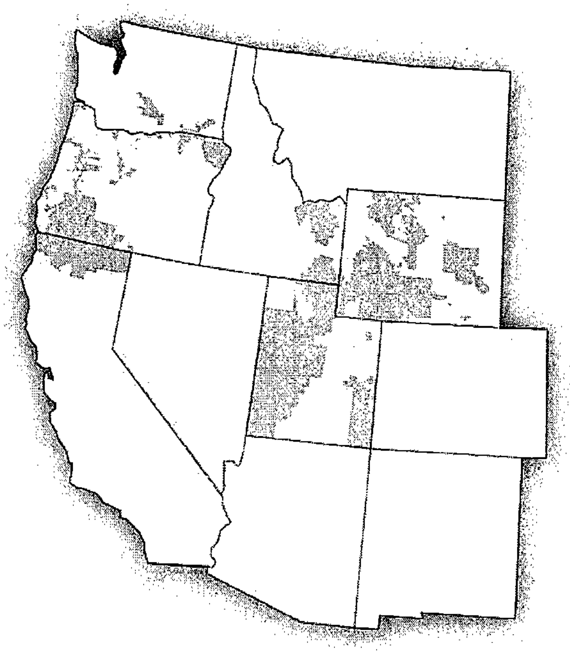
EXHIBIT DTG-3: Wasatch Front Spacial Load Forecast (May 6, 2004)



Wasatch Front Spatial Load Forecast

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May 6, 2004

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1. OBJECTIVE

The Wasatch Front Spatial Load Forecast seeks to identify and predict electric load growth in PacifiCorp's fastest-growing region, Utah's Wasatch Front.

PacifiCorp undertook this study to measure the numerous influences that will contribute to different types of growth, and to pinpoint the infrastructure necessary to ensure uninterrupted power delivery throughout its system in the near and distant future.

This document is intended to be used as a suitable base for comprehensive transmission and distribution expansion planning.

The Wasatch Front Spatial Load Forecast uses Geographic Information System (GIS) technology and spatial load forecast methods to model long-term, electric-load growth for the Wasatch Front. Forecasts are used to determine future load centers, to identify substation property requirements and to ensure the most cost-effective capital expenditures for substation reinforcement.

Utah's Wasatch Front is bounded by Pleasant View on the north, Spanish Fork on the south, and the mountains on the east and west. The area's population has grown at a rate of 2 percent per year for the last 15 years, which has driven electric load growth. This growth has been inflated further by the recent conversion from evaporative cooling systems to central air conditioning systems.

The forecast area boundaries include 56 cities in Utah, including Salt Lake, Weber and Davis Counties. These cities are currently served by 133 distribution substations. The load forecast was produced using a GIS-based model that simulates actual land use. By clearly defining load usage profiles tied to different types of land use, the model can better predict future land use and substation loads.

PacifiCorp has used spatial forecasting technology for many years. The most significant previous spatial forecasting study also was conducted in the Wasatch Front by ABB Consulting, Inc., in the spring of 2002.

PacifiCorp later decided to develop its internal spatial forecasting expertise, and develop a more detailed land use model. The analysis in this study was developed with software called FORESITE™, which is a licensed ABB software product. Substantial parts of the study were performed with GIS software licensed from ESRI, used by the PacifiCorp's Property Management organization.

The forecast used 2003 as the starting year and accounted for the company's substations in service or under construction during the 2003 summer peak. The 2003 summer peak load at each substation was used as the base-load level. Forecast years were defined as 2003 (base year), 2004, 2005, 2006, 2007, 2008, 2010, 2013, 2018 and 2023.

2. BUILDING THE SPATIAL MODEL

The first step in developing a load forecast is to define the model requirements. This section describes the development of major inputs to the spatial model.

2.1 LOAD CLASSES

The 2002 ABB study incorporated eight load classes, which are used in this project:

Medium Density Residential with Central AC (RMAC)

Single-family homes (and residential areas not classified as low density or high density) that predominantly use Central Air Conditioning (AC) for summer air conditioning.

Medium Density Residential with Evaporative Coolers (RMEV)

Single-family homes (or residential areas not classified as low density or high density) that predominantly use evaporative coolers for summer air conditioning.

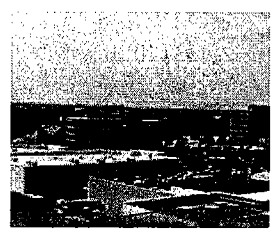
Residential Low Density (RL)

Rural housing, large lot subdivisions and farming areas on growth boundaries.

Residential High Density (RH) – Apartments, condominiums and multifamily homes.

Commercial Retail (CR)

Strip malls, restaurants and retail shopping; which includes big box stores such as Target.



Commercial O&I (COI) – Schools, churches, municipality buildings and office parks.

Light Industrial (LI)

Warehouses, manufacturing, wood products companies and other light-to-medium industrial businesses

Commercial Business District (CBD)

Salt Lake City Center, large commercial, convention centers, apartments and entertainment.

2.2 DATA RESOURCES FOR THE LAND USE MODEL

Data to build the land use model was acquired through several sources. Initially, Utah Power requested base land-use data and model inputs from each of the 52 city governments it serves in the Wasatch Front Range. After a limited response, county offices were solicited and emerged as the best information source. Data requests were directed at Salt Lake, Utah, Weber and Davis county offices.

Parcel and ownership data was obtained from each county. The base year 2003 land use data was derived from the GIS parcel boundary and ownership data. The parcels were joined with tabular data from the county assessor's database, which indicated the land-use classification per parcel. Due to frequent tax assessing, the county assessor database contained the most current and accurate representation of land use in the region. In addition, county assessors maintain residential characteristics – such as square footage and year built – that were important in building the base-year land use model.

Several other data sources were used to create the base-year land use model. These included GIS point data indicating airports and school locations. The model indicated the location of publicly owned lands, wilderness and forested areas where development is restricted. Current aerial photography was obtained. Appendix A provides details of contacts for cities and counties providing data for the study area.

2.3 LAND USE MODEL

The land use model represents current land use and development in the Wasatch Front. Key to the land use model is reproducing the current land use in the area, as well as indicating the current development environment. In many cases this is done using zoning regulations that restrict or encourage particular load classes -- or that restrict or encourage land use type development in certain regions. It is also important to model the land that is currently – or soon will be available – for development. For example, it is possible that land currently considered nonvacant as part of a large, multiacre parcel, may be divided later into multiple, vacant, residential parcels.

Each individual parcel was classified into a corresponding spatial forecast load class according to its current land use as defined by the assessor. Each land use type had to be translated into a corresponding spatial forecast load class to be defined by each class's load profile. When the assessor data was insufficient, relatively current aerial photographs were used to define a land area's proper class.

The land use classification process included the identification of vacant lands available for development, as well as lands considered nondevelopable. Nondevelopable lands include those that are publicly owned, lands on the Great Salt Lake's shore and in the salt marshes, and lands with a slope of greater than 30 percent (a generally followed engineering principle for nondevelopable lands). Slope is an important consideration as both sides of the valley are flanked by mountain ranges. A post-classification error analysis was performed to ensure confidence in the classification results.

Cooling system conversions

The primary concern in the current Wasatch Front development environment is the conversion of older homes from swamp coolers (evaporative cooling systems) to centralized air conditioning (AC). This conversion is generating a significant increase of the system electrical load. Therefore it was important to model the conversion in addition to new development.

Many assessors maintain a residential housing characteristic regarding AC. However, the information is only collected when a home is reassessed. Additional data was used in cases where an AC characteristic was not available, including square footage, year built, and total value. Homes that were built after 1995, with a square footage greater than 2,000 or a total value greater than $150,000, were assumed to have central AC. These homes were placed in the Medium Density Residential AC class (RMAC). All other residential parcels were placed in the Evaporative Cooling Medium Density Residential class (RMEV). Using the FORESITE™ urban redevelopment model, all lands in the RMEV load class were then coded to allow redevelopment to the RMAC class to simulate the conversion of homes from evaporative cooling to central air conditioning.

Additional development parameters

Much of the low-density residential and rural lands of the Wasatch Front will likely become available for higher-density residential and commercial development. It was important to model the possible conversion of these lands by incorporating them into the urban redevelopment model. Those areas now classified as low-density residential/rural were marked for all types of redevelopment in the forecasts. However, a preference was given to new development on vacant lands (over redevelopment) as this is the predominant type of development in the region.

Additionally, the locations of water bodies were used as factors in land use development. The Wasatch Front has two major water bodies, The Great Salt Lake and Utah Lake south in Utah county. It was important to distinguish between these water bodies as they have very different effects on development. The Great Salt Lake is not considered a desirable location for building as it often has an unpleasant odor. It was therefore referred to as Bad Water. Utah Lake tends to encourage development along its shores and is referred to as Good Water. Differentiating these two factors for development was critical to the accuracy of the forecast's model.

Future land use drivers

An Urban Pole map was used to encourage residential and commercial growth in locations that planners labeled as "high-growth regions." Of particular concern to the land use model is the proposed Kennecott development in the western half of the City of South Jordan. Kennecott Land, a subsidiary of Kennecott Utah Copper, owns more than 4,000 acres in South Jordan where a development master plan has been created. The company owns an additional 93,000 acres of unincorporated county land in the Oquirrh Mountains and foothills, which are the largest remaining contiguous land holdings in the Salt Lake Valley. Kennecott Land has announced long-term development plans for much of this area, and will play a crucial role in the region's expected growth over the next 30 years (Kennecott Land website, www.kennecottland.com). The first phase of Kennecott Land's development plans, named "Daybreak," was acquired directly from the company as well as through the City of South Jordan.

The Utah Department of Transportation (UDOT) is overseeing a study on building a major transportation corridor on the west side of the valley called the Mountain View Corridor. While an intense debate from the affected communities is expected, the highway is likely to be built in 15-20 years to relieve the stressed transportation system in the valley and to accommodate projected west-side growth. Information regarding the corridor's proposed location was obtained from the UDOT website. It is incorporated into the land use model at Year 15 (2018) in the Kennecott/Mountain View Corridor forecast, which is also called Scenario 2. It also incorporates several west side planned developments including Kennecott's Daybreak community.

FORESITE™ has a limited area it can forecast. The resolution of the grid data used was one acre, which means that land use was represented in one acre cells. Due to the large size of the Wasatch Front, representing the region as one acre cells exceeded the application's limits. Therefore, the Wasatch Front was broken into three separate study regions (North, Central, and South). Modeling and subsequent forecasting was performed separately on the individual regions. The forecasts for each region were then merged to create a seamless model of land use for each forecast year. Appendix B provides a breakdown of the study areas.

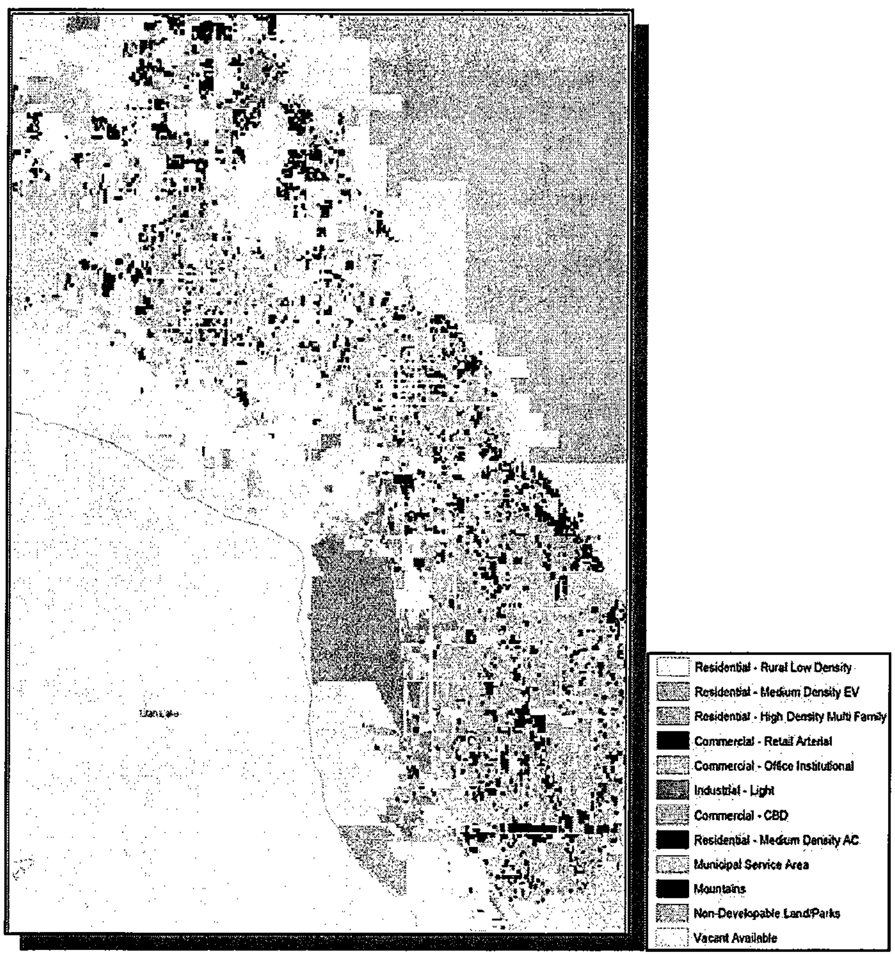


Figure 1: Example of Base Year Land Use (from south section of the study area)

2.4 LOAD PROFILE

One of the building blocks in developing an accurate load forecasting model is determining the daily consumer load in the study area. Plans must accommodate peak load conditions; consequently, planners need to know how loads behave during the system peak. This section evaluates different methods for collecting load data. These methods are used to generate load profiles for each land use class. The final set of load profile curves for the eight load classes are presented.

2.4.1. LOAD CURVE DEVELOPMENT

A systematic approach is used to develop load profile curves and load-per-acre values. The process is based on the requirements of the forecasting tool, the available resources and the study area's specific needs. The fundamental steps for generating the system load profiles are as follows:

- Determine the type of load (consumer class): residential, commercial, etc.
- Obtain system load and identify day of system peak load
- Identify frequency of measurement (hourly, quarter hourly, etc.)
- Assess availability and accessibility of data
- Verify repeatability of data for future studies
- Evaluate portability of process to other study areas

The first step was discussed in section 2.1. The remaining steps are described in the following sections.

2.4.2. SYSTEM PEAK DAY

The 2002 summer system peak day occurred on July 15, 2002, when the high temperature was 100 Fahrenheit, with 22.0 Cooling Degree Day (CDD) for the day. The system peak was used to reflect the most up-to-date growth in the region. Three consecutive hot days preceded the peak day, adding to the weather sensitive load in the region. From Friday through Sunday, the daily CDD and high temperatures were as follows: Friday, 105 F, 20.5 CDD, Saturday, 107 F, 23.0 CDD, Sunday, 101 F, 21.0 CDD. Saturday's 107 F was the all time hottest day recorded on the Wasatch Front.

$$CDD = 65 - \frac{(T_{max} - T_{min})}{2}$$

Equation 1: Cooling Degree Day Definition

2.4.3. FREQUENCY OF MEASUREMENT

Typically, hourly data is used in Spatial Load Forecasting[1] for the system peak day. The load profile curves in the original ABB model were based on hourly data points, and hourly data was also used to generate the new load profile curves. Note that the data used is SCADA (System Control and Data Acquisition) data with a sampling rate greater than hourly. This data is interpolated by the SCHOOL system (Substation/Circuit History of Operational Loading, a system that uses OSIsoft PI software to store historical load data).

2.4.4. AVAILABILITY OF DATA

Initially, this study was to be based on "point of service" data that is measured on 15 minute intervals at the customer meter. This data is collected by the metering group for billing verification. It appeared to be a good source for generating load profile curves based on the randomly selected 664 different metering points located throughout the Wasatch Front Area.

[1] H. Lee Willis, *Spatial Electric Load Forecasting*, Marcel Dekker, Inc, New York 2002

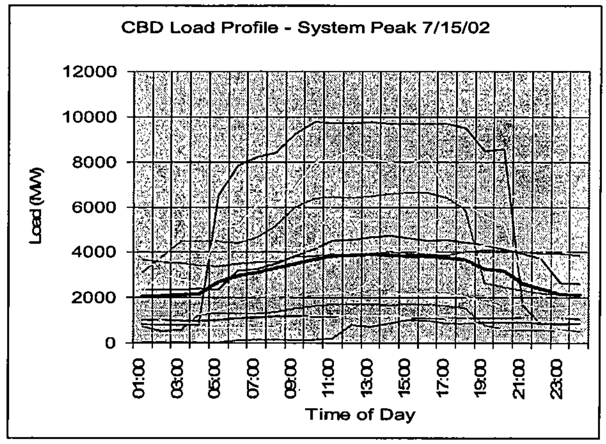


Figure 2: Point of Service Results

As the data was collected and analyzed, the validity of this method came into question. Figure 2 represents the best case results (had the most data points and had the least anomalies) using the "Point of Service" method. This method generated an average of only 20 reasonable data points after rejecting outliers, zero values, spikes, etc.

The results from the "Point of Service" method had many unwanted shortcomings. An example was that the data is based on judgment-based decisions (selection of customers, weighting of customers, verification of data, etc), which produces different results dependant on the person collecting the data. A second challenge was the limited data sample size. This forced the determination of a coincidence factor[2], which is very difficult to quantify. A decision must be made to use the company standard[3] or to generate factors specific to this study.

These are all judgment-based decisions, which are nearly impossible to repeat, very time-intensive, and difficult to justify. Therefore this method is not used to generate the final load profile curves in this report. Refer to Appendix C for a larger version of Figure 2.

This led to the next available level of historical data, which is measured at the distribution-level feeders. The Wasatch Front has many substations with historical SCADA that records power into and out of substations and feeders. This data is stored in the MV-90 database and much of the information is also available in SCHOOL. This information minimized judgment-based decisions at the expense of load class accuracy, since each feeder area does not exclusively feed each load class. This method was deemed the most accurate and is used for generating the load profile curves

The distribution-level feeder method is used to generate the final set of load profile curves with two exceptions. Due to the size of feeder areas, two load classes could not be determined directly, Residential High Density (RH) and Commercial Office and Institutional (COI). For both of these classes, published data[1], studies by other utilities and the results from the "point of service" data were used. The final feeder selections used to generate the load profile curves are shown in Appendix D.

2.4.5. REPEATABILITY OF DATA

The method of using historical load data at specific feeders (that primarily served each load class) provided repeatable and verifiable results. This was verified by generating load profile curves for past summers and winters using SCHOOL data. The results were then presented to the metering group for the Wasatch Front. They determined that the load profile curves were accurate.

[2] H.L. Willis, T.D. Vismor & R.W. Powel "Some Aspects of Sampling Load Curves on Distribution Systems" IEEE Transactions on Power Apparatus and Systems, Nov. 1985

[3] PacifiCorp Standards: DA411 "Residential Electrical Demand" & Unreleased GH0111E "3ϕ Transformer Loading"

2.4.6. PORTABILITY OF PROCESS

One of the benefits of this project was the ability to define a procedure for developing load profile curves for use on other projects. There are many substations with SCADA data recorded in SCHOOL in the eastern half of PacifiCorp's service territory; this procedure should work in those areas with minimal adjustments. Over time, SCADA data will become more accessible in the western service territory, making this procedure possible companywide. Note that there are more accurate methods of data collection that could be incorporated in areas of limited feeder data or in areas where the classes are not served by a single feeder. Refer to Appendix C for a discussion of data acquisition methods.

2.4.7. LOAD PROFILE RESULTS

An Excel spreadsheet was developed to generate representative daily load profile curves for the Wasatch Front Area. This spreadsheet allows users to specify a profile date. An example of the spreadsheet can be seen in Appendix E. The results are for the July 15, 2002, system summer peak. Normalized load profile data is shown in tabular form along with the kW multipliers, acres per feeder and kW/customer. The spreadsheet also generates a graph, as shown in Figure 3, to better evaluate and share the results. These results are similar in shape and magnitude to State of Utah Load Curves from PacifiCorp's metering group (shown in Appendix F), and similar to published results for other utilities with similar service territory characteristics.

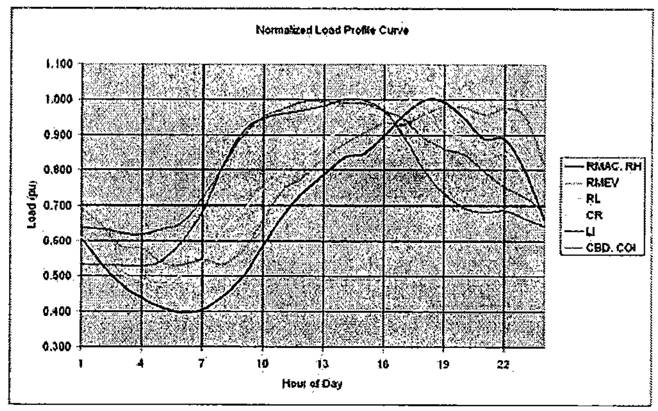


Figure 3: Load Profile Curve

2.5 CALIBRATION

Calibration is the process of matching the model's calculated load for the base year to the actual load. The goal is to achieve the best possible match for the entire system and individual substations, both in magnitude and shape. Matching the magnitude is only a first-order test, but matching the shape ensures the correct type of load has been assigned to each area.

The Wasatch Front study region includes 133 individual substations for the base year (2003). Attempting to analyze the load curve fit for each substation was deemed impractical, so a subset was selected for the calibration process. It is assumed that if the shape and magnitude of load curves for 22 representative substations can be closely matched, the probability that all substations are accurately modeled is high.

2.5.1. SELECTING SUBSTATIONS

Not all 133 substations serve territory exclusively within the study boundary. The first step in the selection process was to determine which substations are entirely within the study region. From this list, substations with SCADA data within the SCHOOL system were chosen so that the load shapes could be compared. Substations with widely varied load class acreage breakdowns were selected, ensuring each load class was accurately modeled.

The final substation list for calibration follows:

13th South	Cottonwood	Oquirrh	Timp
Altaview	Fifth West	Orem	Tri City
American Fork	Lincoln	Pleasant Grove	Vineyard
Angel	Lindon	Sandy	West Jordan
Brunswick	Ninety South	Sharon	
Cherry Wood	Northridge	Taylorsville	

2.5.2. ACTUAL LOAD CURVES

The actual, 24-hour, per-unit load curves for each selected substation were obtained from SCHOOL for the 2003 system peak day, July 22, 2003. Official substation peak values for that same day were provided by Susan Smith.

2.5.3. CALCULATED LOAD CURVES

Calculated 24-hour load curves require three inputs: land-use acreage by load class, per-unit load curves for each load class, and load multipliers (kW/acre by load class). The land use acreage was extracted from the base year land use for each of the selected substations. Per-unit load class curves and load multipliers were determined as described in section 2.4.

2.5.4. ADJUSTABLE PARAMETERS

Parameters must be adjusted to match the actual and calculated load curves. It is critical to determine which parameters can and cannot be modified. Actual load curves are not adjustable, but the calculated curves are. There are only three parameters for the calculated load curves, which were listed in section 2.5.3.

The first of the calculated parameters is the land use acreage. This parameter was meticulously created, as described in section 2.3, and was therefore deemed not adjustable. The second parameter, the per-unit load class curves, is deemed highly reliable and therefore not adjustable.

So, the only adjustable parameters are the load multipliers. However, these cannot be adjusted without bounds. The table below provides the preliminary load multipliers, the upper and lower bounds, and the final multipliers used. Determination of these bounds was made based on the ABB study, guidelines found in *Spatial Electric Load Forecasting*, and judgment.

	RL	RMEV	RH	CR	COI	LI	CBD	RMAC
Preliminary Multipliers[4]	1.9	3.9	17.6	39	11.1	22.3	133	13.2
Upper Bound	2.5	5	20	50	60	25	140	20
Lower Bound	0.9	2.5	10	20	20	15	75	9
Relative Requirements	<RMEV	<RMAC	>RMAC					
Value Used in Model	1.2	3	14	23	42	16.5	100	11.5

Table 1: Load Multipliers and Bounds

[4] The preliminary multiplier for the COI class was significantly less than the one used in the first study by ABB and the guidelines provided in *Spatial Electric Load Forecasting*. This value was judged to be unreasonable. The selected feeder or acreage calculations may have been in error.

2.5.5. CALIBRATION RESULTS

The success of the calibration was measured by six major indicators:

1) Total Load Difference at Hour 17 (Time of Peak)
2) Average Percent Difference for Substation Peaks
3) Maximum Percent Difference for Substation Peaks
4) Minimum Percent Difference for Substation Peaks
5) Time of System Peak
6) Time of Substation Peaks

Items 1 - 4 measure the magnitude of the fit, while 5 and 6 measure the shape. In addition, graphs of the total fit, best fit (substation with the lowest percent difference at peak), worst fit (substation with the highest percent difference at peak), and average fit (substation closest to the average percent difference at peak) were reviewed to help assess the shape of the fit.

It is not possible to optimize every indicator simultaneously. Preference was given to matching the total fit (items 1 and 5 as well as the total graph). Items 3 and 4 measure the outliers, and therefore were deemed the least important.

Table 2 below gives the first 5 indicators.

Total Load Difference at Hour 17 (Time of Peak)		Average Percent Difference for Substation Peaks	Maximum Percent Difference for Substation Peaks		Minimum Percent Difference for Substation Peaks		Time of System Peak	
MW	percent		percent	substation	percent	substation	actual	calculated
17.21	3.2%	20.3%	47.6%	Vineyard	0.5%	Oquirrh	17	16

Table 2: Calibration Success Indicators

The total fit, best fit, worst fit and average fit graphs are provided below.

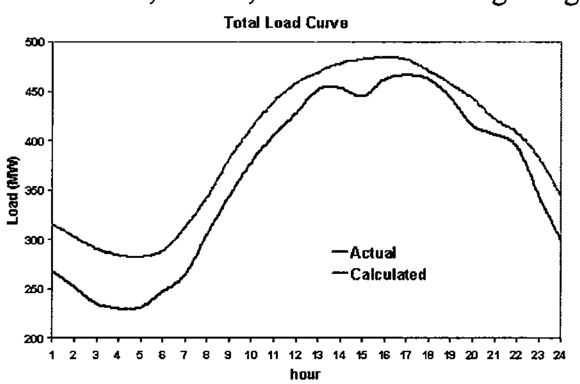


Figure 4: Total Load Curve

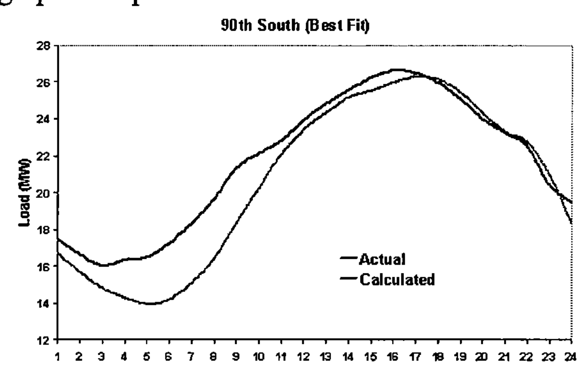


Figure 5: Best Fit

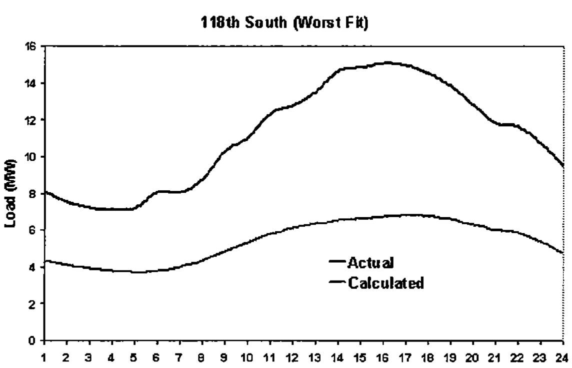


Figure 6: Worst Fit

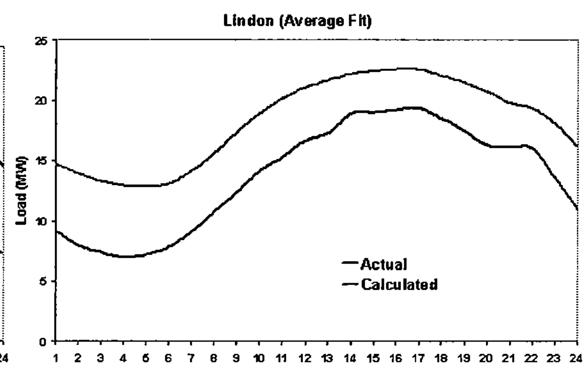


Figure 7: Average Fit

2.6 FORECAST GROWTH RATES

There are two events that cause load growth: new customers and the consumption growth of existing customers. The first (new customers), is responsible for the steep section of an area's 'S' curve. The second (consumption growth), drives the flatter sections of the 'S' curve.

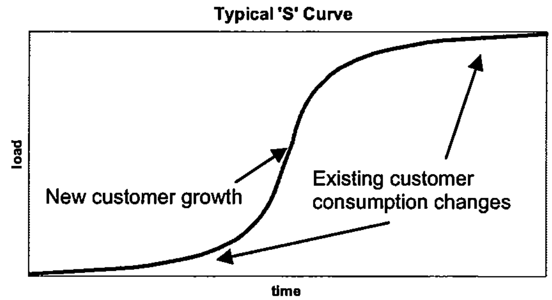


Figure 8: Typical 'S' Curve

2.6.1. NEW CONNECT GROWTH RATES

The number of new connects for all forecasting years was initially provided by the Commercial and Trading Department. Converting these numbers into growth rates required an accurate count of existing customers by type for the base year. This count was obtained from the CADOPS system for the basic types of residential, commercial and industrial customers. The base year acreage counts were used to determine the current breakdown of each of these types.

The resulting growth rates by class then were applied to the existing land use acreage counts to produce approximate forecast acreage totals for each study year. Approximate megawatt (MW) totals were calculated using the acreage counts, new connect growth rates and consumption growth rates.

Ten percent of the Medium Density Residential with Central AC (RMAC) growth was assumed to be lost to the redevelopment of Medium Density Residential with Evaporative Coolers (RMEV) and Low Density Residential (RL). Using this assumption, the RMAC new connect growth rate was inflated until it was equal to the weather-sensitive load growth rate identified by ABB in its 2002 analysis of Wasatch Front region load growth (8.9 percent).

The remaining growth rates were adjusted to produce an overall 5.4 percent electrical load growth from 2003 to 2004. Identified in the 2002 ABB study, the 5.4 percent growth rate was the actual historical growth rate from 2002 to 2003. The resulting 2003 new connect growth rates for each class were divided by the original new connect growth rates provided by the Commercial and Trading Department to quantify the adjustments. The new connect growth rates for each class in each of the remaining years were multiplied by these quotients for consistency. Table 3 below gives the new connect growth rates by class used for each study year.

	RL	RMEV	RH	CR	COI	LI	CBD	RMAC
	class 1	class 2	class 3	class 4	class 5	class 6	class 7	class 8
2003 growth rate	0.39	0.39	3.16	5.53	5.45	0.43	0	9.15
2004 growth rate	0.40	0.40	3.12	5.48	5.40	0.43	0	9.02
2005 growth rate	0.41	0.41	3.11	5.45	5.37	0.44	0	8.9
2006 growth rate	0.41	0.41	3.12	5.40	5.33	0.45	0	8.79
2007 growth rate	0.42	0.42	3.12	5.37	5.29	0.45	0	8.68
2008 growth rate	0.43	0.43	3.13	5.34	5.26	0.46	0	8.57
2010 growth rate	0.44	0.44	3.14	5.27	5.19	0.47	0	8.35
2013 growth rate	0.34	0.34	2.31	3.77	3.72	0.36	0	5.88
2018 growth rate	0.29	0.29	1.90	3.09	3.04	0.31	0	4.78

Table 3: Annual New Connect Growth Rates

2.6.2. CONSUMPTION GROWTH RATES

Consumption growth rates account for the change in energy usage for a given usage type with time. These rates can be positive, negative or zero, and remain constant for the duration of the study. Since consumption growth rates are responsible for much less of the overall electrical growth than the new connect growth rates, their accuracy is less critical. The consumption growth rates are shown in the table below.

	RL	RMEV	RH	CR	COI	LI	CBD	RMAC
	class 1	class 2	class 3	class 4	class 5	class 6	class 7	class 8
Consumption growth rate	0.90	0.50	0.75	1.50	0.75	0.75	3.00	0.75

Table 4: Consumption Growth Rates

The consumption growth rates for Residential Low Density (RL), Residential High Density (RH) and the commercial classes attempt to reflect the conversion from evaporative cooling systems to central air conditioning systems for these classes.

2.7 FORECAST

FORESITE™ has nine parameters that must be set up before a forecast can be executed; they are forecast years, base land use maps, load model data, growth rate, factors, urban poles, preferences, land use allocation order and zoning information.

2.7.1. FACTOR DEFINITION

Factor definitions represent the influence certain spatial features have on new development in a region. These influences are referred to as "factors" and are used to create factor maps representing each factor's influence on development. Factor maps are generally based on proximity functions such as the distance from a location to a particular factor or influence on development. These factors indicate a location's distance from a spatial influence such as a road, water or residential area. For example, a Nearness to Major Road Factor map indicates the distance of every location on the map to a Major Road. The factors used in this model are listed below:

Nearness to Highway
Nearness to Streets and Major Roads
Nearness to Railroads
Nearness to Good Water (Utah Lake)
Nearness to Bad Water (The Great Salt Lake)
Nearness to Residential, Commercial, and Industrial lands
Nearness to Mountains
Highway On

Two additional factors were used, AC Available, and Current EV. These factors were created as preferences for the urban redevelopment model to replicate the conversion of evaporative cooling residential areas to residential air conditioning. Since these factors were created outside of the FORESITE application, they are not listed above. They were used to encourage the redevelopment of RMEV to RMAC. By selecting appropriate preference values for each of the factors, AC conversion was modeled without occluding the development of RMAC on vacant lands. The commands are located in Appendix G - FORESITE Study Procedures.

Factors are one of two types: proximity or convolve. A simple proximity function is a weighted measure of the distance from a point to the nearest feature; for example, the distance to a highway. The convolve function is a weighted summation of a particular feature within a user specified search field, such as the number of residential acres within one half mile of a location. Proximity and convolve functions are "neighborhood analyses," meaning that the function is performed for every one acre cell location in the study area relative to its neighboring cells, and the result is assigned to that cell. Every cell or location on a factor map has a value indicating its "nearness to a highway" or "nearness to a residential area."

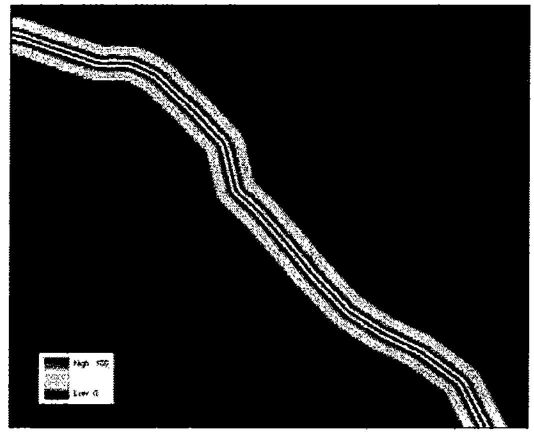


Figure 9: Example of Nearness to Road Factor Map

Figure 9 shows an example of results for a proximity function for nearness to a road.

Factor definitions are later used to develop "preference maps" for each load class. Listed below are the factor definitions used in the Wasatch Front Spatial Load Forecast.

Factor	Type	Radius	Start	End	Break #1	Value	Break #2	Value
Near Major Road	proximity	25			2	100		
Near Highway	proximity	25			6	10		
Near Street	proximity	10	75		1	100		
Near Railroad	proximity	6	100					
Near Commercial	convolve	6	100					
Near Residential	convolve	6	100					
Near Industrial	convolve	6	100					
Near Good Water	proximity	30			1	100	10	30
Near Bad Water	proximity	30	100					
Highway On	proximity	5	100		8			
Nearness to Mountains	convolve	50			1	30	2	100

Table 5: Factor Definitions

Figure 10 shows an example of results for a convolve function for the nearness to residential factor.

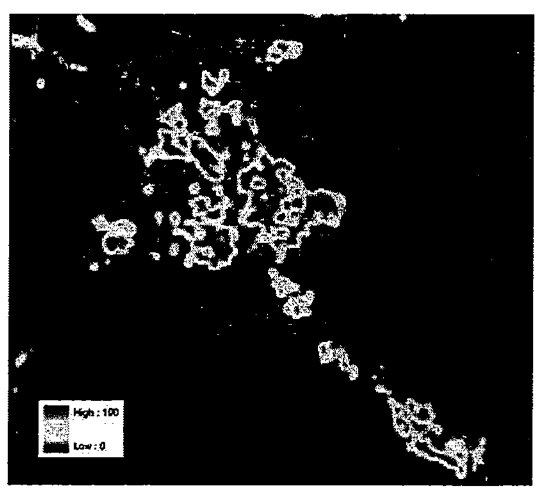


Figure 10: Example of Nearness to Residential Factor Map

2.7.2. URBAN POLES

Urban Poles represent the attraction that land use has toward a geographic location. Urban Pole Maps are created as points within the study area, and are given a distance weighted value that simulates the importance of an economic, cultural or demographic center. These regions are locations with a special attraction to one or more load classes' development. For example, a certain location may be a strong draw for new retail commercial growth or for large residential development.

Urban Poles serve a similar role as Factor Maps when creating a load class's Preference definitions and Suitability Maps. Each class is assigned a value of attraction or detraction for a particular Urban Pole. Listed below are the Urban Poles used in the Wasatch Front Spatial Load Forecast. The radius and height values indicate the size and strength of the pole's influence on load class development in that area.

Name	*Type*	*Height*	*Radius*
Scenario 1: No Kennecott and Mountain View Corridor			
Residential Pole #1			
Ogden	RMAC-RH	80	25
Orem	RMAC-RH	24	70
Downtown	RMAC-RH	144	35
Saratoga	RMAC-RH	64	50
Clearfield Freeport Center	RMAC-RH	40	20
Residential Urban Pole #2			
Eaglewood	RMAC-RH	24	20
Salt Lake Valley East	RMAC-RH	32	20
Commercial Pole			
Downtown	CR-COI	112	30
Ogden	CR-COI	48	20
Airport	CR-COI	64	40
Utah Lake	CR-COI	40	40
Orem	CR-COI	16	30
Salt Lake Valley East	CR-COI	32	20
Scenario 2: Kennecott and Mountain View Corridor			
Kennecott Daybreak Development	RMAC-CR-COI-RH	50	35
Bluffdale	RMAC	28	30
SW-Salt Lake City	CR-COI	10	15
Bluffdale-Herriman South Kennecott	RMAC	47	20
Oquirrh Highlands Development	RMAC	10	15
Western Springs Development	RMAC	5	15

Table 6: Urban Poles of the Model

Note: Scenario 2 Urban Poles were used in addition to the Scenario 1 Poles in those forecasts.

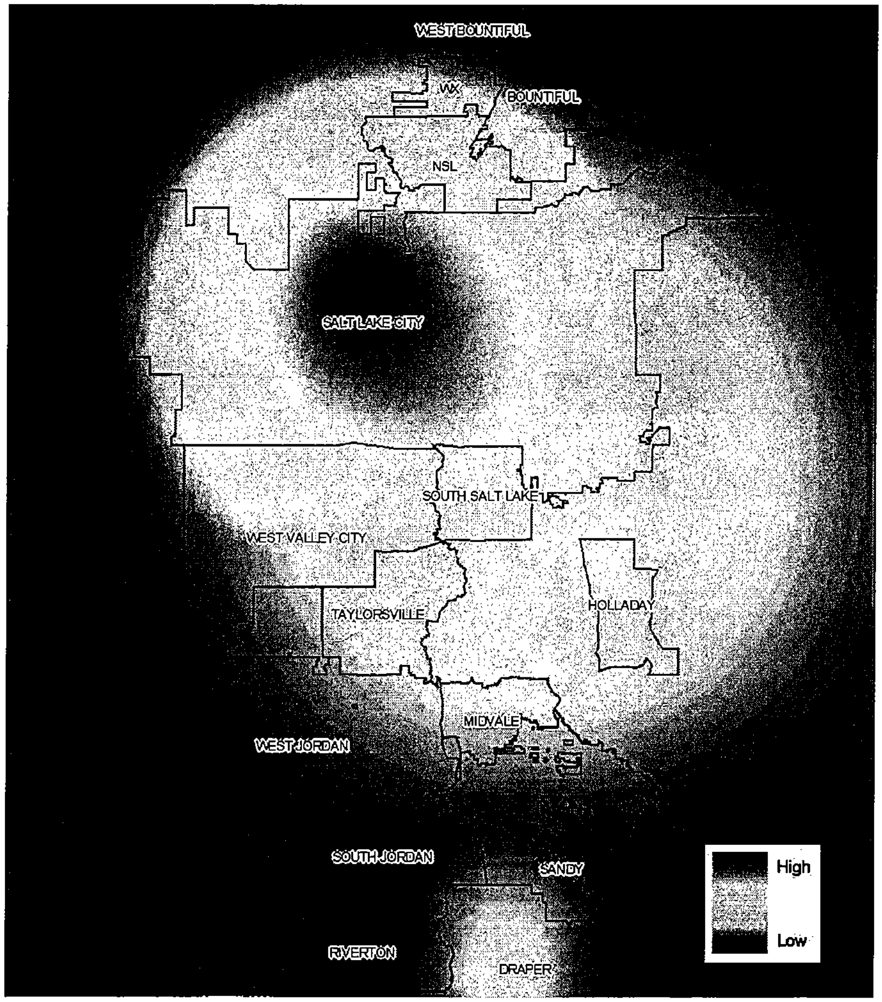


Figure 11: Example of Urban Pole Influences

2.7.3. PREFERENCE DEFINITION

Preference Maps are created from Factor Maps and Urban Poles for each load class. Their values indicate the suitability of each location on the map for development of the respective load class. Often called Suitability Maps, each value ranks a cell's or location's suitability for development by a particular load class. Preference Maps are based on the Factor Maps as they indicate a load class's preference towards each of the factors. For example, residential development would have a high preference to being close to streets, and retail commercial would prefer closeness to interchanges.

Final Preference Maps are derived from a mathematical combination of Factor Maps and Urban Poles using a load class's preference to each of the factors. One Preference Map is created for each load class, based on the mathematical combination of each individual class' preference to the factors.

The result is a map with cells assigned a value indicating each location's suitability for development by that particular load class. Below are the preferences used in the Wasatch Front Spatial Load Forecast.

Preferences	RL	RM-EV	RH	CR	COI	LI	RM-AC
Near Major Road	-	-	30	75	60	65	50
Near Highway	-10	30	60	75	45	25	30
Near Street	75	70	70	50	25	20	65
Near Railroad	-40	-10	10	20	-	40	-20
Near Residential	85	85	40	30	50	-	85
Near Commercial	40	40	65	100	85	-	40
Near Industrial	-5	-5	20	100	30	80	-5
Near Good Water	10	20	10	-	10	-	45
Near Bad Water	-100	-100	-100	-100	-100	-100	-100
Highway On	-50	-15	-	75	-10	50	-10
Near Mountains	10	10	10	-	-	-	10
AC Available	-	-	-	-	-	-	100
Current EV	-	-	-	-	-	-	5
Residential Urban Pole #1	5	15	50	10	10	-	45
Commercial Urban Pole	-	-	20	60	60	-	-
Residential Urban Pole #2	-	-	25	5	5	-	35
Kennecott/Mtn.View Corridor Pole	-	-	35	25	10	-	60

Table 7: Preference Definition of the Model

Note: The Kennecott and Mtn. View Corridor Poles are used only during the Scenario 2 forecasts.

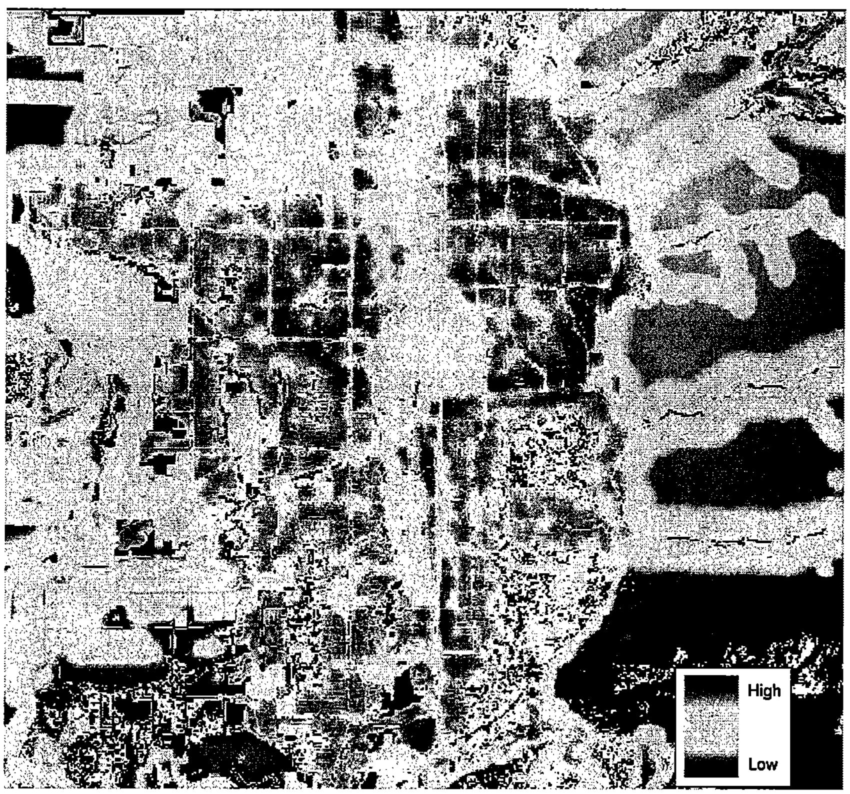


Figure 12: Example of Medium Residential Preference Map

3. INTERPRETING THE FORECAST RESULT
3.1 OVERVIEW OF THE GROWTH CHARACTERISTICS

Land Use Results

0-10 Years

The Wasatch Front Spatial Load Forecast showed rapid and substantial residential growth throughout the Wasatch Front Range, primarily in the Salt Lake Valley. The most likely growth should occur in Medium Density Residential with considerable commercial space development.

The highest-growth areas include Southwest Salt Lake City, the western side of the cities of West Jordan and South Jordan, and continued development along the Interstate 15 corridor along the west side of the cities of Midvale, Sandy, and Draper. The largest additions of commercial retail growth should occur southwest of the airport as well as along the Sandy/Draper Interstate 15 corridor. The region around Farmington, and Centerville and South Weber should experience Medium Density Residential growth.

South from American Fork to Orem, a mix of Medium Density Residential and Commercial Retail is expected. Over the next 5-10 years, the areas of greatest concern will be commercial development in Southwest Salt Lake City, residential and commercial growth on the west side of West and South Jordan, commercial development in Sandy, and residential development in Draper.

Over the next 10 years, it is predicted that 46 new substations will be required to manage the new demands on the distribution system. While new development is anticipated in the growing regions that have vacant and available land, a major concern is the conversion from evaporative cooling to central air conditioning in older homes. Sandy will see considerable commercial development along the I-15 corridor, but the distribution infrastructure in that region will also be taxed due to AC conversion. This conversion is predicted through Midvale, Sandy, West Jordan, Taylorsville and West Valley City. The base-load demand on the system in 2003, subtracted from the predicted load on the system in 2013, shows several stand-out areas of development.

See Appendix H – Results of the Forecast, *for figures indicating the locations of growth, the load difference maps, projected AC conversion maps as well as locations for predicted infrastructure additions and enhancements.*

15 Years and Beyond

Beyond 15 years, the largest area of concern is the impact of Kennecott Land development. Kennecott Land owns 93,000 acres in the Oquirrh Mountains and in the foothills of Western Salt Lake Valley. The planned Kennecott Daybreak development will be an established residential community in 10 years, encouraging the location of commercial development throughout the next 10 years and beyond. The west side of the Salt Lake Valley has the largest amount of contiguous vacant land. Kennecott Land's business model is to act as the "master developer" of this region. With Kennecott's plans, and the likely siting of a major transportation corridor, this area will see the largest and most rapid development.

Commercial growth will continue in Western Salt Lake City. Additional residential development will begin to fill in the currently rural areas of Herriman and Bluffdale in the central region. It also will occur in Hooper, West Point, Clinton, Syracuse, and in the unincorporated Weber County lands to the north. Emigration Canyon, east of Salt Lake

City on the western foothills of the Wasatch Mountain Range, hosts some of the most promising lands for development in the mountains. This area will continue to be an attractive site for residential development. It is likely that the current distribution system will experience stress in 15 years.

Ogden and its surrounding cities of Pleasant View and Harrisville will see continued residential development as rural and low density residential lands fill-in. This also will occur south in Alpine, Highland, American Fork, Pleasant Grove, Spanish Fork and the Mapleton area as municipalities annex agricultural lands and develop them to support continually growing populations.

Population growth in the Wasatch Front Range will not decline over the next 20 years. The influence of Kennecott Land will be the prime driver of development on the west side as the largest landholder. This region likely will outpace development of the smaller, nearby communities, which are annexing and developing agricultural land. The established cities will persist with commercial infill and redevelopment of rural agricultural lands. In the short term, AC conversions will continue to place even greater demand on the distribution system.

Load Specific Results

In order to understand and interpret the forecast results, substations were grouped into zones. The zones are defined in Network and Area Planning's PSS/E load flow base cases. Zone definitions for the 133 substations are provided below.

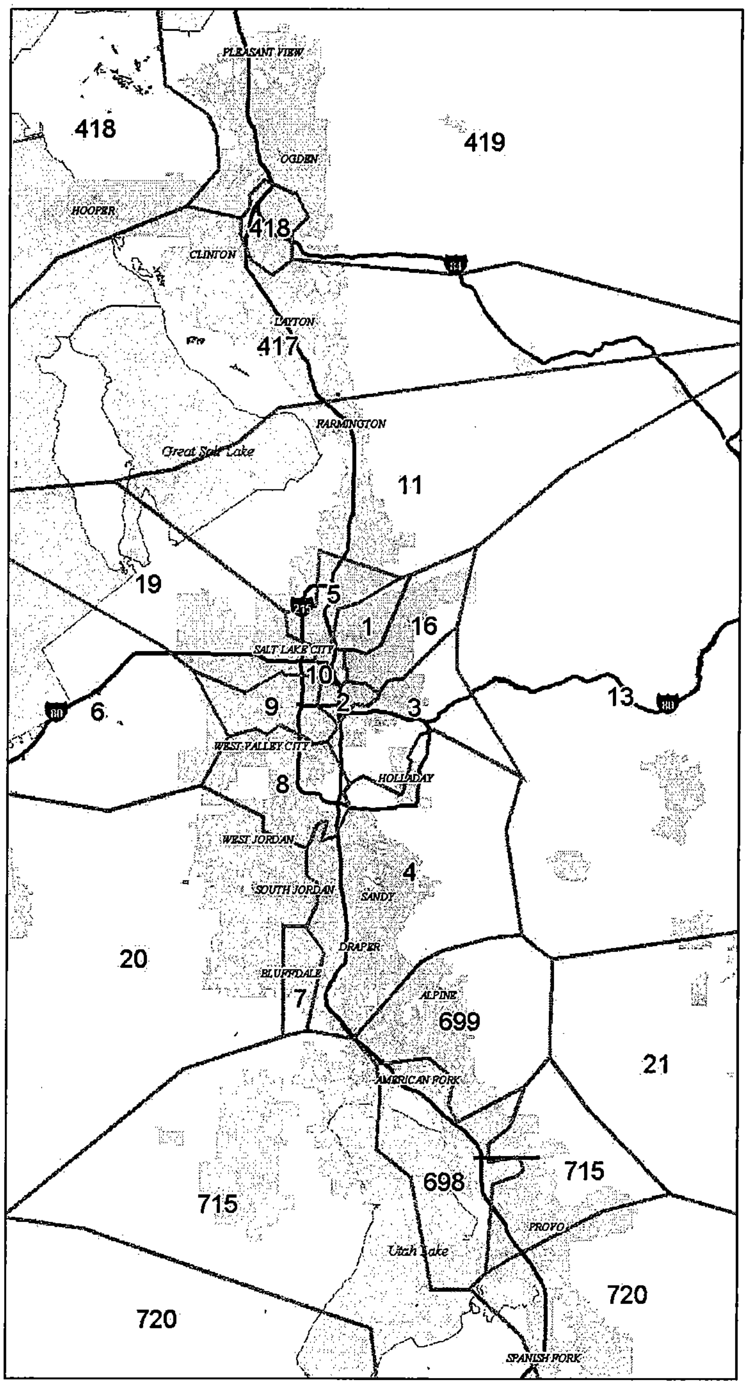


Figure 13: Zone Boundaries

See Appendix I – Zone Definitions, *for a complete list of each zone's member substations.*

3.2 LOAD GROWTH PER ZONE, HOW MUCH

In order to measure load growth electrically, acreage totals for each substation were converted to MW. The substation load data refers to the total load inside the substation service boundary, and does not reflect any recent or planned load transfers. Zones have been defined as a collection of substations, as described above. The load for each zone is the summation of all load inside the member substations.

0-10 Years

The tables below summarize the electrical growth by zone for 5 and 10 years. Reported loads are the coincident peaks.

Zone	2003 MW	2008 MW	5-Year Avg. Annual Growth Rate	2013 MW	10-Year Avg. Annual Growth Rate
Zone 1	28.4	39.1	6.6%	49.6	5.7%
Zone 2	53.6	70.7	5.7%	80.8	4.2%
Zone 3	215.6	282.1	5.5%	316.2	3.9%
Zone 4	509.2	668.3	5.6%	802.2	4.7%
Zone 5	72.1	100.2	6.8%	114.1	4.7%
Zone 6	66.9	76.6	2.7%	102.5	4.4%
Zone 7	20.3	27.7	6.4%	37.0	6.2%
Zone 8	308.4	387.4	4.7%	474.8	4.4%
Zone 9	264.3	394.4	8.3%	520.4	7.0%
Zone 10	72.5	91.0	4.7%	104.2	3.7%
Zone 11	119.9	150.0	4.6%	200.2	5.3%
Zone 13	9.7	16.5	11.3%	25.9	10.3%
Zone 16	125.1	144.2	2.9%	163.0	2.7%
Zone 19	180.5	253.4	7.0%	325.2	6.1%
Zone 20	254.3	301.1	3.4%	478.5	6.5%
Zone 21	4.9	5.1	0.8%	5.3	0.8%
Zone 417	241.3	301.2	4.5%	375.1	4.5%
Zone 418	103.7	128.8	4.4%	166.5	4.9%
Zone 419	378.9	481.7	4.9%	599.3	4.7%
Zone 671	4.7	5.2	2.0%	7.5	4.8%
Zone 698	147.0	210.7	7.5%	268.3	6.2%
Zone 699	85.1	94.0	2.0%	111.2	2.7%
Zone 715	139.0	176.0	4.8%	214.4	4.4%
Zone 717	70.5	101.5	7.6%	129.8	6.3%
Zone 720	60.6	76.4	4.8%	105.0	5.7%
Zone 725	0.6	0.6	1.0%	0.7	1.2%
Total	**3380**	**4362**	**5.2%**	**5499**	**5.0%**

Table 6: Load Growth by Zone (Base Scenario)

Zone	2003 MW	2008 MW	5-Year Avg. Annual Growth Rate	2013 MW	10-Year Avg. Annual Growth Rate
Zone 1	28.4	38.2	6.1%	49.2	5.6%
Zone 2	53.6	70.2	5.6%	80.2	4.1%
Zone 3	215.6	278.1	5.2%	312.2	3.8%
Zone 4	509.2	660.0	5.3%	800.0	4.6%
Zone 5	72.1	99.9	6.7%	113.9	4.7%
Zone 6	66.9	74.8	2.3%	100.6	4.2%
Zone 7	20.3	26.5	5.5%	36.3	6.0%
Zone 8	308.4	386.0	4.6%	473.3	4.4%
Zone 9	264.3	389.2	8.0%	517.6	7.0%
Zone 10	72.5	90.5	4.5%	103.5	3.6%

Zone 11	119.9	149.3	4.5%	199.9	5.2%
Zone 13	9.7	19.3	14.8%	27.6	11.0%
Zone 16	125.1	143.4	2.8%	162.5	2.7%
Zone 19	180.5	257.8	7.4%	327.2	6.1%
Zone 20	254.3	318.6	4.6%	490.2	6.8%
Zone 21	4.9	5.1	0.8%	5.3	0.8%
Zone 417	241.3	301.2	4.5%	375.3	4.5%
Zone 418	103.7	128.8	4.4%	166.5	4.9%
Zone 419	378.9	481.7	4.9%	599.3	4.7%
Zone 671	4.7	5.2	2.0%	7.5	4.8%
Zone 698	147.0	210.7	7.5%	268.2	6.2%
Zone 699	85.1	94.0	2.0%	111.2	2.7%
Zone 715	139.0	176.0	4.8%	214.3	4.4%
Zone 717	70.5	99.9	7.2%	129.3	6.2%
Zone 720	60.6	76.4	4.8%	105.1	5.7%
Zone 725	0.6	0.6	1.0%	0.7	1.2%
Total	**3380**	**4361**	**5.2%**	**5498**	**5.0%**

Table 7: Load Growth by Zone (Scenario 2)

The time of system peak remains the same, 5:00pm through 2008. By 2010, the system peak has shifted by one hour, to 6:00pm. It remains at 6:00pm for the rest of the study. This small shift is attributable to the massive conversion to central air conditioning systems (AC).

Conversion to AC is also responsible for the increasing "peakiness" of the electrical system which can be seen in figures 14 and 15 below.

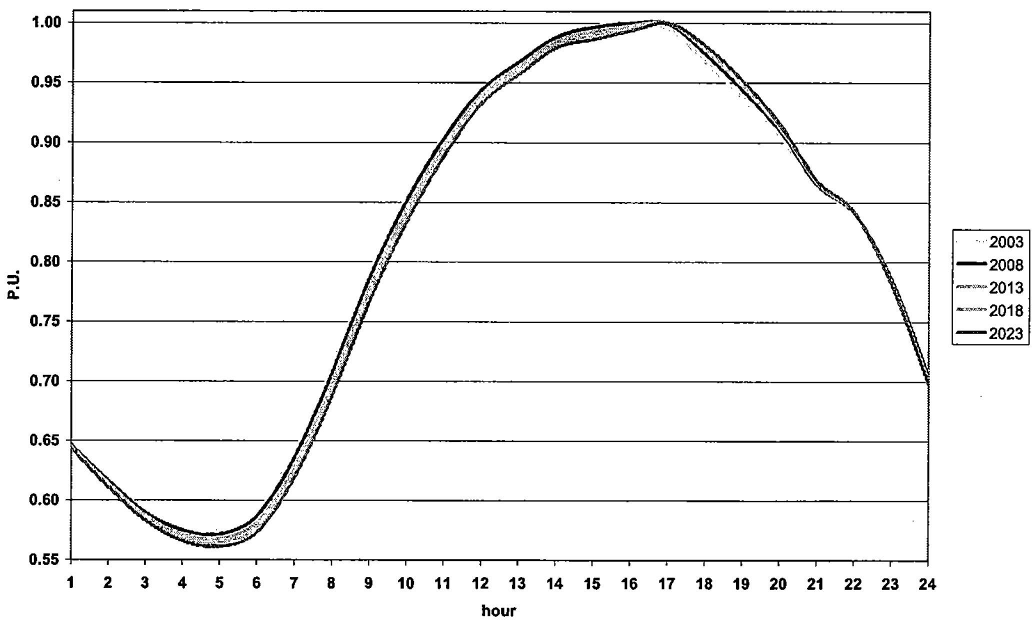


Figure 14: Base Scenario System Load Curve (per unit)

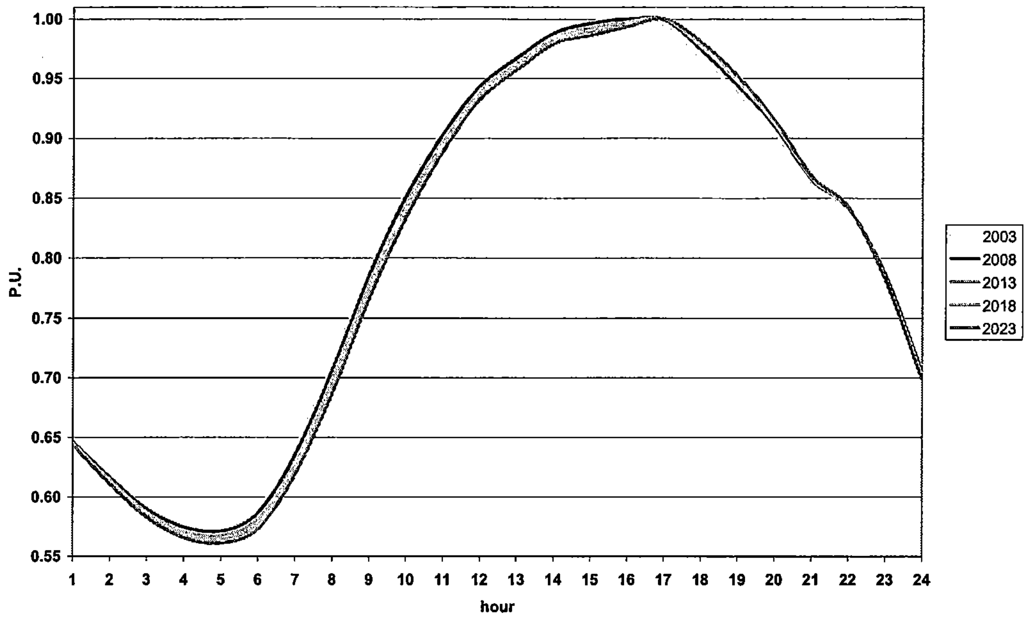


Figure 15: Scenario 2 System Load Curve (per unit)

15 Years and Beyond

The tables below summarize the electrical growth by zone for 15 and 20 years. Reported loads are the coincident peaks.

Zone	2003 MW	2018 MW	15-Year Avg. Annual Growth Rate	2023 MW	20-Year Avg. Annual Growth Rate
Zone 1	28.4	62.4	5.4%	76.8	5.1%
Zone 2	53.6	88.6	3.4%	94.5	2.9%
Zone 3	215.6	340.7	3.1%	361.7	2.6%
Zone 4	509.2	905.0	3.9%	1018.6	3.5%
Zone 5	72.1	123.6	3.7%	132.4	3.1%
Zone 6	66.9	122.4	4.1%	129.9	3.4%
Zone 7	20.3	42.6	5.1%	49.1	4.5%
Zone 8	308.4	534.7	3.7%	585.9	3.3%
Zone 9	264.3	584.7	5.4%	666.4	4.7%
Zone 10	72.5	116.8	3.2%	130.1	3.0%
Zone 11	119.9	296.4	6.2%	423.2	6.5%
Zone 13	9.7	43.0	10.4%	72.8	10.6%
Zone 16	125.1	183.1	2.6%	203.3	2.5%
Zone 19	180.5	446.4	6.2%	593.0	6.1%
Zone 20	254.3	681.5	6.8%	993.0	7.0%
Zone 21	4.9	5.5	0.8%	5.8	0.8%
Zone 417	241.3	455.1	4.3%	561.0	4.3%
Zone 418	103.7	205.6	4.7%	249.3	4.5%
Zone 419	378.9	712.5	4.3%	851.4	4.1%
Zone 671	4.7	10.9	5.8%	15.8	6.3%
Zone 698	147.0	303.4	4.9%	338.3	4.3%
Zone 699	85.1	136.4	3.2%	178.2	3.8%
Zone 715	139.0	261.9	4.3%	328.3	4.4%
Zone 717	70.5	145.5	4.9%	161.5	4.2%
Zone 720	60.6	140.9	5.8%	187.8	5.8%
Zone 725	0.6	0.8	2.1%	1.1	3.1%
Total	**3380**	**6629**	**4.6%**	**8037**	**4.4%**

Table 8: Load Growth by Zone (Base Scenario)

Zone	2003 MW	2018 MW	15-Year Avg. Annual Growth Rate	2023 MW	20-Year Avg. Annual Growth Rate
Zone 1	28.4	62.1	5.4%	74.2	4.9%
Zone 2	53.6	87.8	3.3%	93.6	2.8%
Zone 3	215.6	335.8	3.0%	355.8	2.5%
Zone 4	509.2	901.4	3.9%	1007.7	3.5%
Zone 5	72.1	123.2	3.6%	131.6	3.1%
Zone 6	66.9	121.7	4.1%	129.0	3.3%
Zone 7	20.3	41.6	4.9%	47.5	4.3%
Zone 8	308.4	532.0	3.7%	581.5	3.2%
Zone 9	264.3	581.8	5.4%	663.5	4.7%
Zone 10	72.5	115.9	3.2%	129.0	2.9%
Zone 11	119.9	298.6	6.3%	418.8	6.5%
Zone 13	9.7	43.8	10.6%	71.4	10.5%
Zone 16	125.1	182.6	2.6%	202.6	2.4%
Zone 19	180.5	448.6	6.3%	596.2	6.2%
Zone 20	254.3	695.2	6.9%	1037.5	7.3%
Zone 21	4.9	5.5	0.8%	5.8	0.8%
Zone 417	241.3	455.6	4.3%	560.7	4.3%
Zone 418	103.7	205.6	4.7%	249.3	4.5%
Zone 419	378.9	712.5	4.3%	851.4	4.1%
Zone 671	4.7	11.0	5.9%	15.5	6.2%
Zone 698	147.0	303.3	4.9%	337.2	4.2%
Zone 699	85.1	136.4	3.2%	174.4	3.7%
Zone 715	139.0	261.7	4.3%	324.9	4.3%
Zone 717	70.5	145.2	4.9%	160.4	4.2%
Zone 720	60.6	140.9	5.8%	185.2	5.7%
Zone 725	0.6	0.8	2.1%	1.1	3.0%
Total	**3380**	**6629**	**4.6%**	**8034**	**4.4%**

Table 9: Load Growth by Zone (Scenario 2)

By 2018, the minimum system load for the peak day will exceed the 2003 summer peak. The 2018 system peak is double the peak seen in 2003. System load curves can be seen for the two scenarios in figures 16 and 17.

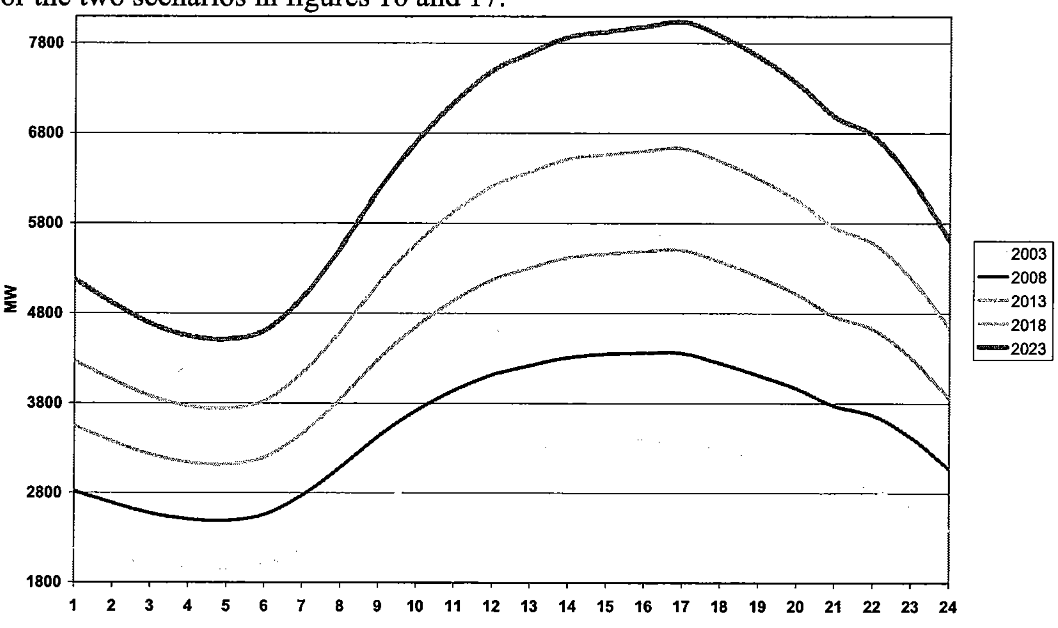


Figure 16: Base Scenario System Load Curve (MW)

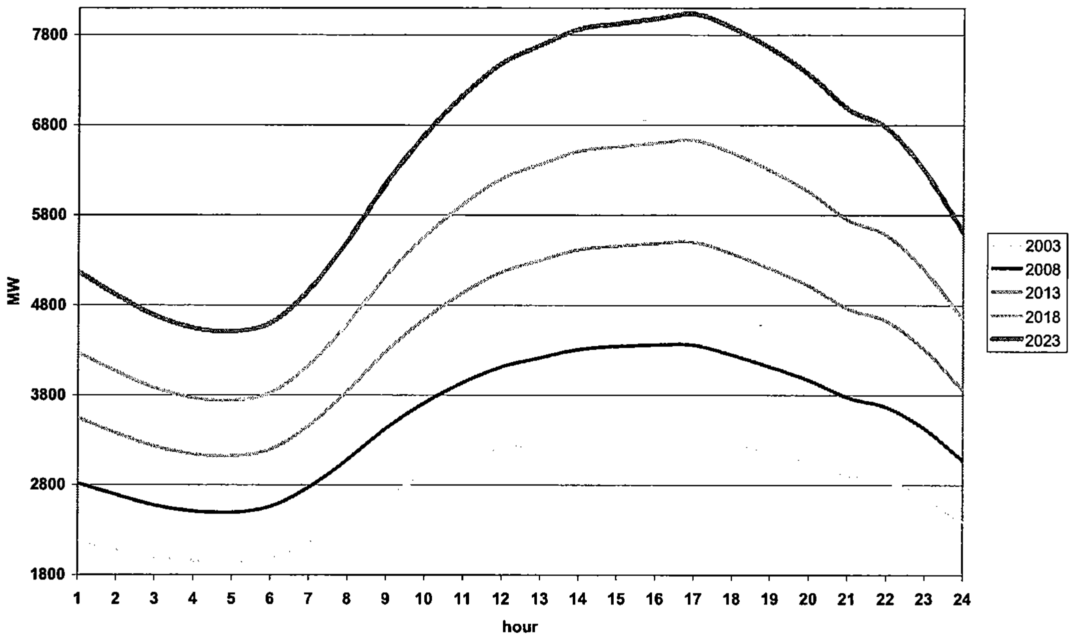


Figure 17: Scenario 2 System Load Curve (MW)

3.3 INFRASTRUCTURE REQUIREMENT

The purpose of a Spatial Load Forecast is to forecast regional load. However, that forecast is of little value without a measure of the impact the projected load will have on the planned and existing infrastructure. Due to the enormous complexity of the entire Wasatch Front electrical system, new infrastructure requirements were evaluated on a purely quantitative level for the distribution transformer level only.

3.3.1. METHODOLOGY

New substation capacity requirements were determined by zone for all study years. The current substation design criteria allows for two 30 MVA transformer banks per yard. Usually, one bank is installed, and space is left for the second in the future. Therefore, additional capacity was projected in blocks of 30 MVA transformers. Capacity increases already submitted by planners for 2006 and earlier were assumed and included in the analysis; capacity increases projected in this study are in addition to those submitted projects.

New capacity is needed within a zone when it reaches 100% utilization and the capacity increase is sufficient to drop the utilization of the zone to or below 100%.

Zone utilization is not merely the calculated average utilization of all the transformers within that zone. The reasoning is that if every transformer is 100% utilized, the zone is most likely overloaded, since load transfers become impossible. The average transformer utilization corresponding to 100% zone utilization was determined by performing by zone capacity addition analysis for thresholds (average transformer loading levels) between 50% and 100%[5].

[5] Each zone was analyzed separately for 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95% and 100% thresholds. The results were then compiled for the entire system.

Average transformer utilization was determined by comparing capacity to the weather-normalized projected MVA load for each zone. Weather-normalized loads were derived using the projected MW loads as reported in section 3.2. The equation used is given below.

$$MW_{weather\ adjusted} =$$
$$MW_{projected} + (CDD_{Adjusted} - CDD_{Actual}) * (MW\ per\ CDD_{2002}) * (1 + Growth\ Rate_{Weather\ Sensitive})^{(year-2002)}$$

Equation 2: Weather Normalized Load

The actual CDD was 21.5 for the 2003 summer peak. All projected loads in this study assume load profile characteristics for this level (see sections 2.4 and 2.5). Normal planning weather is 22.5 CDD, so the weather-normalized loads reflect an increase of 1 CDD over the projected loads. The weather sensitive growth rate is 9.5%, determined by adjusting the assumptions documented in *Analysis of Wasatch Front Region Growth* to better fit reality for a five-year trend with overall load growth of 5.4%. The MW per CDD for the entire Wasatch Front in 2002 was 40. This number was distributed among the zones using the ratio of each individual zone's load to the total system load. A 95% power factor was assumed to convert MW into MVA.

Extreme weather loads were also developed for comparison. These were derived in the same fashion as the weather-normalized loads, but for 26 CDD.

For future studies, weather normalization may be performed using weather-specific load profile curves and kW/acre multipliers. This approach will more accurately reflect the system response to varied weather conditions. Load class curves for varied weather conditions were not available for this study; that is why the approach defined above and in equation 2 was used.

The cumulative required distribution transformer MVA additions for thresholds of 70% - 100% through 2023 are shown in Figure 18. Thresholds below 70% are excluded from this figure as it is unlikely funds will be provided for this level of redundancy.

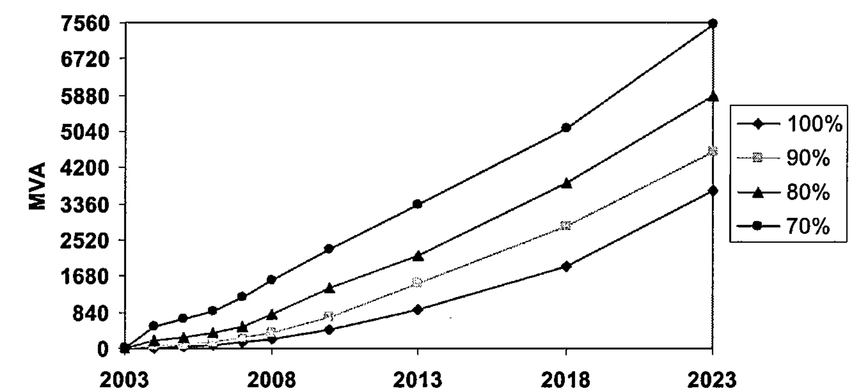


Figure 18: Cumulative MVA Additions (in excess of existing short-range plan)

Seventy-five percent was selected as the appropriate threshold for 100% zone utilization as this level calls for roughly 200 MVA of additional capacity each year. Based on planning experience, 200 MVA per year is the most likely capacity requirement for the immediate future.

The long term consequences of providing sufficient capacity to maintain the 75% threshold are shown in the charts below.

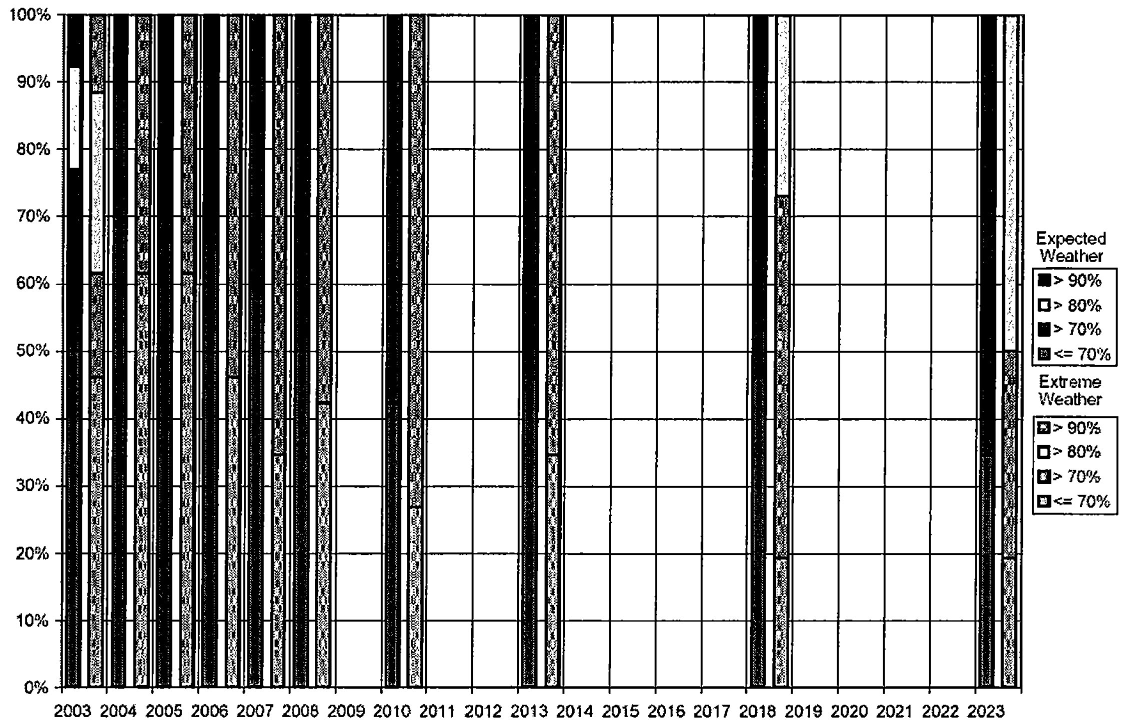


Figure 19: Percent of Zones at Distinct Utilization Levels for Expected and Extreme Weather Load for Zone Utilization Threshold of 75% (Base Scenario)

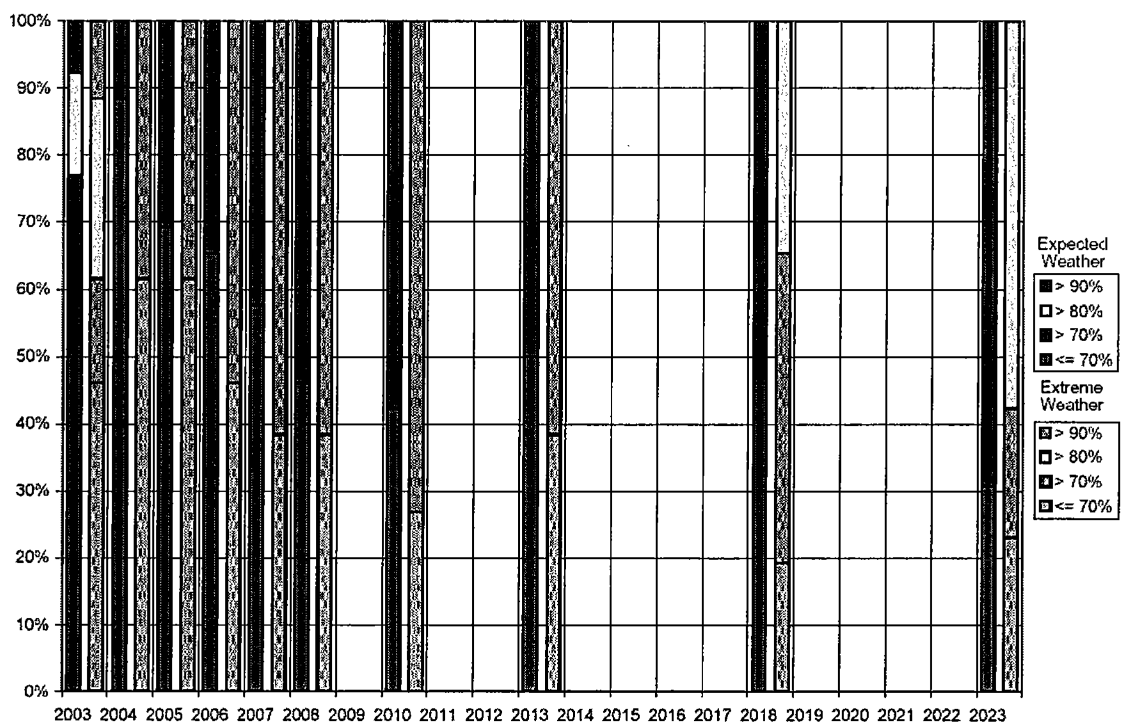


Figure 20: Percent of Zones at Distinct Utilization Levels for Expected and Extreme Weather Load for Zone Utilization Threshold of 75% (Scenario 2)

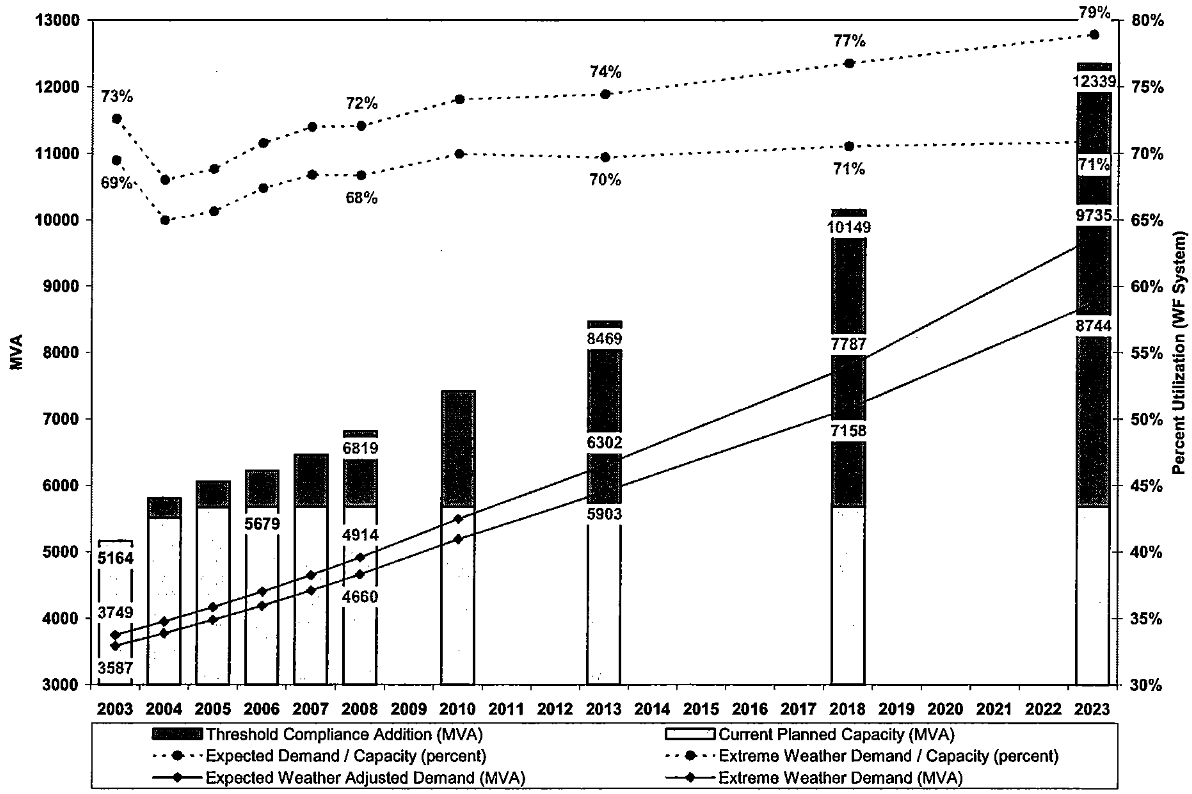


Figure 21: Wasatch Front System Demand/Capacity Comparison for Zone Utilization Threshold of 75% (Base Scenario)

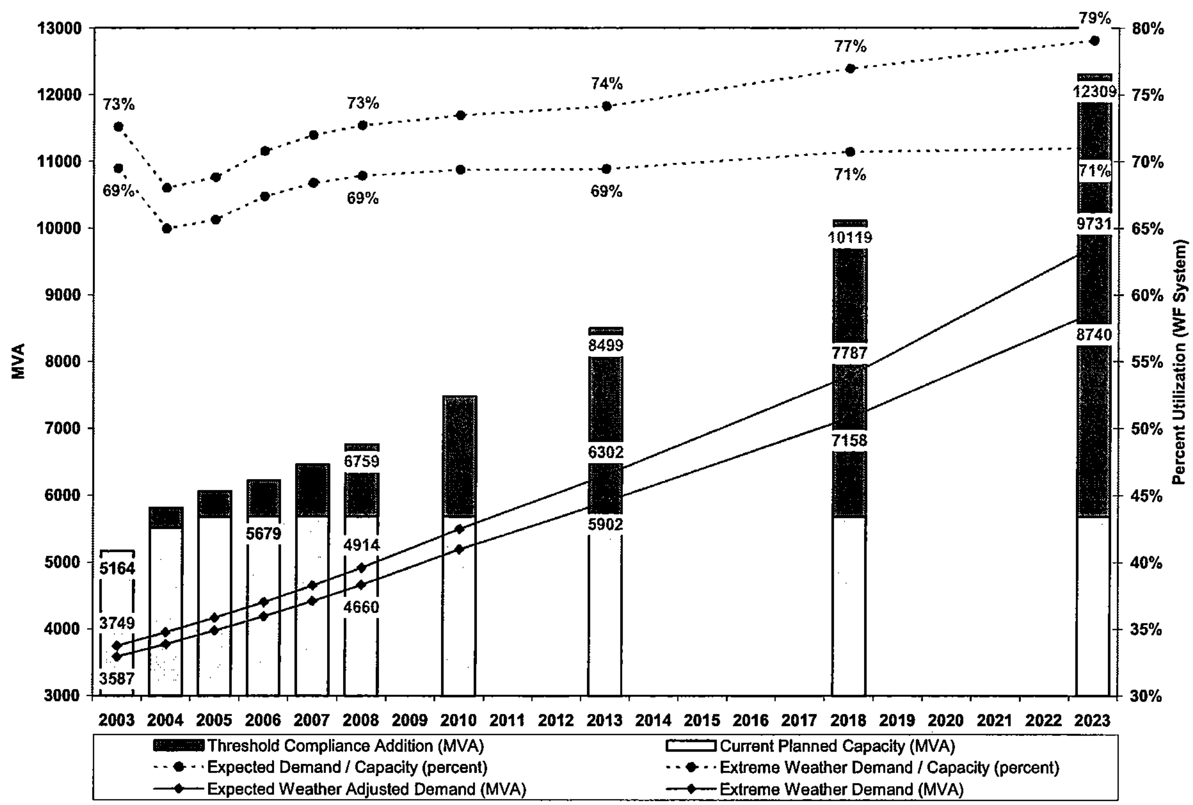


Figure 22: Wasatch Front System Demand/Capacity Comparison for Zone Utilization Threshold of 75% (Scenario 2)

3.3.2. RESULTS

The table below gives the required capacity increases in MVA for each zone for the two scenarios. The new capacity called for in this study is in addition to all known capacity increases through 2006.

Base Scenario

Zone	2005	2008	2013	2018	2023	Total
Zone 1	30	0	30	0	30	90
Zone 2	30	0	30	0	0	60
Zone 3	30	60	30	60	30	210
Zone 4	0	150	180	150	180	660
Zone 5	0	30	30	0	30	90
Zone 6	30	30	30	30	0	120
Zone 7	30	0	0	30	0	60
Zone 8	30	60	150	90	60	390
Zone 9	90	120	180	90	120	600
Zone 10	0	30	0	30	0	60
Zone 11	30	0	90	150	180	450
Zone 13	0	0	0	0	30	30
Zone 16	0	0	0	0	30	30
Zone 19	0	0	90	180	240	510
Zone 20	0	60	240	300	480	1080
Zone 21	0	0	0	0	0	0
Zone 417	0	30	120	90	180	420
Zone 418	0	0	0	60	60	120
Zone 419	0	60	150	180	210	600
Zone 671	30	0	0	0	0	30
Zone 698	30	60	90	60	60	300
Zone 699	0	0	30	30	60	120
Zone 715	0	30	60	60	120	270
Zone 717	30	0	60	30	30	150
Zone 720	0	30	30	60	60	180
Zone 725	0	0	30	0	0	30
Total	**390**	**750**	**1650**	**1680**	**2190**	**6660**

Mountain View Corridor and Kennecott Development Scenario

Zone	2005	2008	2013	2018	2023	Total
Zone 1	30	0	30	0	30	90
Zone 2	30	0	30	0	0	60
Zone 3	30	30	60	30	30	180
Zone 4	0	120	210	150	180	660
Zone 5	0	30	30	0	30	90
Zone 6	30	30	30	30	0	120
Zone 7	30	0	0	30	0	60
Zone 8	30	60	120	90	90	390
Zone 9	90	120	180	90	120	600
Zone 10	0	0	30	30	0	60
Zone 11	30	0	90	150	180	450
Zone 13	0	0	0	0	30	30
Zone 16	0	0	0	0	30	30
Zone 19	0	0	120	150	240	510
Zone 20	0	90	240	300	510	1140
Zone 21	0	0	0	0	0	0
Zone 417	0	30	120	90	180	420
Zone 418	0	0	0	60	60	120
Zone 419	0	60	150	180	210	600
Zone 671	30	0	0	0	0	30
Zone 698	30	60	90	60	60	300
Zone 699	0	0	30	30	60	120
Zone 715	0	30	60	60	90	240
Zone 717	30	0	60	30	0	120
Zone 720	0	30	30	60	60	180
Zone 725	0	0	30	0	0	30
Total	**390**	**690**	**1740**	**1620**	**2190**	**6630**

Table 10: Substation Capacity Increases by Zone

The total system capacity requirements are similar for the two scenarios. For 22 of the 26 zones, the projected capacity additions are identical. The Base Scenario requires just 30 MVA more than Scenario 2. The additional capacity is needed because the current plan assumes some portion of the Kennecott development will occur. It is important to remember both scenarios predict the same amount of load growth, but that growth is distributed differently.

Zone 20, Oquirrh, will require an additional 60 MVA (two transformers), to meet the projected loads of Scenario 2. The first of these will be necessary by 2008. Zones 3, 715 and 717 (Cottonwood, Hale 46 and Provo) each require one more transformer in the Base Scenario as compared with Scenario 2.

Over the next five years, the differences between the two scenarios are relatively minor, and many of the discrepancies after this period are in timing, rather than horizon year total capacity requirements. It will be critical to assess which of the scenarios is a better reflection of reality before substation capacity additions are finalized for 2010 to minimize capital requirements.

Conclusion
A major benefit of this study will be to help ensure successful planning for sustained load growth in one of PacifiCorp's most populous areas. Scientific measurement of anticipated growth will improve communications with regulators and civic leaders on improvements needed to provide reliable electric service to the region.

In addition, this project defined a procedure for performing Spatial Forecasts. This procedure can be adopted for other regional forecasts and improved through experience. Substantial expertise has been developed within PacifiCorp on this subject, and future forecasts may be performed using GIS software tools that better fit the company's needs.

4. REFERENCES

Willis, H. Lee, *Spatial Electric Load Forecasting,* Second Edition, Revised and Expanded, Marcel Dekker New York. 2002.

Willis, Lee; Farmer, David; Josupait, Kevin; ABB Consulting, *Analysis of Wasatch Front Region Load Growth*, 2002.

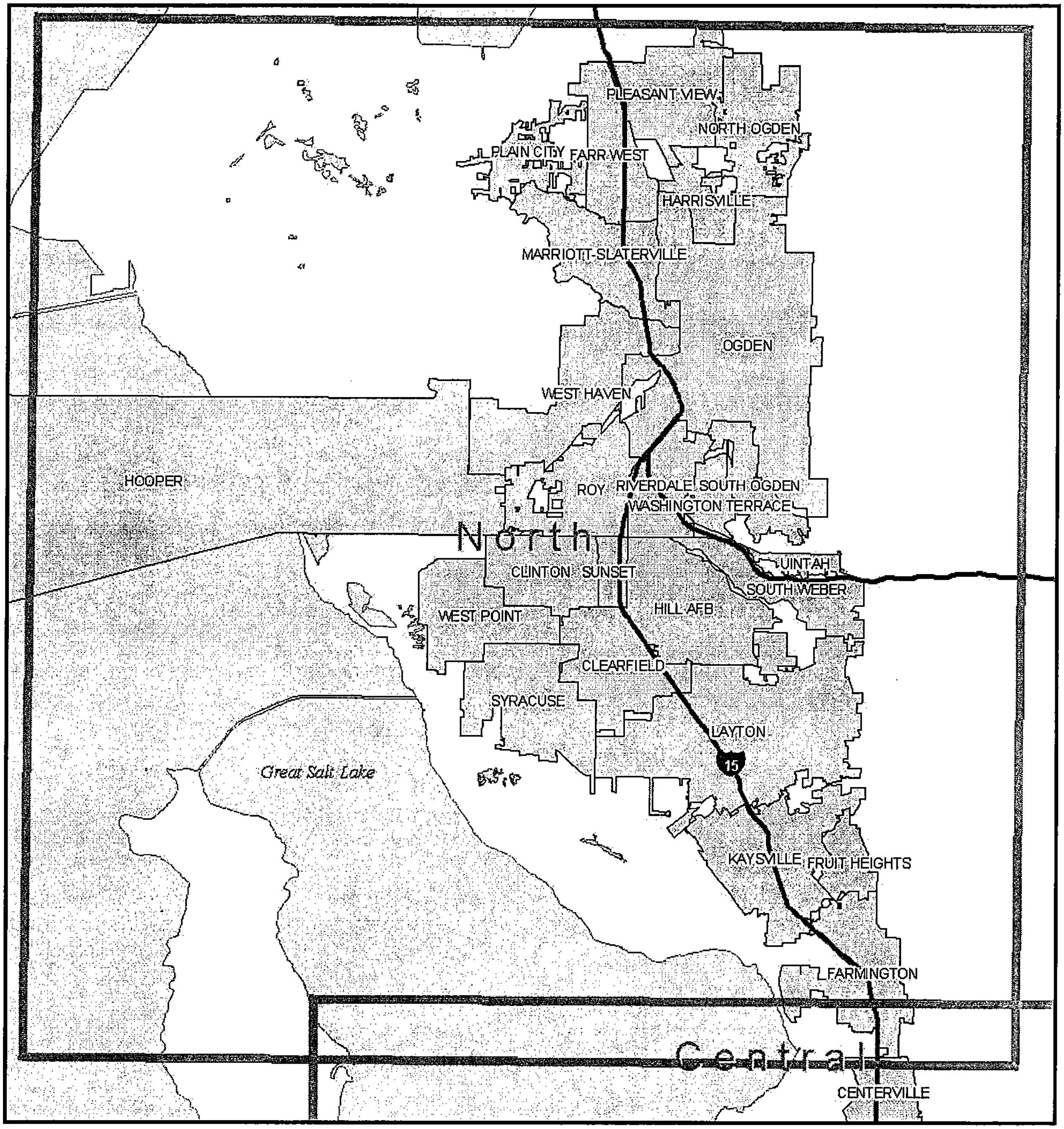
Farmer, David; Josupait, Kevin; Stutts, Charles; Willis, Lee; ABB Consulting, *Spatial Load Forecast for the Wasatch Front Area*, 2002.

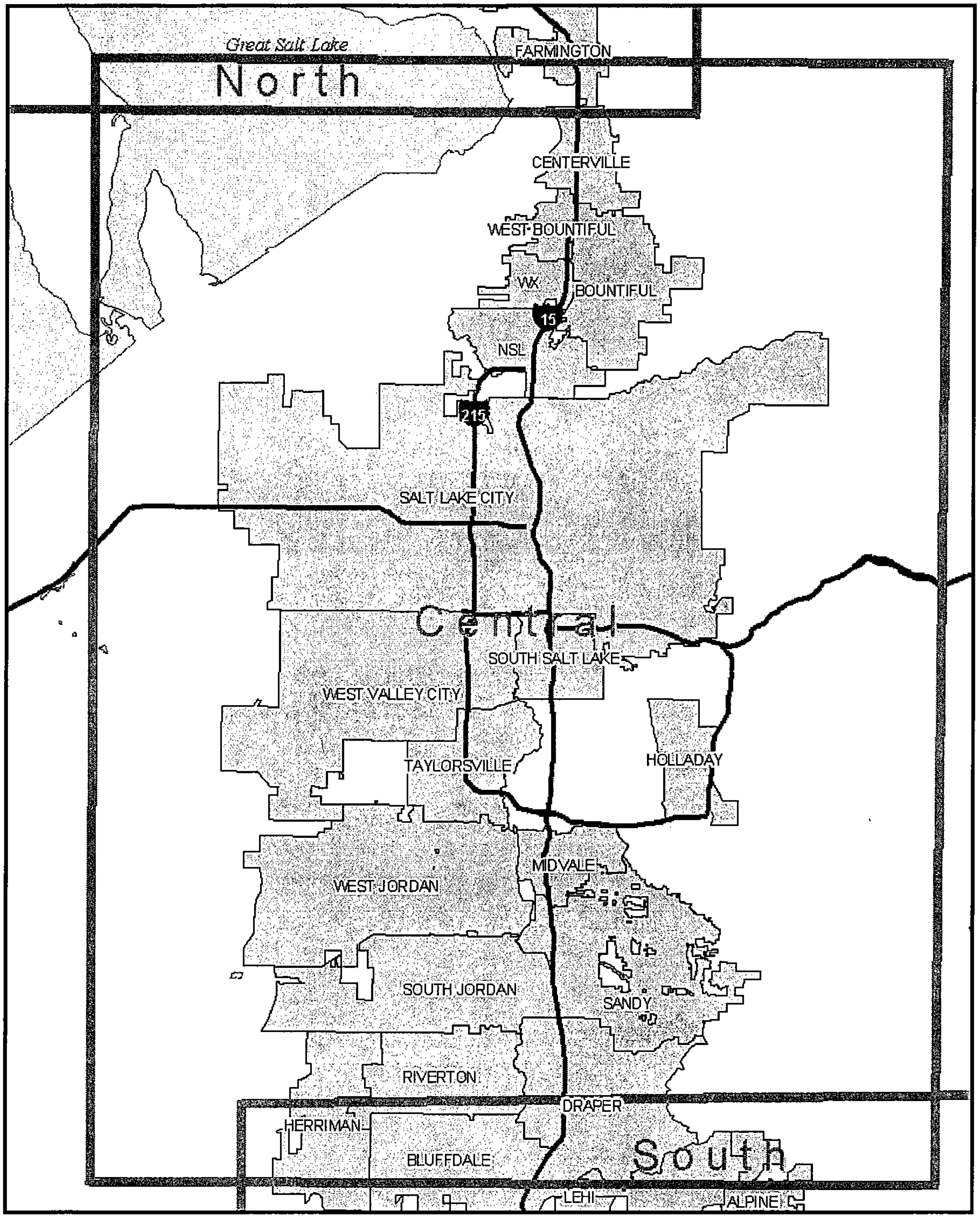
Appendix A – List of Data Sources and Contacts

Client	First Name	Last Name	Title	Address 1	City	State/Province	Postal Code	Organization Phone	Fax	E-Mail
Alpine	Janis	Williams	City Recorder	20 N.Main	Alpine	UT	84004	801-756-6347		
American Fork City	Rod	Despain	City Planner	31 N Church St	American Fork	UT	84003	801-763-3000	801-763-3004	r.hans.d@usa.net
Bluffdale	Diane	Hanson	City Administrator	1475 S. Redwood Rd.	Bluffdale	UT	84065	801-254-2200		
Bountiful	Blaine K.	Gehring	P&Z Dir.	PO Box 369	Bountiful	UT	84011-0369	801-298-6190	801-298-6033	bgehring@btfl.state.ut.us
Cedar Hills	Craig	Gardner	P&Z Comm	3925 W. Cedar Hills Dr.	Cedar Hills	UT	84062	801-785-9668		
Cedar Hills	Rodney	Despain	Planner	3925 W Cedar Hills Dr	Cedar Hills	UT	84062	801-763-3000	801-763-3004	
Centerville	Steve	Thacker	City Administrator	250 N. Main	Centerville	UT	84014	801-295-3477		
Clearfield City	Kent	Bush	P&Z Admin.	55 S State	Clearfield	UT	84015	801-525-2785	801-525-2865	kbush@clearfieldcity.org
Clinton	Lynn	Vinzant	CD Director	1906 W. 1800 N.	Clinton	UT	84015	801-774-2600		
Draper	Ann	Parr	P&Z Chair	12441 S 900 E	Draper	UT	84020	801-576-6500		eric@draper.ut.us
Eagle Mountain	Shawn	Warnke	City Planner	1680 E Heritage Dr	Eagle Mountain	UT	84043	801-789-5982	801-789-2827	swarnke@eaglemtncity.org
Farmington City	David	Petersen	P&Z Dir.	PO Box 160	Farmington	UT	84025	801-451-2383		
Fruit Heights City	Eileen	Moss	P&Z Comm	1394 E Baer Canyon	Fruit Heights	UT	84037	801-546-0861		
Herriman	Glenn R.	Graham	City Planner	13011 S. Pioneer St.	Herriman	UT	84065	801-446-5323	801-967-9583	cityplannerut@athome.com
Highland	Barry	Edwards	City Administrator	5378 W. 10400 N.	Highland	UT	84003	801-756-5751		
Holladay	Patricia	Hanson	City Planner	4707 S. Holladay Blvd.	Holladay	UT	84117	801-272-9450	801-272-9384	phanson@cityofholladay.com
Holladay	Helen	Redd	P&Z Chair	4707 S. Holladay Blvd.	Holladay	UT	84117	801-272-9450	801-272-9384	hredd@cityofholladay.com
Hooper	Sharron	Stark	City Recorder	4220 S. 6300 W.	Hooper	UT	84315	801-731-0294		
Kaysville City	Wade	Flint	P&Z Admin	23 E Center	Kaysville	UT	84037	801-544-1363	801-544-5646	wflint@kaysvillecity.com
Layton	J. Scott	Carter	CD Director	437 N. Wasatch Drive	Layton	UT	84041-3169	801-546-8500		
Lehi City	Dianna C.	Webb	City Planner	99 W Main, Ste 100	Lehi	UT	84043	801-768-7120	801-768-7122	
Lindon City	Kevin D.	Smith	P&Z Dir.	100 N State	Lindon	UT	84042	801-785-7687	801-785-4510	ksmith@lindoncity.org
Mapleton City	Bill	Jones	P&Z Admin.	35 E Maple St	Mapleton	UT	84664	801-489-5657		
Midvale	Christene	Richman	CED Director	655 W. Center St.	Midvale	UT	84047-3000	801.567-7200		
Murray	Dennis	Hamblin	CD Director	PO Box 57520	Murray	UT	84157	801-264-2664		
North Ogden	Gary	Jeppson	CD Director	505 E. 2600 N.	North Odgen	UT	84414	801-782-7211		
North Salt Lake	Conrad	Jacobson	P&Z Chair	10 Oakwood Dr.	North Salt Lake	UT	84054	801-936-6021	801-936-0874	
Ogden	Nate	Pierce	City Administrator	2549 Washington Blvd.	Odgen	UT	84401-3111	801-629-8111		
Orem	Jim	Reams	City Manager	56 N. State St.	Orem	UT	84057	801-229-7035		
Perry	Paul	Nelson	Streets & Water Supt.	3005 S. 1200 W.	Perry	UT	84302	435.723.6461		
Plain City	Carlos	Heslop	Public Works Director	4160 W. 2220 N.	Plain City	UT	84404	801.731.4908		
Pleasant Grove	Ray	Limb	P&Z Administrator	86 S. 100 E.	Pleasant Grove	UT	84062	801-785-6057		
Pleasant Grove City	Ray	Limb	Zoning Officer	86 E 100 S	Pleasant Grove	UT	84062	801-785-6057		rlimb@plgrove.org
Provo	Dixon	Holmes	Planning Analyst	PO Box 1849	Provo	UT	84603	801-852-6407	801-852-6417	provo.dholmes@email.state.ut.us
Riverdale City	Greg	Limburg	P&Z Chair	4600 S Weber River Dr	Riverdale	UT	84405	801-494-5541		
Riverton	Don	Adams	Planning Dir	12765 S 1400 W	Riverton	UT	84065	801-254-0704	801-254-1810	dadams@rivertoncity.com
Roy City	Mark	Larson	City Planner	5051 S 1900 W	Roy	UT	84607	801-774-1042	801-774-1030	larsonm@roycity.state.ut.us
Salt Lake City	Stephen	Goldsmith	P&Z Dir.	451 S State St, Rm 406	Salt Lake	UT	84111	801-535-7757		stephen.goldsmith@ci.slc.ut.us
Salt Lake City	Janice	Jardine	Planning Analyst	451 S State St, Rm 304	Salt Lake	UT	84111	801-535-7600	801-535-7651	janice.jardine@ci.slc.ut.us
Sandy City	George	Shaw	Planning Dir.	10000 Centennial Parkway	Sandy	UT	84070	801-568-7278	801-568-7278	sandypo.gshaw@state.ut.us
South Jordan	Lloyd	Bybee	P&Z Chair	11175 S Redwood Rd	South Jordan	UT	84095	801-254-3742		
South Ogden City	Ken	Jones	City Planner	560 - 39th St	South Ogden	UT	84403	801-622-8585	801-399-4410	kjones@ci.south-ogden.ut.us
South Ogden City	Douglas	Sandidge	P&Z Chair	1808 E. 5725 S.	South Ogden	UT	84403		801-399-4410	
South Weber	Ronald	Chandler	City Manager	1600 E. South Weber Drive	South Weber	UT	84405	801.479-3177		
South Salt Lake	Bruce	Talbot	CD Director	2914 S. 300 E.	South Salt Lake	UT	84115	801.483-6060		
Spanish Fork City	Kevin	Baadsgard	P&Z Chair	40 S Main St	Spanish Fork	UT	84660	801-798-1789	801-798-5005	
Spanish Fork City	Emil	Pierson	Planning Director	40 S Main St	Spanish Fork	UT	84660	801-798-5000x31	801-798-5005	planner@spanishfork.org
Sunset	Susan	Hale	City Recorder	85 W. 1800 N.	Sunset	UT	84015	801.825-1628		
Syracuse City	Rodger S.	Worthen	City Planner	1787 S 2000 W	Syracuse	UT	84075	801-825-1477	801-825-3001	
Taylorsville	Mark	Mcgrath	CD Director	2520 W. 4700 S. Suite A-2	Taylorsville	UT	84118	801.963-5400		
Taylorsville	Janice	Auger	Mayor	2520 W. 4700 S. Suite A-2	Taylorsville	UT	84118	801-963-5400		
Uintah	Robert	Vanasse	P&Z Chair	6855 Buena Vista	Uintah	UT	84405	801-479-4130	801-476-7269	
Vineyard Town	Rod	Despain	P&Z Dir.	1652 S Lakewood Dr	Orem	UT	84058	801-225-6187		
Washington Terrace	Kent	Arave	P&Z Chair	275 E 4425 S	Washington Terrace	UT	84405-5899	801-393-8681		
Washington Terrace	Robert	Garside	P&Z Comm	275 E 4425 S	Washington Terrace	UT	84405-5899	801-393-8681		
Wasatach RFC	George	Ramjoue								gramjoue@wrfc.org
West Haven	Steven	Anderson	City Planner/Engineer	2440 S. 2050 W	West Haven	UT	84401	801-731-4519	801-731-1002	
West Jordan City	Russell	Fox	City Planner	8000 S Redwood Rd	West Jordan	UT	84088	801-569-5060	801-569-5099	russellf@wjordan.com
West Valley City	Kevin	Hooper	Planning	3600 Constitution Blvd	West Valley	UT	84119-3270	801-963-3285	801-966-8455	khooper@ci.west-valley.ut.us
Woods Cross City	Timothy W.	Stephens	City Planner	1555 S 800 W	Woods Cross	UT	84087	801-292-4421	801-292-2225	tstephens@woodscross.com

City	Contact	Additional Contact Name	Add. Contact Number
Alpine	Janis Williams	Shane Sorensen	801-763-9862
American Fork City	Rod Despain		
Bluffdale	Diane Hanson		
Bountiful			
Cedar Hills	Craig Gardner		
Cedar Hills			
Centerville	Steve Thacker	Dustin Lewis GIS/Erik Jensen C&D	801-292-8232
Clearfield City	Kent Bush		
Clinton	Lynn Vinzant		
Draper	Pete Shabestari GIS manager	Pete	801-576-6307
Eagle Mountain			
Farmington City	David Petersen - P&Z	Tom Toronto-GIS intern	801-451-2383
Fruit Heights City	Dick Waite- City Manager		
Herriman	Glenn Graham	Jerry Slaw @ Sunrise Eng.	801-523-0100
Highland	Barry Edwards		
Holladay	Debbie Casey @ Forsgren Assoc.	work contracted out to Forsgren	801-364-4785
Hooper			
Kaysville City	Wade Flint		
Layton	Scott Carter		801-546-8523
Lehi City			
Lindon City	Kevin Smith P&Z	Bruce Cheney - JUB Engineers	801-226-0393
Mapleton City			
Midvale			
Murray	Dennis Hamblin-city planning	Steve Kollman-GIS	270-2452
North Ogden	Gary Jeppeson		
North Salt Lake			
Ogden	Nate Pierce- City Administrator	Wayne Parker-Managing Services Dir.	801-629-8701
Orem	Clint Spencer-GIS		
Perry			
Plain City			
Pleasant Grove	Ray Limb		
Pleasant Grove City			
Provo			
Riverdale City	Randy Daily- Comm. Devel. Admin.	Camron Linsey - GIS guy	801-394-5541 x-241
Riverton	Pam Martin - P&Z		
Roy City	Mark Larson - planner	Ryan Lewis - AutoCAD	801-774-1090
Salt Lake City	Bret Wilde-deputy director planning		
Salt Lake City			
Sandy City			
South Jordan	Derek Allen - Planning GIS	Derek	801-254-1404
South Ogden City	Ken Jones	Mark Miller or **Brad Jensen**	801-775-9191
South Weber	Ron Chandler	Lelan Matinall - Public Works	801-479-3177
South Salt Lake	Bruce Talbot	Nathan Cocks	801-483-6029
Spanish Fork City			
Sunset	Susan Hale		
Syracuse City	Roger Worthen-planner and GIS		
Taylorsville			
Taylorsville			
Uintah			
Vineyard Town			
Washington Terrace			
Washington Terrace			
Wasatach RFC			
West Haven			
West Jordan City	Russel Fox	Matt Jarmon-GIS Admin	569-5174
West Valley City			
Woods Cross City			

Appendix B – Wasatch Front Study Areas

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FARMINGTON
CENTERVILLE
WEST BOUNTIFUL
WX
BOUNTIFUL
15
NSL
215
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Central
SOUTH SALT LAKE
WEST VALLEY CITY
HOLLADAY
TAYLORSVILLE
MIDVALE
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SANDY
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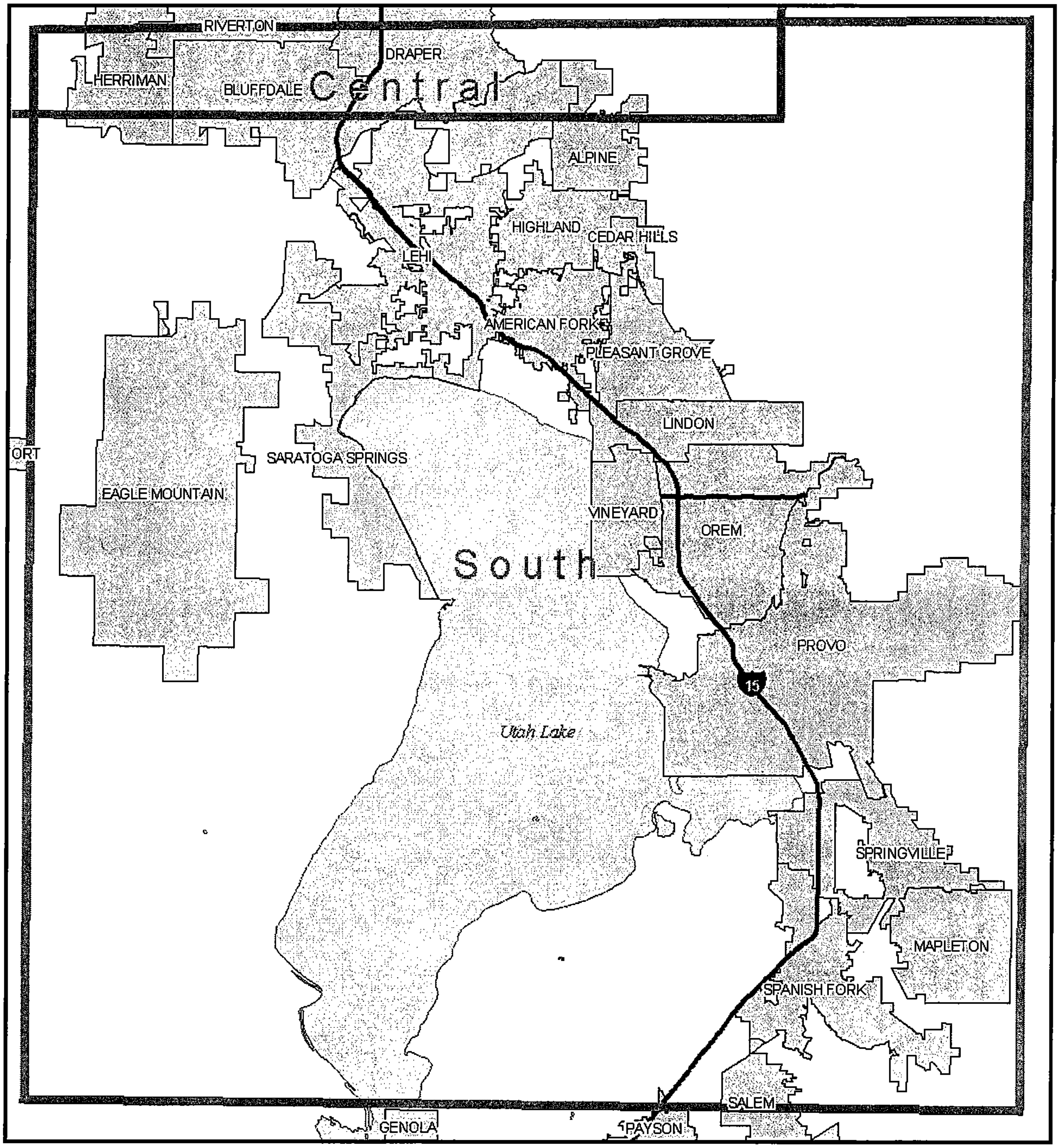
HERRIMAN
BLUFFDALE
South
LEHI
ALPINE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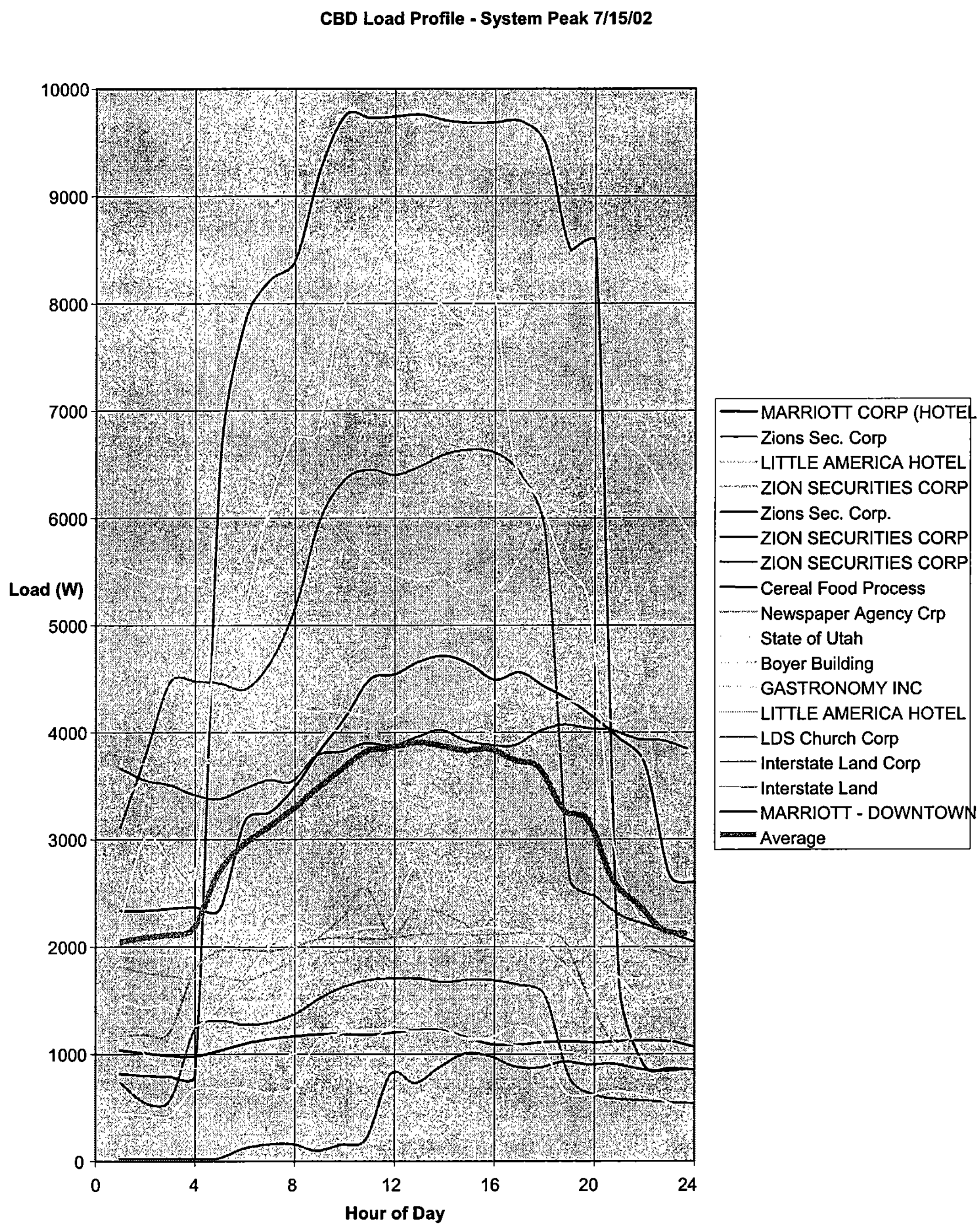
HIGHLAND
CEDAR HILLS
LEHI
AMERICAN FORK
PLEASANT GROVE
LINDON
ORT
SARATOGA SPRINGS
EAGLE MOUNTAIN
VINEYARD
OREM
South
PROVO
15
Utah Lake
SPRINGVILLE
MAPLETON
SPANISH FORK
SALEM
GENOLA
PAYSON

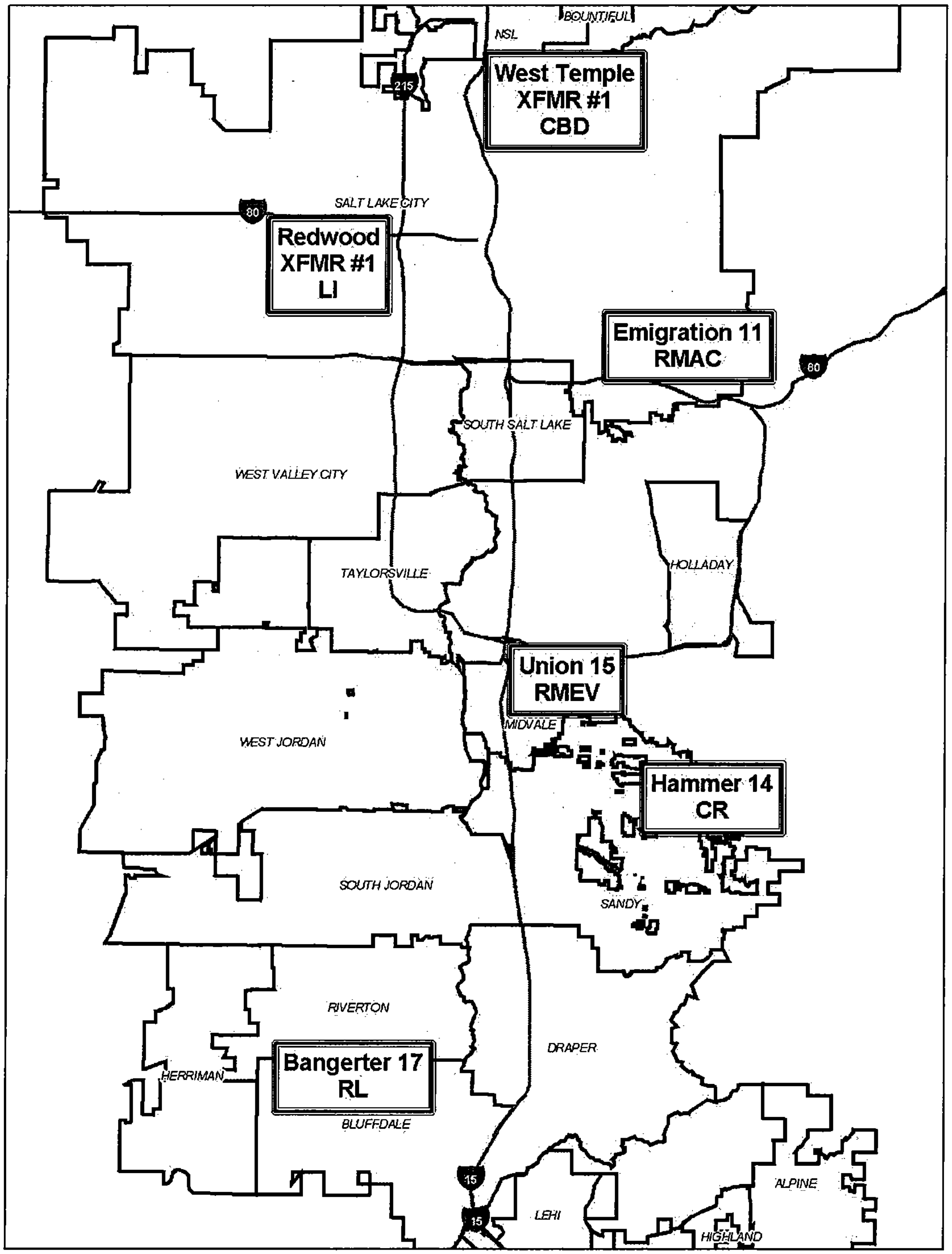
Appendix C – Point of Service Load Profile Curves

Following is the best case example of the "point of service" data collected. The Commercial Business District had the greatest number of data recorders at the meter. Also the class had the least anomalies that required eliminating (no load, possible meter spike, areas of zeros for possible no reads, etc).

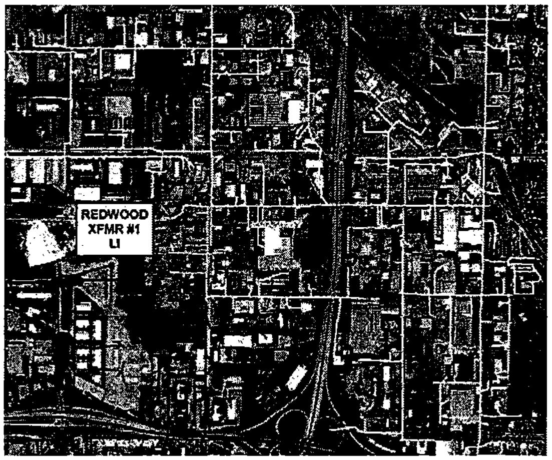


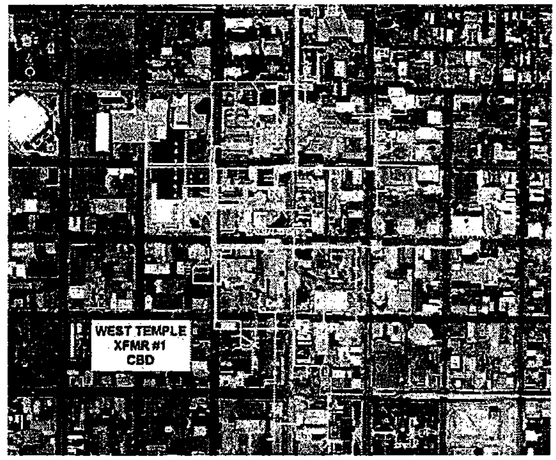
Appendix D – Feeder Circuit Locations

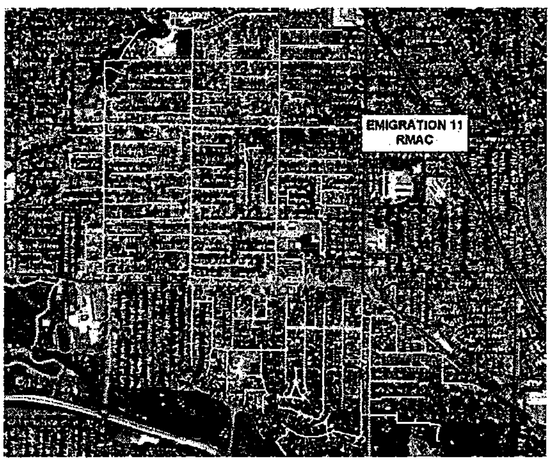
Following is a map of the Wasatch Front showing the location of the feeders used for each load class.

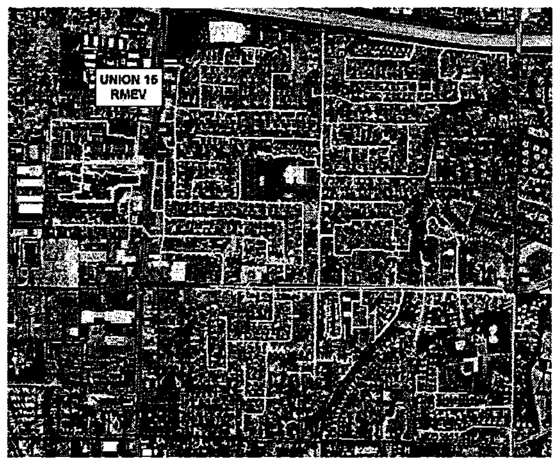


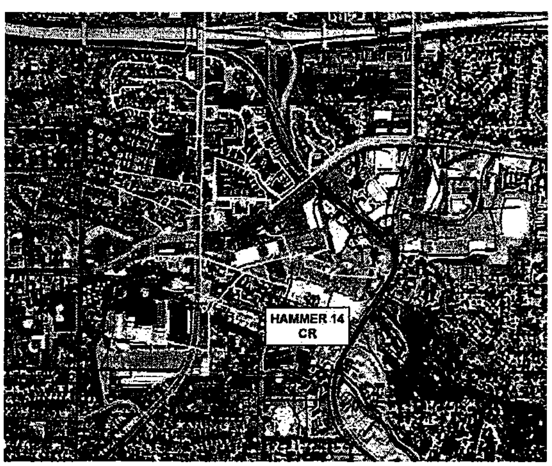
Following are detailed circuit diagrams superimposed onto aerial photos for each of the six feeders used in the study.

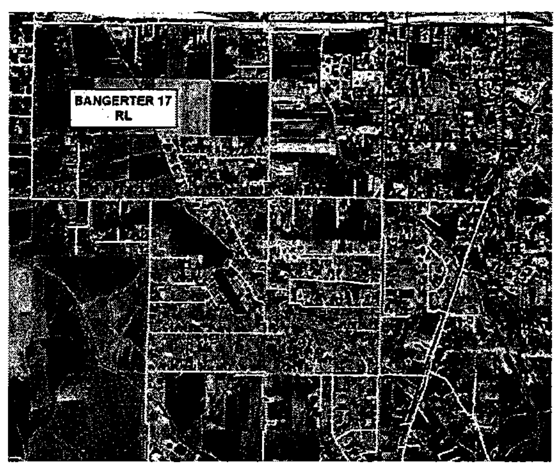












Appendix E – Sample Output from the Load Profile Curve Generator

Load Profile Curve Generator for the Wasatch Front - Curves generated for ForeSite Spacial Load Forecasting *Rev. C*

This pulls data out of School for specific feeders in the WF area that provide service to the Load Classes for use in ForeSite.

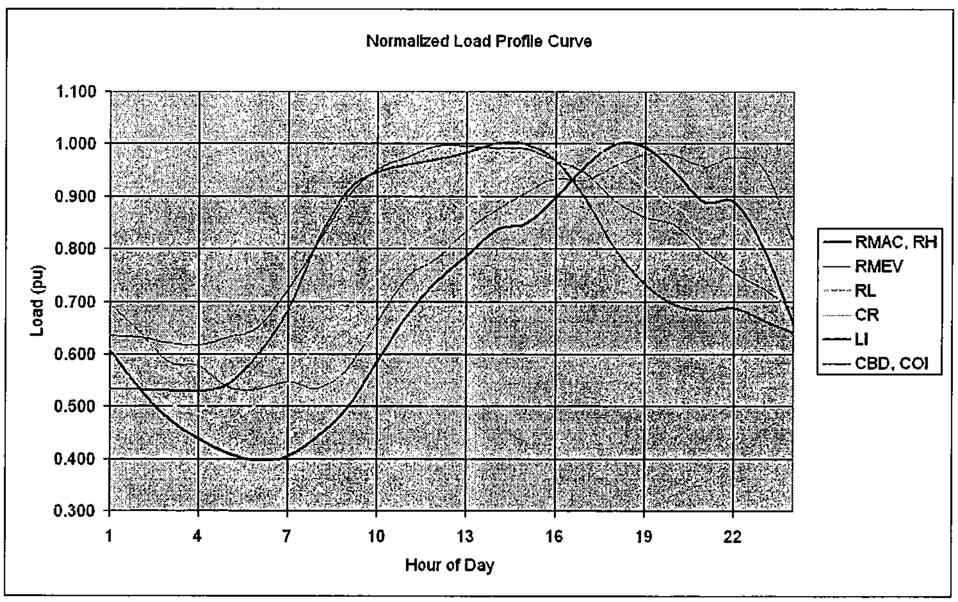
Enter load profile date: 7/15/2002 *This date is the search criterion for a School look-up, the data is spotty from 5/03 thru 7/03*

Normalized 24 hour load curve data points, based on feeder data per load class									
	Hour	RMAC	RMEV	RL	RH	CR	COI	LI	CBD
15-Jul-02 01:00:00	1	0.609	0.694	0.610	0.609	0.579	0.636	0.534	0.636
15-Jul-02 02:00:00	2	0.533	0.642	0.551	0.533	0.546	0.632	0.533	0.632
15-Jul-02 03:00:00	3	0.475	0.584	0.505	0.475	0.525	0.622	0.531	0.622
15-Jul-02 04:00:00	4	0.439	0.577	0.485	0.439	0.506	0.617	0.529	0.617
15-Jul-02 05:00:00	5	0.410	0.535	0.473	0.410	0.485	0.632	0.543	0.632
15-Jul-02 06:00:00	6	0.396	0.533	0.505	0.396	0.504	0.651	0.600	0.651
15-Jul-02 07:00:00	7	0.404	0.547	0.543	0.404	0.521	0.722	0.683	0.722
15-Jul-02 08:00:00	8	0.442	0.535	0.626	0.442	0.545	0.810	0.815	0.810
15-Jul-02 09:00:00	9	0.498	0.571	0.682	0.498	0.617	0.900	0.909	0.900
15-Jul-02 10:00:00	10	0.586	0.659	0.747	0.586	0.686	0.950	0.946	0.950
15-Jul-02 11:00:00	11	0.672	0.745	0.800	0.672	0.780	0.973	0.960	0.973
15-Jul-02 12:00:00	12	0.738	0.781	0.839	0.738	0.848	0.995	0.971	0.995
15-Jul-02 13:00:00	13	0.786	0.833	0.883	0.786	0.896	0.995	0.983	0.995
15-Jul-02 14:00:00	14	0.836	0.873	0.925	0.836	0.934	0.992	1.000	0.992
15-Jul-02 15:00:00	15	0.847	0.906	0.971	0.847	0.958	0.989	0.999	0.989
15-Jul-02 16:00:00	16	0.897	0.934	0.991	0.897	0.982	0.967	0.967	0.967
15-Jul-02 17:00:00	17	0.958	0.929	0.997	0.958	0.998	0.945	0.893	0.945
15-Jul-02 18:00:00	18	1.000	0.957	0.967	1.000	1.000	0.890	0.799	0.890
15-Jul-02 19:00:00	19	0.994	0.979	0.917	0.994	0.953	0.859	0.733	0.859
15-Jul-02 20:00:00	20	0.946	0.978	0.881	0.946	0.876	0.845	0.694	0.845
15-Jul-02 21:00:00	21	0.888	0.956	0.839	0.888	0.863	0.795	0.682	0.795
15-Jul-02 22:00:00	22	0.890	0.974	0.850	0.890	0.820	0.753	0.686	0.753
15-Jul-02 23:00:00	23	0.800	0.952	0.775	0.800	0.722	0.724	0.664	0.724
15-Jul-02 23:59:00	24	0.661	0.812	0.638	0.661	0.621	0.685	0.641	0.685

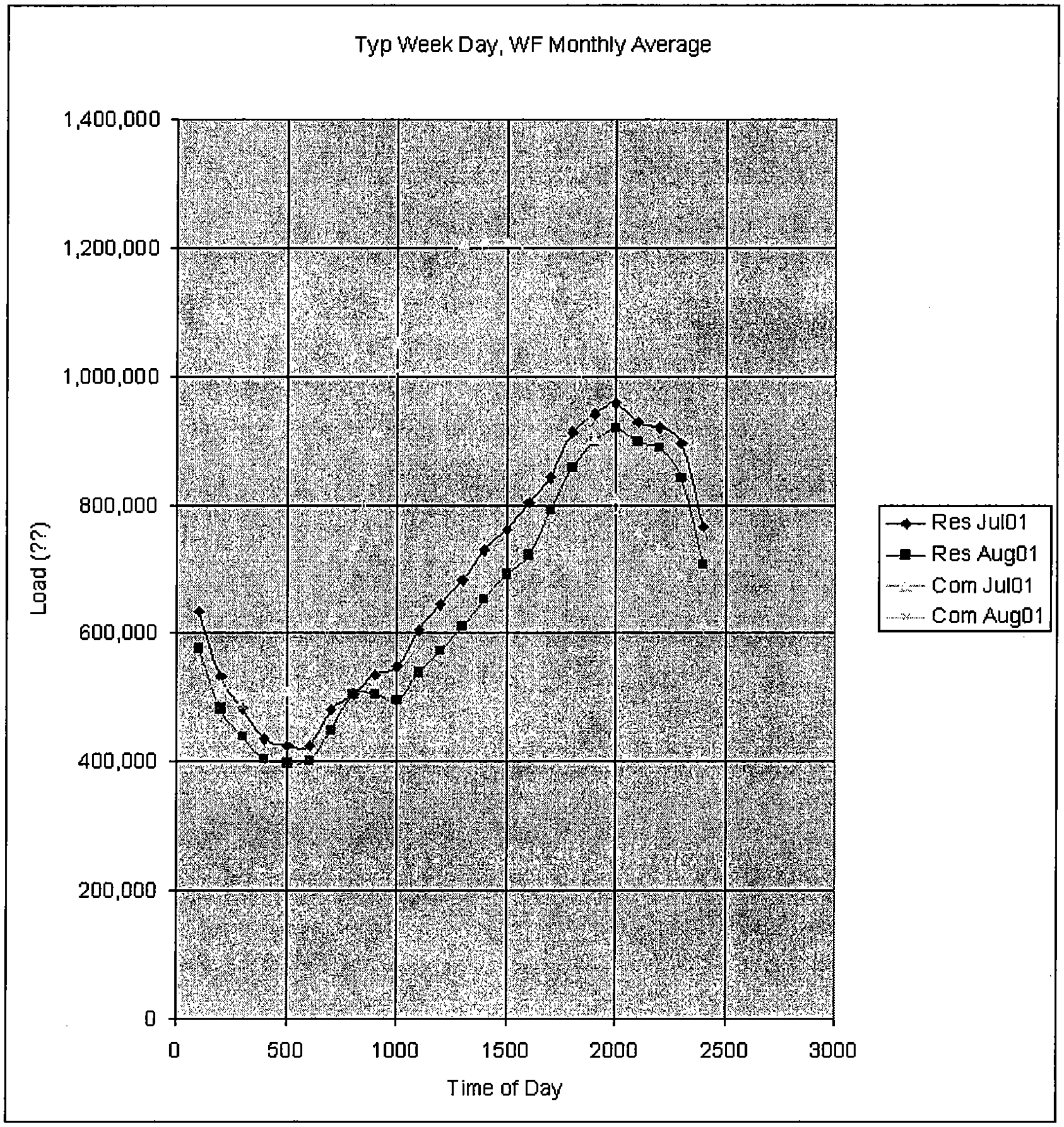
	RMAC	RMEV	RL	RH	CR	COI	LI	CBD
kW[4] Multiplier (Peak)	8840	1674	6625	11787	9359	997	18519	11967
Acres fed by feeder	670	426	3562	670	240	90	832	90
kW/acre[3]	13.2	3.9	1.9	17.6	39.0	11.1	22.3	133.0
Substation	Emigration	Union	Bangerter	See Note 1	Hammer	See Note 2	Redwood	WestTemple
Feeder Circuit	EM11	UNN15	BGT17		HAM14		XFMR#1	XFMR#1&2

Notes:

1. RH class is not fed by a feeder. Reference data indicates that this class best matches RMAC, but at 4/3 of the load.
2. COI class is not fed by a feeder. Reference data indicates that this class best matches CBD, but at 1/12 of the load.
3. Acreage determined by outlining feeder in OMS and using AutoCad to determine area
4. kVA is apparent power, the maximum hourly value for day, SCADA data taken at feeder in substation



Appendix F – State of Utah Load Curves, Generated by PacifiCorp's Metering Group



Appendix G – FORESITE Study Procedures

FORESITE Study Procedure

Preparation (prior to running the software)

1) Define study area
2) Define load classes (and obtain load profiles and kW/acre data)
3) Obtain current land-use data
4) Obtain other geographic data (to be used for factors)
5) Determine all substations within the study area, their service boundaries and load data
6) Determine growth rates for each load class. (Consumption AND New Connects)

Note: FORESITE requires grids to be no greater than 1000 cells in either dimension. Coordinate boundaries must be integers, and the difference between the maximum and minimum coordinates must be an exact multiple of the chosen cell size.

Study Set-Up

1) Create a new workspace. Enter a name in the "Create Empty Workspace" field and click in the "Initialize Workspace with Basemap Data" field. (In the future, open this workspace by right clicking in the "Use Existing Workspace" field. Select the study, and click "OK".)
2) Under FORESITE\Setup\Constants/Classes, define the study boundaries, cell size, and forecast years. Select Sampling Rate of 60 minutes (for load curves with data once an hour). Choose Day for Length, and Class Curves for Type. Enter the load class names by clicking on each of the class numbers under "Customers/Landuse". (If kW/acre was the quantity determined, the customers/cell must be 1.0!) Be sure to indicate the appropriate type of class.
3) Under Load Model\Setup\Load Curve Definitions, click on Class Curve Entry/Update. Right Click in the "Load Curve to Input:" field. Create ALL load curves. Do not worry about inputing values.
4) When you have created ALL curves, you can replace the files under C:\Foredata\foresite\ *Study Name* \data\class with flat files containing the actual per unit load curves.
5) Under Load Model\Setup\Load Multipliers, enter the consumption growth and the base year kW/cell (customer/cell=1 : kW/cell=kW/customer)
6) Load the base year landuse and name as map11.
7) Under Forecast\Setup\Scenario Definitions\Background Trends, Click on Base Cells from Map 11. Then click on Rate for each of your classes. Enter the landuse (or new connects) growth rates for each of your study years.
8) Under Forecast\Spatial Analysis\MAPS 101-112, with Input Grid# as 11, click Execute Expression for each of the Output Grid#s.
9) Under Forecast\Spatial Analysis\MAPS 113-140, with Input Grid# as 11, click Execute Expression for each of the Output Grid#s.
10) Under Forecast\Setup\Scenario Definitions\Actual Trends (if you will be using the Urban Redevelopment model), click on Copy: Growth Totals from Background Trends.
11) Under Forecast\Setup\Factor Definitions, create all needed factors. Developed->map51 = con(map11 == 99, 0, 100)
    AC available->map52 = (con(map11 == 1, 100, 0))+(con(map11 == 2, 100, 0))+(con(map11 == 99, 100, 0))
    Current EV->map53 = con(map11 == 2, 100, 0)
12) Load any urban pole maps into maps 31-36.
13) Under Forecast\Setup\Preference Definitions, click on each of the classes and choose appropriate settings. Then click Create This Preference Map. (These are stored beginning with map61, for class 1. Map62 is for class2, etc.)
14) Under Forecast\Spatial Analysis\Spatial Distribution, The Landuse Grid should be map11, and the Load point is the peak load hour (ex. 17). Click Execute Expression. Rename this map to map1.

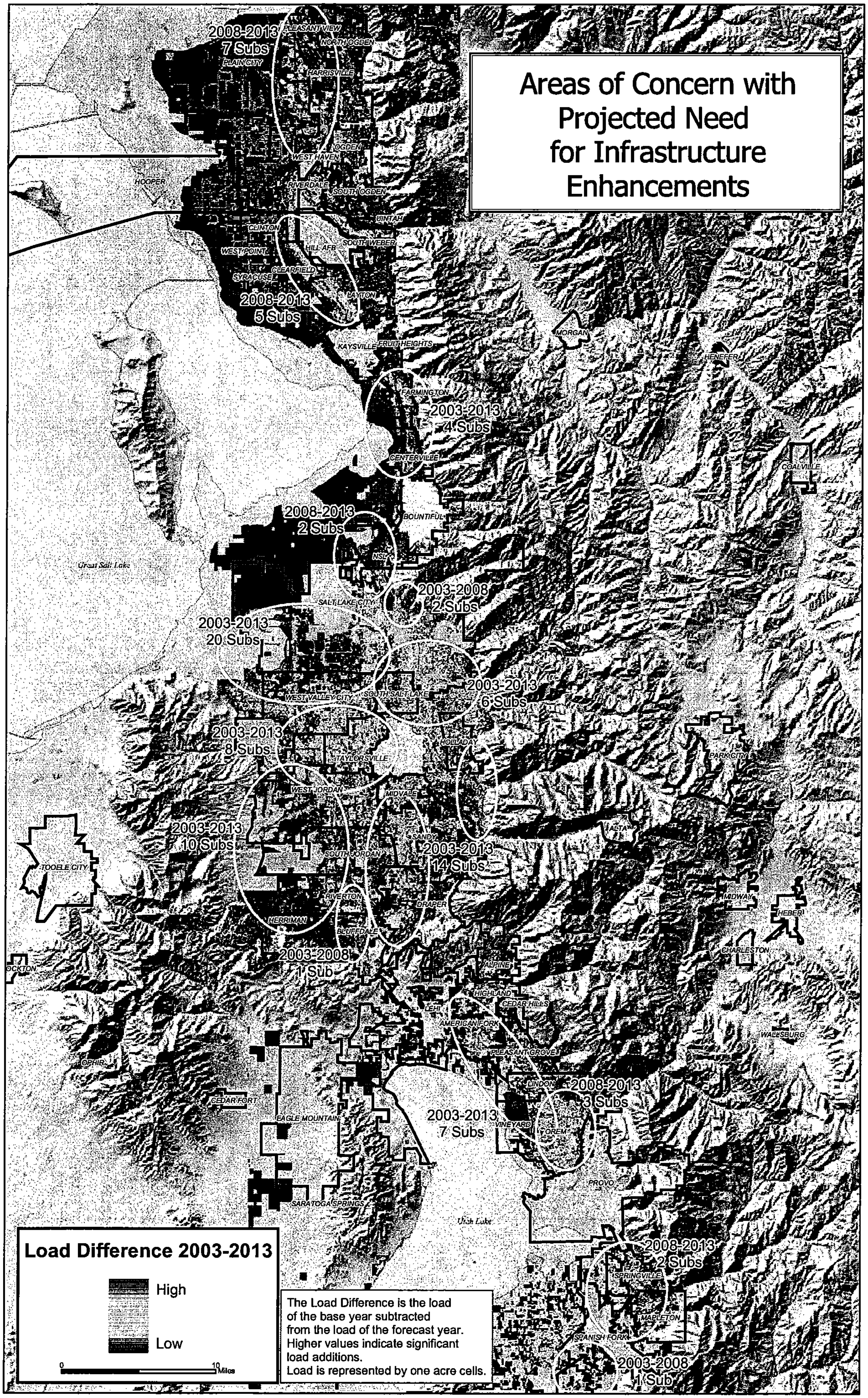
Running the Forecast

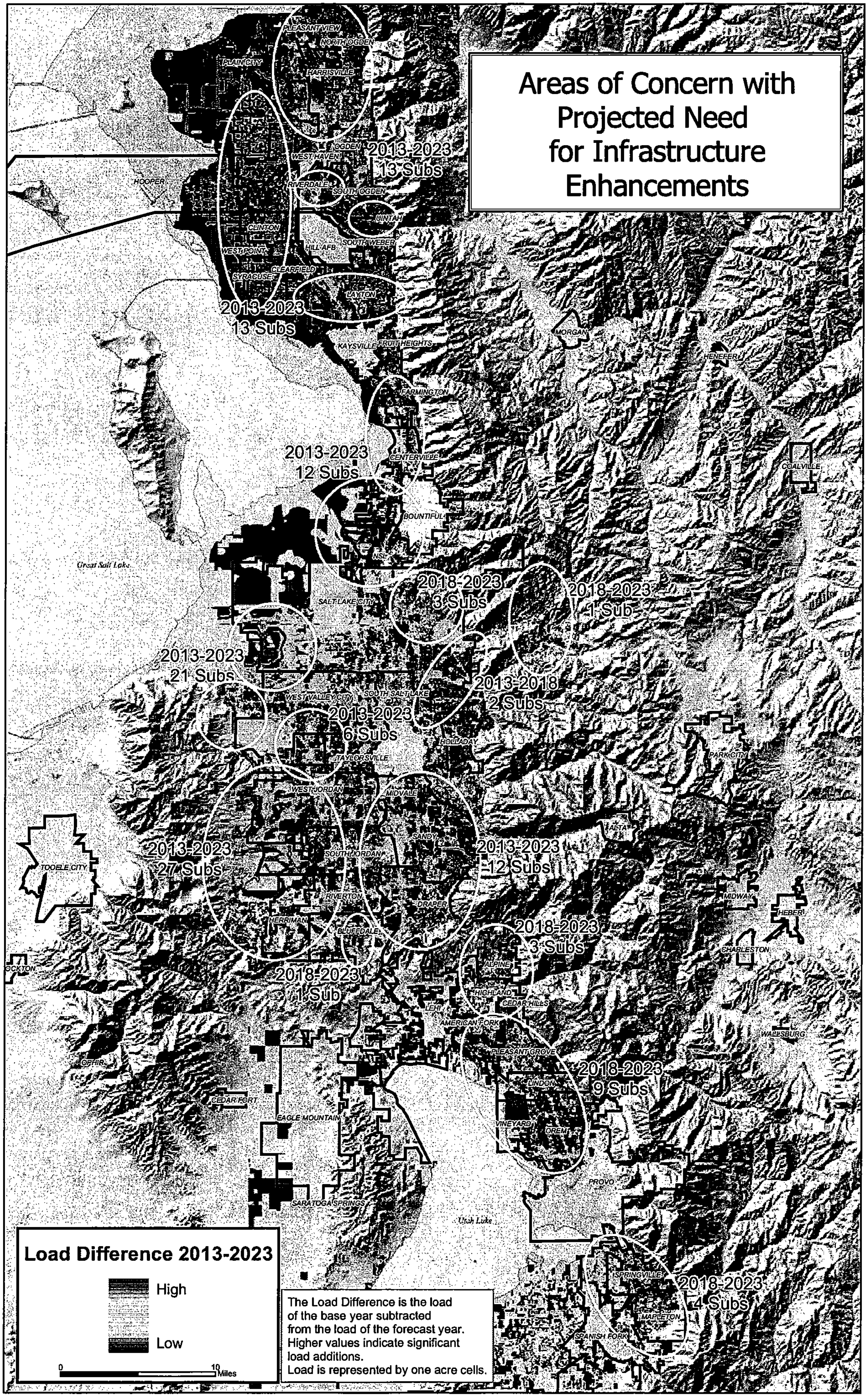
1) Create (recreate) Factor Maps (includes maps 101-128) (see steps 8,9 and 11 above)
2) Create (recreate) redevelopable map (map 221 -) map221 = (con(map11 == 1, 1, 0)) + (con(map11 == 2, 1, 0))
3) Create (recreate) preference maps (maps 61 -)
4) Calculate land use totals before running forecast!
5) Run the forecast for 1 year. (Do NOT recreate factors and preferences.) Run the forecast by Selecting Forecast\Start Forecast...
6) Repeat steps 1 - 5 until all study years are completed.

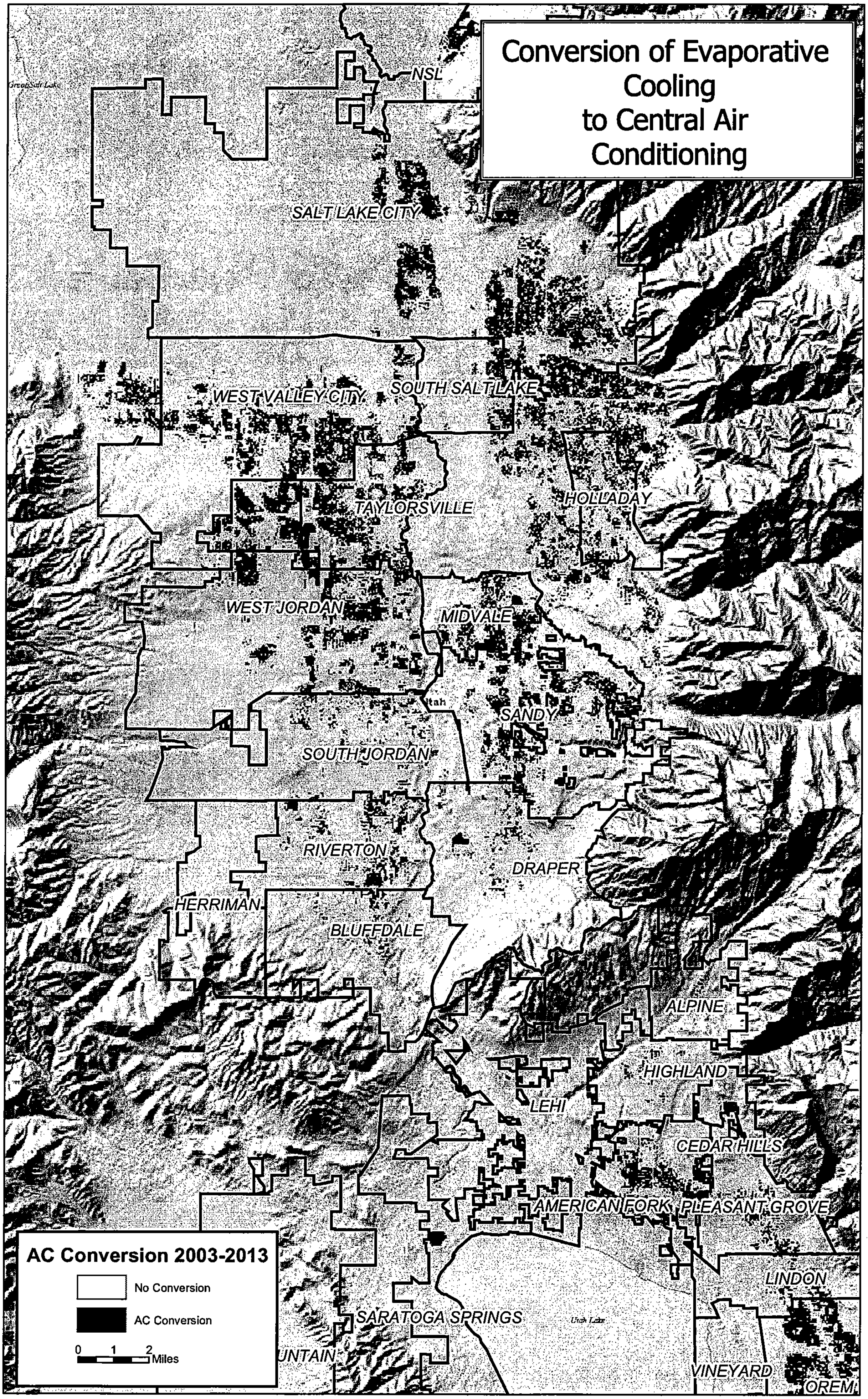
Viewing the Results

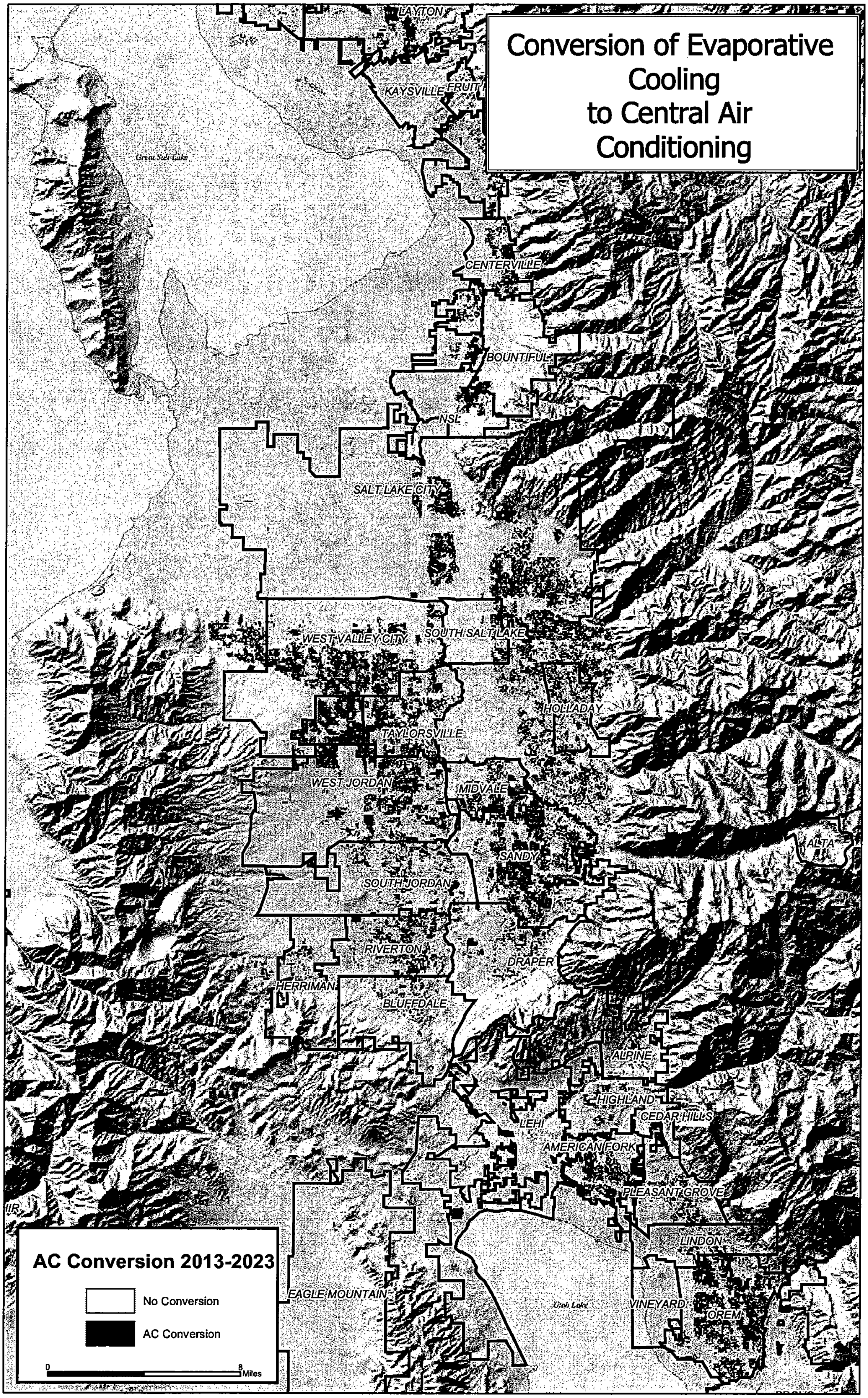
1) Developed land = con(map12 == map11, 0, map12) (for comparing the first forecast year to the base year)
2) Redeveloped land = Developed land * map232
3) Newly developed land = Developed land - Redeveloped land

Appendix H – Results of the Forecast


Areas of Concern with Projected Need for Infrastructure Enhancements
2008-2013
7 Subs
PLEASANT VIEW
NORTH OGDEN
PLAIN CITY
HARRISVILLE
OGDEN
WEST HAVEN
HOOPER
RIVERDALE
SOUTH OGDEN
UINTAH
CLINTON
HILL AFB
SOUTH WEBER
WEST POINT
CLEARFIELD
SYRACUSE
LAYTON
2008-2013
5 Subs
KAYSVILLE
FRUIT HEIGHTS
MORGAN
HENEFER
FARMINGTON
2003-2013
4 Subs
CENTERVILLE
COALVILLE
2008-2013
2 Subs
BOUNTIFUL
NSL
Great Salt Lake
2003-2008
2 Subs
SALT LAKE CITY
2003-2013
20 Subs
2003-2013
6 Subs
WEST VALLEY CITY
SOUTH SALT LAKE
2003-2013
8 Subs
HOLLADAY
TAYLORSVILLE
PARK CITY
WEST JORDAN
MIDVALE
2003-2013
10 Subs
SANDY
ALTA
2003-2013
14 Subs
SOUTH JORDAN
TOOELE CITY
RIVERTON
DRAPER
MIDWAY
HEBER
HERRIMAN
BLUFFDALE
2003-2008
1 Sub
CHARLESTON
ALPINE
HIGHLAND
CEDAR HILLS
LEHI
AMERICAN FORK
WALLSBURG
OPHIR
PLEASANT GROVE
LINDON
2008-2013
3 Subs
CEDAR FORT
2003-2013
7 Subs
EAGLE MOUNTAIN
VINEYARD
OREM
PROVO
SARATOGA SPRINGS
Utah Lake
2008-2013
2 Subs
SPRINGVILLE
MAPLETON
SPANISH FORK
2003-2008
1 Sub
Load Difference 2003-2013
High
Low
0
10
Miles
The Load Difference is the load of the base year subtracted from the load of the forecast year. Higher values indicate significant load additions. Load is represented by one acre cells.


Areas of Concern with Projected Need for Infrastructure Enhancements
Load Difference 2013-2023
High
Low
0
10
Miles
The Load Difference is the load of the base year subtracted from the load of the forecast year. Higher values indicate significant load additions. Load is represented by one acre cells.
2013-2023 13 Subs
2013-2023 13 Subs
2013-2023 12 Subs
2018-2023 3 Subs
2018-2023 1 Sub
2013-2023 21 Subs
2013-2018 2 Subs
2013-2023 6 Subs
2013-2023 27 Subs
2013-2023 12 Subs
2018-2023 3 Subs
2018-2023 1 Sub
2018-2023 9 Subs
2018-2023 4 Subs
PLEASANT VIEW
NORTH OGDEN
PLAIN CITY
HARRISVILLE
OGDEN
WEST HAVEN
HOOPER
RIVERDALE
SOUTH OGDEN
UINTAH
CLINTON
WEST POINT
HILL AFB
SOUTH WEBER
CLEARFIELD
SYRACUSE
LAYTON
MORGAN
KAYSVILLE
FRUIT HEIGHTS
HENEFER
FARMINGTON
CENTERVILLE
COALVILLE
BOUNTIFUL
NSL
Great Salt Lake
SALT LAKE CITY
WEST VALLEY CITY
SOUTH SALT LAKE
HOLLADAY
TAYLORSVILLE
PARK CITY
WEST JORDAN
MIDVALE
ALTA
SANDY
TOOELE CITY
SOUTH JORDAN
RIVERTON
DRAPER
MIDWAY
HEBER
HERRIMAN
BLUFFDALE
CHARLESTON
ALPINE
HIGHLAND
CEDAR HILLS
LEHI
AMERICAN FORK
WALLSBURG
OPHIR
PLEASANT GROVE
LINDON
CEDAR FORT
EAGLE MOUNTAIN
VINEYARD
OREM
PROVO
SARATOGA SPRINGS
Utah Lake
SPRINGVILLE
MAPLETON
SPANISH FORK

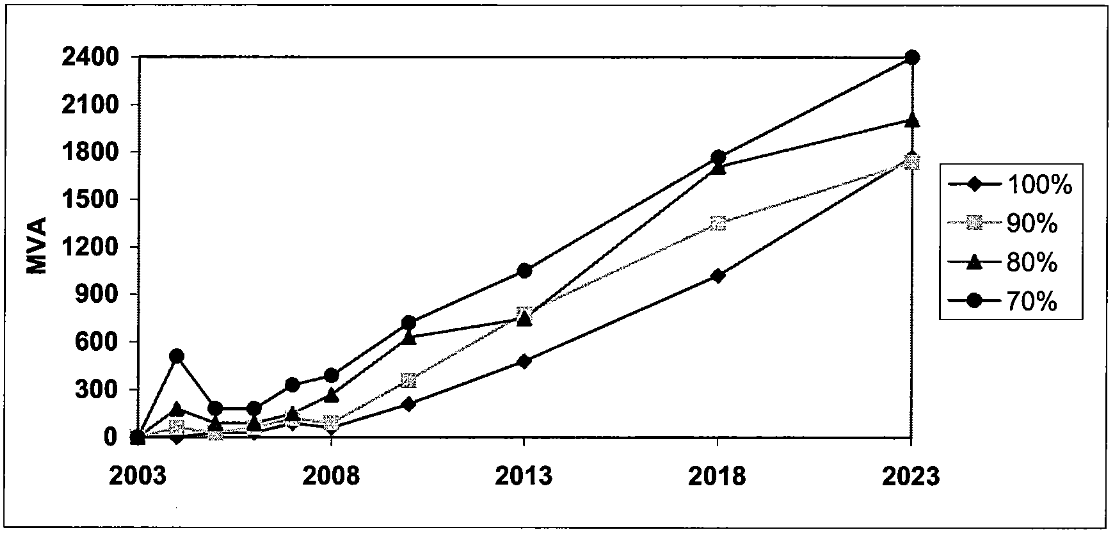

Conversion of Evaporative Cooling to Central Air Conditioning
NSL
SALT LAKE CITY
WEST VALLEY CITY
SOUTH SALT LAKE
TAYLORSVILLE
HOLLADAY
WEST JORDAN
MIDVALE
SANDY
SOUTH JORDAN
RIVERTON
DRAPER
HERRIMAN
BLUFFDALE
ALPINE
HIGHLAND
LEHI
CEDAR HILLS
AMERICAN FORK
PLEASANT GROVE
LINDON
SARATOGA SPRINGS
UNTAIN
VINEYARD
OREM
AC Conversion 2003-2013
No Conversion
AC Conversion
0 1 2 Miles


Conversion of Evaporative Cooling to Central Air Conditioning
LAYTON
KAYSVILLE
Great Salt Lake
CENTERVILLE
BOUNTIFUL
NSL
SALT LAKE CITY
WEST VALLEY CITY
SOUTH SALT LAKE
HOLLADAY
TAYLORSVILLE
WEST JORDAN
MIDVALE
SANDY
ALTA
SOUTH JORDAN
RIVERTON
DRAPER
HERRIMAN
BLUFFDALE
ALPINE
HIGHLAND
LEHI
CEDAR HILLS
AMERICAN FORK
PLEASANT GROVE
LINDON
EAGLE MOUNTAIN
Utah Lake
VINEYARD
OREM
AC Conversion 2013-2023
No Conversion
AC Conversion
0
8 Miles

Appendix I – Zone Definitions

Zone	Zone Description	Substations
1	Rosepark	Capitol, North Bench
2	Southwest	13th South, Cannon, Kensington, Southwest
3	Cottonwood	Cottonwood, E Millcreek, Emigration, Hogle, Holladay, Le Grande, Oakland, Parleys, Southeast, Valley Center
4	Sandy	118th South, Altaview, Butlerville, Casto, Dimple Dell, Draper, Dumas, Hammer, Ninety South, Olympus, Quarry, Sandy, South Mountain, SouthPark, Union
5	North Salt Lake	N Salt Lake, Rose Park
6	Riter	Riter
7	Bingham	Bluffdale
8	Taylorsville	Granger, Hunter, Kearns, Meadowbrook, Midvale, Taylorsville, West Jordan
9	Redwood	Centennial, Decker Lake, Lake Park, Parkway, Redwood, Ridgeland
10	Jordan	Fifth West, Jordan, Snarr, Third West
11	Woods Cross	Centerville, Cudahy, Farmington, Parrish, Woodscross
13	Park City	Brighton, Mt Dell
16	University	Brunswick, McClelland, Medical, Morton Court, North East, Research, Sixth South, University, West Temple
19	Orange	Grow, Orange, Terminal
20	Oquirrh	Bangerter, Bingham, Hoggard, Lark, Oquirrh, Welby
21	Midway	Walsburg
417	Davis County	Angel, Clearfield, Clinton, E Layton, Farmington, Fruit Heights, Layton, Syracuse, West Roy
418	Riverdale	Little Mountain, Newgate, Riverdale, South Ogden, Taylor
419	Elmonte	Box Elder, Brickyard, Coldwater, East Bench, Eden, Lincoln, Marriott, McKay, Midland, North Ogden, Pioneer, Pleasant View, Second Street, Twenty Third, Uintah, Warren, West Commercial, West Ogden
671	Pay Area	Loafer
698	Timp 46	American Fork, Lindon, Sharon, Timp, Tri City, Vineyard
699	Highland 46	Highland, Manila, Pleasant Grove
715	Hale 46	Benjamin, Cherry Wood, Hale, Northridge, Orem, Pelican Point, Saratoga, Willow Ridge
717	Provo	Draper, Timp
720	Spanish Fork 46	Ironton No2, Mapleton, Red Narrows, Welfare
725	Nebo	Summit Creek

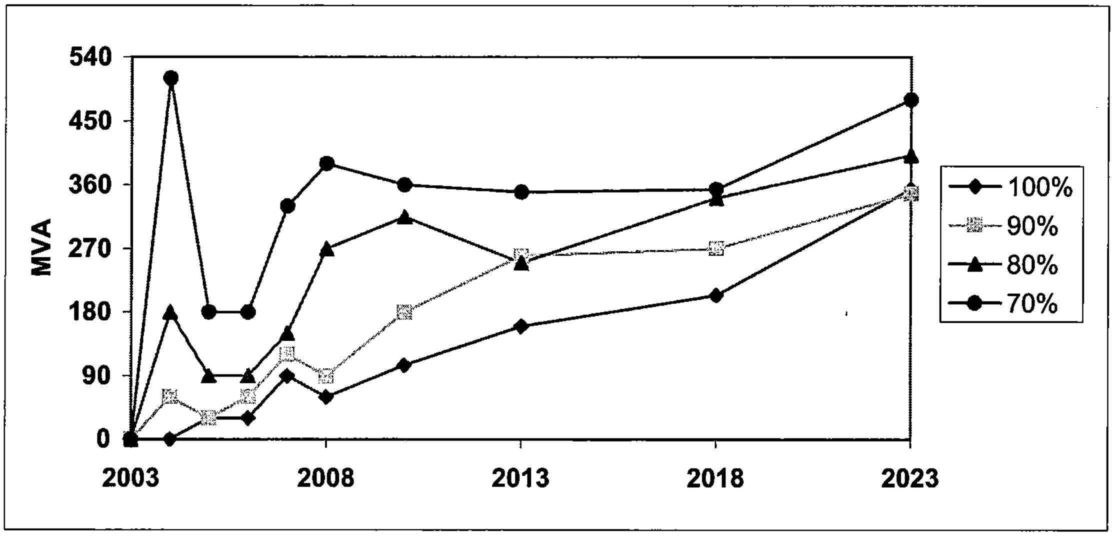
Appendix J – Capacity Analysis



MVA Additions per Study Year

	2004	2005	2006	2007	2008	2010	2013	2018	2023
100%	0	30	30	90	60	210	480	1020	1770
90%	60	30	60	120	90	360	780	1350	1740
80%	180	90	90	150	270	630	750	1710	2010
70%	510	180	180	330	390	720	1050	1770	2400

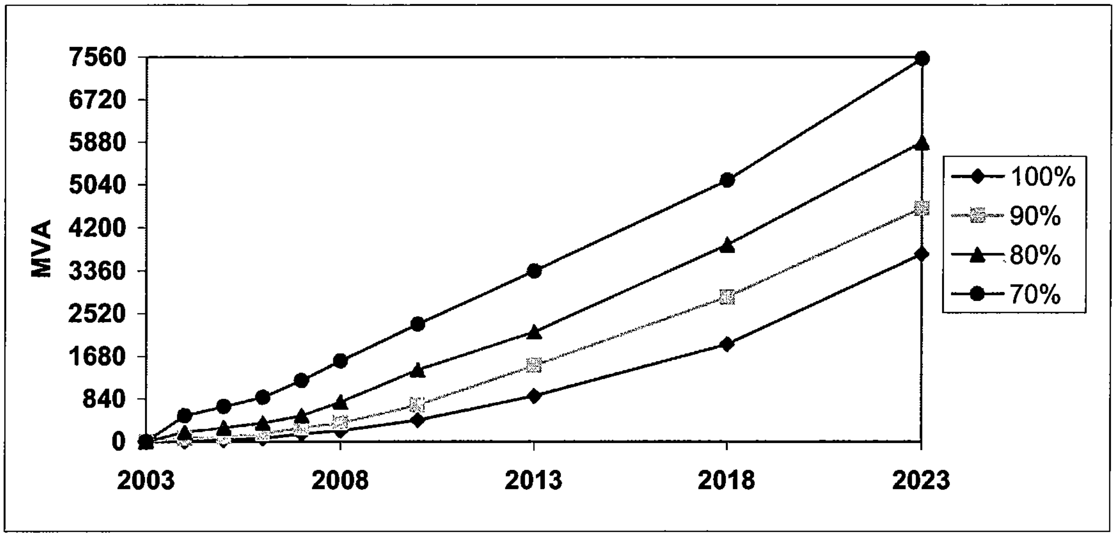
These projections were developed using the Wasatch Front Spatial Load Forecast load projections for each of the 10 study years, 2003, 2004, 2005, 2006, 2007, 2008, 2010, 2013, 2018, and 2023. New capacity is projected in increments of 30 MVA transformers for groups of distribution substations called zones. Whenever the utilization of a zone exceeds the utilization threshold, enough new capacity additions are projected to drop that zone's utilization back below the threshold. The table and graph above give the capacity additions in MVA for each of the study years for the given utilization threshold percentages. The planned capacity increases through 2006 were assumed and are not reflected in the table or graph.



Average Annual MVA Additions

	2004	2005	2006	2007	2008	2010	2013	2018	2023
100%	0	30	30	90	60	105	160	204	354
90%	60	30	60	120	90	180	260	270	348
80%	180	90	90	150	270	315	250	342	402
70%	510	180	180	330	390	360	350	354	480

These projections were developed using the Wasatch Front Spatial Load Forecast load projections for each of the 10 study years, 2003, 2004, 2005, 2006, 2007, 2008, 2010, 2013, 2018, and 2023. New capacity is projected in increments of 30 MVA transformers for groups of distribution substations called zones. Whenever the utilization of a zone exceeds the utilization threshold, enough new capacity additions are projected to drop that zone's utilization back below the threshold. The table and graph above give the capacity additions in MVA for each of the study years for the given utilization threshold percentages. For non-consecutive years, the MVA additions shown were averaged for the backward looking time period. The planned capacity increases through 2006 were assumed and are not reflected in the table or graph.

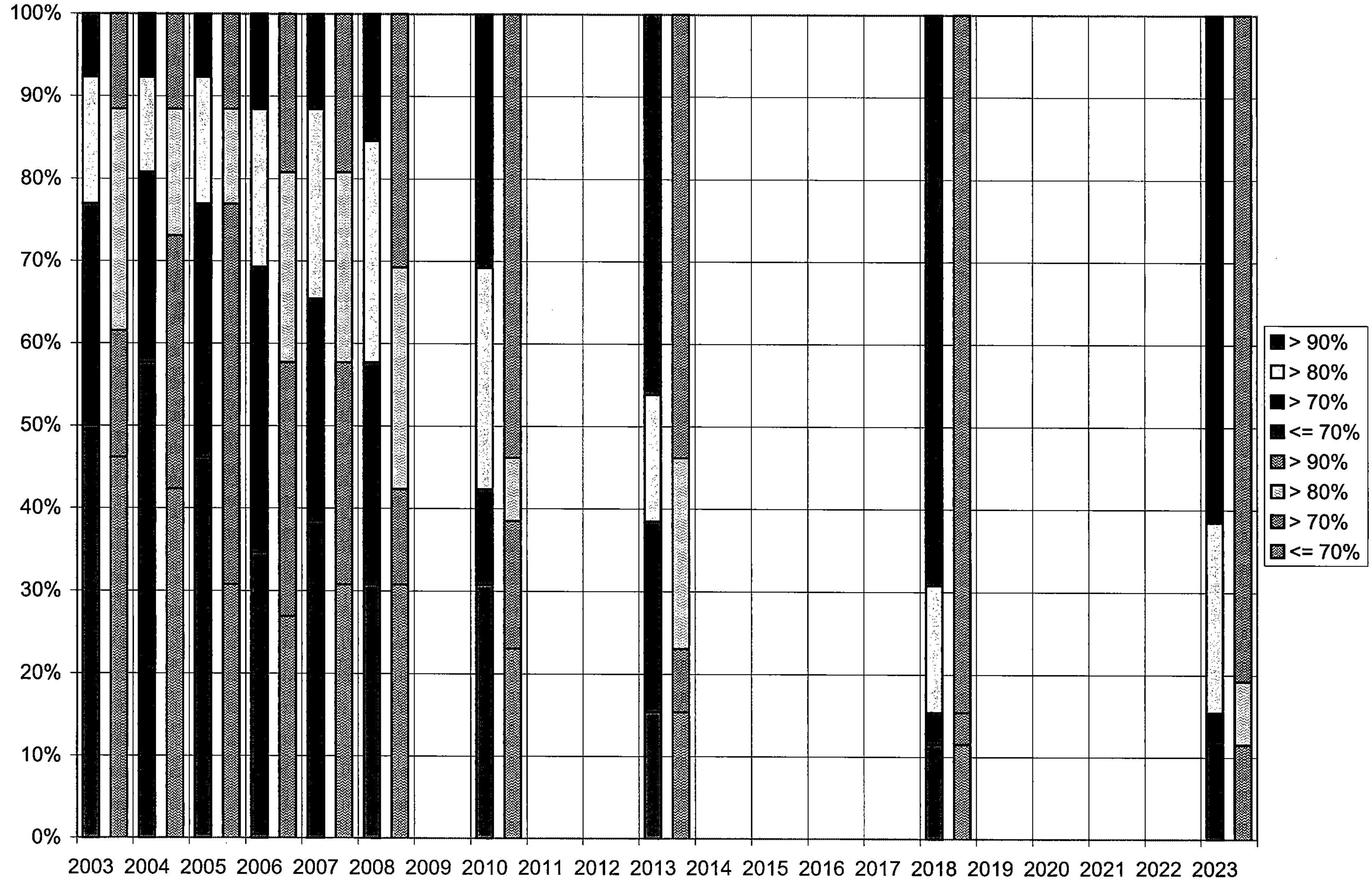


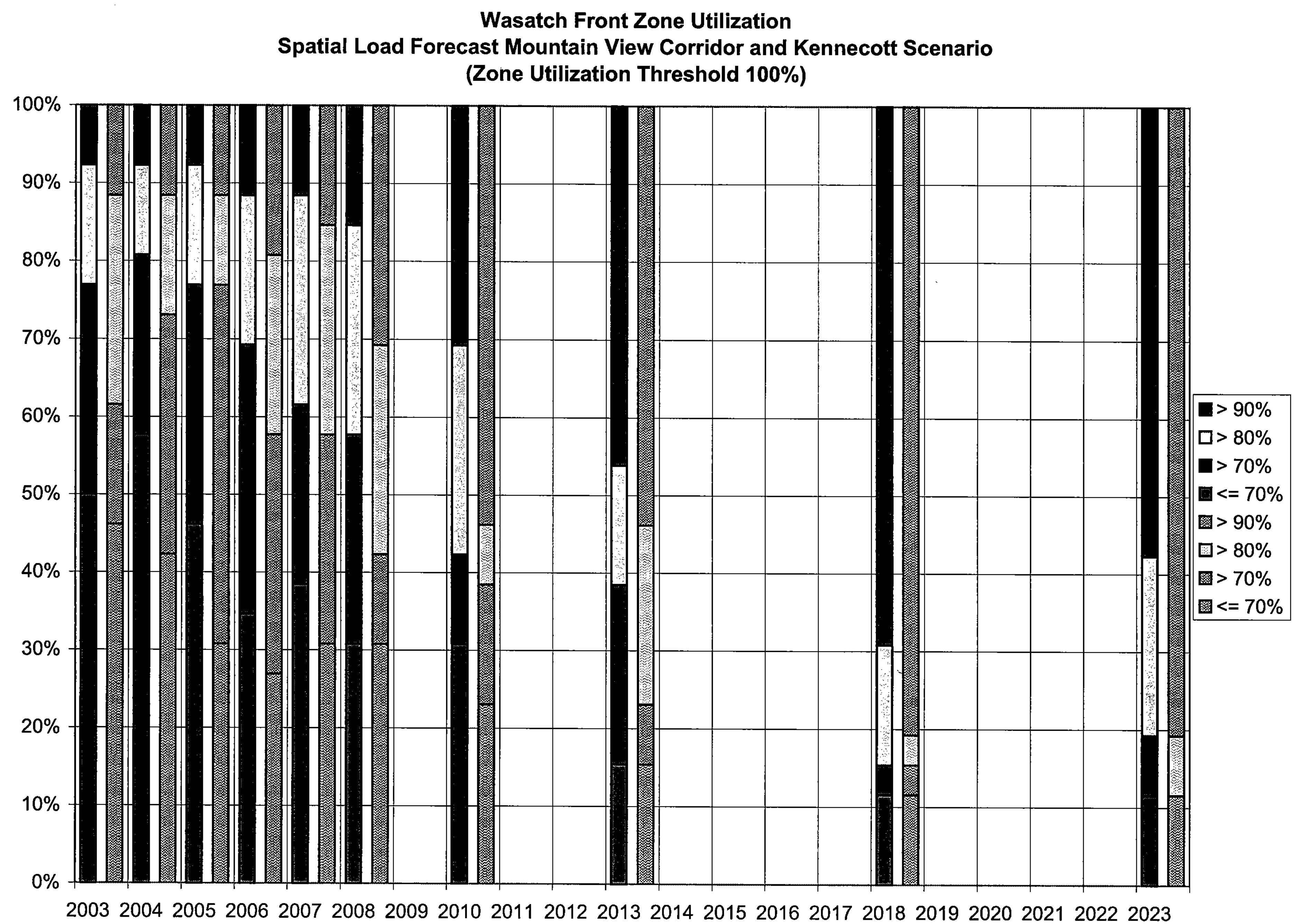
Cumulative MVA Additions

	2004	2005	2006	2007	2008	2010	2013	2018	2023
100%	0	30	60	150	210	420	900	1920	3690
90%	60	90	150	270	360	720	1500	2850	4590
80%	180	270	360	510	780	1410	2160	3870	5880
70%	510	690	870	1200	1590	2310	3360	5130	7530

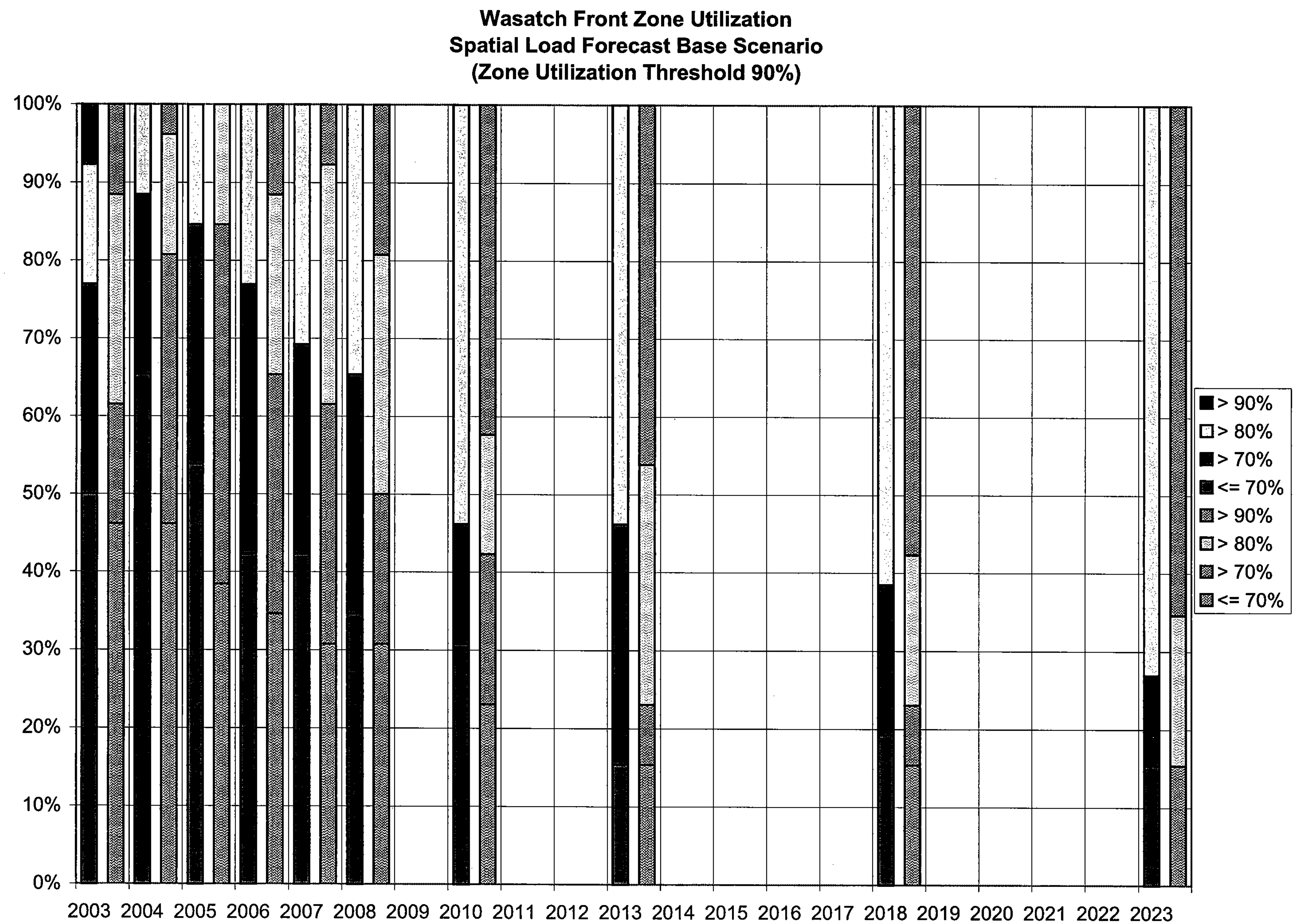
These projections were developed using the Wasatch Front Spatial Load Forecast load projections for each of the 10 study years, 2003, 2004, 2005, 2006, 2007, 2008, 2010, 2013, 2018, and 2023. New capacity is projected in increments of 30 MVA transformers for groups of distribution substations called zones. Whenever the utilization of a zone exceeds the utilization threshold, enough new capacity additions are projected to drop that zone's utilization back below the threshold. The table and graph above give the cumulative capacity additions in MVA for each of the study years for the given utilization threshold percentages. The planned capacity increases through 2006 were assumed and are not reflected in the table or graph.

Wasatch Front Zone Utilization
Spatial Load Forecast Base Scenario
(Zone Utilization Threshold 100%)

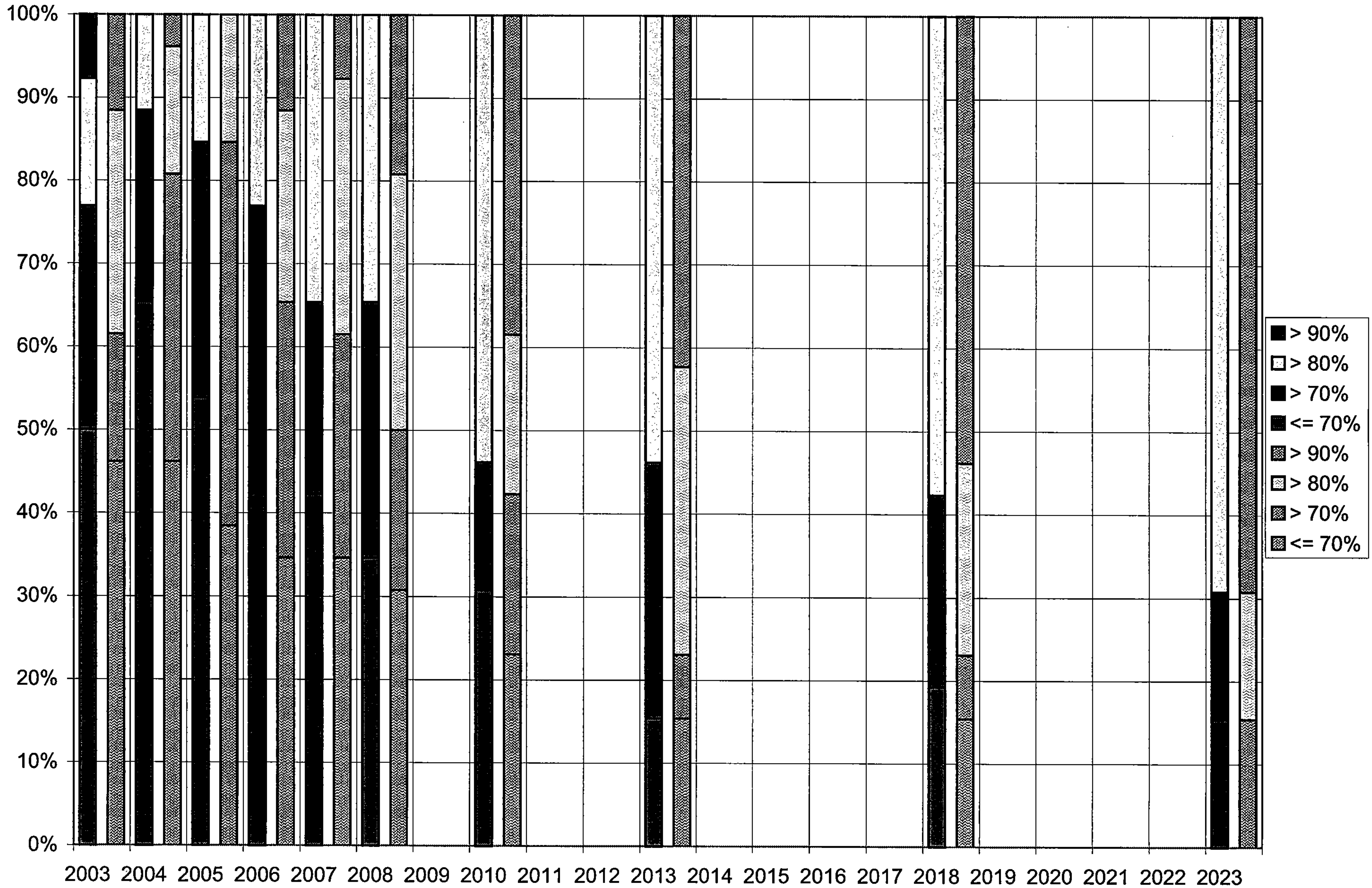




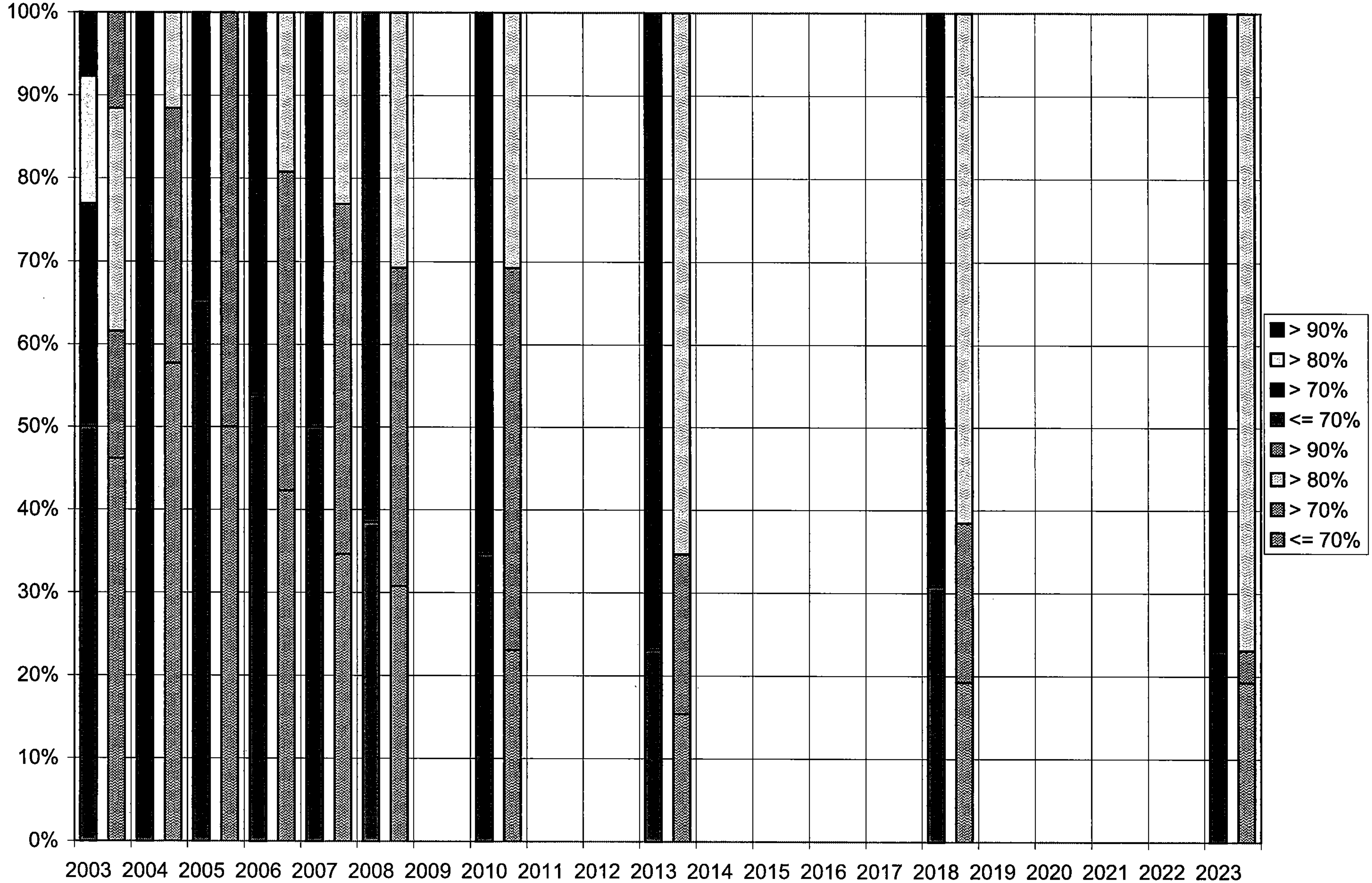
Wasatch Front Zone Utilization
Spatial Load Forecast Mountain View Corridor and Kennecott Scenario
(Zone Utilization Threshold 100%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
> 90%
> 80%
> 70%
<= 70%
> 90%
> 80%
> 70%
<= 70%

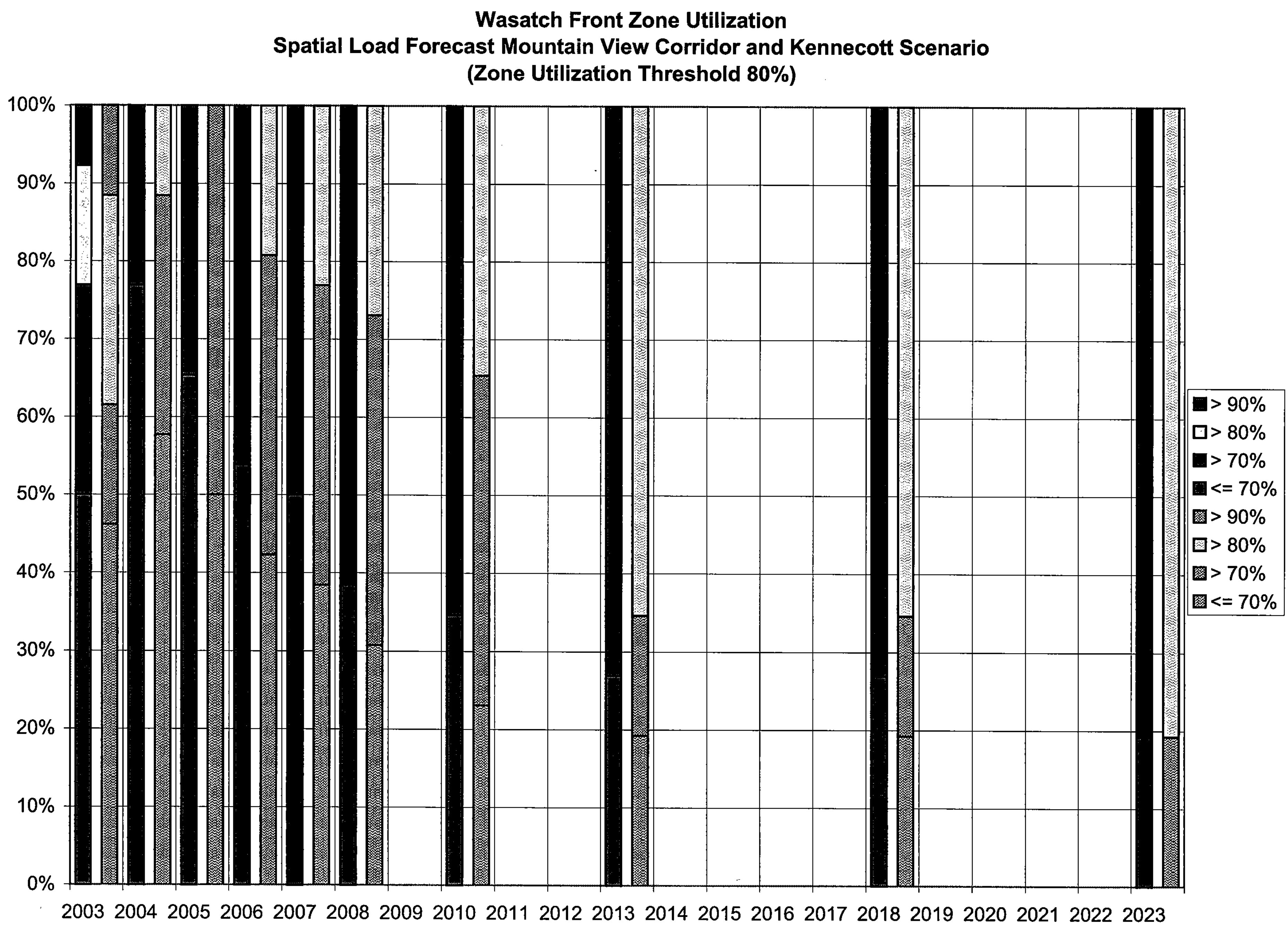

Wasatch Front Zone Utilization
Spatial Load Forecast Base Scenario
(Zone Utilization Threshold 90%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023
> 90%
> 80%
> 70%
<= 70%
> 90%
> 80%
> 70%
<= 70%

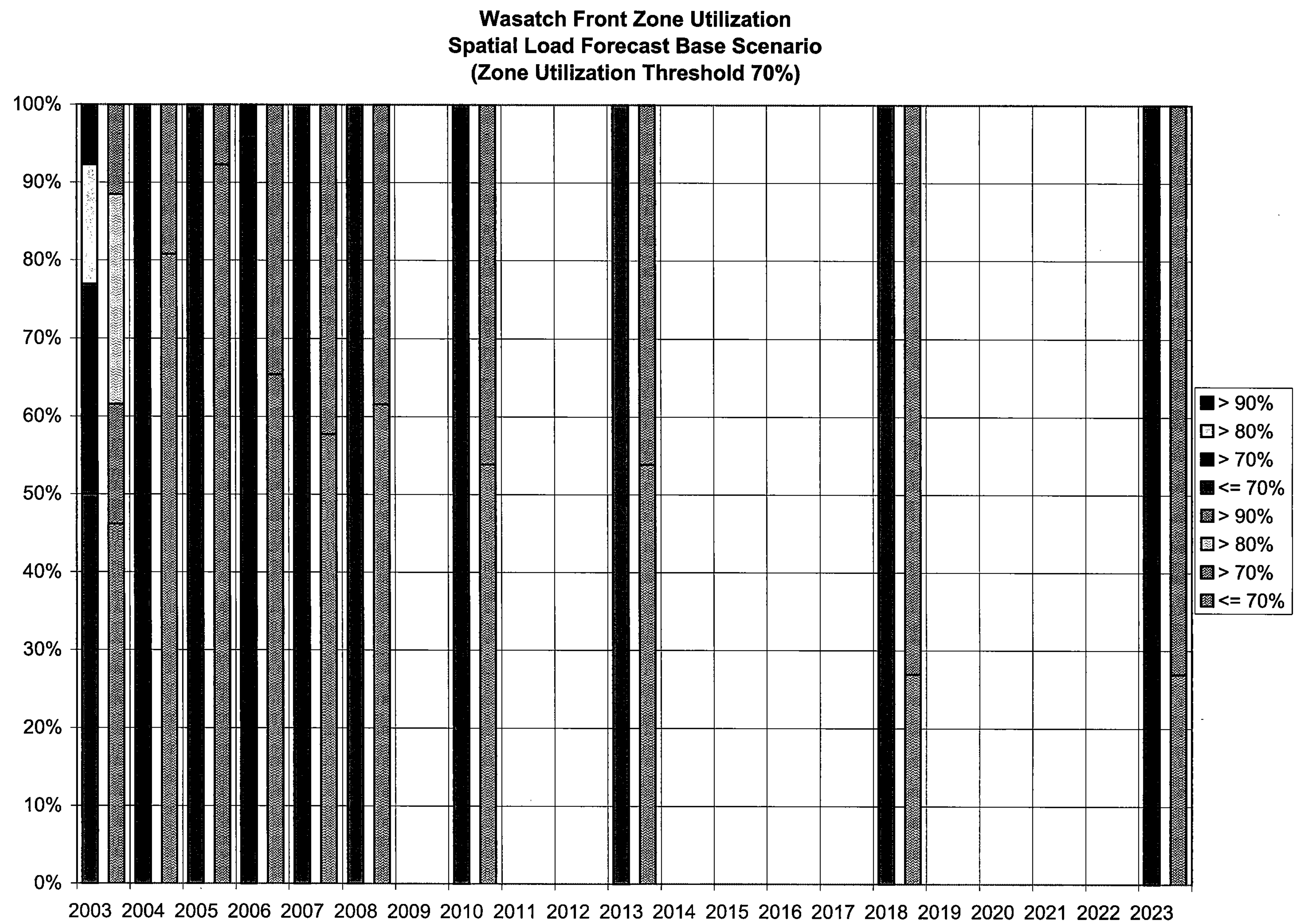
Wasatch Front Zone Utilization
Spatial Load Forecast Mountain View Corridor and Kennecott Scenario
(Zone Utilization Threshold 90%)



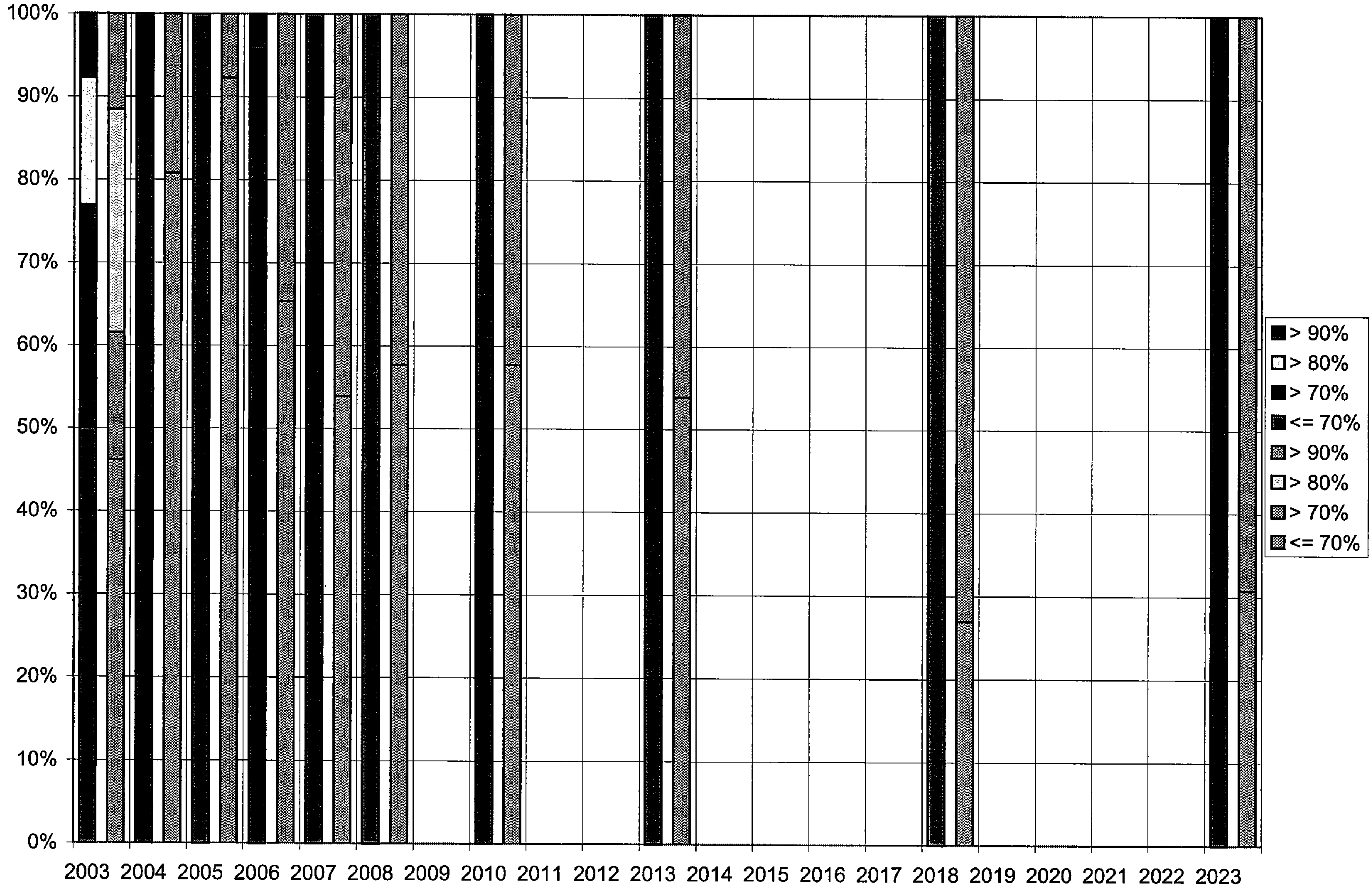
Wasatch Front Zone Utilization
Spatial Load Forecast Base Scenario
(Zone Utilization Threshold 80%)

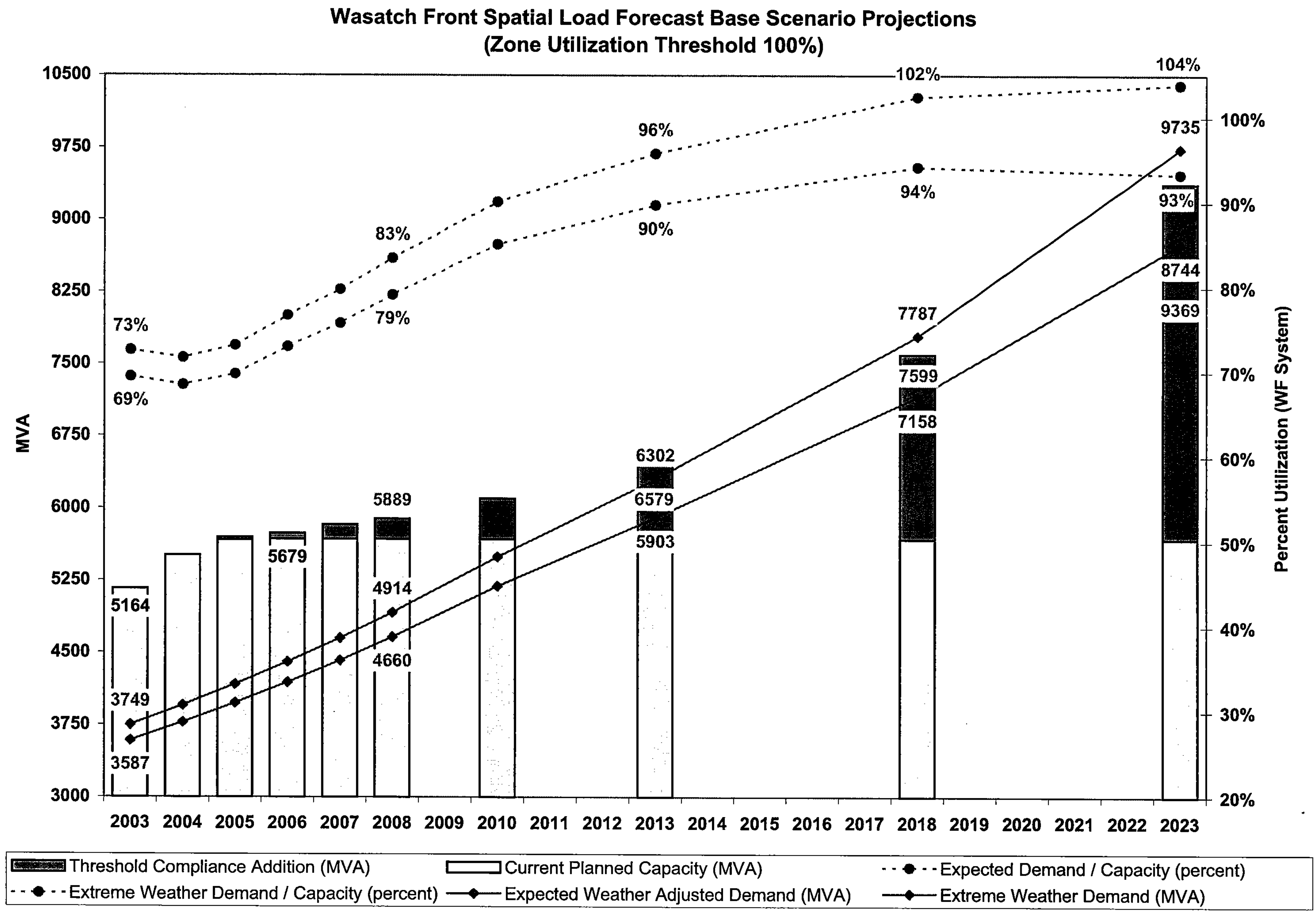



Wasatch Front Zone Utilization
Spatial Load Forecast Mountain View Corridor and Kennecott Scenario
(Zone Utilization Threshold 80%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
> 90%
> 80%
> 70%
<= 70%
> 90%
> 80%
> 70%
<= 70%


Wasatch Front Zone Utilization
Spatial Load Forecast Base Scenario
(Zone Utilization Threshold 70%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
> 90%
> 80%
> 70%
<= 70%
> 90%
> 80%
> 70%
<= 70%

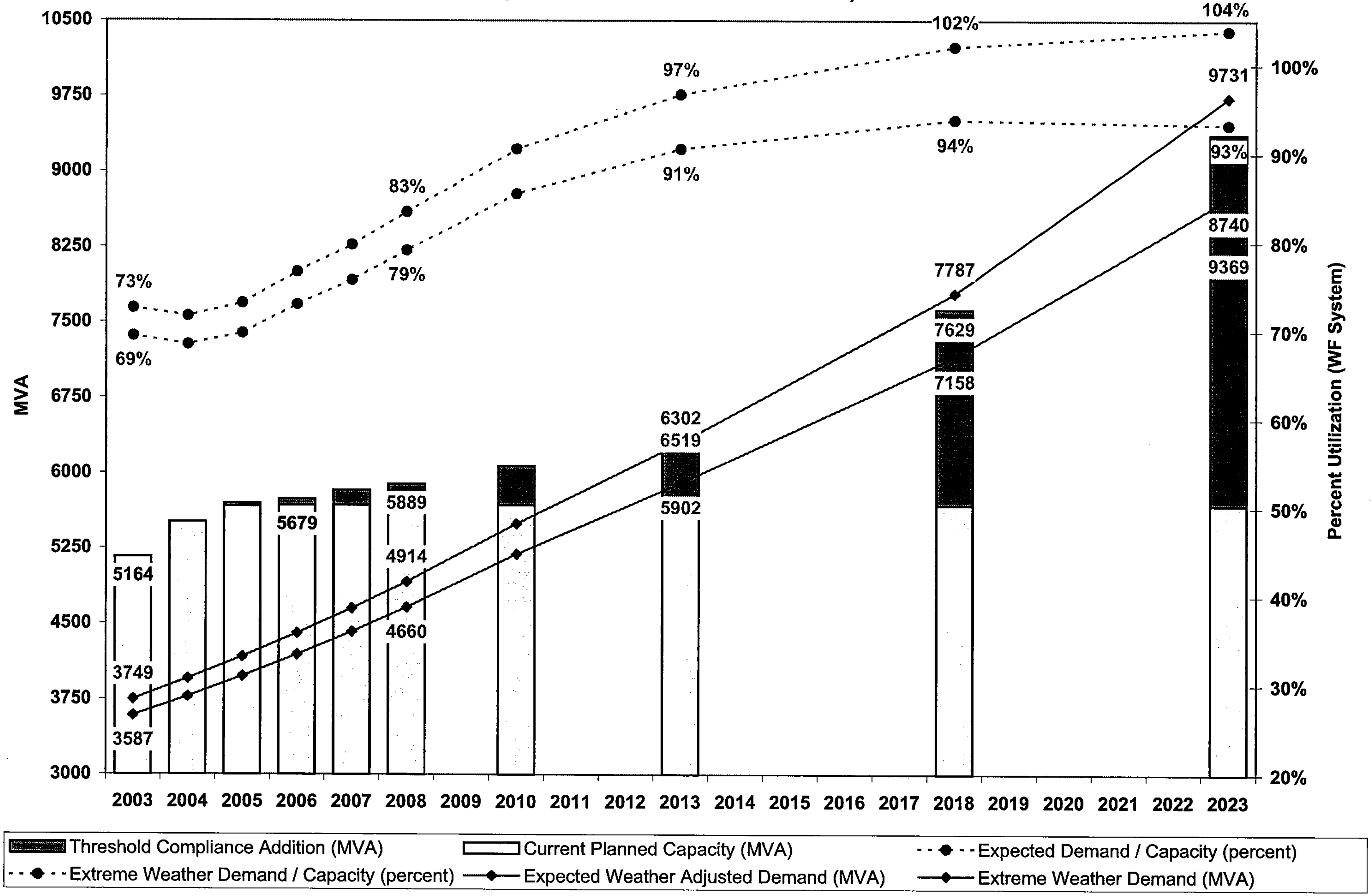
Wasatch Front Zone Utilization
Spatial Load Forecast Mountain View Corridor and Kennecott Scenario
(Zone Utilization Threshold 70%)

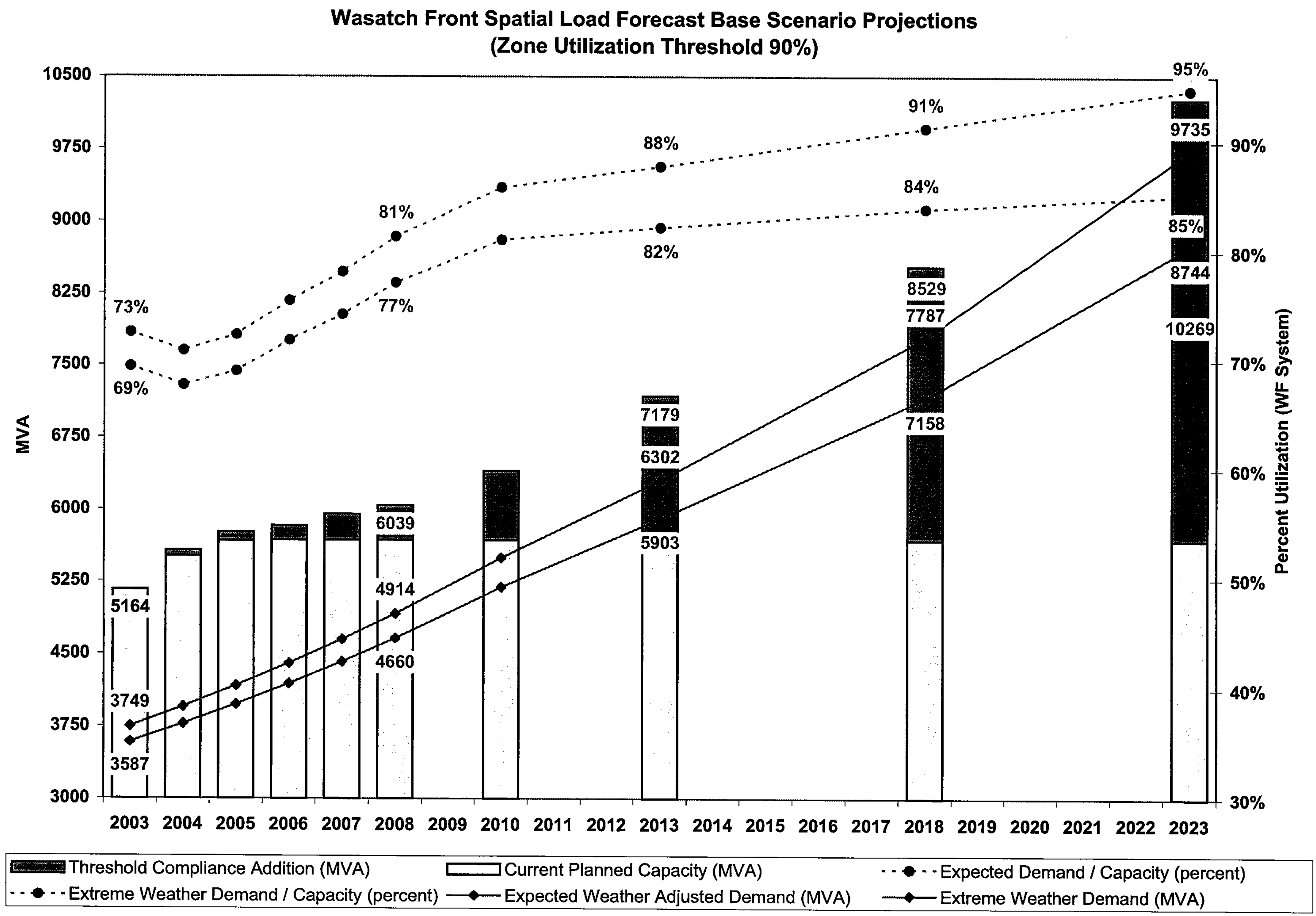




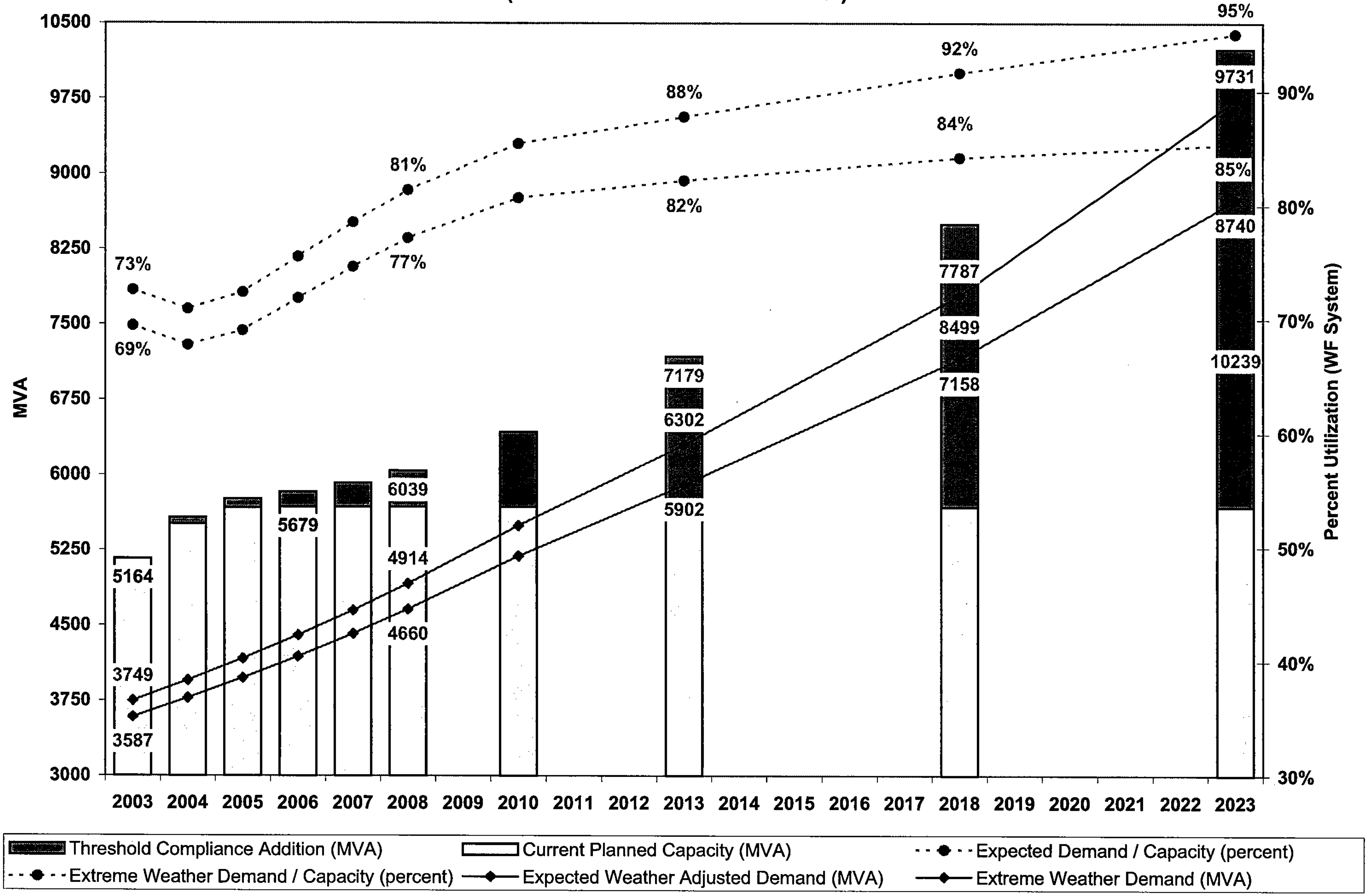
Wasatch Front Spatial Load Forecast Base Scenario Projections
(Zone Utilization Threshold 100%)
MVA
Percent Utilization (WF System)
10500
9750
9000
8250
7500
6750
6000
5250
4500
3750
3000
100%
90%
80%
70%
60%
50%
40%
30%
20%
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
73%
69%
83%
79%
96%
90%
102%
94%
104%
93%
9735
5164
3749
3587
5679
5889
4914
4660
6302
6579
5903
7787
7599
7158
8744
9369
Threshold Compliance Addition (MVA)
Current Planned Capacity (MVA)
Expected Demand / Capacity (percent)
Extreme Weather Demand / Capacity (percent)
Expected Weather Adjusted Demand (MVA)
Extreme Weather Demand (MVA)

Wasatch Front Spatial Load Forecast Mountain View Corridor and Kennecott Projections
(Zone Utilization Threshold 100%)

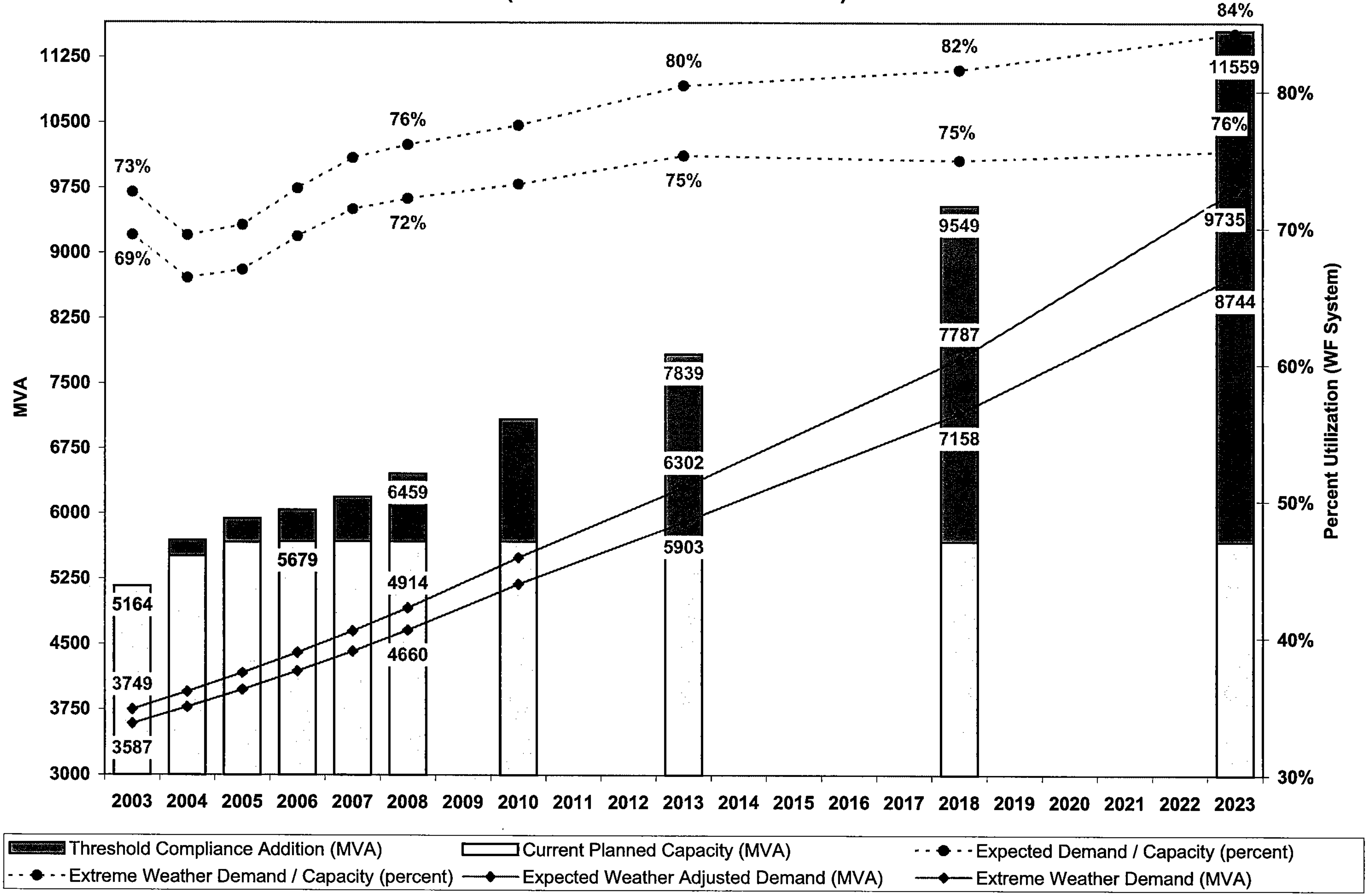


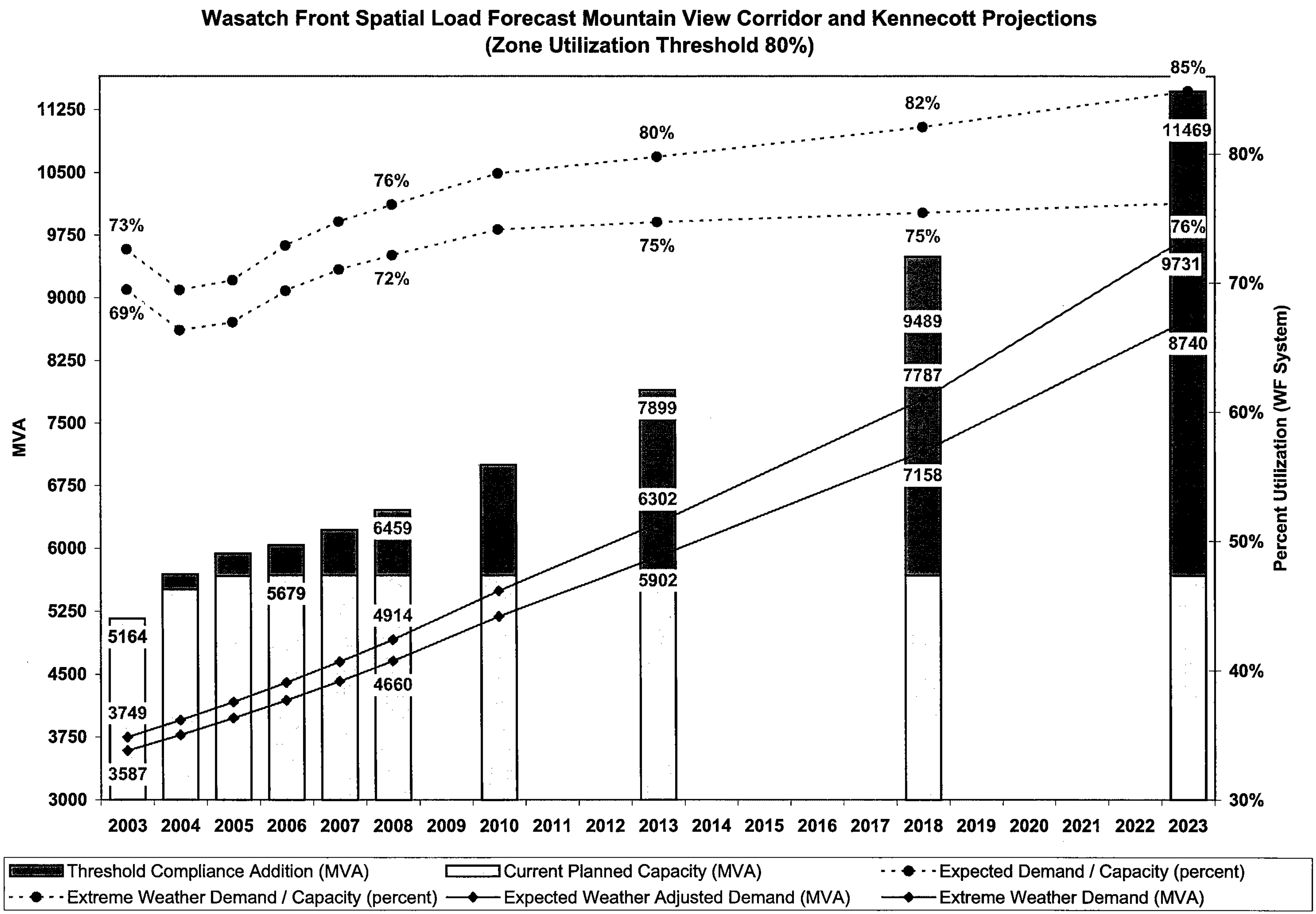

Wasatch Front Spatial Load Forecast Base Scenario Projections
(Zone Utilization Threshold 90%)
MVA
Percent Utilization (WF System)
10500
9750
9000
8250
7500
6750
6000
5250
4500
3750
3000
95%
91%
88%
84%
85%
81%
82%
73%
77%
69%
90%
80%
70%
60%
50%
40%
30%
9735
8744
10269
8529
7787
7158
7179
6302
5903
6039
4914
4660
5164
3749
3587
2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023
Threshold Compliance Addition (MVA)
Current Planned Capacity (MVA)
Expected Demand / Capacity (percent)
Extreme Weather Demand / Capacity (percent)
Expected Weather Adjusted Demand (MVA)
Extreme Weather Demand (MVA)

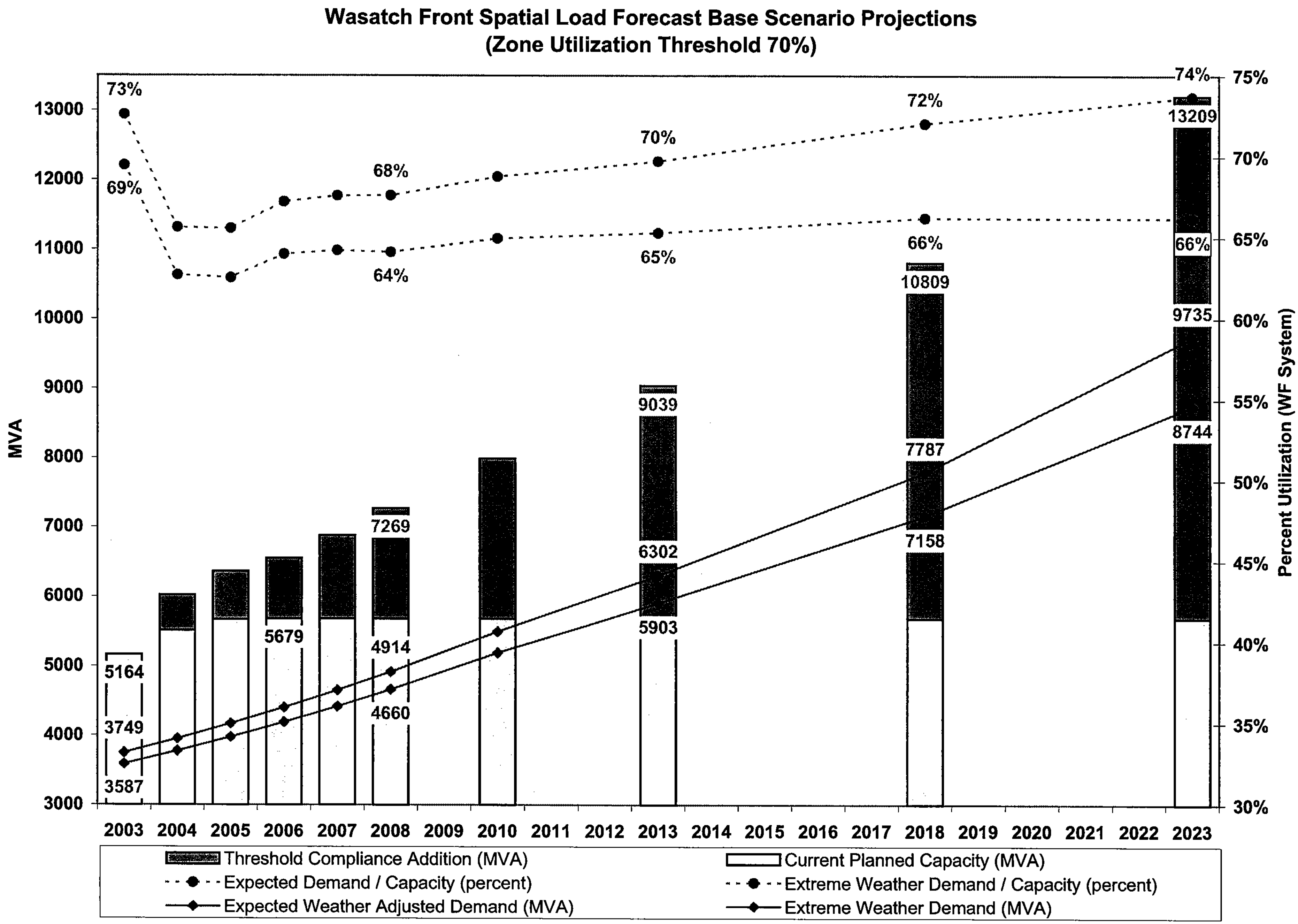
Wasatch Front Spatial Load Forecast Mountain View Corridor and Kennecott Projections
(Zone Utilization Threshold 90%)

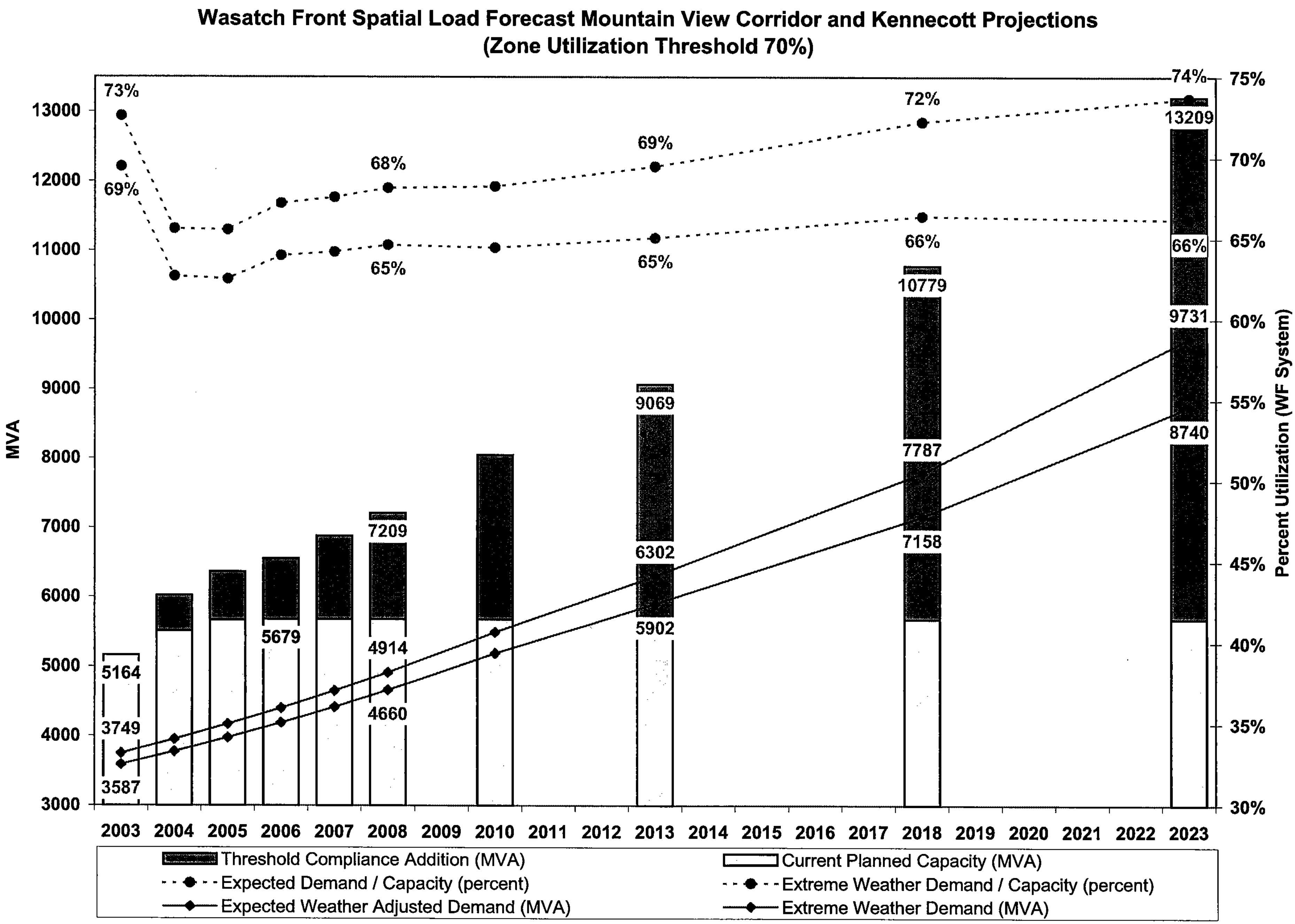


Wasatch Front Spatial Load Forecast Base Scenario Projections
(Zone Utilization Threshold 80%)




Wasatch Front Spatial Load Forecast Mountain View Corridor and Kennecott Projections
(Zone Utilization Threshold 80%)
MVA
Percent Utilization (WF System)
11250
10500
9750
9000
8250
7500
6750
6000
5250
4500
3750
3000
80%
70%
60%
50%
40%
30%
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
73%
69%
76%
72%
80%
75%
82%
75%
85%
76%
5164
3749
3587
5679
6459
4914
4660
7899
6302
5902
9489
7787
7158
11469
9731
8740
Threshold Compliance Addition (MVA)
Current Planned Capacity (MVA)
Expected Demand / Capacity (percent)
Extreme Weather Demand / Capacity (percent)
Expected Weather Adjusted Demand (MVA)
Extreme Weather Demand (MVA)


Wasatch Front Spatial Load Forecast Base Scenario Projections
(Zone Utilization Threshold 70%)
MVA
Percent Utilization (WF System)
73%
69%
68%
64%
70%
65%
72%
66%
74%
66%
5164
3749
3587
5679
7269
4914
4660
9039
6302
5903
10809
7787
7158
13209
9735
8744
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Threshold Compliance Addition (MVA)
Current Planned Capacity (MVA)
Expected Demand / Capacity (percent)
Extreme Weather Demand / Capacity (percent)
Expected Weather Adjusted Demand (MVA)
Extreme Weather Demand (MVA)


Wasatch Front Spatial Load Forecast Mountain View Corridor and Kennecott Projections
(Zone Utilization Threshold 70%)
MVA
Percent Utilization (WF System)
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
75%
70%
65%
60%
55%
50%
45%
40%
35%
30%
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
73%
69%
68%
65%
69%
65%
72%
66%
74%
66%
5164
3749
3587
5679
7209
4914
4660
9069
6302
5902
10779
7787
7158
13209
9731
8740
Threshold Compliance Addition (MVA)
Current Planned Capacity (MVA)
Expected Demand / Capacity (percent)
Extreme Weather Demand / Capacity (percent)
Expected Weather Adjusted Demand (MVA)
Extreme Weather Demand (MVA)