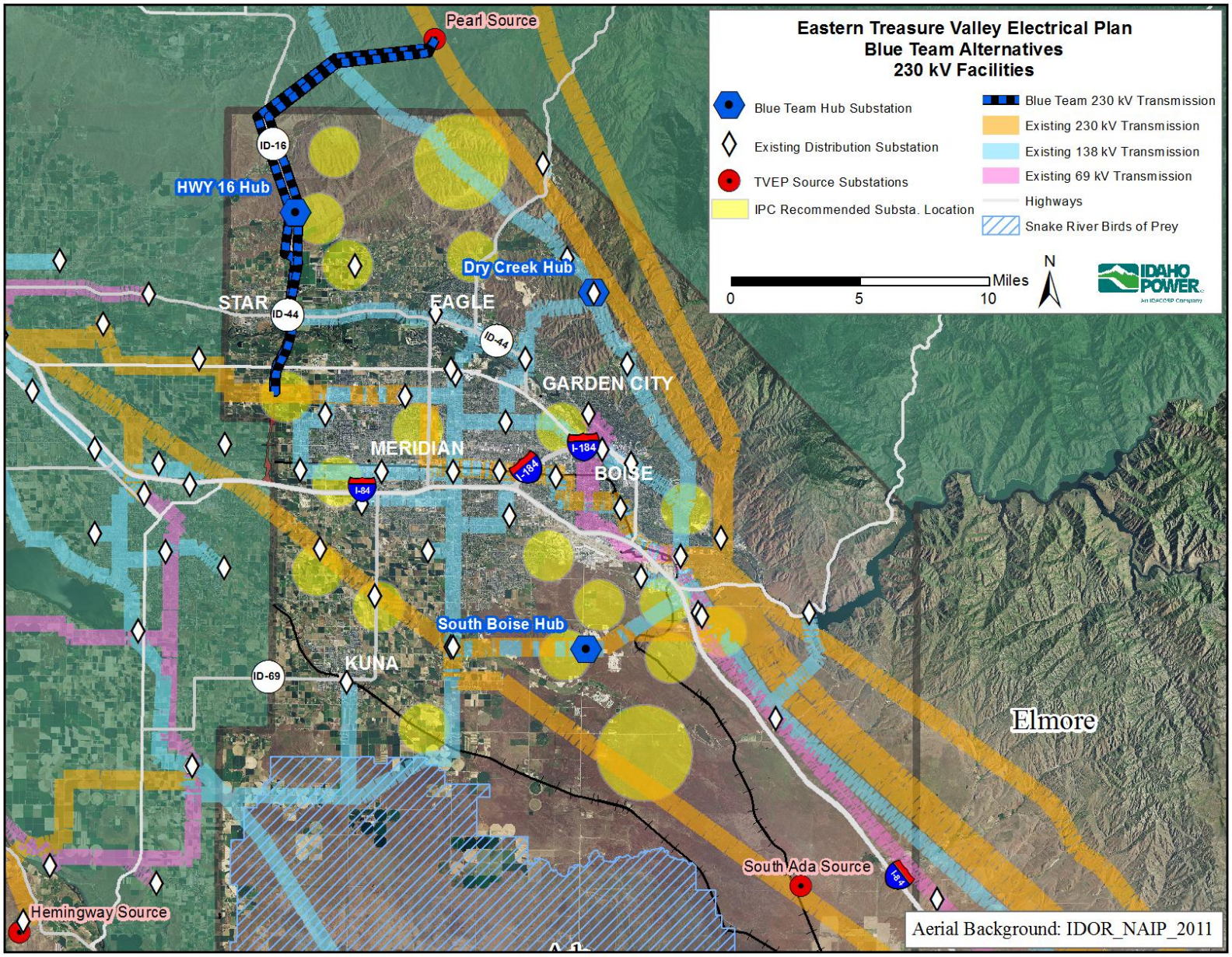

Figure 22: Blue Team Ada County 230 kV Mapping Results

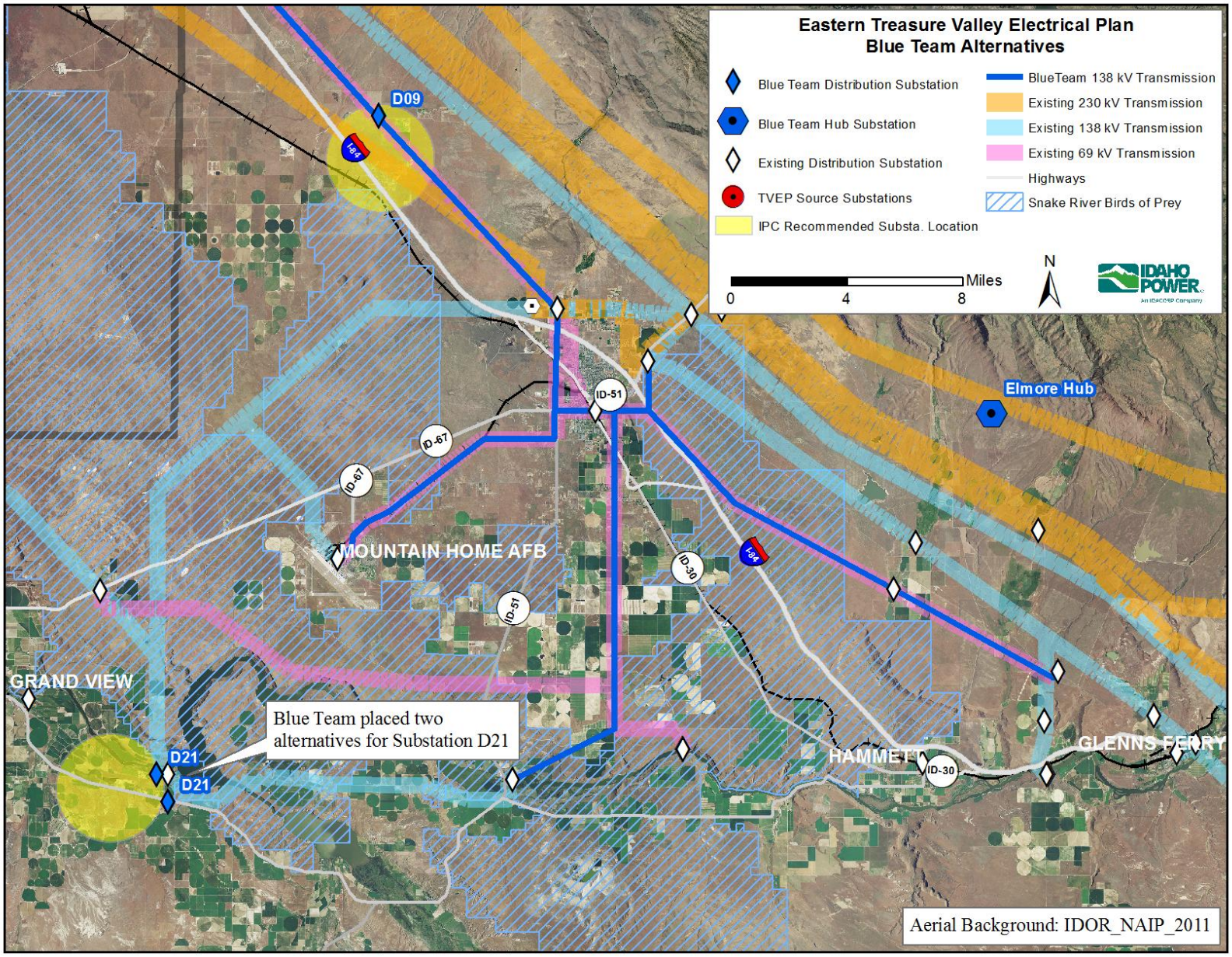

Figure 23: Blue Team Elmore and Owyhee Counties Mapping Results

Combined and Common Mapping Results

From the results of the small group mapping exercise, IPC's staff created a set of drawings that combined the alternatives so the Committee could see where commonalities and differences existed between the five teams. The first map developed (Figure 24) shows where all the new hub substations and 230 kV transmission lines designated by the teams in Ada County are located. As shown on this map, there are a number of different sites chosen for hub substations. Figure 25 shows where the teams sited hub substations in Elmore County. The Committee discussed the feasibility of each site and evaluated each based on the Committee's *Guiding Principles and Community Criteria*. The Committee eventually came to consensus in choosing a preferred set of hub substation locations and 230 kV transmission routes for the area. This preferred alternative is discussed in detail in the *Committee's Preferred Alternative* section of this report. It is noted that most of the 230 kV transmission line routes were previously sited in the TVEP and the Committee mostly confirmed those locations.

Figure 26 shows the 138 kV transmission lines and new distribution substations proposed by each team and overlaid on the same map for Ada County and Figure 27 shows the same for Elmore and Owyhee counties. There were many different options evaluated by the small mapping teams. As with the process used with the 230 kV combined map, the Committee discussed the feasibility of each 138 kV alternative.

Idaho Power staff also developed maps that show the commonalities between the various mapping team alternatives. Figures 28 and 29 show 230 kV facility commonalities between all four mapping teams, first for Ada County then for Elmore County. If a circle on the maps is colored orange, it means three mapping teams chose that particular location for a hub substation site. If the circle is blue, two of the teams chose that location. The color scheme includes green colored circles that indicate only one mapping team chose that particular location for a hub substation site.

Figure 30 and 31 show 138 kV facility commonalities between the various mapping team alternatives. The color coding on this map is similar to the color coding used on the Common 230 kV Facilities map. The teams were not in complete agreement with most new transmission line routes. That is, if teams chose to develop new transmission line routes, there was little similarity between the various teams' maps. The map also includes many green circles which would seem to indicate little agreement on distribution substation siting. However, in many cases, the differences were small. For example, sometimes individual teams sited distribution substations at the same intersection, but at different corners of that intersection.

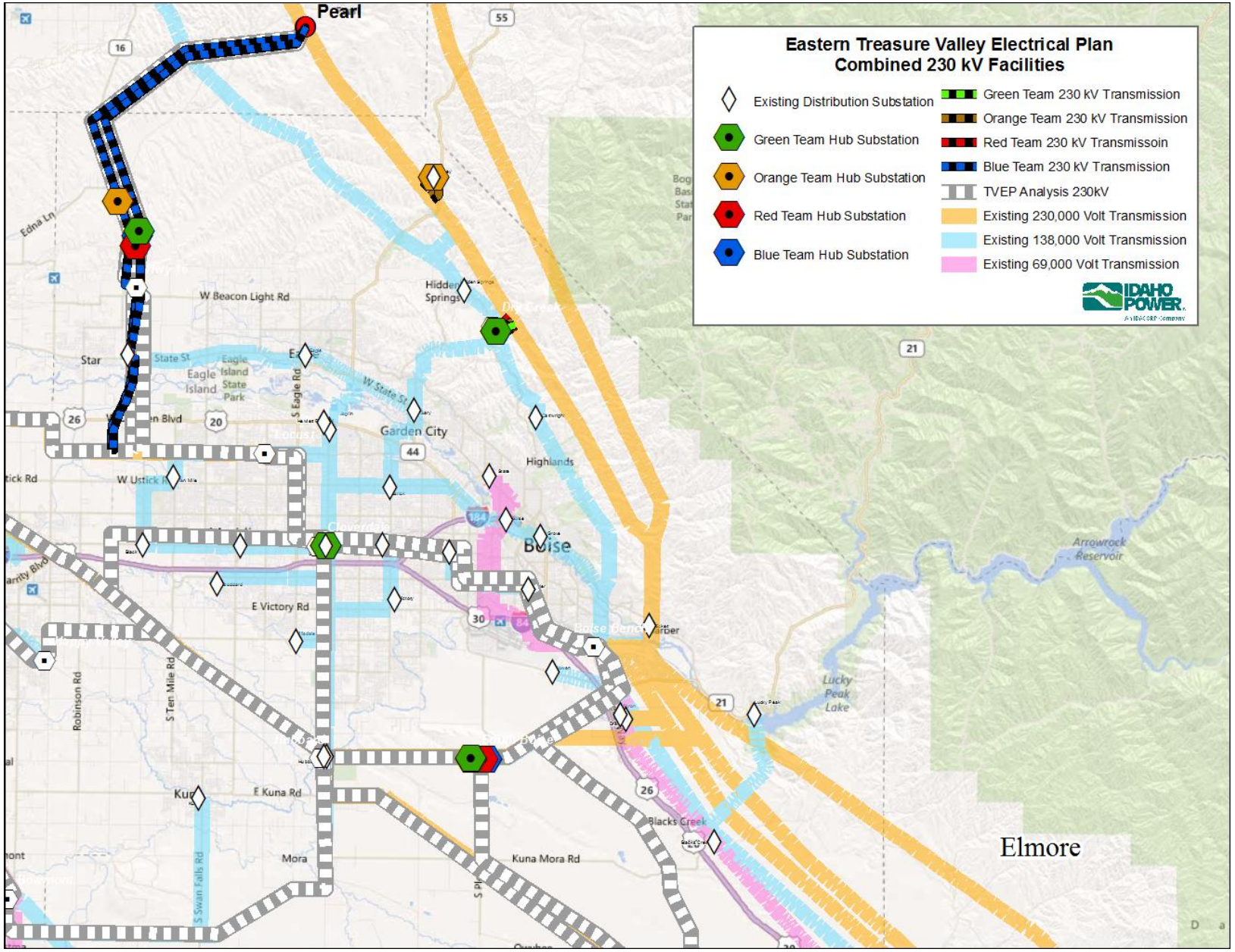

Figure 24: All Team Combined Hub Substations and 230 kV Transmission Lines - Ada County

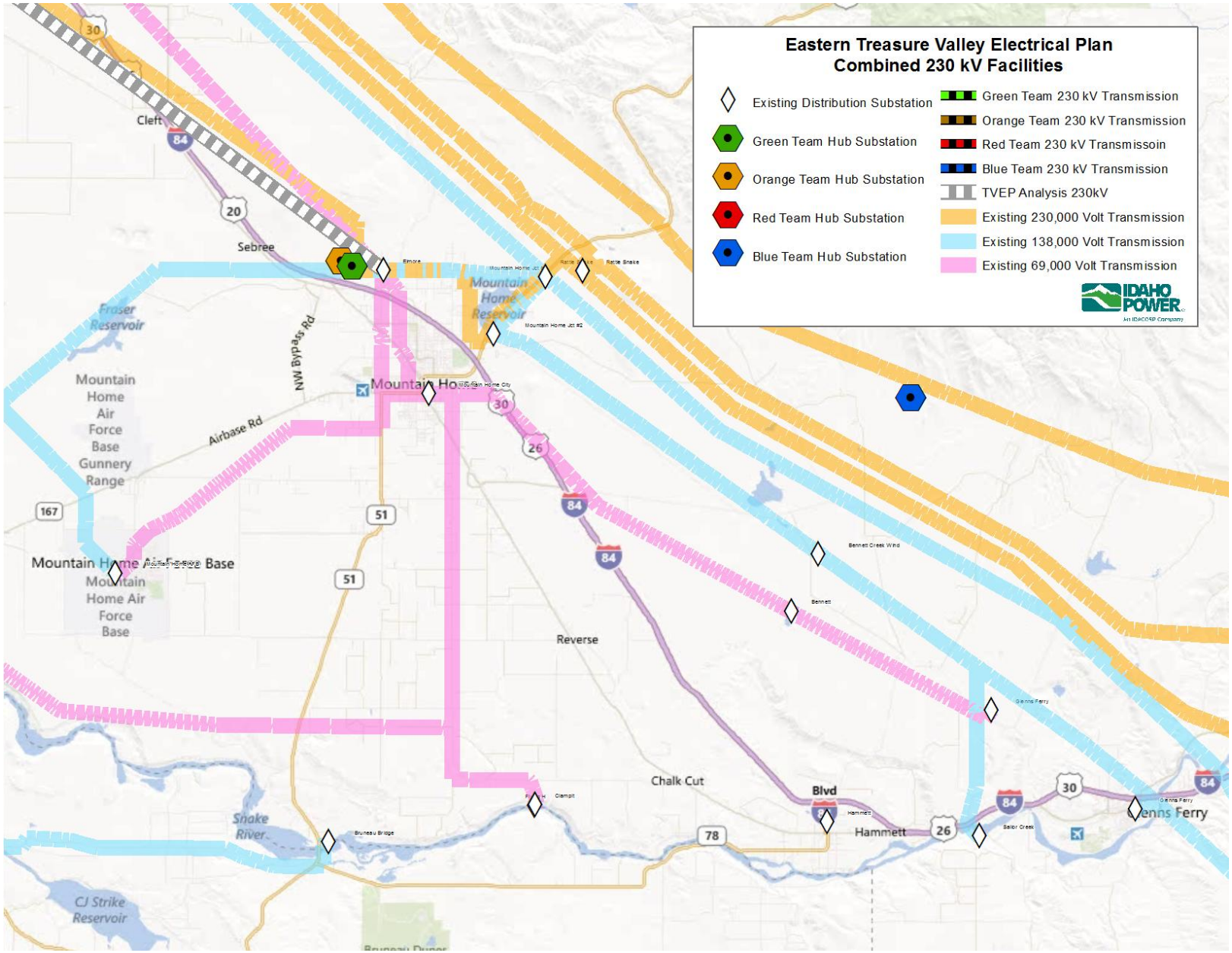

Figure 25: All Team Combined Hub Substations and 230 kV Transmission Lines - Elmore and Owyhee Counties

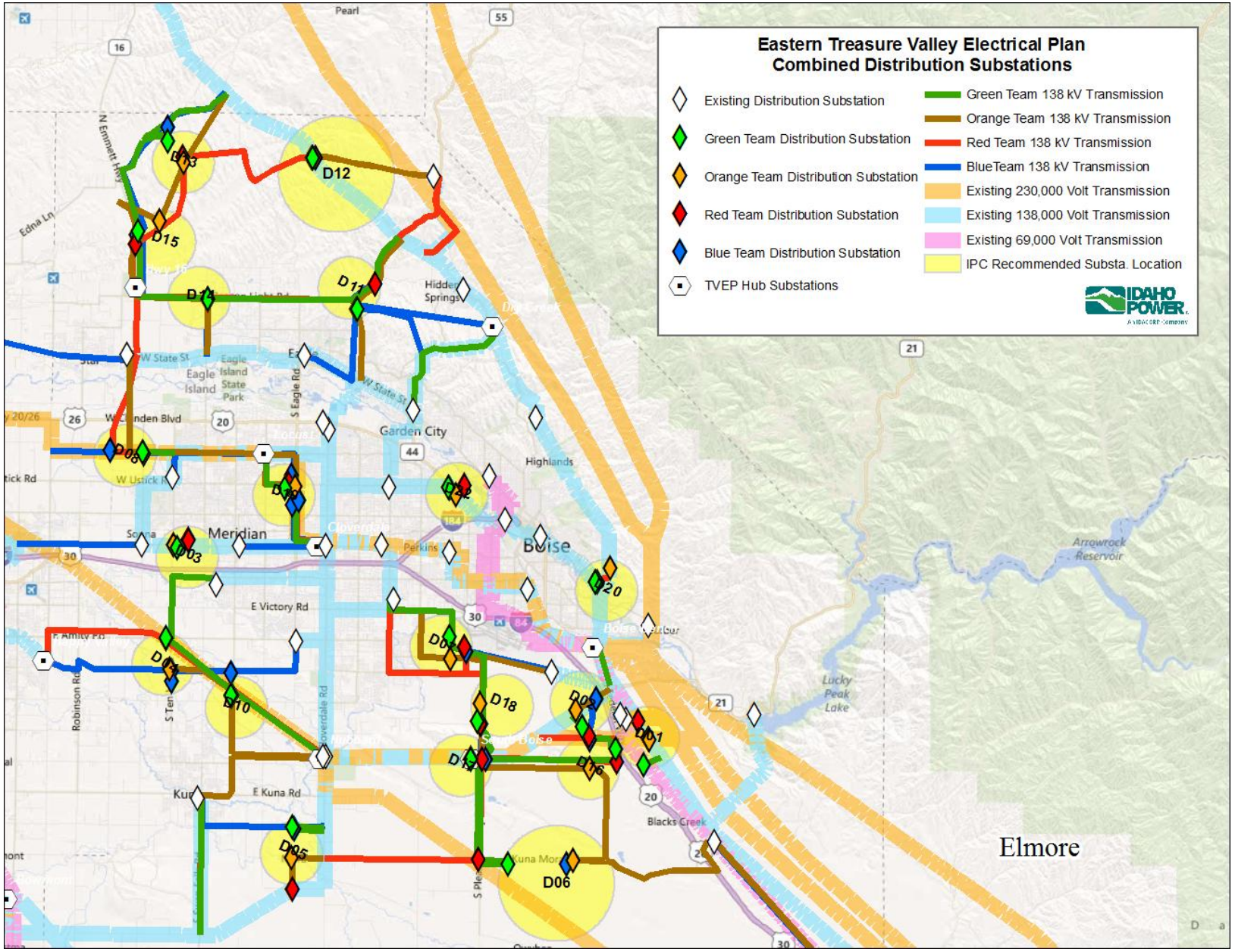

Figure 26: All Team Combined Distribution Substations and 138 kV Transmission Lines - Ada County

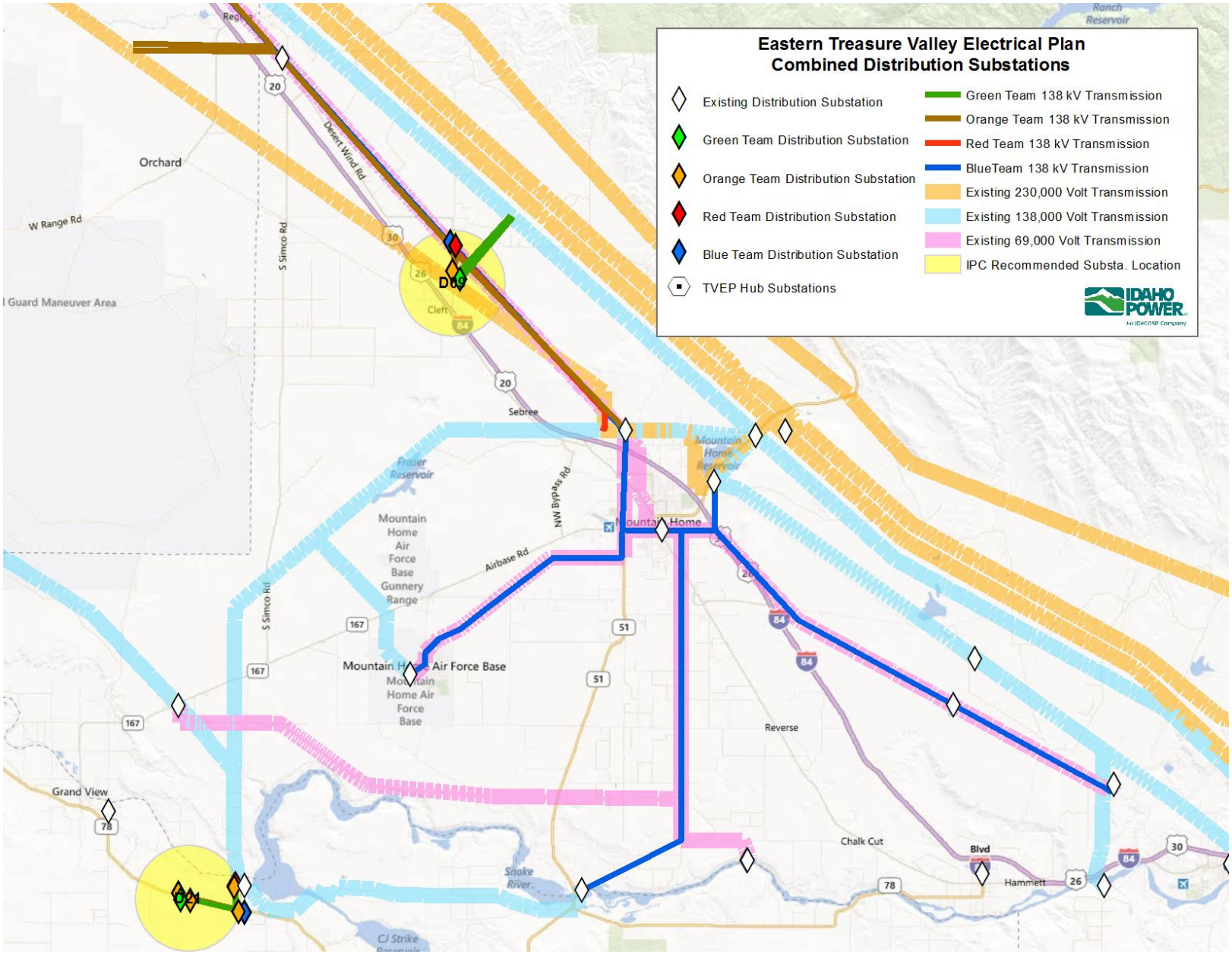

Figure 27: All Team Combined Distribution Substations and 138 kV Transmission Lines - Elmore and Owyhee Counties

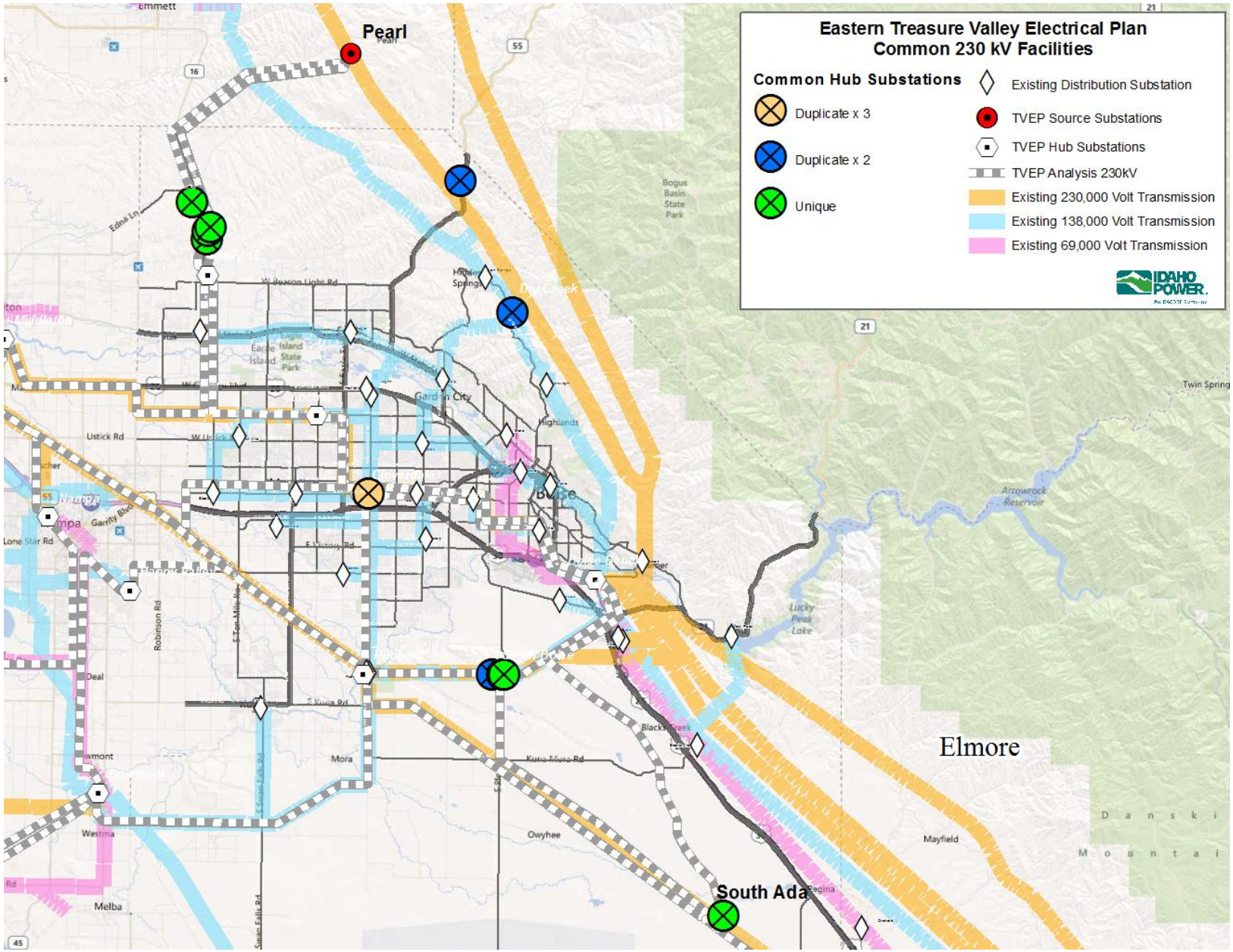

Figure 28: Common 230 kV Facilities - Ada County

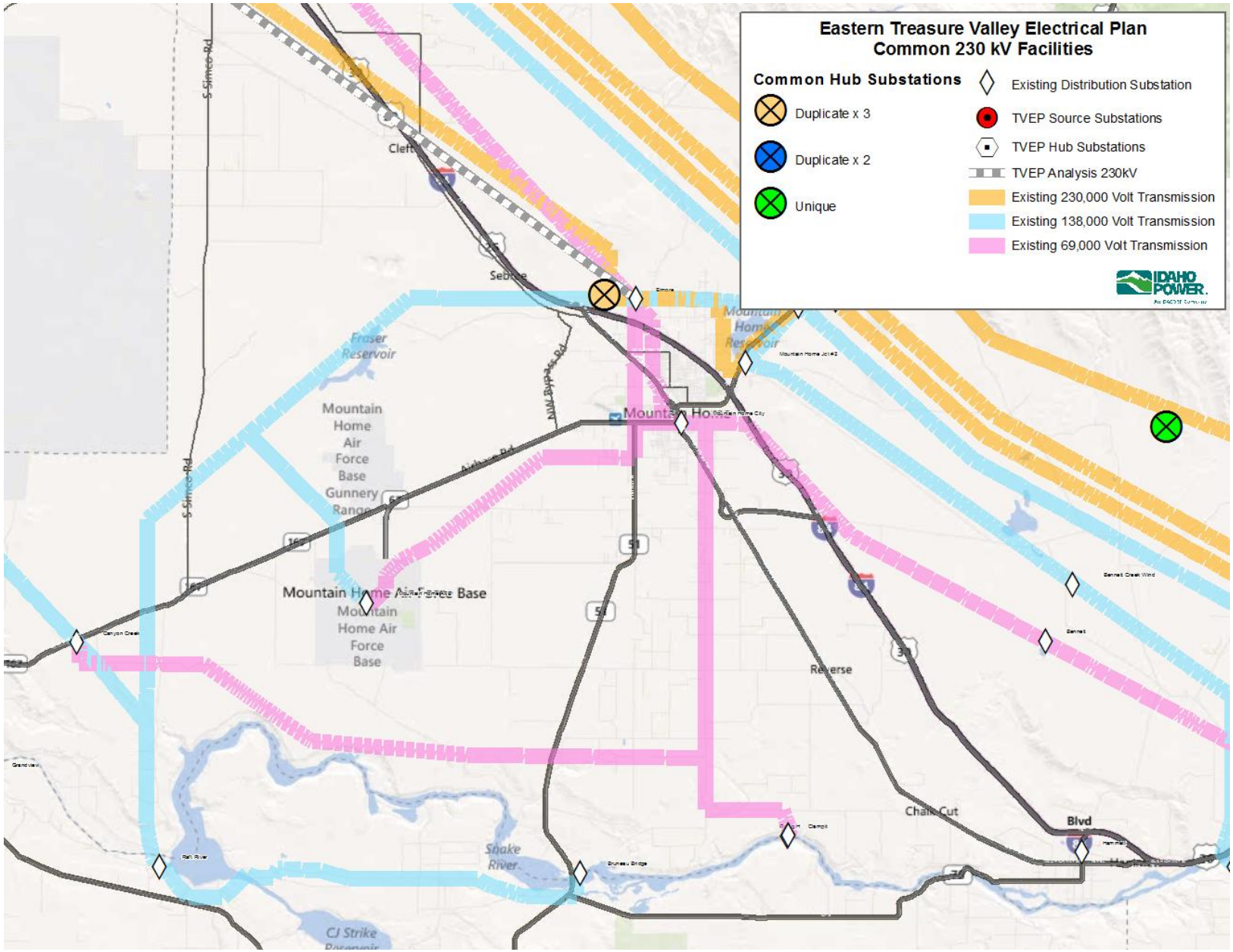

Figure 29: Common 230 kV Facilities - Elmore and Owyhee Counties

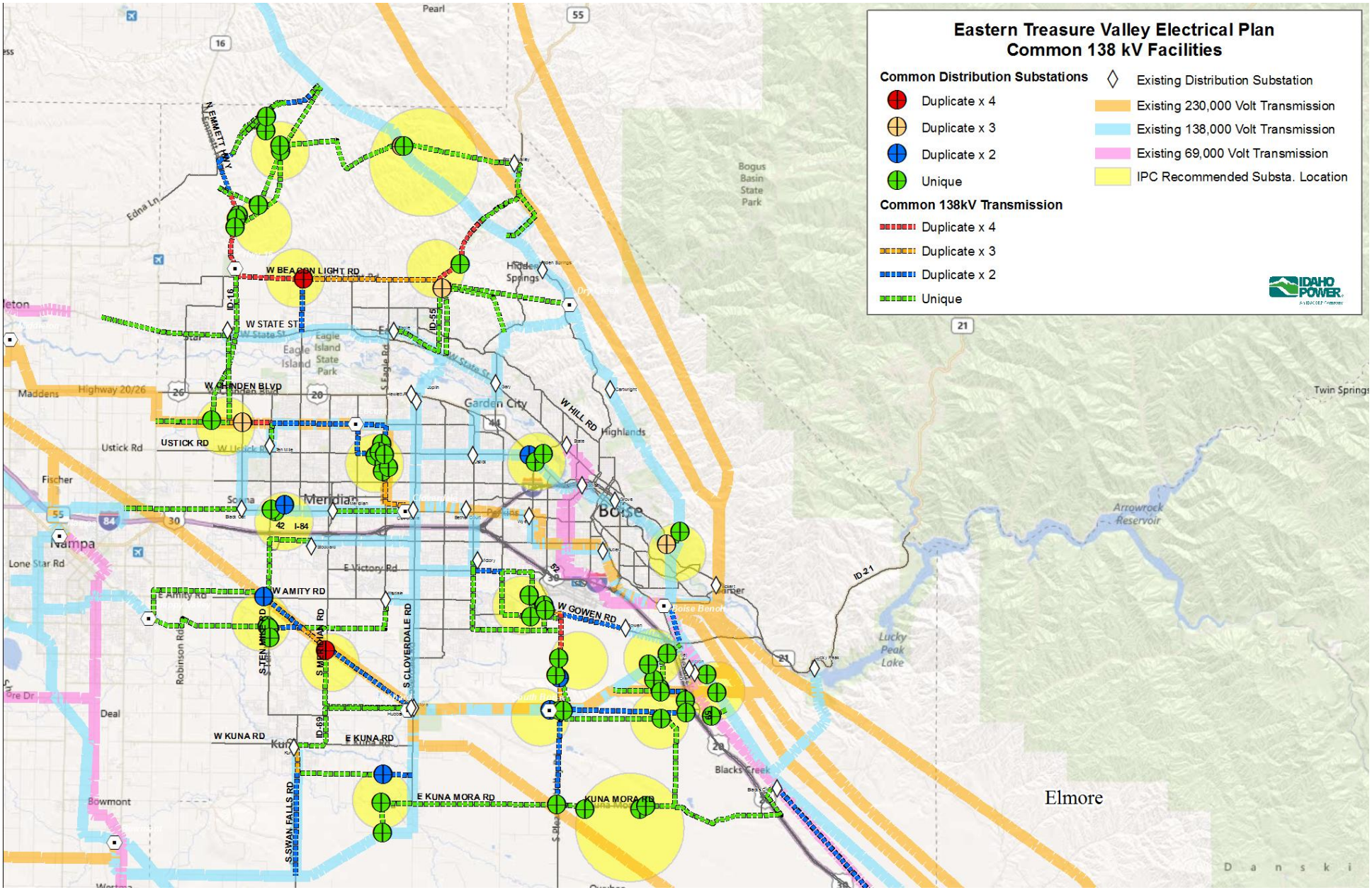

Figure 30: Common 138 kV Facilities - Ada County

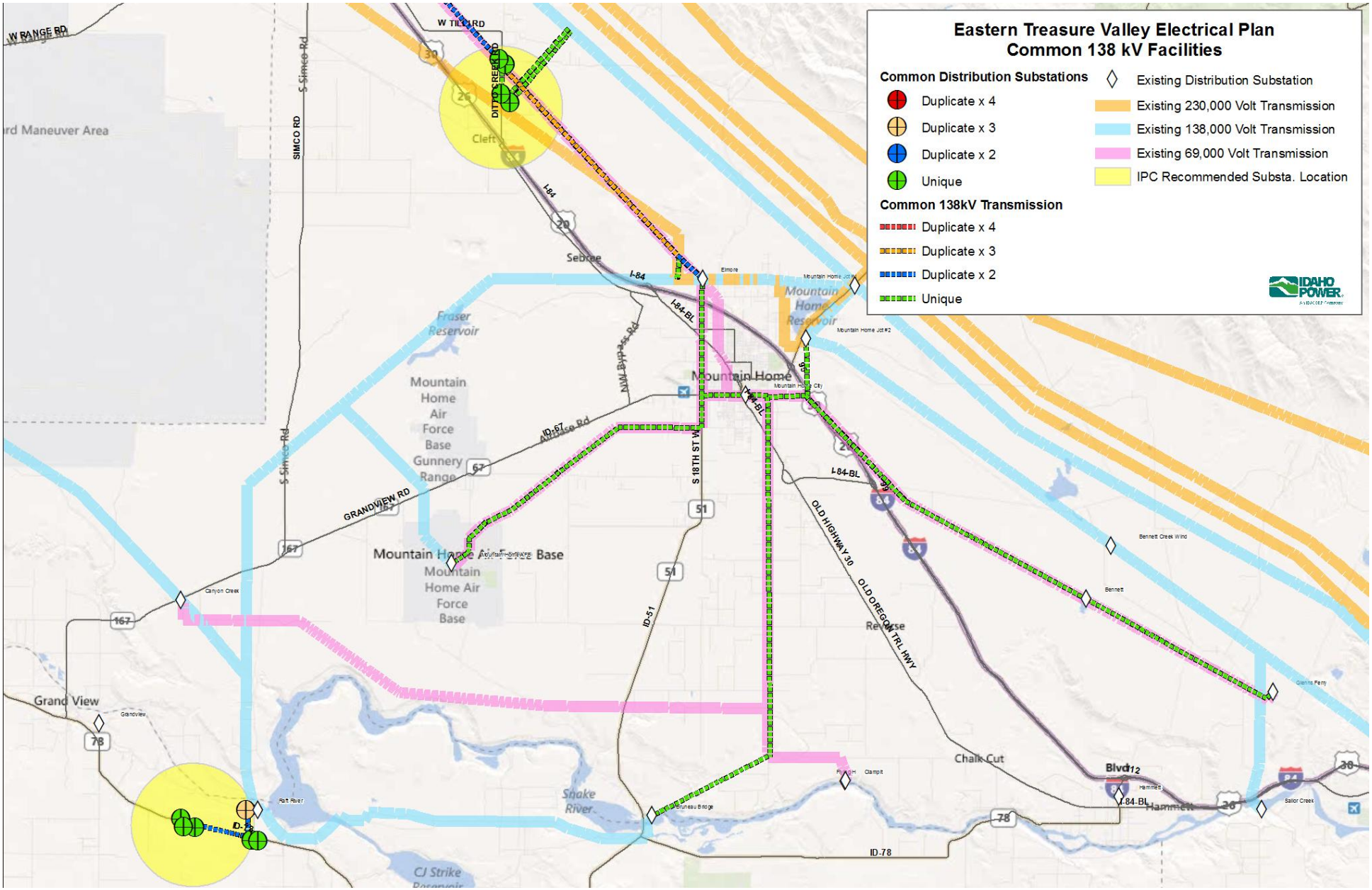

Figure 31: Common 138 kV Facilities - Elmore and Owyhee Counties

IPC also provided a rough, higher-order cost estimate for each alternative to help the Committee make comparisons. These estimates are shown in Table 12. The total buildout system cost estimates ranged from about $269 million up to $275 million in 2012 dollars. In general, the cost estimates for each group are quite similar at this high level so should be considered equal.

Table 12: Mapping Exercise Alternative Cost Comparisons (M=1,000,000, k=100,000)

	Blue Team		Orange Team		Red Team		Green Team	
Lines	***Length (miles)***	***Cost ($)***	***Length (miles)***	***Cost ($)***	***Length (miles)***	***Cost ($)***	***Length (miles)***	***Cost ($)***
138 kV	64	28M	74	35M	60	25M	71	31M
230 kV	190	112M	190	112M	189	112M	190	112M
Subtotal	254	140M	264	147M	249	137M	261	142M
Rebuilds	***Length (miles)***	***Cost ($)***	***Length (miles)***	***Cost ($)***	***Length (miles)***	***Cost ($)***	***Length (miles)***	***Cost ($)***
138 kV	96	42M	61	30M	83	44M	80	35M
Subtotal	96	42M	61	30M	83	44M	80	35M
Substations	***Qty***	***Cost***	***Qty***	***Cost***	***Qty***	***Cost***	***Qty***	***Cost***
Hub	5	35M	6	43M	5	37M	5	37M
Distribution	22	55M	22	55M	22	55M	22	55M
Subtotal	27	90M	28	98M	27	92M	27	92M
Total		**272M**		**275M**		**273M**		**269M**

Committee's Preferred Alternatives

At the May 2012 meeting, the Committee evaluated each team's alternative and began to determine their preferred locations for individual substations and transmission line routes. The Committee looked at each substation site and transmission line route individually to determine which team's alternative was preferred and if alterations to alternatives were needed. In the end, the Committee decided that instead of narrowing the facility locations down to one alternative, they would eliminate "no go" alternatives and indicate if the remaining alternatives were preferred over others.

The Committee generally recommended that IPC refer to Committee-derived *Guiding Principles and Community Criteria* when siting any new facility in the eastern Treasure Valley.

The Committee reached consensus on preferred substation locations and transmission line routes in each of the geographical sub-areas of the Plan. Figure 32 shows the preferred 230 kV alternatives for the Ada County area and Figure 33 shows the preferred 230 kV alternative for Elmore County (there were no 230 kV facilities sited in Owyhee County). The preferred 138 kV alternatives for Ada County are shown in Figure 34 and the preferred 138 kV alternatives for Elmore and Owyhee counties are shown in Figure 35. Of course, both 230 kV and 138 kV facilities will be needed and will overlay one another, but multiple figures are provided for clarity. Also shown on these drawings are alternatives the Committee considered as secondary in that if the preferred alternative for some transmission line routes and substation locations could not be obtained, IPC could choose the secondary alternatives.

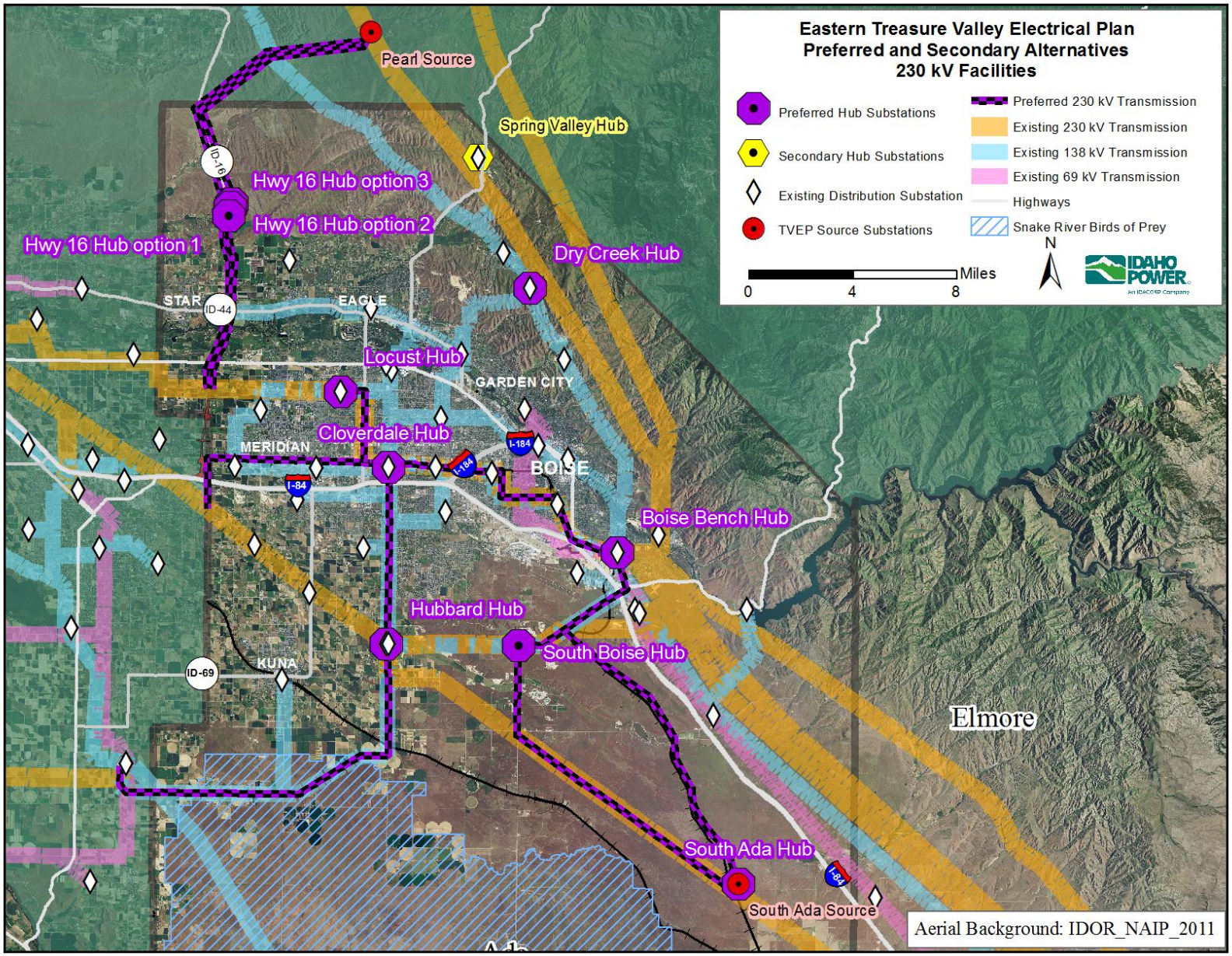

Figure 32: Preferred 230 kV Alternatives - Ada County

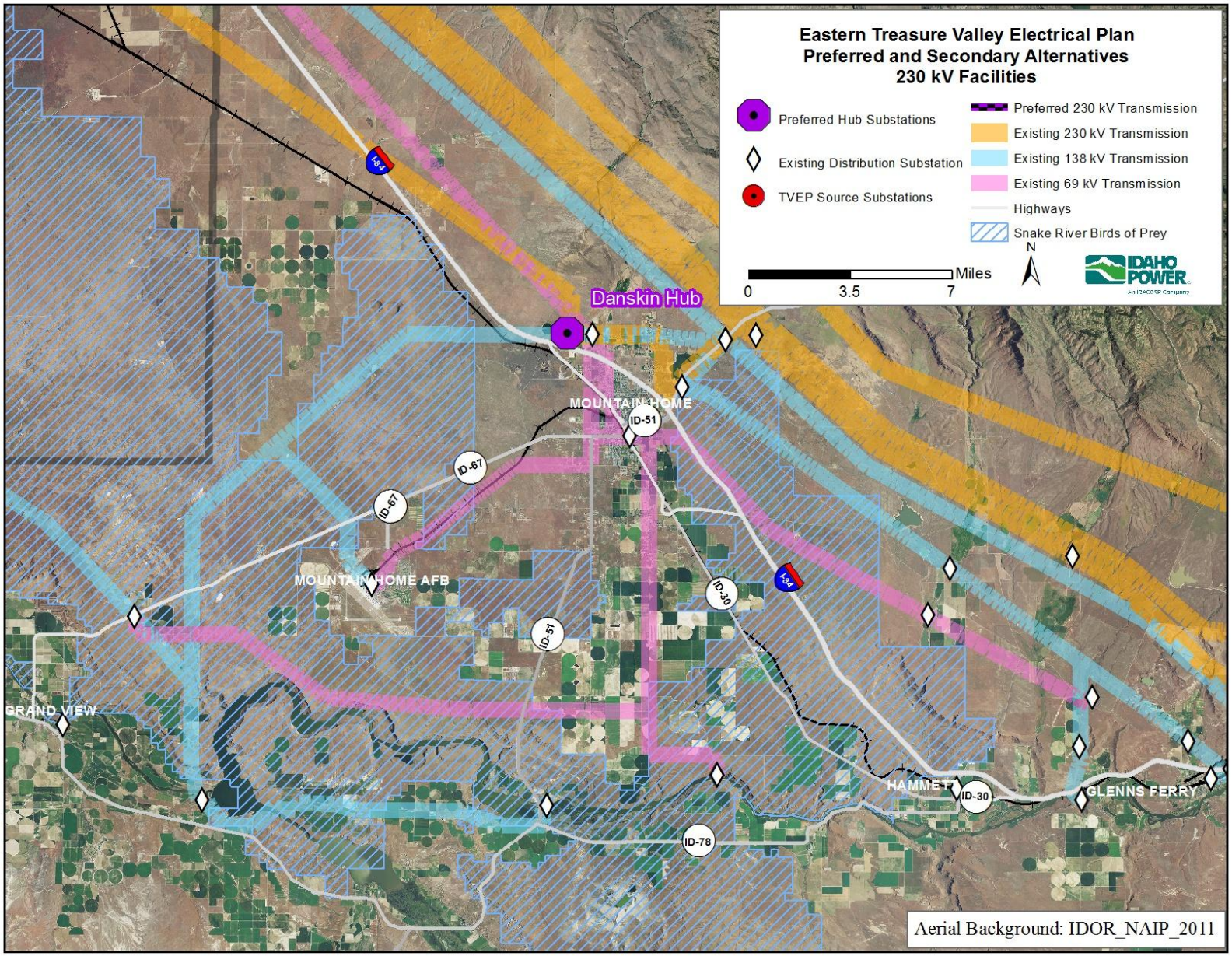

Figure 33: Preferred 230 kV Alternatives - Elmore County

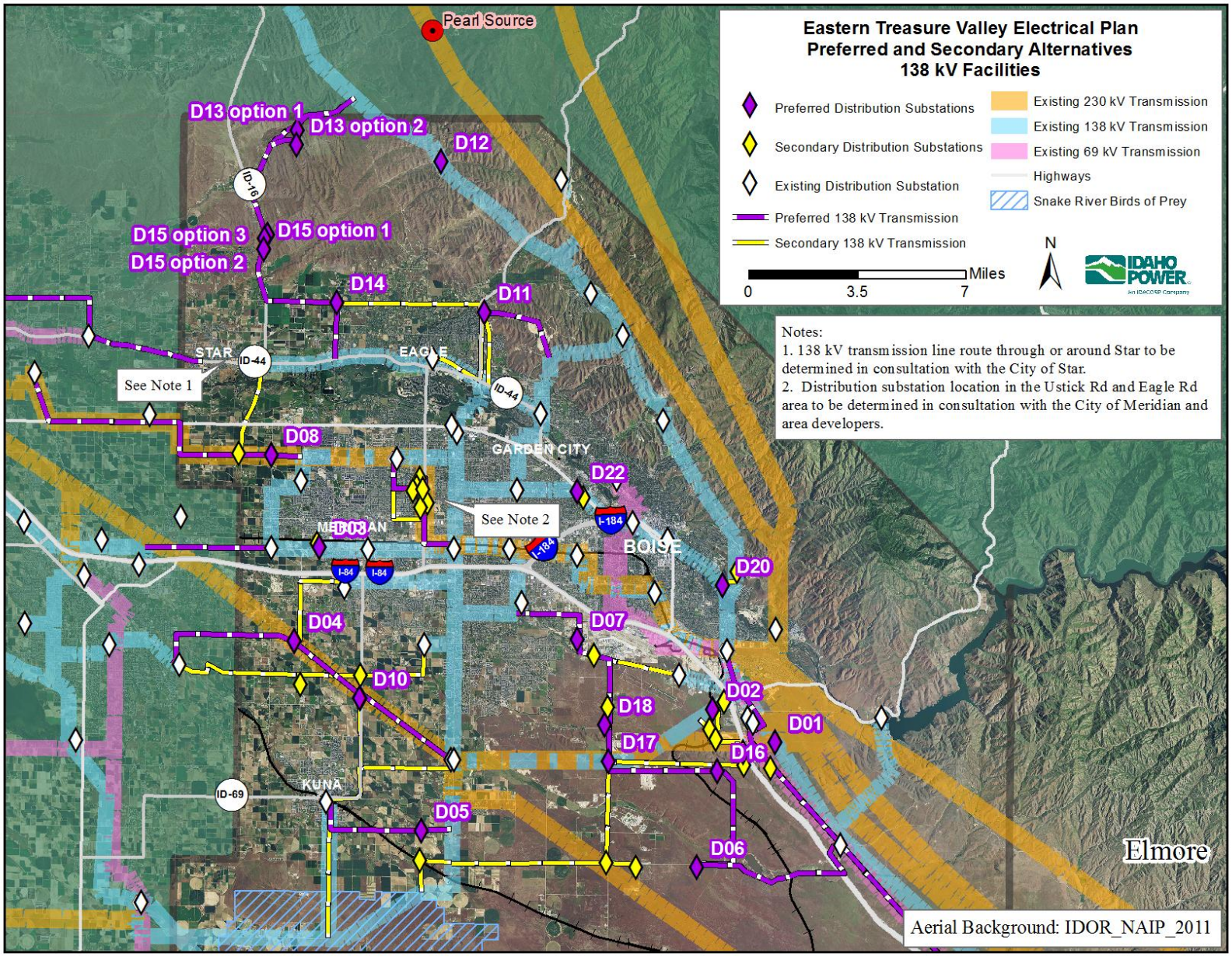

Figure 34: Preferred 138 kV Alternatives - Ada County

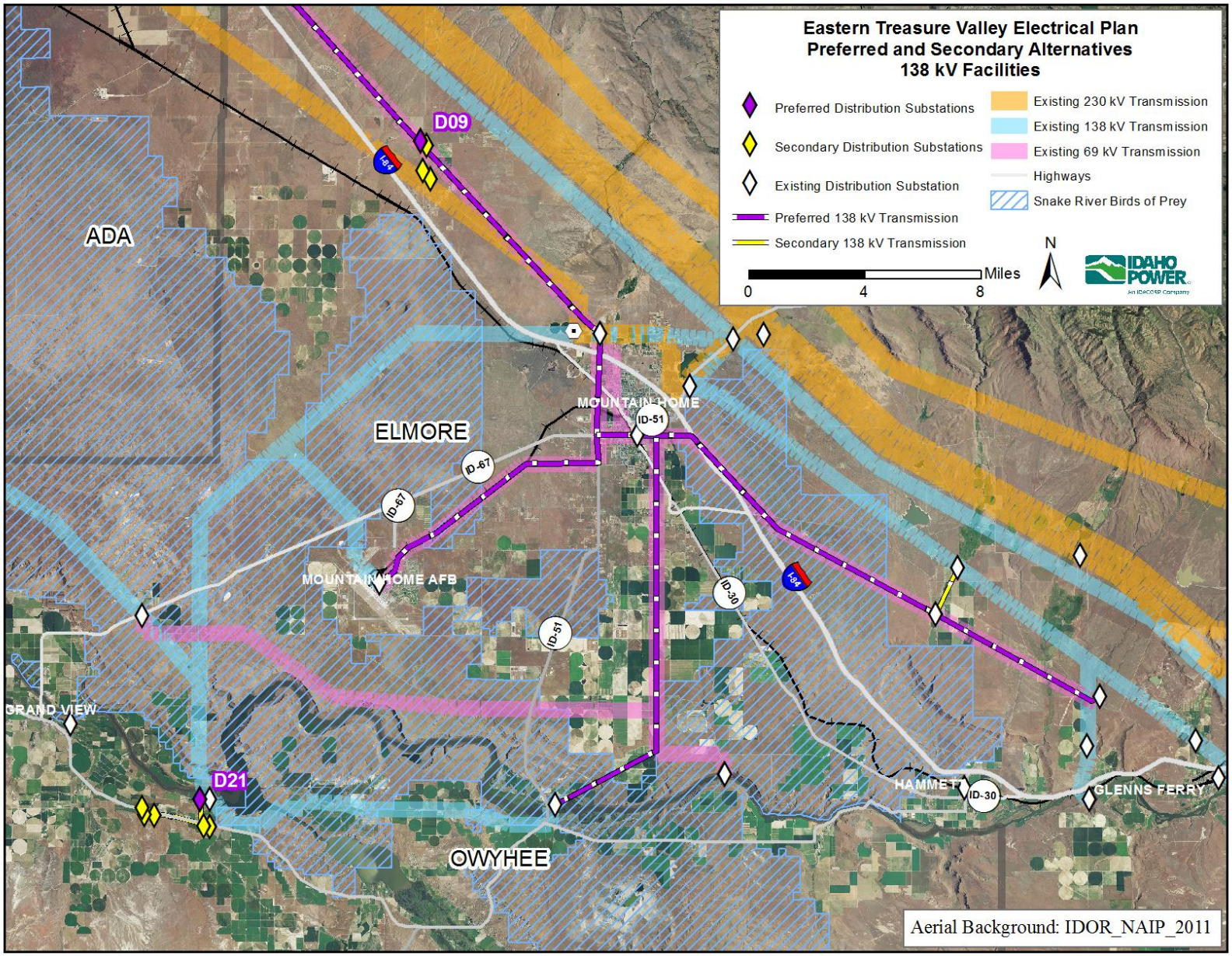

Figure 35: Preferred 138 kV Alternatives - Elmore and Owyhee Counties

Eagle Area

- Hub Substations (See Figure 32):
  - The Committee provided three options for a new Highway 16 (hub) Substation on ID-16 northeast of Star:
    - Option 1: Co-locate with distribution Substation D15 on Highway 16 northeast of Star near West Deep Canyon Drive
    - Option 2: Co-locate with distribution Substation D15 on Highway 16 northeast of Star 0.7 miles north of West Deep Canyon Drive.
    - Option 3: Co-locate with distribution Substation D15 on Highway 16 northeast of Star 0.8 miles north of West Deep Canyon Drive.
  - New Dry Creek (hub) Substation located at the future Dry Creek Substation site. This is in agreement with the TVEP.

The Committee also provided one secondary hub substation location to be used if the Dry Creek (hub) Substation cannot be built.

  - New Spring Valley (hub) Substation co-located with the existing Spring Valley Substation northeast of Eagle along ID-55.

- 230 kV Transmission Lines (See Figure 32):
  - New 230 kV transmission line from Dry Creek (hub) Substation to existing 230 kV transmission line between Boise Bench Substation and Brownlee Substation. The line heads northeast from Dry Creek Substation cross-country with no identified route.
  - Second new 230 kV transmission line from Dry Creek (hub) Substation to existing 230 kV transmission line between Boise Bench Substation and Brownlee Substation. The line heads northeast from Dry Creek Substation cross-country with no identified route.
  - New 230 kV transmission line from Pearl Source Substation to Highway 16 (hub) Substation. The new line follows the route identified in the TVEP.
  - Second new 230 kV transmission line from Pearl Source Substation to Highway 16 (hub) Substation. The new line follows the route identified in the TVEP. This could potentially be run double circuit with the 230 kV line in the previous bullet if reliability analysis does not prohibit it.
  - New 230 kV transmission line from Highway 16 (hub) Substation to tie into the exiting 230 kV transmission line between Locust Substation and Caldwell Substation. The new line follows the TVEP 230 kV route except the line should follow the new Highway 16 road extension alignment as determined by the Idaho Transportation Department as it heads south, crosses the Boise River and heads towards McMillan Road.
  - Second new 230 kV transmission line from Highway 16 (hub) Substation to tie into the exiting 230 kV transmission line between Locust Substation and Caldwell Substation. The new line follows the TVEP 230 kV route except the line should follow the new Highway 16 road extension alignment as determined by the Idaho Transportation Department as it heads south, crosses the Boise River and heads towards McMillan Road. This could potentially be run double circuit with the 230 kV line in the previous bullet if reliability analysis does not prohibit it.

- Distribution Substations (See Appendix D, Figure D-1):
  - D11 – Northeast of Eagle, along N. Horseshoe Bend Road and W. Goose Creek Road.
  - D12 – North of Eagle, near where Aerie Lane crosses the existing 138 kV transmission line.
  - D13 – The Committee provided two equal options for the Substation D13 location:
    - Option 1 – North of Eagle, 2.1 miles east of ID-16, 0.15 miles south of W. Chaparral Road.
    - Option 2 – North of Eagle, 2 miles east of ID-16, 0.6 miles south of W. Chaparral Road.
  - D14 – In east Eagle at the corner of North Linder Road and West Beacon Light Road on existing Idaho Power owned land. Idaho Power has named this future substation, "Beacon Light Substation."
  - D15 – The Committee provided three equal options for the Substation D15 location:
    - Option 1 – Co-locate with Hwy 16 (hub) Substation on Highway 16 northeast of Star near West Deep Canyon Drive.
    - Option 2 - Co-locate with Hwy 16 (hub) Substation on Highway 16 northeast of Star 0.7 miles north of West Deep Canyon Drive.
    - Option 3 - Co-locate with Hwy 16 (hub) Substation on Highway 16 northeast of Star 0.8 miles north of West Deep Canyon Drive.

- 138 kV Transmission Lines (See Appendix D, Figure D-1):
  - New 138 kV transmission line serving Substation D14. The new line is connected to the existing Eagle Substation to Star Substation 138 kV transmission line where the line crosses N. Linder Road. The line follows N. Linder Road its entire route.
  - New 138 kV transmission line from Highway 16 (hub) Substation to Substation D14. The line heads southeast from Highway 16 Substation, cross-country and then follows ID-55 until it terminates at Substation D14. The first part of the route depends on which Highway 16 Substation is chosen.
  - New 138 kV transmission line from the existing 138 kV transmission line between Dry Creek (future) Substation and Gary Substation to Substation D11. The new line connects into the existing transmission line approximately 2 miles north of Gary Substation. It heads northwest across the Ada County landfill then angles west on the ridgeline above the landfill until it reaches Substation D11. The Committee stated that this line could be placed over the top of the Ada County landfill.
  - New 138 kV transmission line from Highway 16 (hub) Substation to Substation D13. The line follows ID-16 north from Highway 16 (hub) Substation then turns east on W. Chaparral Road. It follows W. Chaparral Road for about 2.3 miles then turns southeast until it reaches Substation D13, Option 1. If Substation D13, Option 2 is chosen, the line follows W. Chaparral Road for 1.4 miles before angling off to the southeast to serve Substation D13, Option 2.
  - New 138 kV transmission line from Substation D13 to the existing 138 kV transmission line between Hidden Springs Substation and Emmett Substation. The line heads northwest from Substation D13 then follows Chaparral Road until it reaches the existing 138 kV transmission line.

- New 138 kV transmission line from Star Substation to Lansing Substation. The new line heads west along ID-44 from Star Substation and follows ID-44 until it reaches Lansing Substation. Note, the line is not contiguous through the City of Star. Idaho Power will consult with the City of Star to route the line through Star.
- New 138 kV transmission line from Lansing Substation to Willis Substation in accordance with the Western Treasure Valley Electrical Plan. The line is in Canyon County.

The Committee also provided some secondary 138 kV transmission line routes if a particular preferred route is difficult to obtain (See Appendix D, Figure D-1).

- Alternate new 138 kV transmission line from Substation D14 to Substation D11. From Substation S14, the line heads east along W. Beacon Light Road until it reaches ID-55. It then heads southeast cross-country until it reaches Substation D11.
- Alternate new 138 kV transmission line serving Substation D11. The new line follows ID-55 south from Substation D11 then is run double circuit on the existing 138 kV transmission line between Gary Substation and Eagle Substation until it reaches Eagle Substation.
- Alternate new 138 kV transmission line from Substation D11 to tap into existing 138 kV transmission line between Gary Substation and Eagle Substation. The line follows N. Horseshoe Bend Road for nearly its entire length.

Meridian Area

- Hub Substations (See Figure 32):
  - Add facilities to existing Locust (hub) Substation. This is in agreement with the TVEP.
  - Add facilities to existing Cloverdale distribution Substation. This is in agreement with the TVEP.
- Distribution Substations (See Appendix D, Figure D-2):
  - D03 – In Meridian, just off Franklin Road west of the waste transfer station on school district owned land.
  - D08 – In Meridian, at the corner of West McMillan Road and North Black Cat Road.
  - D19 – No preferred option. Idaho Power is to work with City of Meridian and developers on location.

  The Committee also provided some secondary distribution substation sites in the Meridian area (See Appendix D, Figure D-2).
  - D03 – Just off Franklin Road west of the school bus lot.
  - D08 – At intersection of N. McDermott Road and W. McMillan Road.
  - D19 Alternative 1 – 1/3 miles north of E. Ustick Road and N. Eagle Road intersection in field west of Eagle Road.
  - D19 Alternative 2 – Along East Ustick Road, 1/4 mile west of North Eagle Road (behind Kohl's).
  - D19 Alternative 3 – 1/3 mile west of E. Ustick Road and N. Eagle Road intersection, on south side of Ustick Road.
  - D19 Alternative 4 – Just east of N. Eagle Road near E. River Valley Road.
  - D19 Alternative 5 – 1/3 miles north of E. Fairview Ave and N. Eagle Road intersection on west side of road.

- D19 Alternative 6 – At the southwest corner of E. Ustick Road and N. Eagle Road.

- 138 kV Transmission Lines (See Appendix D, Figure D-2):
  - New 138 kV transmission line from Black Cat Substation west of Meridian to the existing 138 kV transmission line between Karcher Substation and Zilog Substation. The new line runs west along E. Franklin Road until Ridgecrest Golf Course. It crosses the golf course still heading west until it ties into the existing transmission line.
  - New 138 kV transmission line from Cloverdale Substation to Substation D19. From Cloverdale Substation, the new line is run double circuit along railroad tracks with the existing Boise Bench Substation to Locust Substation 230 kV transmission line then heads north along Eagle Road, still double circuit with existing 230 kV transmission line. The line heads west along E. Ustick Road until it reaches Substation D19.
  - New 138 kV transmission line from Locust Substation to Substation D19. The line follows N. Locust Grove Road heading south from Locust Substation then turns east on W. Ustick Road until it reaches Substation D19.
  - Extension of Cloverdale Substation to Substation D19 if necessary. Depends on where D19 is located. The line follows the existing 230 kV transmission line along N. Eagle Road heading north from E. Ustick Road for 1/3 miles then turns west to connect to Substation D19.
  - New 138 kV transmission line serving Substation D08 in Meridian. The new line ties into the existing 138 kV transmission line between Locust Substation and Ten Mile Substation at W. McMillan Road and N. Ten Mile Road. The line follows W. McMillan Road until it reaches Substation D08.
  - New 138 kV transmission line from Substation D08 in Meridian to future Garnet Substation in Middleton. From Substation D08, the line is run double circuit with the existing 230 kV transmission line that runs west along W. McMillan Road, turns north along N. Can Ada Road, turns west on ID 20/26 then angles to the northwest until it reaches Garnet Substation. This line is in agreement with the Western Treasure Valley Electrical Plan.

  The Committee also provided some secondary 138 kV transmission line routes if a particular preferred route is difficult to obtain (See Appendix D, Figure D-2).
  - An alternate path from Cloverdale Substation to Substation D19: From the Cloverdale Substation, the 138 kV transmission line can head west to N. Eagle Road, north to E. Fairview Avenue, then west along E. Fairview Avenue (instead of continuing north along N. Eagle Road) then north along N. Locust Grove Road until it reaches Locust Substation.
  - New 138 kV transmission line from Star Substation to Substation D08. From Star Substation, the line follows the new ID-16 alignment until McMillan Road. It turns east and follows McMillan Road to the Substation D08 Alternative location.
  - New 138 kV transmission line to serve Substation D03 in Meridian. The new line ties into the existing 138 kV transmission line between Meridian Substation and Black Cat Substation along W. Franklin Road just west of the transfer substation then connects (double circuit) to Substation D03.

Kuna Area

- Hub Substations (See Figure 32):
  - Add facilities to existing Hubbard (hub) Substation. This is in agreement with the TVEP.

- Distribution Substations (See Appendix D, Figure D-3):
  - D04 – On Amity Road west of South Ten Mile Road, on existing Idaho Power owned land.
  - D05 – Southeast of Kuna at S. Eagle Road and E. King Road.
  - D10 – North of Kuna along South Meridian Road north of East Columbia Road, on existing Idaho Power owned land.

  The Committee also provided some secondary distribution substation sites in the Kuna area:
  - D04 – Between Kuna and Meridian, south of W. Lake Hazel Road and S. Ten Mile Road intersection, south of Kuna water treatment plant.
  - D05 – East of Kuna, along railroad line near corner of E. Kuna Mora Road and S. Eagle Road.
  - D10 – North of Kuna along South Meridian Road north of East Columbia Road, on existing Idaho Power owned land.

- 138 kV Transmission Lines (See Appendix D, Figure D-3):
  - New 138 kV transmission line from existing 138 kV transmission line between Bowmont Substation and Mora Substation to Substation D05. The line follows E. King Road its entire route.
  - New 138 kV transmission line from Kuna Substation to Substation D05. The line heads south from Kuna Substation following S. Swan Falls Road. It turns east along E. King Road and follows it until the line reaches Substation D05.
  - New 138 kV transmission line from Mora Substation to Substation D10. The line follows the same route northwest as the existing 230 kV transmission line between Hubbard Substation and Nampa Substation then heads south on S. Meridian Road until it reaches Substation D10.
  - New 138 kV transmission line from Substation D10 to Substation D04. The line follows the same route northwest as the existing 230 kV transmission line between Hubbard Substation and Caldwell Substation.
  - New 138 kV transmission line from Substation D04 to Happy Valley Substation. The line follows the proposed TVEP 230 kV line route, paralleling W. Amity Road, then turns south on S. Happy Valley Road until it reaches Happy Valley Substation.

  The Committee also provided some secondary 138 kV transmission line routes if a particular preferred route is difficult to obtain (See Appendix D, Figure D-3).
  - Alternate new 138 kV transmission line from Substation D10 to Mora Substation. From Substation D10, the line follows S. Meridian Road heading south from Substation D10, turning west on E. Deer Flat Road then angling the last 1/2 mile to Mora Substation.

- New 138 kV transmission line from existing 138 kV transmission line between Bowmont Substation and Mora Substation to Kuna Substation. This is a second circuit on an existing 138 kV transmission line. The line runs along S. Swan Falls Road.
- New 138 kV transmission line from Mora Substation to Kuna Substation. From Mora Substation, the line angles to the southwest for 1/2 mile then follows E. Deer Flat Road until it turns south on S. Meridian Road. The line then turns west along Avalon Street then south on S. Swan Falls Road until it reaches Kuna Substation.
- New 138 kV transmission line from Substation D05 to existing 138 kV transmission line between Bowmont Substation and Mora Substation. From Substation D05, the line heads directly east until it connects into the existing transmission line.
- Second new 138 kV transmission line from Substation D05 to existing 138 kV transmission line between Bowmont Substation and Mora Substation. From Substation D05, the line heads directly south until it connects into the existing transmission line. This line could potentially be run double circuit with the line described in the previous bullet.
- New 138 kV transmission line from Stoddard Substation to Substation D04. The new line follows W. Overland Road heading west from Stoddard Substation until it reaches S. Ten Mile Road. Note, the line does not follow Overland as it curves toward S. Ten Mile but takes a straight line route to S. Ten Mile Road. The line then turns south along S. Ten Mile Road and then heads west along W. Amity Road until it reaches Substation D04.
- New 138 kV transmission line from Hillsdale Substation in Meridian to Substation D10. The new line heads south along S. Eagle Road from Hillsdale Substation then turns west on E. Lake Hazel Road until it reaches Substation D10.
- New 138 kV transmission line from Happy Valley Substation to Substation D04 then to Substation D10. The new line heads southeast cross-country from Happy Valley Substation until it reaches Cruse Lane. It follows Cruse Lane then heads north on Robinson Road until W. Lake Hazel Road. It follows W. Lake Hazel Road until it reaches Substation D04 then continues on along W. Lake Hazel Road until it reaches Substation D10.

South Boise Area

- Hub Substations (See Figure 32):
  - New South Boise (hub) Substation co-located with distribution Substation D17 near where the existing 230 kV transmission line crosses South Pleasant Valley Road
  - New South Ada (hub) Substation south of Boise, northeast of where rail line crosses under the existing Danskin Substation to Hubbard Substation 230 kV transmission line. In accordance with general location given by TVEP. Note, the South Ada (source/hub) Substation as designated in the TVEP was an approximate location. The actual site could be anywhere within a 10 square mile area.

- 230 kV Transmission Lines (See Figure 32):
  - New 230 kV transmission line from the future South Ada source Substation to the future South Boise (hub) Substation. As identified in the TVEP, the line would follow the existing 230 kV transmission line between Danskin Substation and

Hubbard Substation from South Ada source Substation then turn north to run along S. Pleasant Valley Road until it reaches the South Boise (hub) Substation.
- New 230 kV transmission line from the 230 kV transmission line between Boise Bench Substation and South Boise (hub) Substation to the future South Ada source Substation. The new line will tie into the existing 230 kV transmission line about 2 miles east of the South Boise (hub) Substation then approximately follow the railroad right-of-way to the South Ada source Substation. This line was designated in the TVEP.
- New 230 kV transmission line from Boise Bench Substation to future South Boise (hub) Substation. As designated in the TVEP, the line would follow the existing 138 kV right-of-way between Boise Bench Substation and Hubbard Substation.

- Distribution Substations (See Appendix D, Figure D-4):
  - D01 – In southeast Boise, southeast of Micron where existing Boise Bench Substation to Hubbard Substation 230 kV transmission line crosses existing 138 kV transmission line.
  - D02 – In southeast Boise, near existing Boise Bench Substation to Mora Substation 138 kV transmission line southwest of Boise Factory Outlet Mall on west side of railroad track.
  - D06 – Along Kuna Mora Road, 2.9 miles east of S. Pleasant Valley Road.
  - D07 – West of Boise Airport near intersection of S. Curtis Road and Albatross Street.
  - D16 – In south Boise, 0.9 miles southwest of the Eisenman Road interchange
  - D17 – Co-locate with South Boise (hub) Substation near where the existing 230 kV transmission line crosses South Pleasant Valley Road
  - D18 – In south Boise, 0.15 miles west of S. Pleasant Valley Road, 0.12 miles north of W. Hollilynn Drive.

  The Committee also provided some secondary distribution substations sites in the south Boise area (See Appendix D, Figure D-4).
  - D01 – In southeast Boise, 1.4 miles southeast of Micron along existing 69 kV transmission line.
  - D02 Alternative 1 – In south Boise, 0.4 miles northwest of Winco Distribution Center.
  - D02 Alternative 2 – In south Boise, near southwest corner of Winco Distribution Center and under existing 230 kV transmission line.
  - D02 Alternative 3 – In southeast Boise, along S. Eisenman Road just south of Boise Factory Outlet mall, near existing Boise Bench Substation to Mora Substation 138 kV transmission line.
  - D06 Alternative 1 – At northwest corner of South Pleasant Valley Road and West Kuna Mora Road, south of Boise
  - D06 Alternative 2 – East of Kuna at W. Kuna Mora Road and S. Vista Ave.
  - D07 – West end of Boise airport, south of South Orchard Street and West Gowen Road intersection in airport land.
  - D16 Alternative 1 – In south Boise just west of the Eisenman Road interchange.
  - D16 Alternative 2 – In south Boise, along S. Eisenman Road, 0.25 miles east of I-84 exit.

- D18 – 1.75 mile north of South Boise (hub) Substation along South Pleasant Valley Road

- 138 kV Transmission Lines (See Appendix D, Figure D-4):
  - New 138 kV transmission line from South Boise (hub) Substation to Substation D18, Substation D07 then on to Victory Substation. The new transmission line follows S. Pleasant Valley Road north from South Boise (hub) Substation, turns west along W. Gowen Road then follows S. Curtis Road to W. Wright Street. The line follows S. Curtis Road heading north from Substation D07 then turns west along W. Victory Road. The line then follows the existing 138 kV transmission line along S. Maple Grove Road north until it reaches Victory Substation.
  - New 138 kV transmission line from Substation D16 to South Boise (hub) Substation. From Substation D16 the line heads west along W Amyx Lane then turns north on S. Pleasant Valley Road. The line turns west when it is even with South Boise (hub) then connects to the hub substation.
  - New 138 kV transmission line from Substation D06 to Substation D16. From Substation D06, the line follows Kuna Mora Road east for 1 mile then turns north and terminates in Substation D16.
  - New 138 kV transmission line from Substation D06 to Blacks Creek Substation. The line follows Kuna Mora Road east from Substation D06, leaving the road where it turns north and instead continues east until it crosses I-84. It then follows I-84 northwest until it turns west on E. Blacks Creek Road until it reaches Blacks Creek Substation.

  The Committee also provided some secondary 138 kV transmission line routes if a particular preferred route is difficult to obtain (See Appendix D, Figure D-4).
  - New 138 kV transmission line from Gowen Substation to the new preferred 138 kV transmission line between Substation D18 and Substation D07 in south Boise. From Gowen Substation, the alternate route follows Gowen Road west until it reaches the preferred transmission line route at S. Pleasant Valley Road.
  - New 138 kV transmission line feeding Substation D02 alternative 2. The new line ties into the existing Boise Bench Substation to Mora Substation 138 kV transmission line about 1/4 mile southwest of S. Eisenman Road. It follows the railroad line south until it's approximately 1/4 mile from Substation D02 Alternative 2. It then heads directly south, cross-country until it reaches Substation D02 Alternative 2.
  - New 138 kV transmission line from Substation D02 Alternative 1 to existing 138 kV transmission line between Boise Bench Substation and Mora Substation. The new line heads northwest from Substation D02 Alt 1 cross-country until it connects into the existing transmission line.
  - New 138 kV transmission line from Substation D16 Alternative 1 to Substation D02 Alternative 1. The line follows I-84 north from Substation D16 Alternative 1 until it reaches where the 230 kV transmission line crosses I-84. It then follows the 230 kV transmission line route west until it is directly south of Substation D02 Alt 1. The line then heads directly north, cross-country until it reaches Substation D02 Alternative 1.

- New 138 kV transmission line from South Boise (hub) Substation to Substation D16 Alternative 1. The line follows the existing 230 kV transmission line heading east from the South Boise (hub) Substation then heads cross-country to Substation D16 Alternative 1. Because of the existing undeveloped characteristics of this area, the route is to be determined during siting.
- New 138 kV transmission line from Substation D16 Alternative 1 to Substation D02 Alternative 1. The line follows S. Eisenman Road north from Substation D16 Alternative 1 until it reaches the 230 kV transmission line. It then follows the 230 kV transmission line route west until it is directly south of Substation D02 Alternative 1. The line then heads directly north, cross-country until it reaches Substation D02 Alternative 1. The line can also be used if Substation 16 Alternative 2 is used.
- New 138 kV transmission line from South Boise (hub) Substation to Substation D06 Alternative 1. The line follows S. Pleasant Valley Road.
- New 138 kV transmission line from South Boise (hub) Substation to Substation D06 Alternative 2. The line follows S. Pleasant Valley Road heading south from South Boise (hub) Substation then turns east and follows Kuna Mora Road to Substation D06 Alternative 2.
- New 138 kV transmission line from existing 138 kV transmission line between Bowmont Substation and Mora Substation to Substation D06 Alternative 1. The line follows E. Kuna Mora Road from the existing transmission line to Substation D06 Alternative 1.

Boise/Garden City Area

- Hub Substations (See Figure 32):
  - Add facilities to existing Boise Bench (hub) Substation. This is in agreement with the TVEP.

- 230 kV Transmission Lines (See Figure 32):
  - New 230 kV transmission line from Boise Bench Substation to Cloverdale Substation. This would be a second circuit and would run double circuit with the existing 230 kV circuit. Identified in the TVEP.
  - New 230 kV transmission line from Cloverdale Substation to Locust Substation. The line would be second 230 kV transmission line between the substations and would follow the same route as the existing. Identified in the TVEP.
  - New 230 kV transmission line from Hubbard Substation to Cloverdale Substation. As identified in the TVEP, the line would run along Cloverdale Road its entire length.

- Distribution Substations (See Appendix D, Figure D-5):
  - D20 – In southeast Boise, along East Warm Springs Avenue just southeast of Warm Springs Golf Course and along existing Boise Bench Substation to Grove Substation 138 kV transmission line.
  - D22 – In Garden City, at southwest end of W. 44th St. next to existing 138 kV transmission line.

  The Committee also provided some secondary distribution substations sites in the Boise/Garden City area (See Appendix D, Figure D-5).

- D20 – In southeast Boise, near existing Boise Bench to Cartwright 138 kV transmission line, 1/4 mile west of Table Rock.
- D22 – In Garden City, along N. Curtis Road near W. Ustick Road, near existing 138 kV transmission line.

- 138 kV Transmission Lines (See Appendix D, Figure D-5):
  - The Committee did not designate any preferred 138 kV transmission line routes. It did however designate one secondary 138 kV transmission line route should Idaho Power deem it necessary to build Substation D20 in its secondary location. The new 138 kV transmission line would run double circuit from the existing 138 kV transmission line between Boise Bench Substation and Cartwright Substation into and out of Substation D20. The line route heads northeast cross-country from Substation D20 then turns west until it ties into the existing 138 kV transmission line.

Mountain Home/Grand View Area

- Hub Substations (See Figure 33):
  - Use the existing Danskin Substation facility located at Danskin Power Plan in Mountain Home.
  - The Committee sited an additional hub substation east of Mountain Home for the stated purpose of providing capacity should load growth warrant it. The location was not specific but was only a general area located near the existing 230 kV transmission lines east of Mountain Home. Based on comments received from the Elmore County Growth and Development Department relating to its proximity to land designated as agricultural ground, the second hub substation location has been removed from the map. If load growth warrants it, siting of an additional hub substation will be pursued in future Eastern Treasure Valley Electrical Plan committee processes. It is noted that the Danskin (hub) Substation location is forecast to be adequate for future load growth and an additional hub substation location is not needed unless growth greatly exceeds Idaho Power's forecasts.

- Distribution Substations (See Appendix D, Figures D-6 and D-8):
  - D09 – Northwest of Mountain Home at the intersection of Ditto Creek Road and West Martha Avenue on private land.
  - D21 – 1/2 mile west of CJ Strike Dam on Idaho Power owned land off River Road.

  The Committee also provided some secondary distribution substations sites in the Mountain Home/Grand View area (See Appendix D, Figures D-6 and D-8).
  - D09 Alternative 1 – Northwest of Mountain Home at northeast corner of W. Dessert Duck Road and Ditto Creek Road.
  - D09 Alternative 2 – Northwest of Mountain Home along Ditto Creek Road, 1 mile south of Martha Avenue.
  - D09 Alternative 3 – Northwest of Mountain Home at the intersection of Ditto Creek Road and West Martha Avenue on BLM land.
  - D21 Alternative 1 – East of Grand View Alternative 1 - 2.25 miles southwest of CJ Strike Dam, south of ID-78, 1.6 miles west of River Road.

- D21 Alternative 2 – East of Grand View - south of ID-78, 1.9 miles east of River Road on Owyhee County land.
- D21 Alternative 3 – East of Grand View Alternative 2 - 2.5 miles southwest of CJ Strike Dam, north of ID-78, 2 miles west of River Road.
- D21 Alternative 4 – East of Grand View Alternative - south of ID-78, 1/3 miles east of River Road on Owyhee County land.
- D21 Alternative 5 – East of Grand View Alternative 3 - south of ID-78, 0.2 miles east of River Road on Owyhee County land.

- 138 kV Transmission Lines (See Appendix D, Figures D-6, D-7 and D-8):
  - Upgrade the existing 69 kV transmission from Elmore Substation in Mountain Home to Mountain Home Air Force Base Substation to 138 kV.
  - Upgrade the existing 69 kV transmission line to 138 kV from Mountain Home City Substation to where it ties into the Elmore Substation to Mountain Home Air Force Base Substation 69 kV transmission line.
  - Upgrade the existing 69 kV transmission from Mountain Home City Substation to Bennett Substation to 138 kV.
  - Upgrade the existing 69 kV transmission line from Bennett Substation to Glenns Ferry Pipeline Substation to 138 kV.
  - New 138 kV transmission line feeding Bruneau Bridge Substation south of Mountain Home. The new line is run double circuit with the existing 69 kV transmission line until the line turns east (feeding Flying H Substation). The new line then runs single circuit, southwest and cross-country until it reaches Bruneau Bridge Substation.
  - Upgrade the existing 69 kV transmission line from Boise Bench Substation to Elmore Substation to 138 kV.
  - New set of 138 kV transmission lines tied into the upgraded 138 kV transmission line between Boise Bench Substation and Elmore Substation to feed into and out of the South Ada (hub) Substation. The new lines tie into the 138 kV transmission line near the I-84 S. Orchard Access Road exit and run directly west until they reach the South Ada (hub) Substation. The new lines will be run either double circuit or in separate rights-of-way.

  The Committee also provided some secondary 138 kV transmission line routes if a particular preferred route is difficult to obtain (See Appendix D, Figure D-7 and D-8).
  - New 138 kV Transmission from Raft River Substation to Substation D21. From Raft River Substation the line follows Black Sands road west then turns south along River Road. It follows River Road until it reaches ID-78, turns west along ID-73 and follows it to Substation D21. The CAC did not specify transmission routes to reach Substation D21 alternatives to the east of River Road on ID-73.
  - IPC added for reliability, new 138 kV transmission line from Bennett Substation to Bennett Creek Wind Substation. The new line heads in a straight line between the two substations indicating the actual route is to be determined.

Preferred Alternative Analysis

IPC planning engineers performed power flow analyses of the Committee's preferred alternative to ensure that it (1) provides adequate capacity and (2) meets IPC's reliability standards. Because the Committee provided multiple options within their preferred alternative, the engineers developed an *Analysis Scenario* that chooses only one of the line and substation options for each individual substation site and transmission line route. Figure 36 shows the *Analysis Scenario* for 230 kV facilities for Ada County. Figures 37 and 38 show the *Analysis Scenario* 138 kV facilities for Ada County and Elmore/Owyhee counties, respectively. Note, the only 230 kV facility in Elmore and Owyhee counties is the Danskin (hub) Substation and that is shown in Figure 38.

The power flow analyses indicated that the aggregate preferred alternatives provide both adequate capacity and reliability. No additional lines or substations were required.

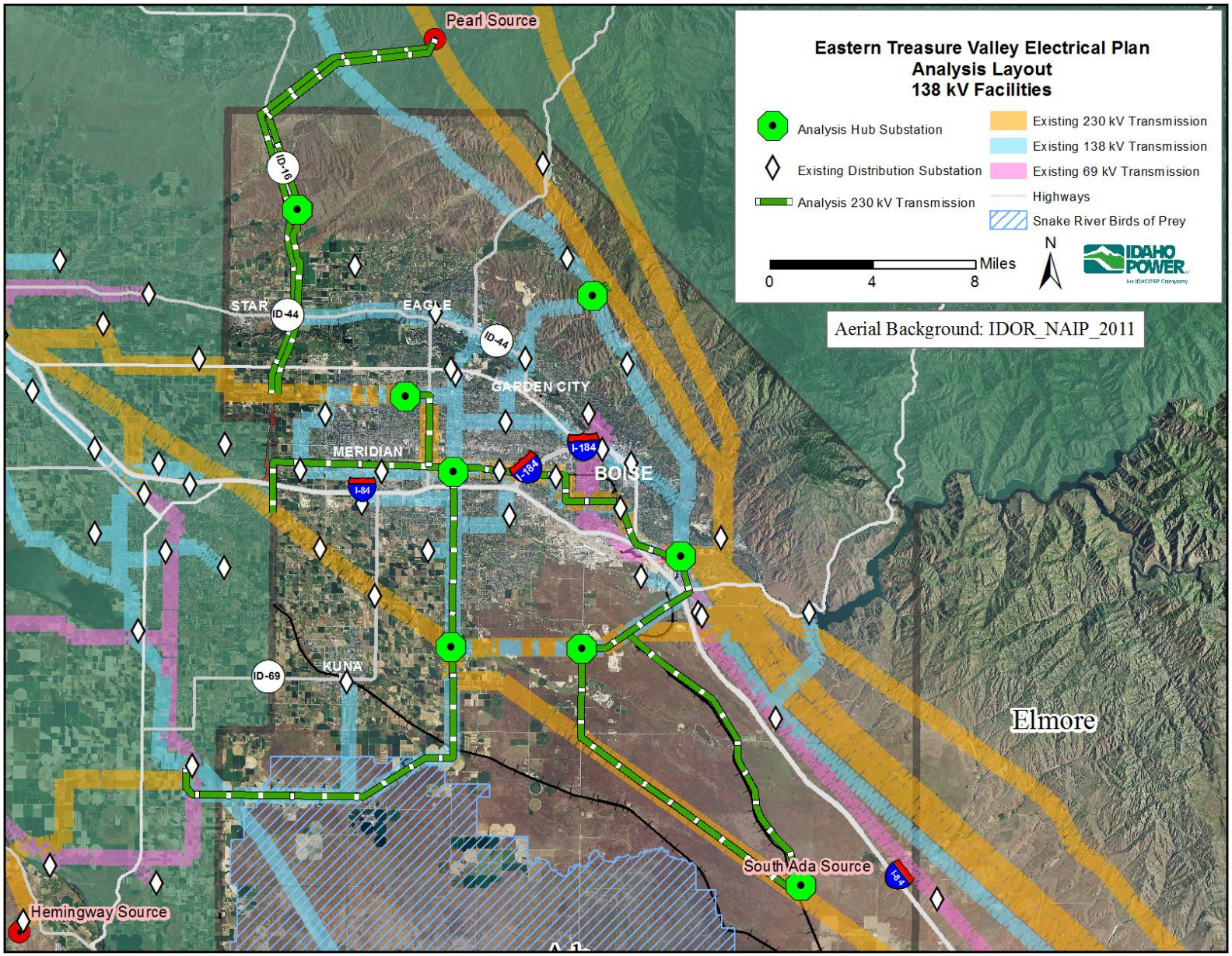

Figure 36: Analysis Scenario 230 kV Facilities - Ada County

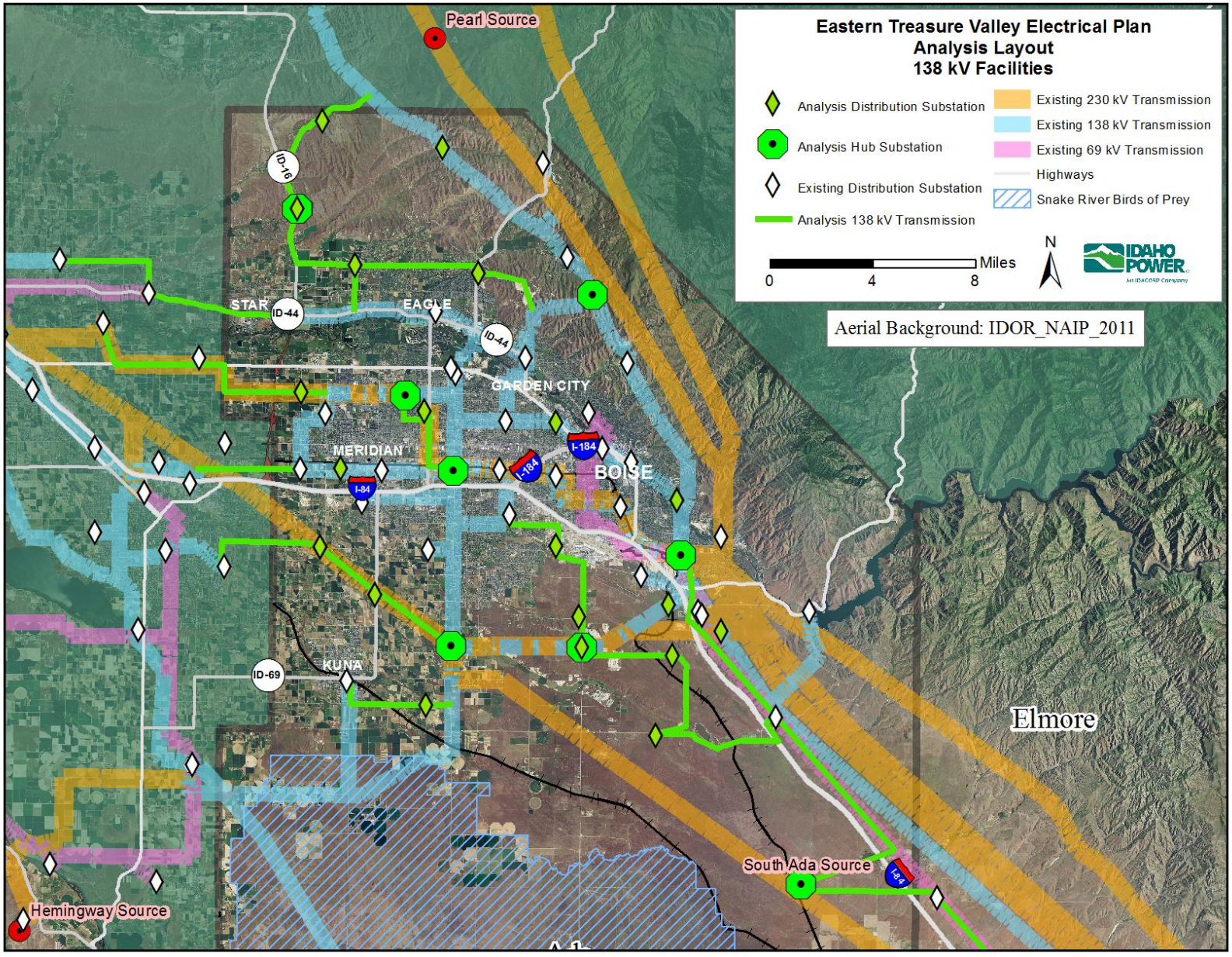

Figure 37: Analysis Scenario 138 kV Facilities - Ada County

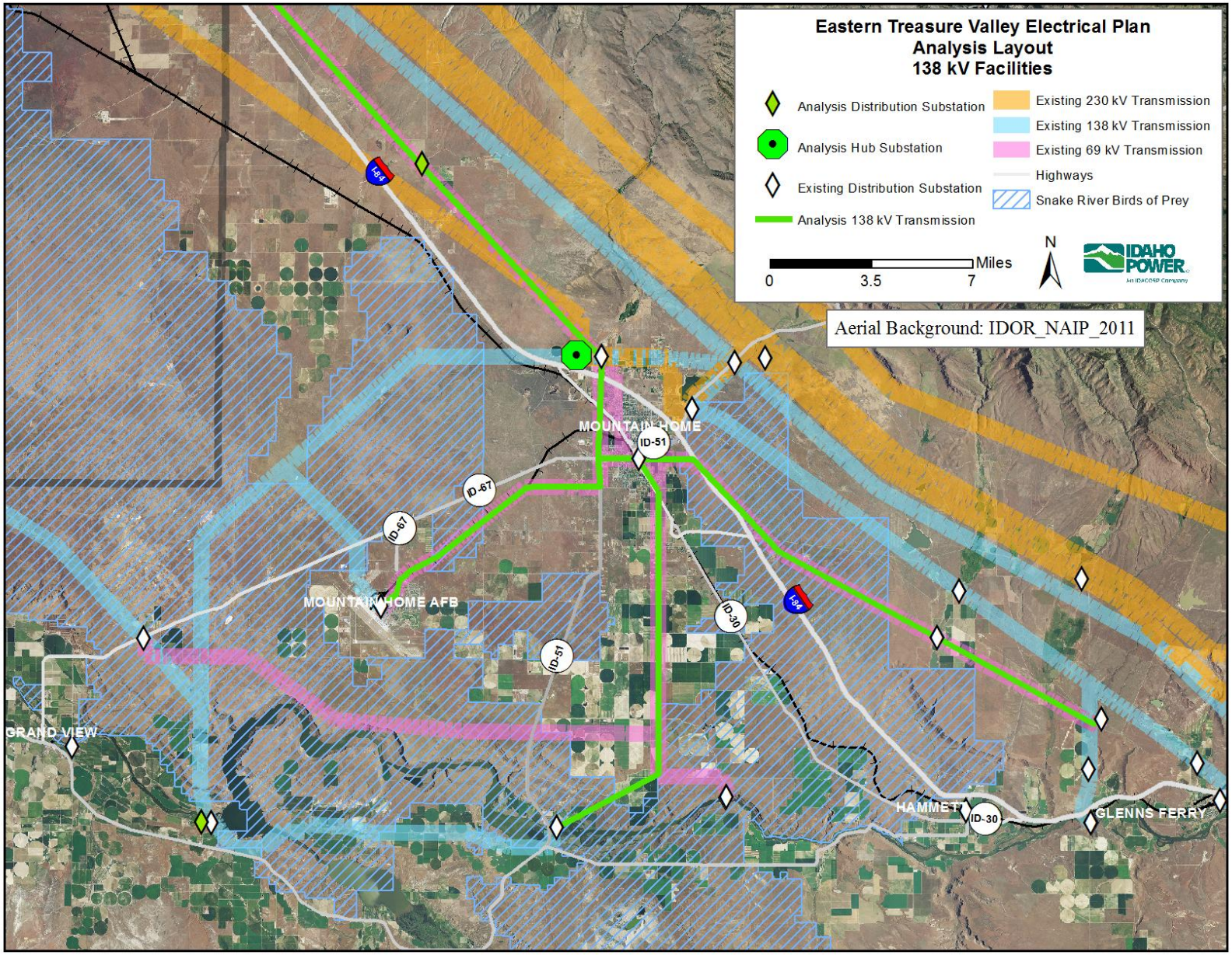

Figure 38: Analysis Scenario 138 kV Facilities - Elmore and Owyhee Counties

Plan Implementation

The Eastern Treasure Valley Electrical Plan is a long-term plan that (1) outlines the expected growth in electrical demand in the eastern Treasure Valley region of IPC's service area and (2) delineate the upgrades and additions to the power system needed to serve this growth. This Plan is the result of the Community Advisory Committee process where IPC collected and incorporated the local community's vision and perspective in the earliest stages of the planning process. Creating this Plan is only the first step in building and maintaining a power system that meets the needs of Idaho Power customers in the area. Continued coordination between Idaho Power and the local community is critical when implementing this Plan. There are three principle elements that will be used to successfully implement the Plan:

1. Introduce the Plan to the public.
2. Integrate the Plan into local comprehensive plans.
3. Phase in the construction of the power system outlined in the Plan.

Introduce the Plan

The collaborative effort between IPC and the Community Advisory Committee has culminated in a written plan to serve eastern Treasure Valley residents from now to buildout. IPC and the Committee recognize that continued public involvement is very important to successfully implement this Plan. The Committee's wishes concerning introduction of the Plan to the public differed between jurisdictions. Some Committee members desired that IPC announce the plan to the public and perhaps hold public meetings while others suggested that the Plan be presented to city councils and county commissions without public presentations. In the coming months, IPC will contact the various members of the Committee to determine specific public roll-out wishes.

IPC staff will be available to make presentations to local stake holder groups when requested. These presentations would be additional informational opportunities for local gatherings such as civic groups, labor or agricultural organizations, and Chambers of Commerce. These presentations will also help publicize the Eastern Treasure Valley Electrical Plan and give interested parties a chance to ask questions and exchange information with IPC.

Media Coverage

The media plays an important role in publicizing the Eastern Treasure Valley Electrical Plan. IPC will coordinate with written, television, and radio news outlets, as necessary, to inform and appropriately involve the public throughout the plan implementation process. IPC intends to provide information and resources to the media to distribute accurate information about the Plan. These resources will include the Eastern Treasure Valley Electrical Plan webpage, which contains a description of the community advisory process, details of the Eastern Treasure Valley Electrical Plan including a link to the final report and a contact person for more information. As requested, IPC staff will also be available for interviews by the media throughout the implementation process.

Local Integration Plan

The Eastern Treasure Valley Electrical Plan is designed to be a road map, not only for IPC when planning and building the power system of the future in the eastern Treasure Valley, but also to assist local governments in their planning processes. Local planning and zoning commissioners, county commissioners, and city planners are encouraged to be familiar with the Plan and to integrate it into their own comprehensive plans. This will help maintain the Eastern Treasure Valley Electrical Plan as a relevant, useful part of local area planning. The potential conflict between new residential or commercial developments and the required power system infrastructure can be minimized by planning for future transmission lines and substations and showing their proposed locations in local comprehensive plans as appropriate.

The Eastern Treasure Valley Electrical Plan will be recognized by the BLM during planning activities as part of the state and/or local government future expansion and development plans for consideration in determining appropriate management strategies to ensure community goals can be reached.

IPC intends to present the Eastern Treasure Valley Electrical Plan to local planning and zoning (P&Z) commissions to encourage them to incorporate the Plan into local city and county comprehensive plans as appropriate. Recognizing that most jurisdictions have a formal process to modify comprehensive plans, IPC will coordinate with city and county P&Z commissions to present the Eastern Treasure Valley Electrical Plan to their respective councils for adoption into their comprehensive plans.

System Implementation

The recommendations of the Eastern Treasure Valley Electrical Plan cover sufficient infrastructure improvements to the IPC system to deliver power for eastern Idaho's projected load buildout. Individual projects will be designed and constructed when needed based on future load growth and reliability requirements. As the need for each project nears, IPC will proceed through a detailed design, siting, and permitting process. The recommendations included in this Plan define the optimal location to start the siting process for each individual project in the eastern Treasure Valley. The current zoning ordinances, land use restrictions and availability of the property or right-of-way will be included in the siting analysis for each project.

The Eastern Treasure Valley Electrical Plan is only the first step in the power system planning process. Idaho Power endeavors to keep the public informed and involved throughout each project's development. The public siting process is adjusted as needed to fit the local community needs as well as the unique technical and regulatory requirements of each project. Comments from local residents and business owners in the general vicinity of specific projects are gathered through public open houses as necessary. All concerns and recommendations from citizens and jurisdictional representatives will be addressed and considered in choosing the final site or right-of-way. Final transmission line routes and substation locations are subject to obtaining required permits, easements, and rights-of-way.

Although a schedule for implementation is listed below, the final implementation of the Eastern Treasure Valley Electrical Plan is dependent upon several factors including:

- Load growth rates (resulting from population changes, energy use characteristics, and technology changes)
- Reliability requirements
- Transmission line and transformer capacities (adequacy)
- Budget
- Community Advisory Committee recommendations

The following is a timeline of IPC's recommended near-term implementation plan:

0-10 Years (see Figure 39).
The siting for the following two projects was underway prior to the formation of the Eastern Treasure Valley Electrical Plan Community Advisory Committee and was thus outside the scope of the Committee's work.

- Construct a double-circuit transmission line between Bowmont Substation and Hubbard Substation in southwest Boise. Currently, there is a 138 kV transmission line between Bowmont Substation and Hubbard Substation with a tap proceeding north from it into Kuna Substation. The new double-circuit configuration would have a 230 kV transmission line that feeds between Bowmont and Hubbard substations and also the existing 138 kV transmission line that runs from Bowmont Substation to Hubbard Substation. The new double-circuit line would replace the existing 138 kV line and use the same right-of-way. This project is tied to the Boardman to Hemingway 500 kV transmission project and must be energized 3 months prior to completion of the 500 kV project in order to deliver power into the east end of the Treasure Valley.
- Cloverdale (hub) Substation — Install a 230kV source by (1) installing a new 300MVA 230-138kV transformer, (2) installing two 230kV bays, and (3) upgrading existing facilities at the substation. Currently there is a 230 kV transmission line that passes nearby to Cloverdale Substation and it will be connected to Cloverdale (hub) Substation via the aforementioned equipment.
- It is noted that because of the high growth rate of commercial properties in and around Meridian, committee members representing the City of Meridian recommend that Idaho Power obtain substation properties as soon as possible before they are purchased for commercial development and preferably within the next two years. In particular, Idaho Power should consider purchasing property for substations in the Ustick Road/Eagle Road area and the Franklin Road area between Linder Road and Ten Mile Road.

10-20 Years (see Figure 40).

- Construct Beacon Light Substation (D14). Land has been purchased for this substation. The new substation will be located on the southeast corner of W Beacon Light Road and N Linder Road in Eagle.
- Construct a new 138 kV transmission line from Beacon Light Substation south along N Linder Road to the existing 138 kV transmission line from Star Substation to Eagle Substation in Eagle.
- Construct Amity Substation (D4). Land has been purchased for this substation. The new substation will be located near the northwest corner of W Amity Road and S Ten Mile Road, south of Meridian.

- Construct a new 138 kV transmission line from Amity Substation west along W Amity Road then south on S Happy Valley Road to the existing Happy Valley Substation near the railroad tracks north of E Greenhurst Road in Nampa.
- Construct Garden City Substation (D22). The new substation may be located just west of the intersection of W 44th Street and Stockton Street in Garden City.
- Construct a new 138 kV transmission line from Garden City Substation to the nearest point on the existing 138 kV transmission line between Ustick Substation and Boise Substation in Garden City.
- Construct Dry Creek (hub) Substation approximately ¼ mile southeast of N Scarlet Gila Lane
- Connect Dry Creek (hub) Substation to the existing 230 kV line between Boise Bench and Brownlee with a new double-circuit 230kV transmission line to the northeast.
- Rebuild the 138 kV line to accommodate another 138 kV line (double circuit) from Gowen Substation to the point where it taps the existing Boise Bench to Mora 138 kV line.
- No new facilities are expected to be built in Elmore or Owyhee counties within the next 20 years.

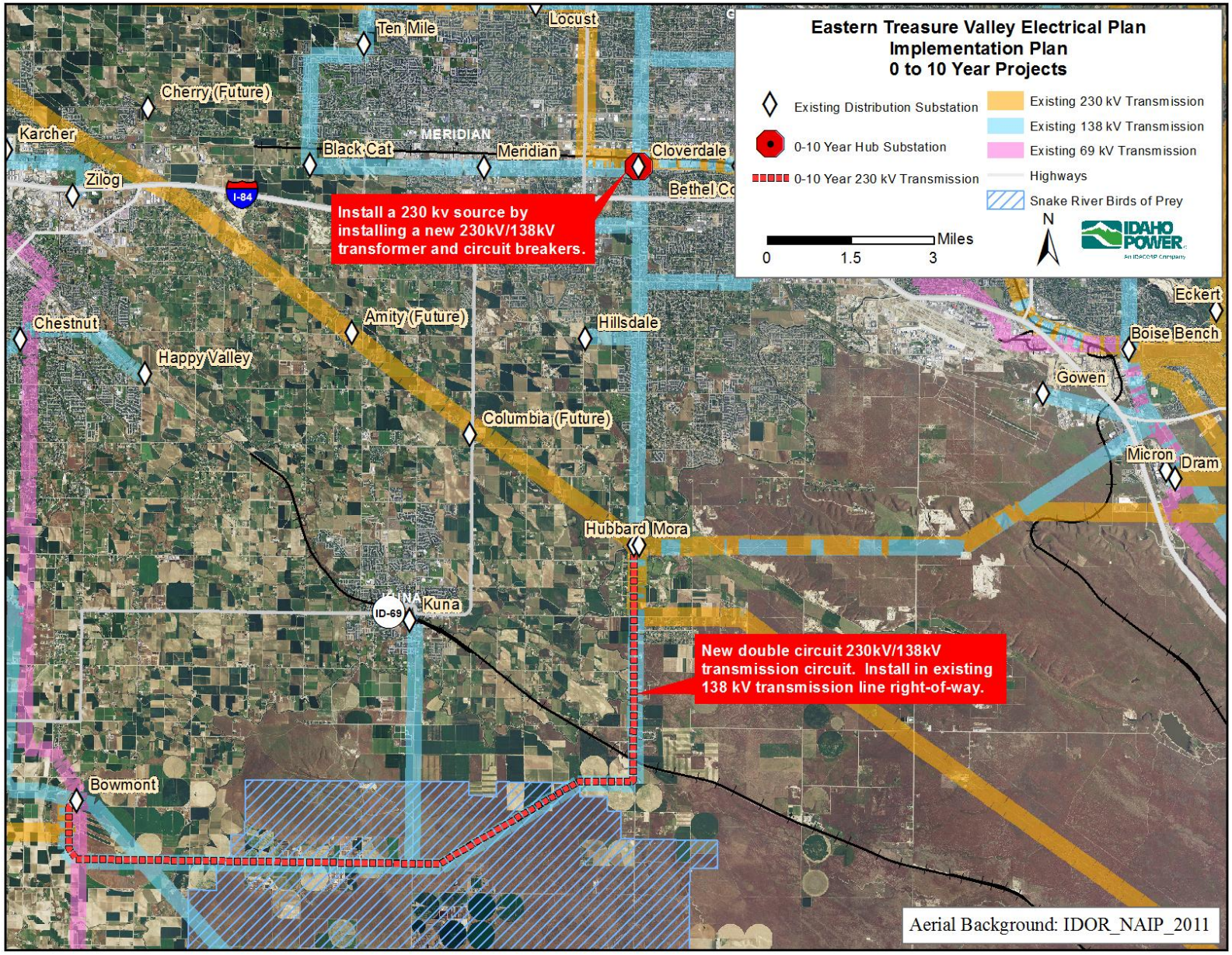

Figure 39: 0 to 10 Year Implementation Plan

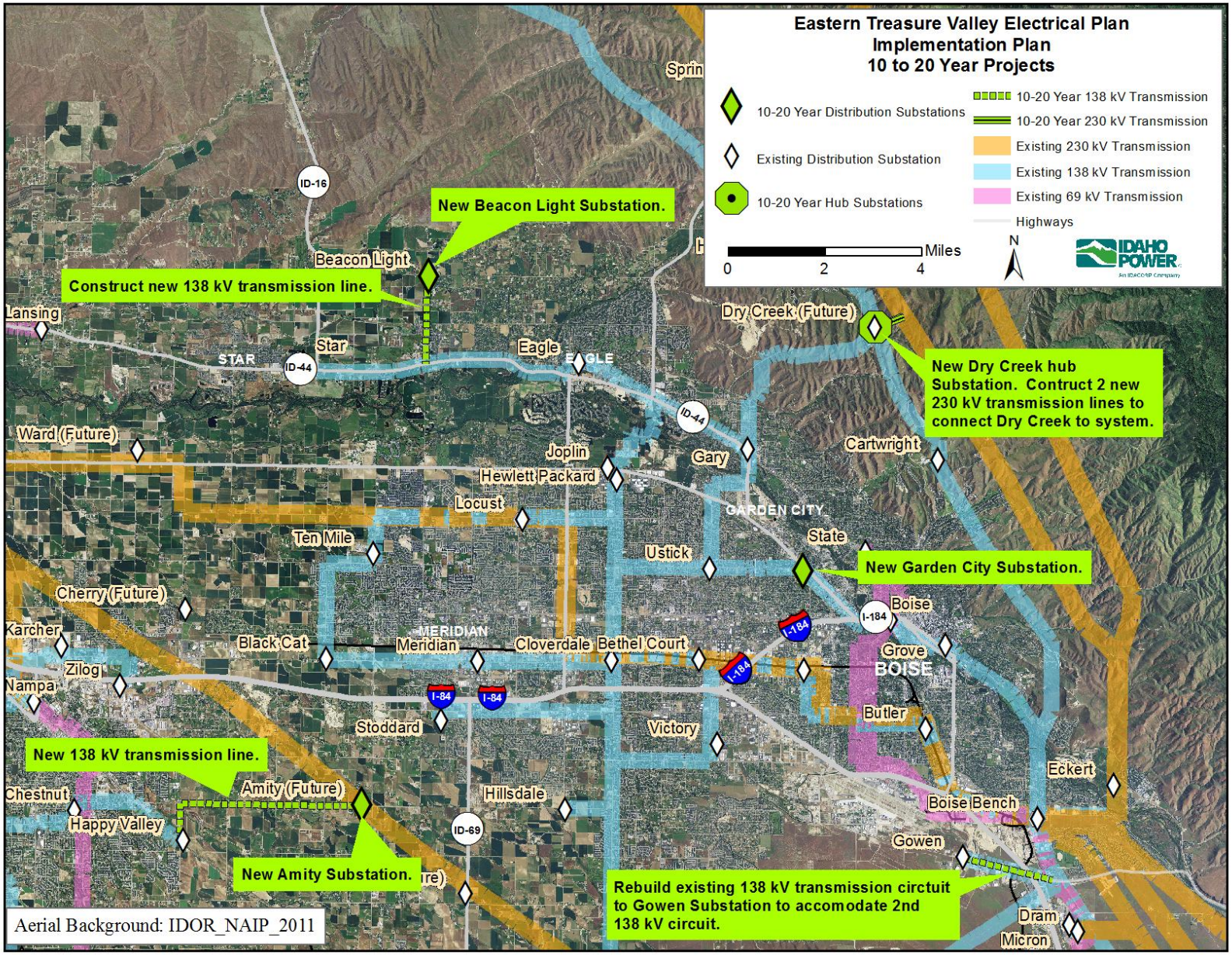

Figure 40: 10 to 20 Year Implementation Plan

Conclusion

The eastern Treasure Valley's population, and thus its electrical load, has grown significantly over the past 20 years. While the present economic downturn has slowed development, it is merely a lull in the region's growth. Even with slower growth, Idaho Power's existing customers continue to purchase devices that consume more and more energy. And businesses, agricultural operations, and residences are becoming more dependent on a reliable supply of electricity with every passing year.

For these reasons, IPC must be proactive in planning for new infrastructure to serve the needs of the eastern Treasure Valley and help support the continued economic prosperity of the area by providing a reliable electric supply. A long-term plan is necessary to ensure the transmission lines and substations are there when they are needed, and it is important to locate the facilities so they fit into a larger strategy to serve the area. This larger strategy or plan should accommodate the vision and perspective of local communities.

The Eastern Treasure Valley Electrical Plan lays out 230 kV and 138 kV transmission and substation infrastructure from now through the area's population and electrical load buildout. Developed in a cooperative effort between IPC and the Community Advisory Committee, the Plan identifies locations for transmission lines serving the area for many years to come and provides locations for new substations to serve the region's electrical load. Individual projects proposed by this Plan will still require jurisdictional approval and will be put through a public siting process. The Eastern Treasure Valley Electrical Plan is the first step in the planning process. The Plan will provide local governments and citizens advanced notice as to where future transmission and substations facilities may be located and thus allow them to plan accordingly.

The estimated cost in 2011 dollars for the new infrastructure needed to serve the buildout projected load, as recommended by the Committee, is approximately $300 Million. Future changes in technology may make some of the proposed improvements unnecessary, or at least delay their need. While these types of shifts are difficult to predict, IPC will monitor them and update the Plan to reflect the changes.

Appendix A – Alternative Energy Generating Technologies

Alternative Energy Generating Technologies

The Committee received a presentation on alternative energy generating technologies during an education session. This presentation and the discussion that followed outlined various alternative energy generating technologies that could possibly be used to meet the energy needs of the eastern Treasure Valley or to reduce the need for future transmission lines. The technologies discussed included wind turbines, solar (photovoltaic and thermal), geothermal generators, and fuel cells. A detailed description and discussion concerning these alternative energy generating technologies follows.

Wind Turbines – Wind turbines are becoming an important resource throughout the United States and they are becoming more prevalent in Idaho and Oregon for the following reasons:

- The wind speed in the area is generally favorable for wind generation.
- There is much land that could serve to host wind turbines. A wind turbine can be built on farm land with very little crop land being lost. Additionally, farmers earn rental income by allowing wind turbines to be sited on their land.

Many wind turbine generating facilities have connected to the Idaho Power system in the past 8 years and more are planned in the next few. Of course, to receive the energy produced by these facilities requires transmission lines, so wind turbines do little to reduce the need for transmission infrastructure.

On a smaller scale, residential-size wind turbines mounted atop houses and businesses could provide energy that could displace utility infrastructure. The local residents and governments are the ones who will promote growth in this industry and increase the number of small-scale wind turbines in the area.

Solar-Photovoltaic – The number of sunny days that Western Idaho sees every year would seem to indicate that it would be a good location for photovoltaic use. On a large scale, solar energy sites could benefit from land availability much like wind turbines do in the region. The main negative aspect to photovoltaic energy production currently is the cost of the photovoltaic panels. The costs are continually decreasing, but it will be a number of years before this type of power production becomes economically viable in Idaho because of the low energy rates already charged to consumers. Like wind turbines, a large photovoltaic facility would still require transmission lines to deliver the energy to end users.

But, also like wind, residential- and commercial-size photovoltaic panels could certainly be installed and could displace the need for more utility infrastructure. Again, this would be up to the residents, businesses, and local governments to bring greater use of small-scale photovoltaic to fruition.

Solar-Thermal – This type of generation harnesses the energy from the sun to heat a liquid or gaseous medium (such as water, sodium, or hydrogen) to turn a turbine that generates electricity. This type of generation requires a tremendous amount of land to produce significant amounts of

power. Western Idaho has the advantage of having much land that could serve this purpose; however, most of the land that would be available is controlled by the Bureau of Land Management and environmental restrictions could limit the land's use. Unlike wind turbine generation, it is unlikely that farm land could be used for solar-thermal generation because it would be quite difficult to farm around these facilities. However, as costs for this generation decrease, some of these solar-thermal facilities might be built in the region. This type of generation would also require transmission lines to deliver its energy.

Geothermal – There are credible geothermal resources within eastern Oregon and western Idaho. While much of the geothermal is at a lower temperature and thus not usable for power generation, there is some that is usable. The nearest developed geothermal power generating resources are the Raft River Project located near Raft River, Idaho and the Neil Hot Springs Project near Vale, Oregon. IPC purchases all the output from these plants.

If a new geothermal facility is developed in the region, it would also require electrical transmission lines to deliver the energy to residents.

Fuel Cells – Used in a distributed manner among homes and businesses, fuel cells could displace, or at least delay the need for, additional transmission lines in the eastern Treasure Valley. There are some drawbacks that will take a few years to overcome:

- Residential-size fuel cell systems are currently quite expensive, though there are a number of companies aggressively working to bring down the cost.
- Fuel cells require an outside fuel source, whether it is natural gas, methanol, or pure hydrogen. Unless the fuel cell is fueled by pure hydrogen, there are some emissions that result from making electricity using a fuel cell.

Appendix B – Energy Efficiency

Idaho Power Energy Efficiency Activities and Programs

Idaho Power offers a full portfolio of different energy efficiency programs in the eastern Treasure Valley as well as throughout most of its service area. A more detailed listing of each program and the various incentives that IPC offers can be found at www.idahopower.com. The following is a brief listing of each program that is currently offered.

Residential Customer Programs

A/C Cool Credit

Residential customers with central air conditioning can receive a $7 per month credit when the customer allows Idaho Power to cycle their air conditioning system during periodic June, July, and August afternoons.

Energy Efficiency Education

Teaches customers how to save money and care for the environment. Classes are scheduled in communities or can be requested.

Energy Efficient Lighting

Teaches customers how ENERGY STAR® qualified compact fluorescent light bulbs (CFLs) can save them money every time they flip a light switch. The program offers customer education through retail in-store events, outreach events, and Web site.

Energy House Calls

Residential customers can earn a free package of services designed to help save energy for residents of manufactured homes heated by an electric furnace or heat pump.

ENERGY STAR® Homes Northwest

Residential home builders can earn an incentive for each home built to the Northwest ENERGY STAR® standard, which is 15 percent more efficient than a home built to the Idaho energy code.

Green Power

Customers contribute funds to purchase energy generated from renewable resources such as solar and wind. A portion of those funds is used for the Solar 4R Schools program which installs solar demonstration projects at local schools.

Heating and Cooling Efficiency

The program provides cash incentives to residential customers and HVAC contractors for choosing and installing qualified energy efficient heat pumps through approved HVAC contractors.

Home Improvement

Residential customers can earn a 15 cent per square foot cash incentive for upgrading their attic insulation.

Home Products
Customers can earn an incentive payment from Idaho Power for purchasing a qualifying ENERGY STAR® product.

Rebate Advantage
The program pays incentives to eligible customers who purchase a new electrically-heated ENERGY STAR® manufactured home.

See Ya Later Refrigerator
Residential customers can receive $30 plus free removal of their old refrigerators or stand alone freezers.

Weatherization Assistance for Qualified Customers
The program offers weatherization measures for electrically-heated homes of qualified customers that helps customers maintain a comfortable and energy efficient home environment.

Irrigation Customer Programs
Irrigation Efficiency Rewards
Agriculture customers can receive incentives of up to 75 percent for efficiency improvements of an existing pump system or up to 10 percent when installing a new efficiently designed system.

Irrigation Peak Rewards
The program provides a demand credit for specific irrigation customers who allow Idaho Power to turn off their pumps for a few hours on selected summer days reducing afternoon peak demand and lowering electric bills. The program works to reduce load on Idaho Power's system as opposed to saving energy.

Commercial/Industrial Customer Programs
Easy Upgrades (simple retrofits)
Commercial customers can receive incentives of up to $100,000 per project for simple energy-saving retrofits to existing commercial and industrial buildings. A menu of eligible retrofits includes improvements such as new lighting, HVAC equipment, and controls.

Building Efficiency
The program pays incentives of up to $100,000 per project designed to offset part of additional capital expenses for more efficient lighting designs, cooling systems, controls, and building shell in new commercial or industrial construction projects.

Custom Efficiency (complex projects)
Customers can receive financial incentives for large commercial and industrial energy saving projects to improve the efficiency of their electrical systems or processes. Incentives of $0.12/kWh up to 70 percent of the project cost.

Flex Peak Management
Recurring payments for reducing a set amount of electricity consumption in response to Idaho Power peak demand and other system needs.

Holiday Lighting Program
Provides incentives for replacing less efficient incandescent holiday light strings with energy efficient LED lights. Open to all non-residential customers.

Appendix C – GIS Data Layers

Layer	Coverage	Description	Notes
Team Red			
	Substation_Hub_Red		
	Substation_Distribution_Red		
	Transmissinon_230kV_Red		
	Transmission_138kV_Red		
Team Purple	Same		
Team Yellow	Same		
Team Green	Same		
Team Blue	Same		
Team Orange	Same		
TVEP			
	TVEP_General_Hub_Substations	TVEP CAC recommended general areas for siting hub substations	
	TVEP_230kV_Analysis	TVEP 230 kV transmission line routes, Idaho Power selected	
	TVEP_Hub_Substations	TVEP CAC recommended specific hub substation sites	
	TVEP_Source_Substations	TVEP CAC recommended specific source substation sites	
	TVEP_General_Source_Substations	TVEP CAC recommended general areas for siting source substations	
Misc			
	Parks	Geo Names USGS	
	Cemetery	Geo Names USGS	Added
	Airfield	Geo Names USGS	Added
	Schools	Geo Names USGS	Added
	NatRegHistoricPlace	National Register Historic Place Database	Added
	Military Zones	Ownership	
	Airport_Influence	Restricted airspace around airport where tower heights may be issue	Added
	OregonTrail_ID	SHPO data	Added
	Historic Trails	BLM trails	Added

Layer	Coverage	Description	Notes
	SnakeRiver_Scenic Byway	Designated byway	Added
	West Wide Energy Corridor	Federal utility corridors	Added
	GeoNames	Geo Names USGS - places, things	Added
	ScenicBywayRoutes		Added
Facilities			
	Distribution Substation	Idaho Power data	Added
	Hub Substation		
	Source Substation		
	Transmission	Idaho Power Enterprise GIS Data	
	LanglyGulch_230kV		None - Canyon County
	LangleyGulch_230kV_Tap		None - Canyon County
	Gas Line	USGS - Idaho Power Data	Added
	Boardman_Heminway_Proposed		Added
	Pacificorp_500kV	Idaho Power data	Added
	Gateway West Proposed		
	Substations_Area_Future		
	Feeder_Boundary	Idaho Power data	Added
	ETVEP_Areas		
	Ada County Master Street Plan	Ada County Highway District	
Environmental			
	State Parks	Added from IPCo GIS	Added Bruneau State Park
	Natural Areas -IPC GIS Database	Areas of very high environmental values	Added all the WSA, RNA, ACEC's from Enterprise GIS Data
	Snake River Birds of Prey	Birds of Prey Boundary	
	Visual Resource Management	BLM desination for class 1 and 2 visual resource management	Added- only Class 1 shown on maps
	Wetlands_ID	National Wetlands Inventory data	Added from National Wetlands Inventory database
	Wild_Scenic_River	Federally designated wild and scenic river	Added- small section of the Bruneau River
	Wilderness	USFS Wilderness Areas - Sawtooth Region	Added - North Elmore County near Sawtooth Mtns

Layer	Coverage	Description	Notes
	WildernessStudyArea_ID	Designated by BLM as having wilderness characteristics, none in study area	Added -added from Natural Areas
	Wildlife management Area IDFG	Idaho Department of Fish and Game management area	Added - CJ Strike WMA
	SageGrouse_Lek_IDFG	Lek locations / Both Active and unoccopied	Added-
	Sage Grouse Priority Habitat	Key Habitats identified by the BLM 2010	Added Priority-General areas
	SlickSpot Peppergrass Management Area	Slick Spot Protected species management zones	Added from Idaho National Heritage database
	Focal Areas_IDFG		Added from WTVEP study
	Area Critical Environmental Concern	Known as ACEC, many areas have regulatory requirement	Added
	Big Game Winter Range - IDFG	Critical Elk / Deer Wintering Ground - Identified by IDF&G	Add via Rick Ward
	Rare Plants	Idaho conservation data center plant info - National Heritage	Combined with CDC Plant & Plan Obs to create RarePlants
	CDC_Animal_ID	Places where certain species of wildlife have been observed. Has no regulatory authority. Only informational Conservation Data Center Wildlife Observations	Added
	Bull Trout - Streams	Idaho Conservation Data Center	Added
	Bull Trout - Lakes	Idaho Conservation Data Center	Added
	Oregon Trail	Idaho State Historical Society	Added
	Historic Trails	BLM - Historic trails of Idaho	Added
	National Register of Historic Places	Database downloaded from NRHP website	Added as point locations
	Airport Influence Areas	Airport avoidance areas from the Gateway West Project	Added
	Military Areas	Identified from BLM general surface ownership layer	Added
	Scenic By Way	National scenic byways from the NSBP database	Added
	Prime Farmland	Derived from SSURGO database / soils polygons	Added
	Agricultural	Irrigated & Nonirrigated Lands	Sagemap Land cover data
	Brownfield Data	Idaho Department of Environmental Quality	
	Floodplain (Ada County only)	Federal Emergency Management Agency	Ada County is the only county digitized

Layer	Coverage	Description	Notes
	Foothills Preservation	City of Boise	
BaseLayers			
	Cities	Idaho Power Enterprise GIS Data	Added
	Roads	Idaho Power Enterprise GIS Data	Added
	Railroads	Idaho Power Enterprise GIS Data	Added
	Highway	Idaho Power Enterprise GIS Data	Added
	City_Boundaries	Idaho Power Enterprise GIS Data	Added
	IPCoLands	Idaho Power Enterprise GIS Data	Added
	Subdivisions	Idaho Power Enterprise GIS Data	
	Parcel	Idaho Power Enterprise GIS Data	Added
	Ownership	Idaho Power Enterprise GIS Data	Added
	Waterbody	Idaho Power Enterprise GIS Data	Added
	Streams_Rivers	Idaho Power Enterprise GIS Data	Added
	StudyArea_ETVEP	Created	Added
	County	Idaho Power Enterprise GIS Data	Added
Zoning			
	Zoning	Aggregated from Ada/Elmore/Owyhee Co and cities	Added
	FutureLandUse_BoiseCity	Future land use layer provided by Boise City	
Mask		Mask everything except Ada, Elmore and Owyhee counties	
Basemap			
	World Street Map		

Appendix D – Preferred Alternative Details

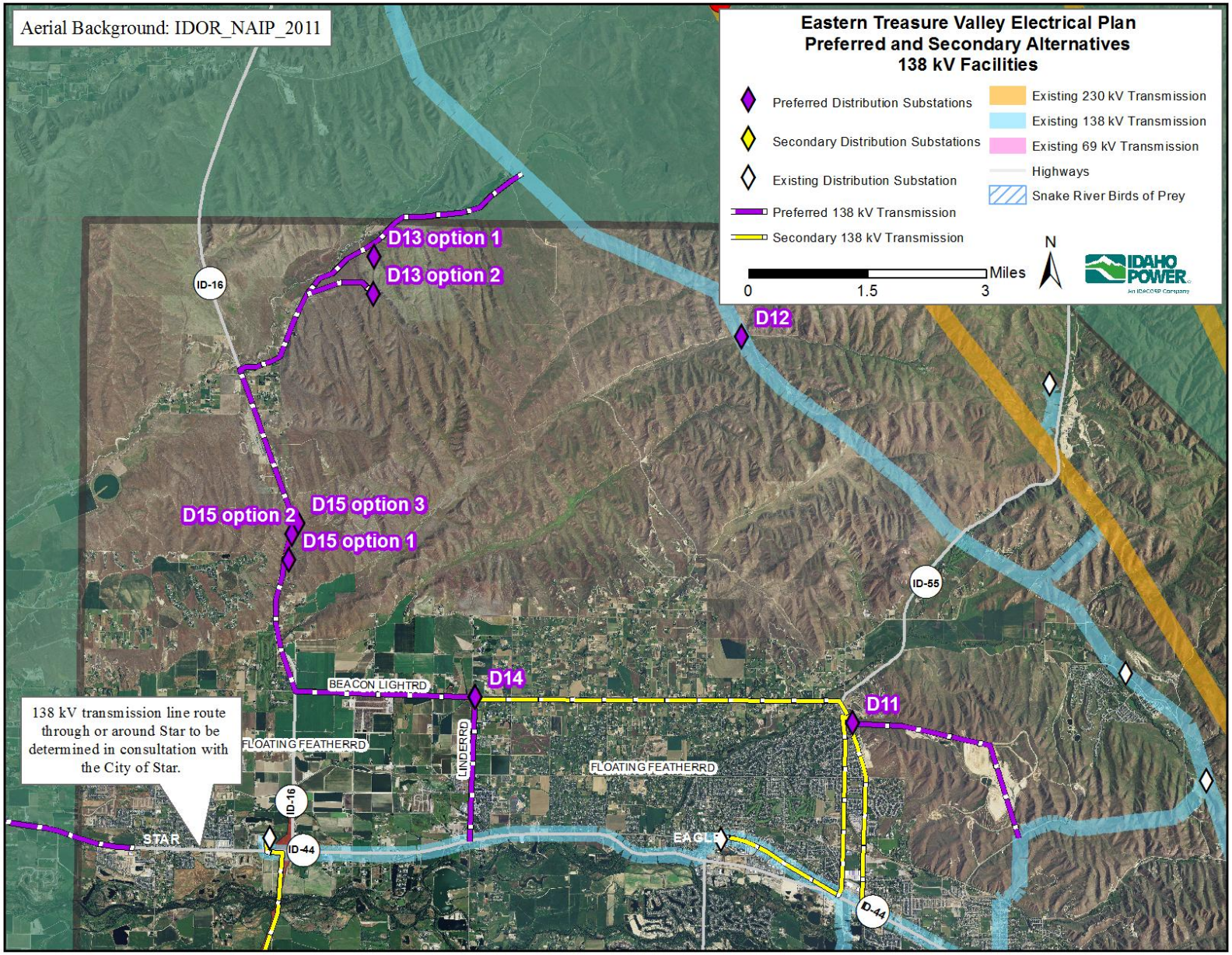

Figure D- 1: Preferred and Secondary Alternatives - Eagle Area

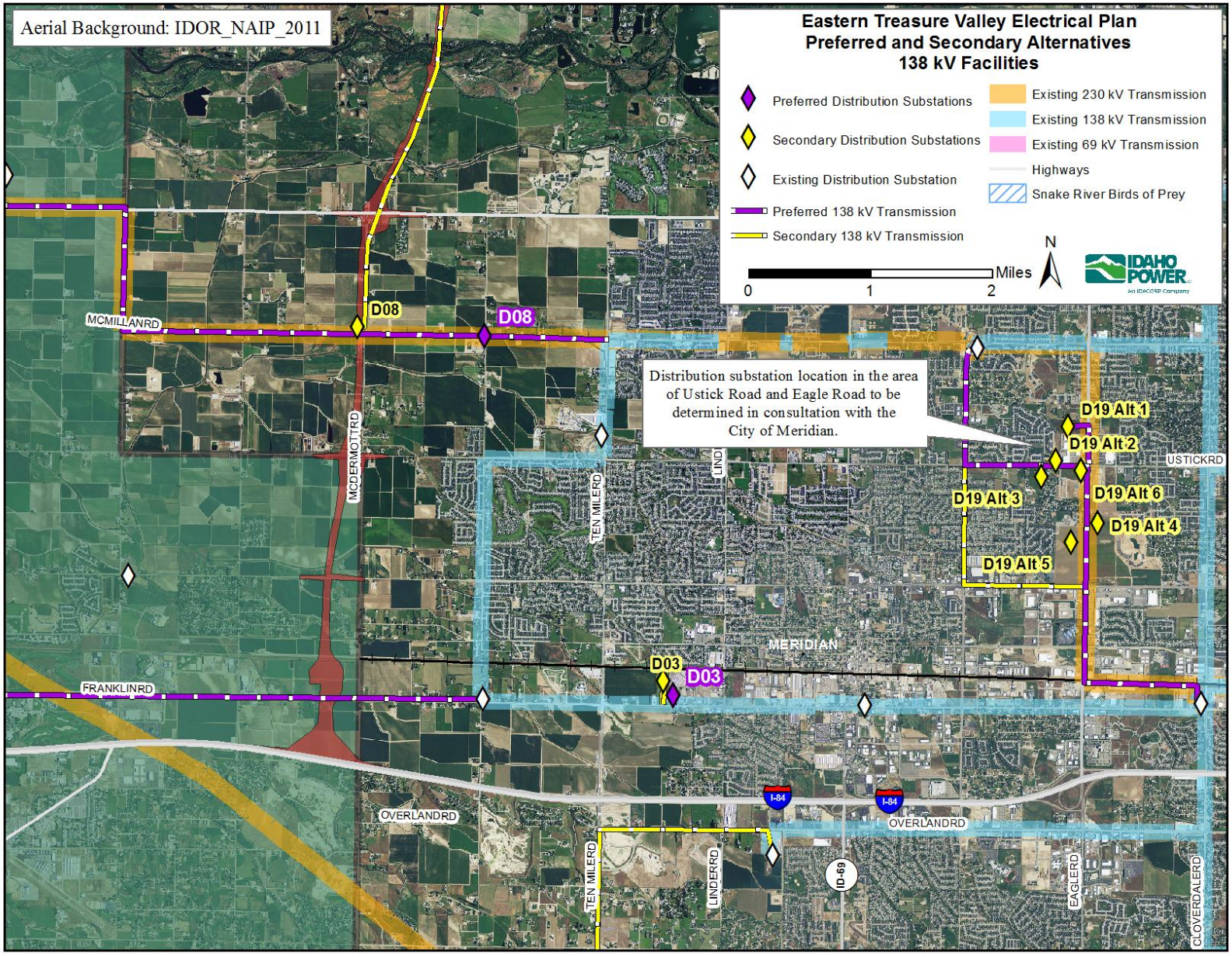

Figure D- 2: Preferred and Secondary Alternatives - Meridian Area

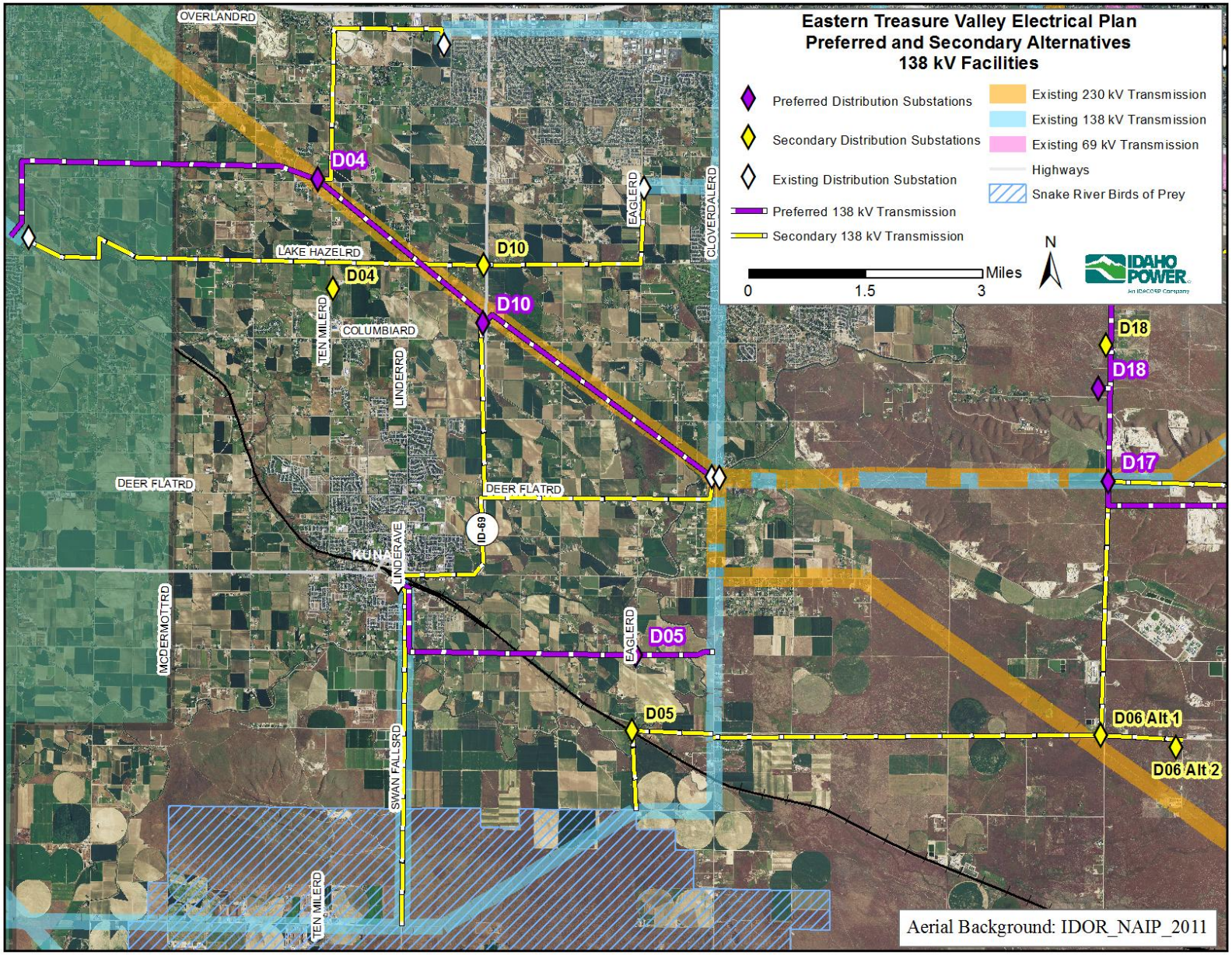

Figure D- 3: Preferred and Secondary Alternatives - Kuna Area

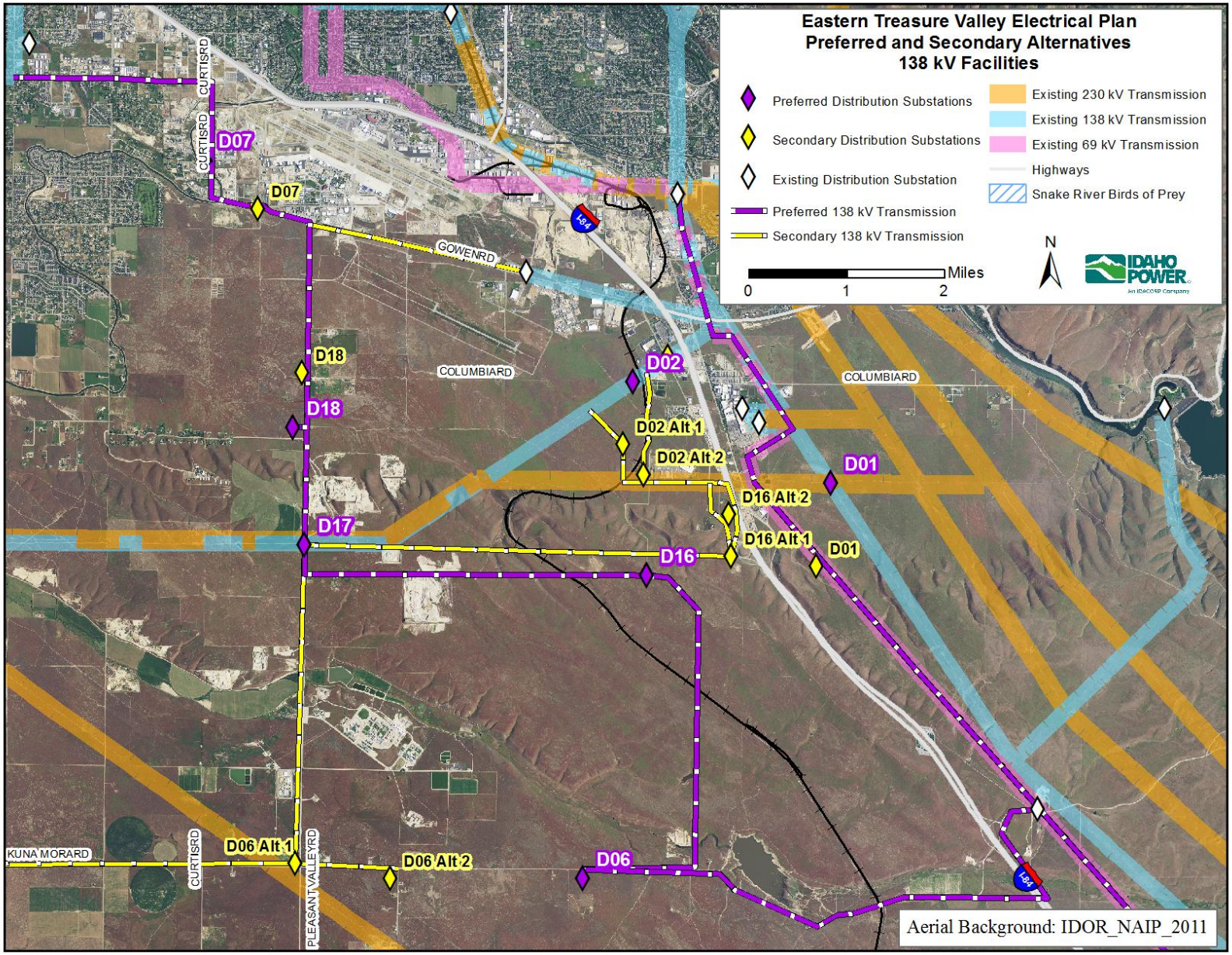

Figure D- 4: Preferred and Secondary Alternatives - South Boise Area

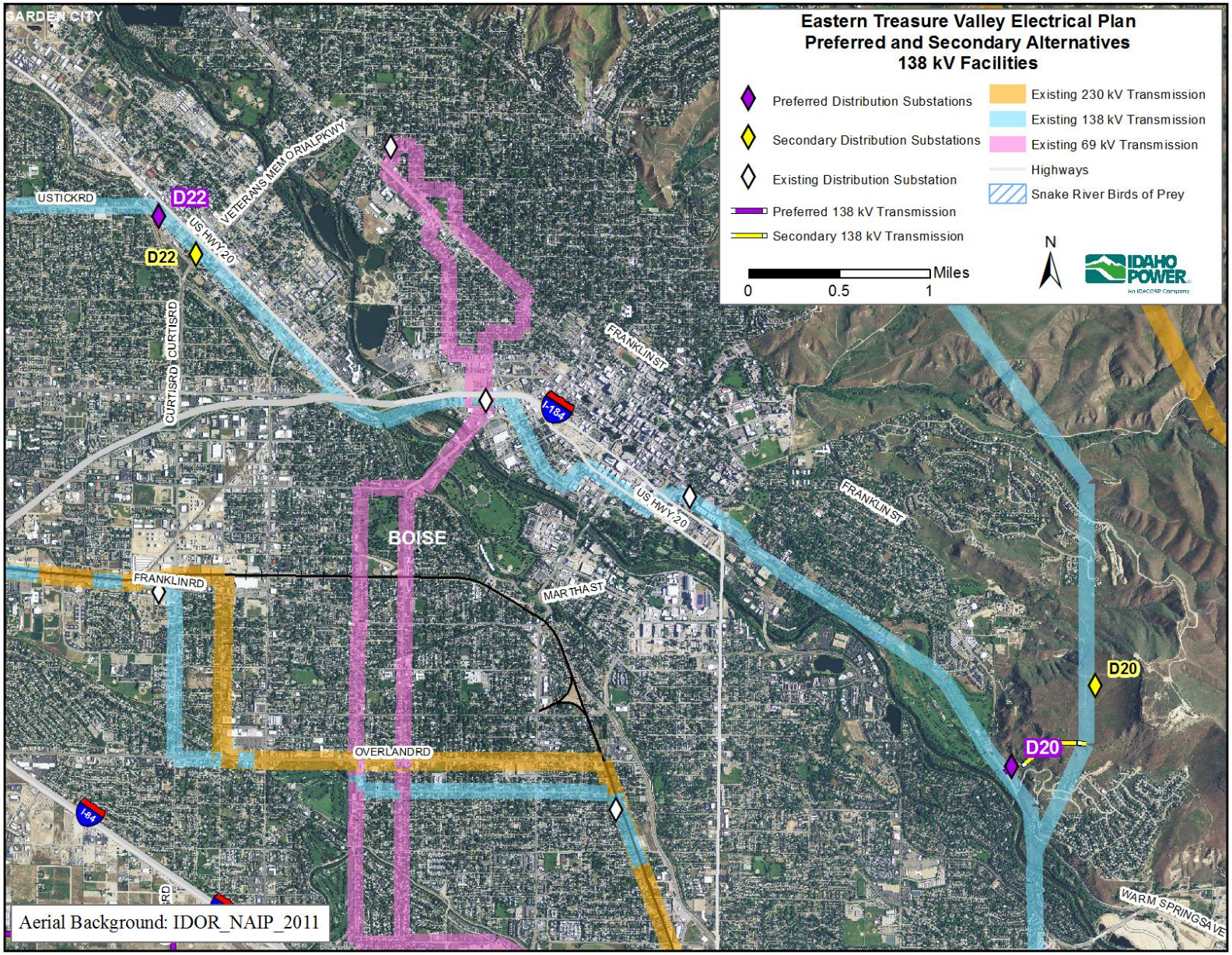

Figure D- 5: Preferred and Secondary Alternatives - Boise and Garden City Area

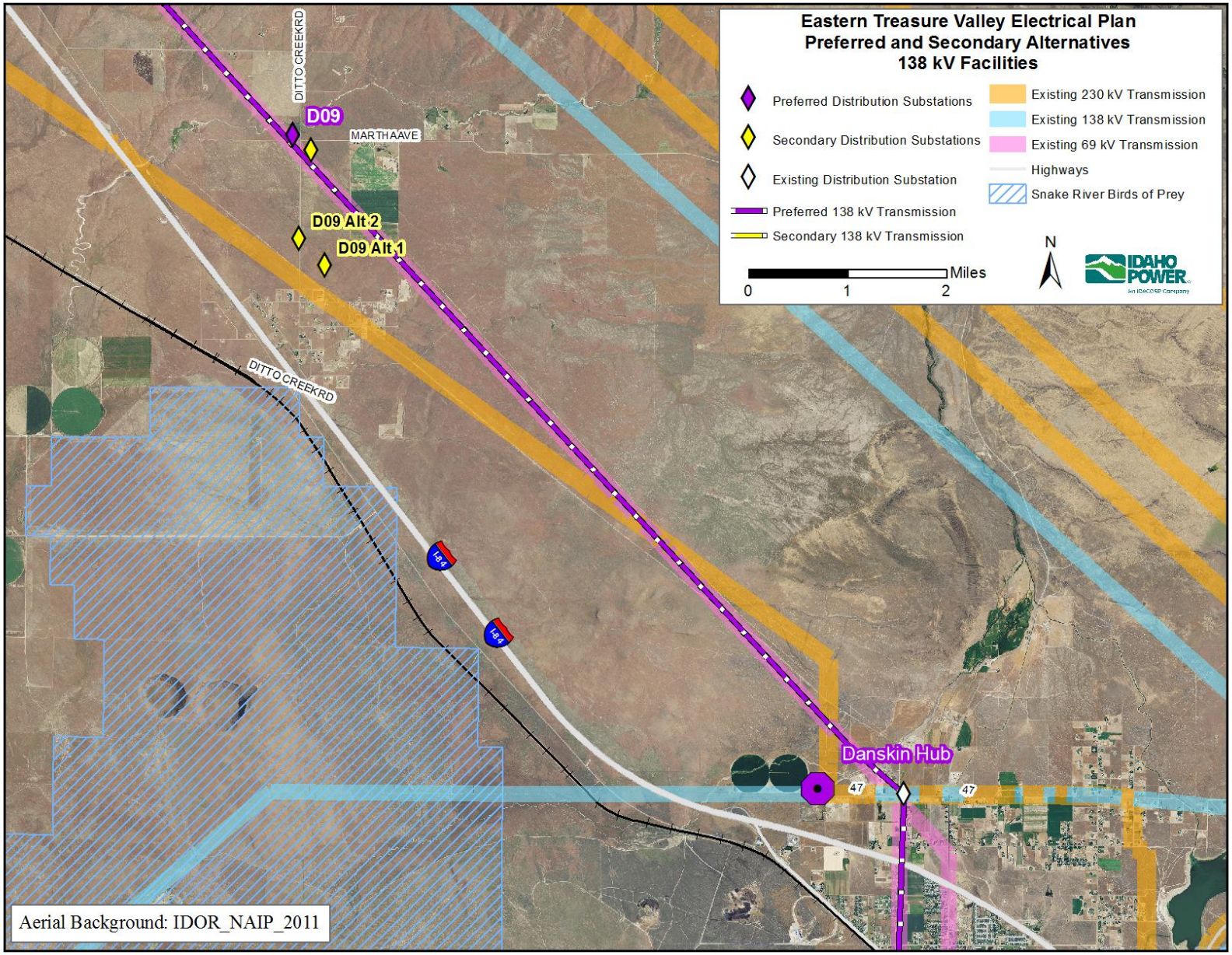

Figure D- 6: Preferred and Secondary Alternatives - Mountain Home Area North

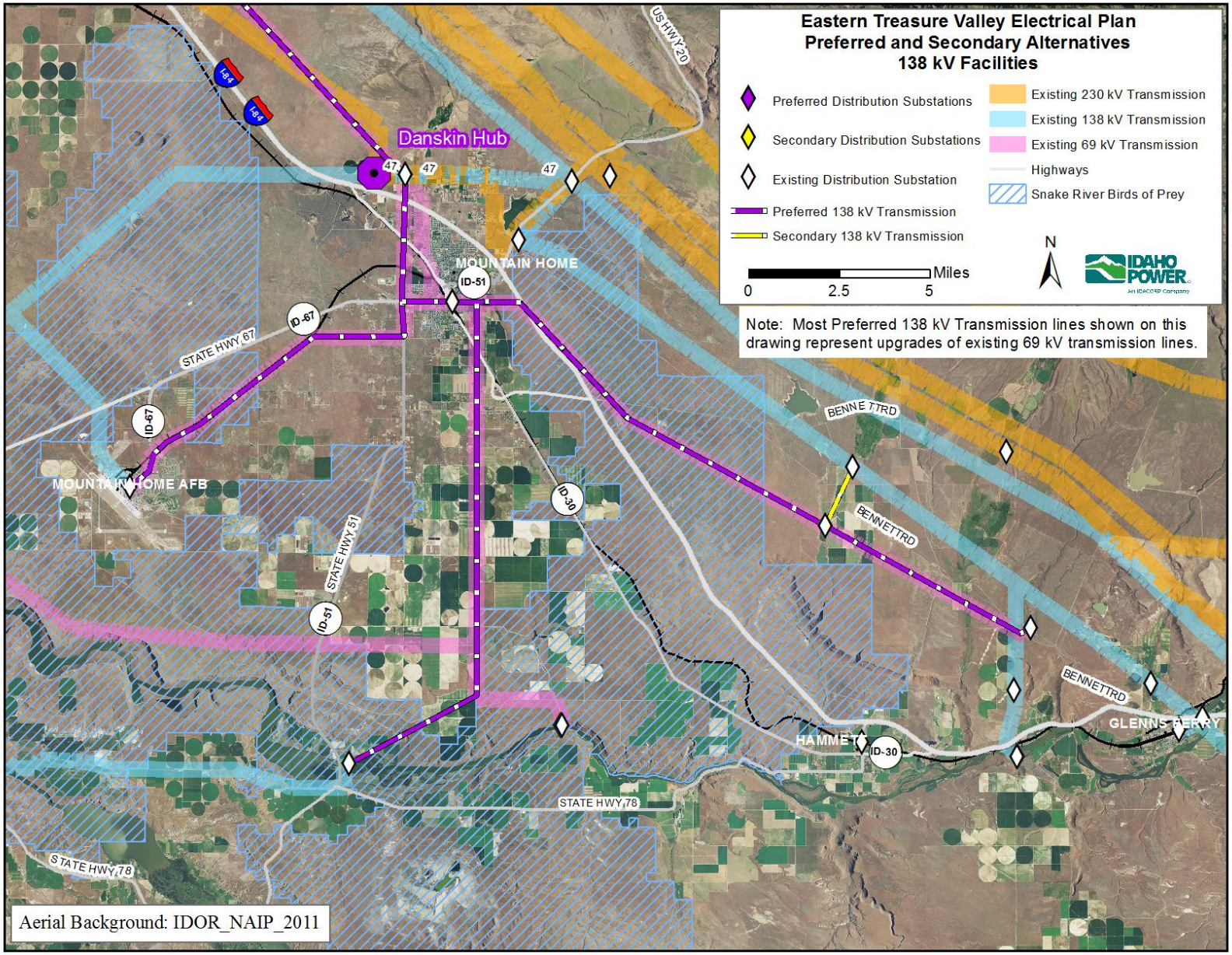

Figure D- 7: Preferred and Secondary Alternatives - Mountain Home Area South

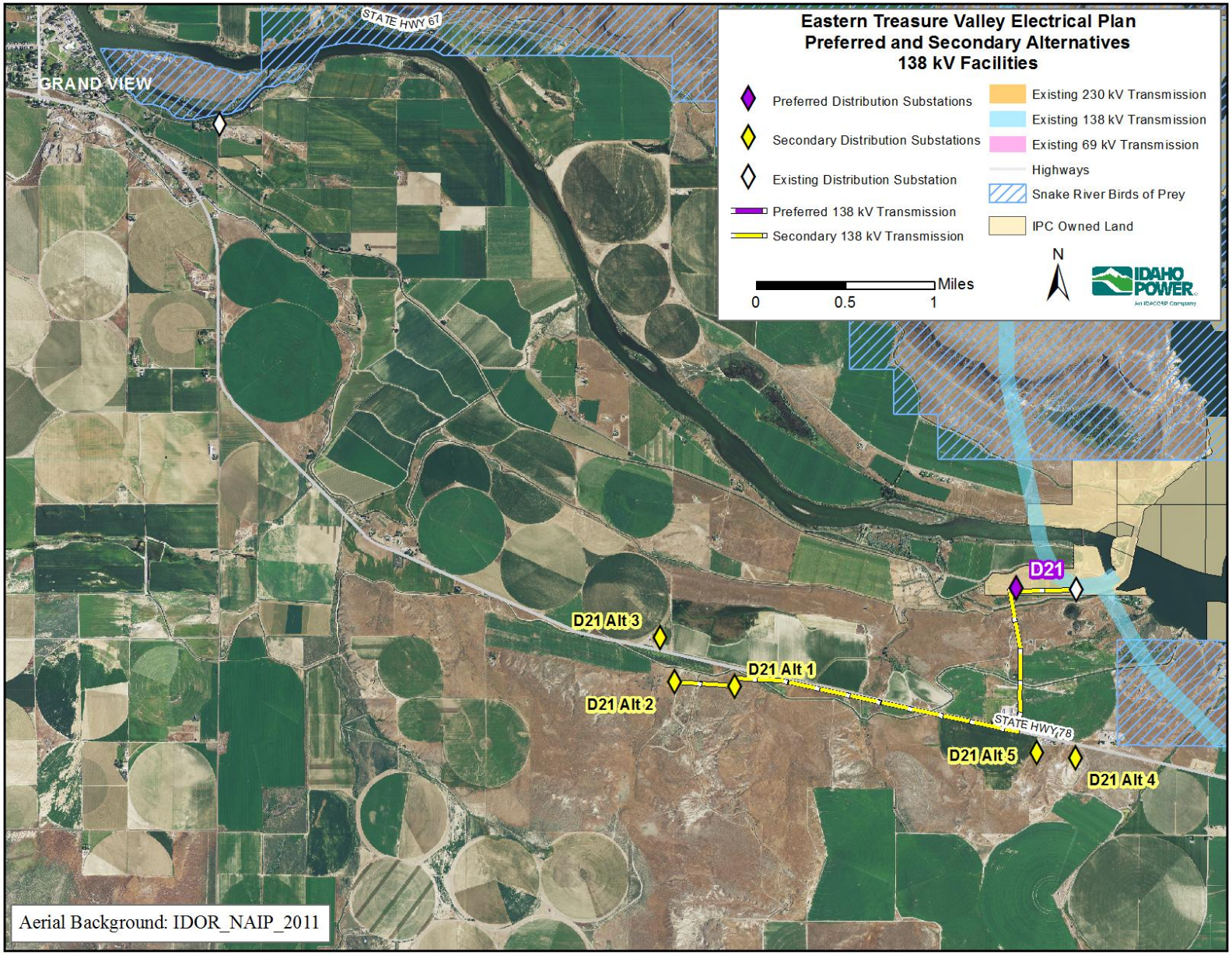

Figure D- 8: Preferred and Secondary Alternatives - Grand View Area

Appendix E – ROW Analysis

As discussed previously, the Community Advisory Committee chose a number of routes in which IPC could place 138 kV and 230 kV transmission lines. Most of the routes follow existing road and transmission rights-of-way. If the lines are placed in existing transmission corridors, either replacing or upgrading the existing infrastructure or expanding the corridor's width will be required. Securing the rights-of-way necessary for all the transmission lines slated for the eastern Treasure Valley will likely prove the most challenging task facing Idaho Power as it constructs electrical infrastructure to meet the region's buildout scenario.

Transmission line rights-of-way can be obtained using any of the following methods:

Easement – An easement gives Idaho Power the right to use the land for a specific purpose. Idaho Power acquires rights from private property owners through negotiations. The easement specifies rights and restrictions on Idaho Power's use of the land while the property owner retains ownership of the land. This is the most common arrangement.
Fee Title Ownership – A landowner may sell the land needed for the transmission line to Idaho Power. Idaho Power then owns the property, receiving title through a deed.
Permit – Idaho Power applies to the appropriate agency for a permit to place the necessary facilities on public lands.
Eminent Domain or Condemnation – If the landowner and Idaho Power are unable to negotiate a price for an easement or purchase of property, Idaho Power may exercise its rights under state law to take the easement or property through court action. The court then determines the fair price to be paid based on testimony provided by independent assessors, Idaho Power, and the property owner's witnesses.

If a transmission line route follows a transportation corridor (right-of-way), Idaho Power can either place the transmission line within the road right-of-way or purchase a private easement along the road right-of-way.

Appendix F – Load Density Based on Zoning

Jurisdiction	*Land Use Definitions*	*kW/Square Mile*
Ada County	**(Land use definitions from the Ada County Zoning Districts document)**	
Rural Preservations	RP	58
Rural Residential	RR	544
Southwest Community Residential	RSW	979
Estate Residential	R1	5440
Estate Residential - Manufactured Home	R1M	5440
Low Density Residential	R2	10880
Medium Low Density Residential	R4	9792
Medium Density Residential	R6	12240
Medium High Density Residential	R8	19584
Medium High Density Residential - Manufactured Home	R8M	19584
High Density Residential	R12	13056
Very High Density Residential	R20	21760
Limited Office	LO	11520
Neighborhood Commercial	C1	11520
Community Commercial	C2	14552
Technological Industrial	TI	14552
Limited Industrial	M1	25000
General Industrial	M2	25000
Airport Industrial	M3	20257
Pedestrian Commercial	PC	15840
Rural-Urban Transition	RUT	9792
Boise City	**(Land use definitions from Boise Zoning Designations, Boise Zoning Districts, and Boise Planning and Development Services documents)**	
Single-Family Residential	R-1A	5440
	R-1B	5440
	R-1C	5440
	R-1A-BSN	5440
	R-1A/DA	5440
	R-1AS	5440
	R-1B	5440
	R-1B-DA	5440
	R-1B/DA	5440
	R-1BH	5440
	R-1C	5440
	R-1C/DA	5440
	R-1CC	5440
	R-1CD	5440

Jurisdiction	Land Use Definitions	kW/Square Mile
	R-1CH	5440
	R-1CS	5440
Modular Lotting	R-1M	24480
	R-1MD	24480
	R-1MH	24480
Combined Residential	R-2	12240
	R-2-DA	12240
	R-2D	12240
	R-2D/DA	12240
	R-2H	12240
	R-2HD	12240
Multi-Family Residential	R-3	13056
	R-3D	13056
	R-3D/CD	13056
	R-3D/DA	13056
	R-3DC	13056
	R-3DD	13056
	R-3HD	13056
	R-3HD/CD	13056
	R-3HDD	13056
	R-3HD/DA	13056
Residential-Office	R-OD	31216
	R-OD/DA	31216
	R-ODD	31216
Limited Office	L-OD	11520
	L-OD/DA	11520
	L-OHD	11520
	L-OHD/CD	11520
Neighborhood Commercial	C-1	11520
	C-1CHD	11520
	C-1D	11520
	C-1D/DA	11520
	C-1DD	11520
	C-1H	11520
General Commercial	C-2	14552
	C-2D	14552
	C-2D/DA	14552
	C-2DC	14552
	C-2DD	14552
	C-2DDC	14552
Service Commercial	C-3D	25000
	C-3	25000
	C-3D/DA	25000
	C-3DC	25000

Jurisdiction	Land Use Definitions	kW/Square Mile
	C-3DD	25000
Planned Commercial	C-4	12648
	C-4D	12648
	C-4D/DA	12648
	C-4D/EF	12648
Central Business	C-5DD	25000
	C-5DD/DA	25000
	C-5DDC	25000
	C-5HD	25000
	C-5HDC	25000
Pedestrian Commercial	PC	15840
	PC-D	15840
	PC-D/DA	15840
	PC-DC/DA	15840
Health Service	H-SD	43044
	H-SDD	43044
Limited Industrial	M-1	25000
	M-1D	25000
	M-1D/DA	25000
General Industrial	M-2	40000
	M-2D	40000
	M-2D/DA	40000
Neighborhood Office	N-OD	11520
	N-OD/DA	11520
Specific Plan	SP-01	7253
	SP-02	7253
University	U	22801
	UC	22801
Open Land	A-1	10880
	A-1/DA	10880
	A-1C	10880
	A-1DD	10880
	A-1DDC	10880
	A-1H	10880
	A-2	10880
Technological-Industrial Park	T-1D	40000
Technological-Manufacturing Park	T-2D	20000
Overlay Districts	(Subzoning code descriptions for Boise zoning)	
Near North End Conservation	CD	
Design Review	D	
Historic Design Review	HD	
Downtown Design Review	DD	
Capitol Boulevard Special Design	C	

Jurisdiction	*Land Use Definitions*	*kW/Square Mile*
Eagle City	**(Land use definitions from Title 8, Chapter 2 of Eagle, Idaho: City Code)**	
Agricultural	A	7344
Agricultural-Residential	A-R	490
	A-R-DA	490
Residential-Estates	R-E	979
	R-E-DA	979
	R-E-DA-P	979
Residential 1	R-1	5440
	R-1-DA	5440
	R-1-P	5440
Residential10	R-10	24480
Residential12	R-12	29376
Residential15	R-15	36720
Residential2	R-2	4896
	R-2-DA	4896
	R-2-DA-P	4896
	R-2-P	4896
Residential3	R-3	7344
	R-3-DA	7344
	R-3-DA-P	7344
Residential4	R-4	9792
	R-4-DA	9792
	R-4-DA-P	9792
	R-4-P	9792
Residential9	R-9	22032
Limited Office	L-O-DA-P	11520
Neighborhood Business	C-1	11520
	C-1-DA	11520
General Business	C-2	14552
	C-2-DA	14552
Highway Business	C-3	28750
	C-3-DA	28750
Central Business	CBD	20000
	CBD-DA	20000
Light Industrial	M-1	25000
Business Park	BP	25000
	BP-DA	25000
	BP-P	25000
Public/Semipublic	PS	7309
	PS-DA	7309
Mixed Use	MU	15840
	MU-DA	15840
	MU-DA-P	15840
	MU-P	15840

Jurisdiction	*Land Use Definitions*	*kW/Square Mile*
Overlay Districts	(Subzoning code descriptions for Eagle zoning)	
Planned Unit Development	P	5440
Development Agreement	DA	5440
Garden City	**(Land use definitions from Title 8, Chapter 2 of Garden City, Idaho: City Code)**	
Agricultural	A	9792
Highway Commercial	C-1	25000
General Commercial	C-2	14552
	C-2/DA	14552
Light Industrial	M	25000
Rural Density Residential	R-1A	5440
Low Density Residential	R-2	12240
Medium-High Density Residential	R-20	48960
Medium Density Residential	R-3	24480
	R-3/DA	24480
Kuna	**(Land use definitions from Title 5, Chapter 2 of Kuna, Idaho - Code of Ordinances)**	
Agricultural	A	9792
Neighborhood Business	C-1	11520
Area Business	C-2	8360
Service Business	C-3	25000
Central Business	CBD	5200
Limited Office	L-O	11520
Light Manufacturing	M-1	25000
Heavy Manufacturing	M-2	40000
Public	P	4571
Planned Unit Development	PUD	5440
Rural Density Residential	R-1	5440
Residential12	R-12	29376
Residential16	R-16	39168
Low Density Residential	R-2	4896
High Density Multifamily Residential	R-20	21760
Low Density Residential	R-3	7344
Low Density Residential	R-4	9792
Residential5	R-5	12240
Medium-Low Density	R-6	12240
High Density Residential	R-8	19584
Star	**(Land use definitions found in StarCode document)**	
Neighborhood Business	C-1	11520
	C-1-DA	11520
	C-1/SA	11520
General Business	C-2	14552

Jurisdiction	*Land Use Definitions*	*kW/Square Mile*
Central Business	CBD	5200
Limited Office	L-O	11520
Light Industrial	LI	25000
Mixed Use	MU	12000
	MU-DA	12000
Low-Density Residential	R-1	5440
Low-Density Residential	R-2	4896
	R-2-DA	4896
Medium Low Density Residential	R-3	7344
	R-3/DA	7344
Medium Low Density Residential	R-4	9792
	R-4-DA	9792
Medium High Density Residential	R-8	19584
Rural Transition	RT	21760
Meridian	**(Land use definitions from Title 11, Chapter 2 of Meridian, Idaho: City Code)**	
Community Business	C-C	11520
General Retail and Service Commercial	C-G	14552
Neighborhood Business	C-N	29300
Light Industrial	I-L	25000
Limited Office	L-O	11520
Mixed Employment	M-E	18260
High Density Employment	H-E	25000
Old Town	O-T	35021
Medium High-Density Residential	R-15	36720
Low-Density Residential	R-2	10880
Medium Low-Density Residential	R-4	21760
High-Density Residential	R-40	43520
Medium-Density Residential	R-8	19584
Traditional Neighborhood Center	TN-C	14000
Traditional Neighborhood Residential	TN-R	36720
Elmore County	**(Land use definitions from Elmore County Comprehensive Plan)**	
General Agriculture/Grazing/Forest	AG	75
Highway/Interstate Commercial	C2	14000
Light Industrial/Manufacturing	M1	58
Heavy Industrial/Manufacturing	M2	58
City	CITY	6165
Residential	R	3427
Air Base Commercial	ABCZ	3291
Air Base Hazard	ABHZ	1500
Planned Community	PC-MT	10000

Jurisdiction	*Land Use Definitions*	*kW/Square Mile*
Mountain Home	**(Land use definitions from Title 9, Chapter 5 and Chapter 13 of Mountain Home, Idaho: City Code)**	
Neighborhood Commercial	C1	11520
Central Business	C2	8360
General Commercial	C3	10000
Heavy Commercial	C4	12000
Light Industrial	I1	15000
Industrial	I2	20000
Manufactured/Mobile Home Park	MHP	8704
Limited Office and Residential	R-LO	12187
Very Low Density Residential	R1	5018
Low Density Residential	R2	8705
Medium Density Residential	R3	9273
High Density Residential	R4	5000
Glenns Ferry	**(Land use definitions found in GlennsFerryCodes document)**	
Agricultural	ZONE AGR - CURRENT	150
	AGR - FUTURE	150
Commercial	COMM - FUTURE	14000
	ZONE COMM - CURRENT	14000
Public	PUBLIC - FUTURE	76
	ZONE REC - CURRENT	1000
Residential-Suburban	RES_SUBR - FUTURE	4739
Residential-Urban	RES_URBAN_1-5 - FUTURE	5250
	ZONE R1 - CURRENT	5018
	ZONE R2 - CURRENT	8705
	ZONE R3 - CURRENT	9273
	RES_URBAN_5 - FUTURE	5250
Shore	SHORE - FUTURE	0
Industrial	INDUS - FUTURE	4000
	ZONE LT IDUST - CURRENT	3000
	ZONE HVY INDUST - CURRENT	4000
Owyhee County	**(Land use definition from Owyhee County Comprehensive Plan)**	
Agricultural	AG	150
Multi-Use	MU	12000
	I	4000

Appendix G – N-1 Reliability Criteria Example

Idaho Power must adhere to what's known as an "N-1" criterion.

> ***For multiple transmission lines delivering power to the same point, if one of the lines goes out of service, the remaining lines must be able to carry both the load they were carrying before the event, plus the load carried by the line that goes out of service.***

- This is true even if the line with the highest capacity is the one that goes out of service.
- This only holds true for major transmission lines.

Take for example three, extra-high-voltage, 345,000-volt transmission lines operating electrically in parallel as shown in Figure G1. In other words, all three lines originate at the same location and deliver power to the same location. Each line might take a different path to get there, but all three begin and end in the same locations.

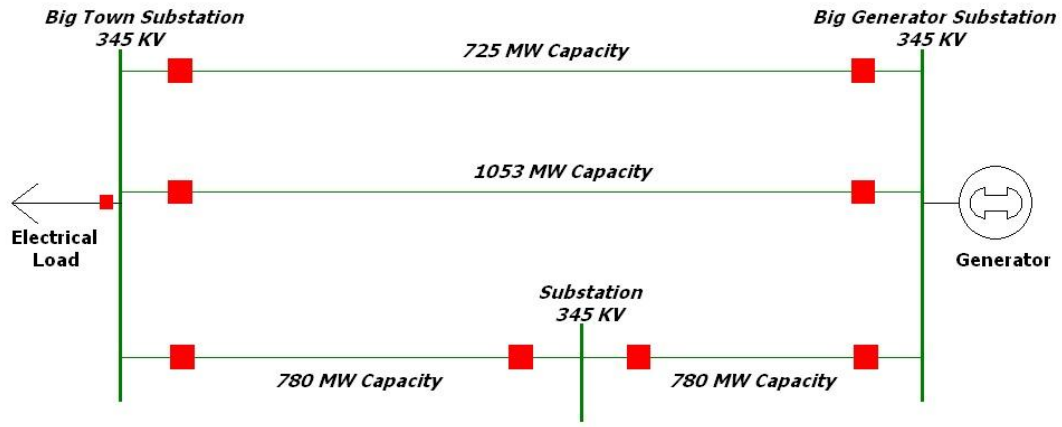

Figure G1. Three Parallel Transmission Lines.

In Figure G1, the top line is 100 miles long and has a capacity of 725 MW, the middle line is also 100 miles long and has a capacity of 1,053 MW, and the bottom line is 200 miles long and has a capacity of 780 MW. Additionally, there is a substation located at the halfway point on the bottom line, but it has no effect on the power flow.

Normal Operation, No Lines Out

The three lines in Figure G2 are carrying a total of 1,400 MW to a load located at Big Town Substation. Note that the generator is producing 1,406 MW of power while the load is only consuming 1,400 MW. The difference between the two is due to MW losses on the transmission system, losses that must be supplied by the generator. The green arrows shown on the drawings indicate the direction of power flow.

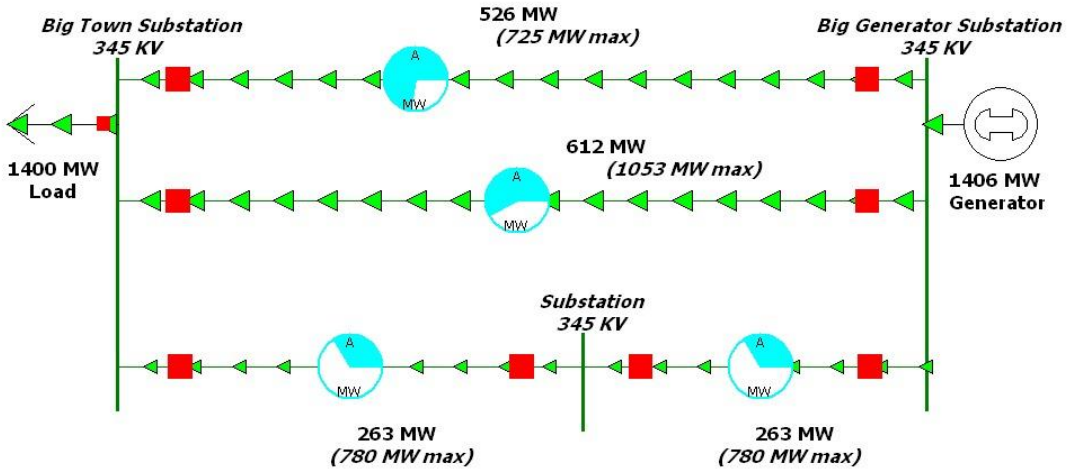

Figure G2. Three Parallel Transmission Lines During Normal Operation.

The blue circle shown on each transmission line is a visual indication of the amount of electrical load on each line. The top circle indicates that the line is carrying about ¾ of the amount it is capable of. If the circle turns orange, it indicates that the line is approaching its maximum capacity. A red circle indicates that the line has exceeded its capacity.

All three lines are operating within their capacity and could operate like this indefinitely.

Top line capacity = 725 MW
    Top line operating at 526 MW
Middle line capacity = 1053 MW
    Middle line operating at 612 MW
Bottom line capacity = 780 MW
    Bottom line operating at 263 MW

Bottom Line Out of Service

Now let's see what happens if we take the bottom line is removed from service. The circuit breaker located on the right side of the line (red box in upper drawing) turns to a hollow green box when the circuit breaker is open, thus de-energizing the line.

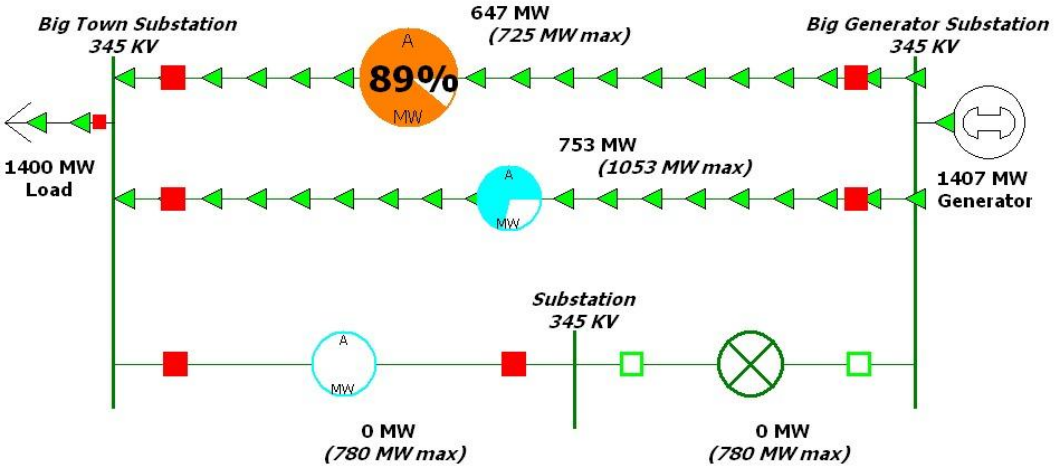

Figure G3. Three Parallel Transmission Lines, Bottom Line Out of Service.

Notice that no power flows on the bottom line now. The middle line, which has the highest capacity of all three, is now operating to about ¾ of its capability. The top line indicates that it is operating at 89% of its capability, giving us a warning. However, these lines could operate like this indefinitely so no action is required. In this case, we have met the N-1 criteria.

Top line capacity = 725 MW
Top line operating at 647 MW

Middle line capacity = 1053 MW
Middle line operating at 753 MW

Bottom line capacity = 780 MW
Bottom line operating at 0 MW

Note that the generator on the right side of the drawing is producing more power compared to the last case. This is because the power losses are higher with one of the lines out of service because there is more resistance to power flow.

Top Line Out of Service

Now we will put the bottom line back in-service and the top line is removed from service. Again, the circuit breaker on the right of the top line will go from solid red to hollow green, indicating that the line is out of service.

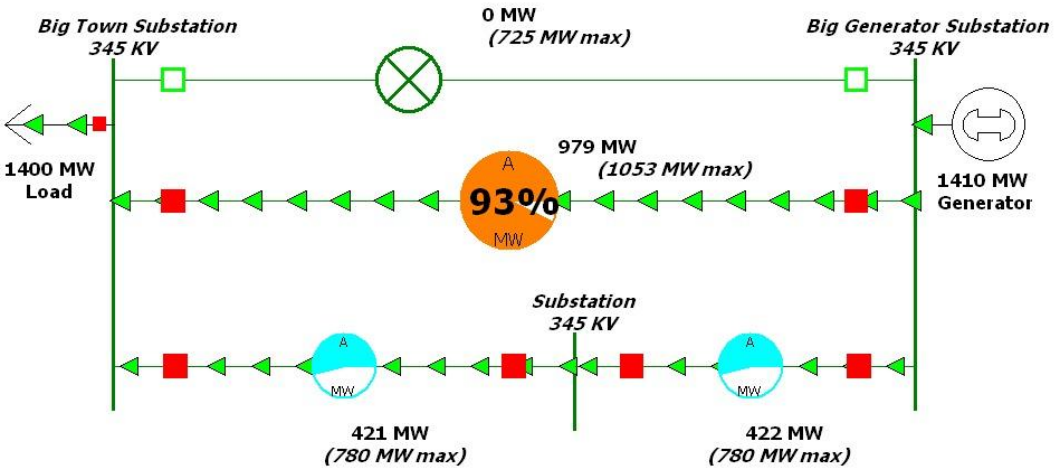

Figure G4. Three Parallel Transmission Lines, Top Line Out of Service.

Notice that no power flows through the top line now. The bottom line indicates that it is operating at about 2/3 of its capability while the middle line is warning us that it is operating at 93% of its capability. These two lines could operate like this indefinitely so again, no action is required.

Top line capacity = 725 MW
Top line operating at 0 MW

Middle line capacity = 1053 MW
Middle line operating at 979 MW

Bottom line capacity = 780 MW
Bottom line operating at 421 to 422 MW

Notice that the generator is now producing more power because of the greater line losses that occur with one of the lines out of service.

Middle Line Out of Service

The top line is put back in-service and the middle line is removed from service. This is indicated in Figure G5 by the circuit breaker located on the right side of the middle line changing from a solid red box to a hollow green box.

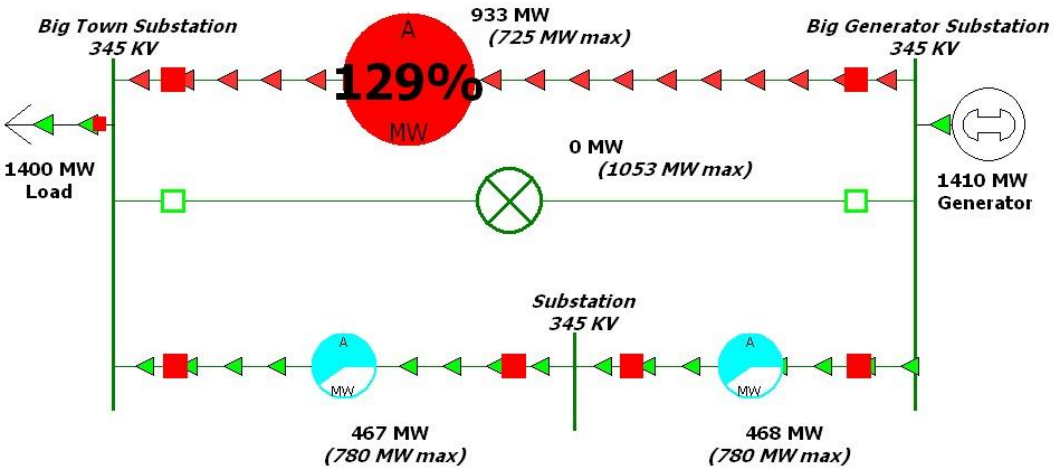

Figure G5. Three Parallel Transmission Lines, Middle Line Out of Service.

Figure G5 indicates that the bottom line is operating at about 2/3 of its capability and this can be maintained indefinitely. However, notice that the top line's indicator shows that it is now operating at 129% of its capability. A transmission line cannot operate like this for very long because the line gets too hot and it can be damaged to the point of breaking. So, in this case, our three transmission lines have failed the N-1 test. When the largest transmission line was taken out of service, the other two could not safely carry the power it was carrying plus the power they were carrying before the incident.

Top line capacity = 725 MW
Top line operating at **933 MW**

Middle line capacity = 1053 MW
Middle line operating at 0 MW

Bottom line capacity = 780 MW
Bottom line operating at 467 to 468 MW