

Payson City Power

Capital Facility Plan

2024-2029

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1. BACKGROUND

1.1 Introduction

This report was prepared to document the capital improvements that are required to continue to meet the requirements of the Payson City electrical power system during the period 2024-2029. The Payson City Power Department is responsible for distributing power to consumers within the city of Payson, Utah, in Utah County. The Payson City power service area includes all of the incorporated city of Payson, about 13 square miles in area. As of 2023, the city serves about 8,181 customers. The coincident peak power demand of the Payson City power system was 33.79 megawatts (MW) in August 2023.

This study analyzes the existing Payson City power system for its current capacity and analyzes the anticipated load growth to determine the improvements necessary to continue to provide service to consumers throughout the study period. The study was performed with the power system as it was configured in August 2023.

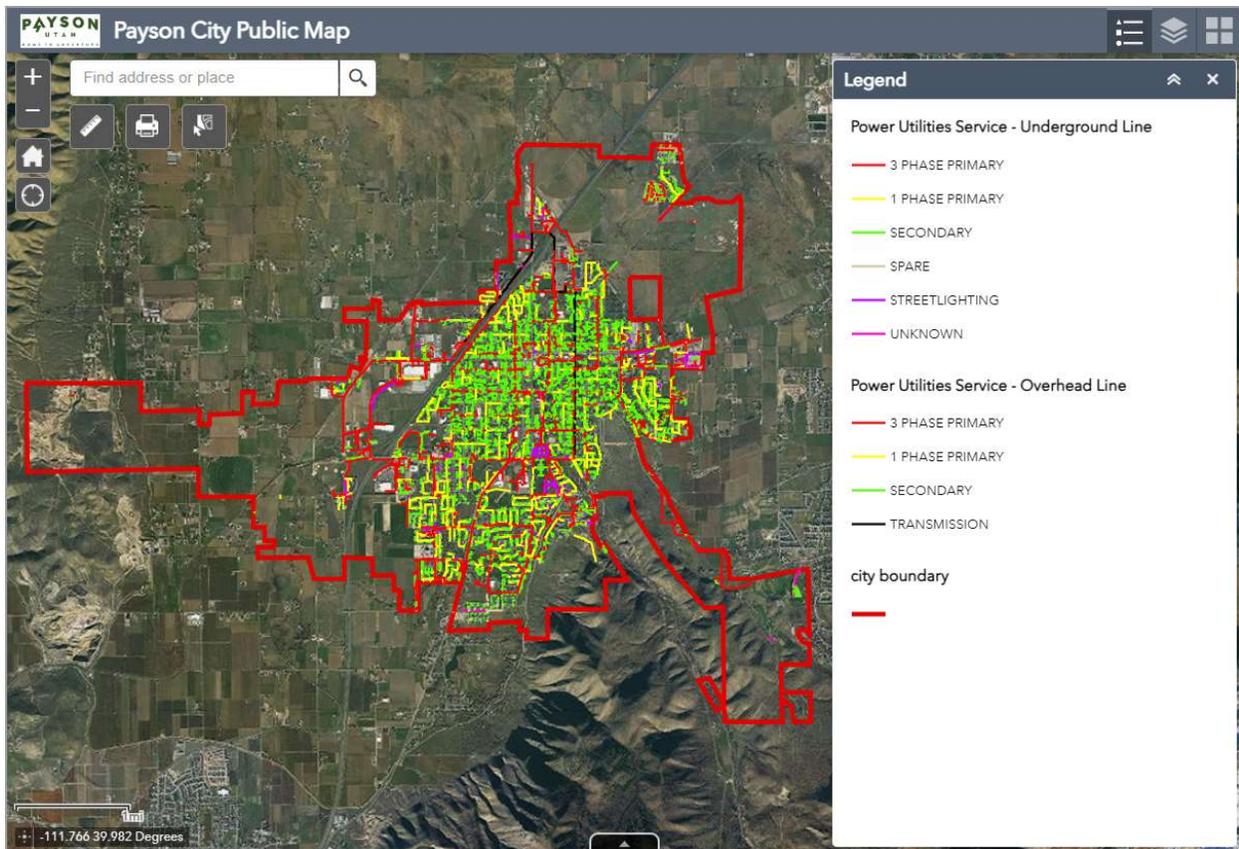


Figure 1. Payson City Power Distribution System Map

1.2 Population

The 2010 Census population of Payson City was 18,294. The 2020 Census population of Payson City was 21,101. The projected 2023 population is 23,869. The graph below shows the census population from 2020 and projected population 2020-2032 based on an average growth rate of 3.83% per year.

Development is moving north, south, and west from Payson center, with commercial development planned west of Interstate 15. This trend is predicted to continue for several decades, and the community is projected to grow rapidly for at least two decades.

According to this scenario, the city will have a projected population of 30,000 by 2030. Growth is expected to slow after that date, growing at a projected AAGR of 2.1% until reaching a build-out population. The projected population of Payson is about 65,000 in 2050 to 2060.

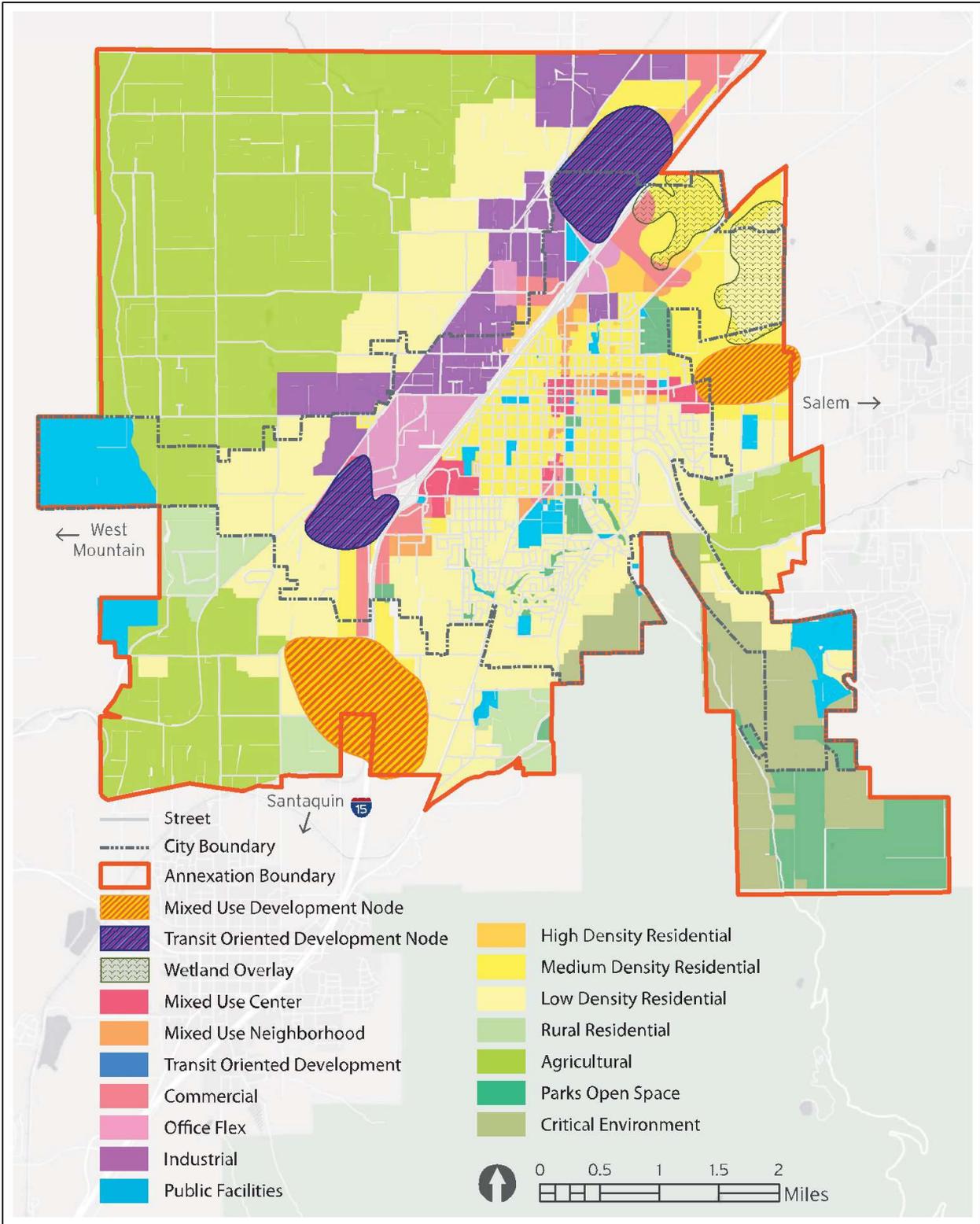


Figure 3. Payson City Future Land Use Map, General Plan

Figure 5 shows the major proposed development area and the electrical load estimated for each. Table 1 shows the data that was used in the spatial load estimate. Appendix C shows the calculation basis that was used for estimating the load of the proposed large developments.

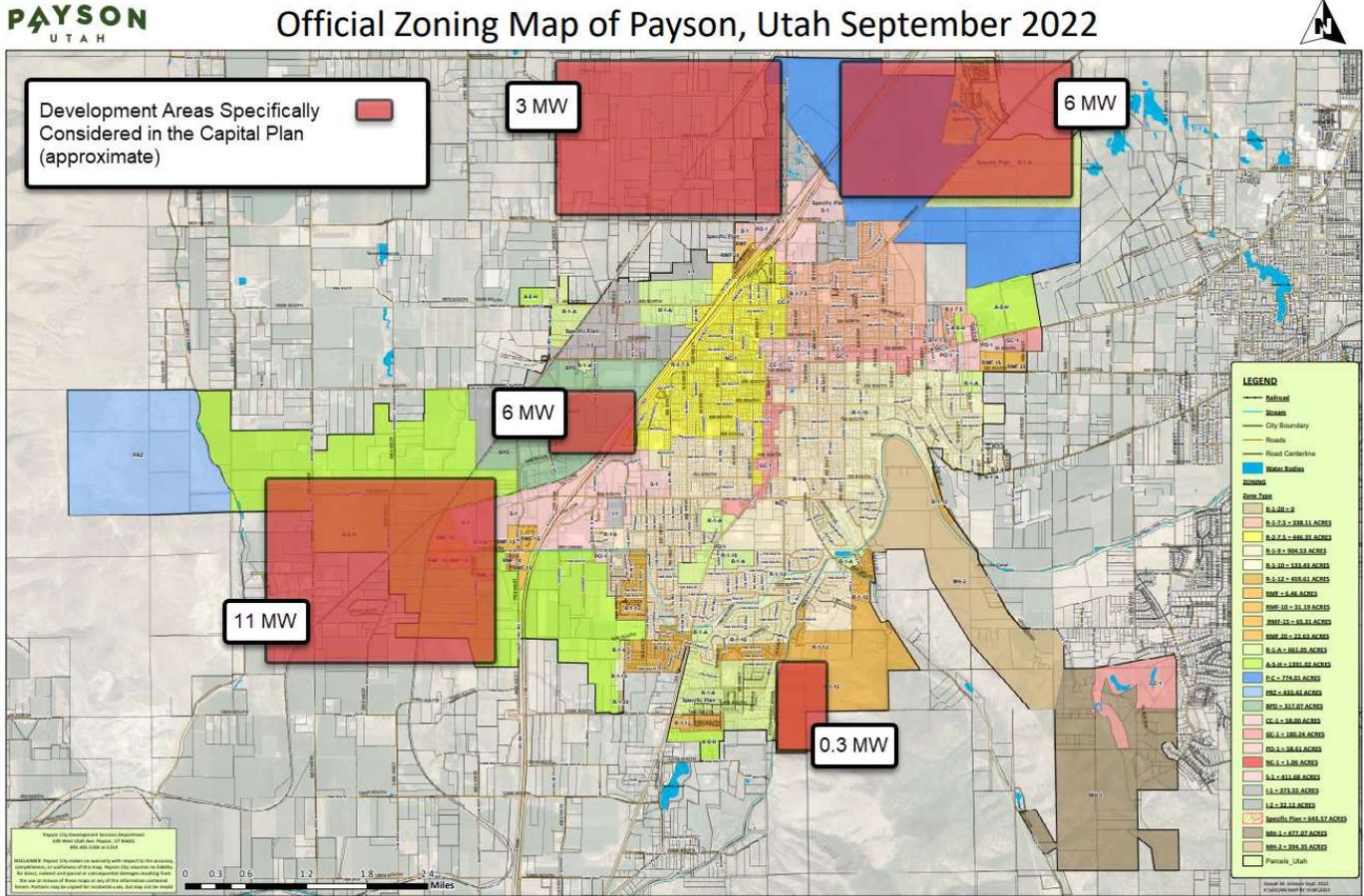


Figure 5. Major Development Areas with Estimated Load

Table 1. Development Area Load Forecast

New Load	2024-2029 Forecast Known/Proposed Additions Demand (MW)	2030-2033 Forecast Known/Proposed Additions Demand (MW)
Northwest Payson	1.5	1.5
Arrowhead Trail Area	6	unknown
South	0.3	unknown
Southwest	8	3
Business Park	4	2
Total	19.8 MW	6.5 MW

About 19.8 MW of the total spatial forecast demand will be used as the 2024-2029 spatial forecast load. The 2030-2033 spatial forecast demand of an additional 6.5 MVA is for the eventual development of these areas that may take longer than the 5-year period considered in this study.

The overall power demand forecast that considers this spatial load forecast is developed in Section 2.3. The full power demand forecast by feeder is provided in the Appendix B.

2. SYSTEM OVERVIEW

2.1 Existing Infrastructure

2.1.1 Supply

Payson City is a member of the Utah Associated Municipal Power Systems (UAMPS), an organization that allows each member to invest collectively in projects which benefit each specific member. Through UAMPS the city is able to participate along with other Municipalities in projects including wind, natural gas, hydroelectric, solar and geothermal generation.

Electric power is supplied to Payson City through the transmission substations and lines owned and maintained by Southern Utah Valley Power Systems (SUVPS) at 46 kV transmission voltage. This transmission system delivers power at Payson's Power Plant substation.

A map of the SUVPS power system is included as Figure 6. The city is located at the southernmost edge of the SUVPS system.

Southern Utah Valley Power Systems 2022

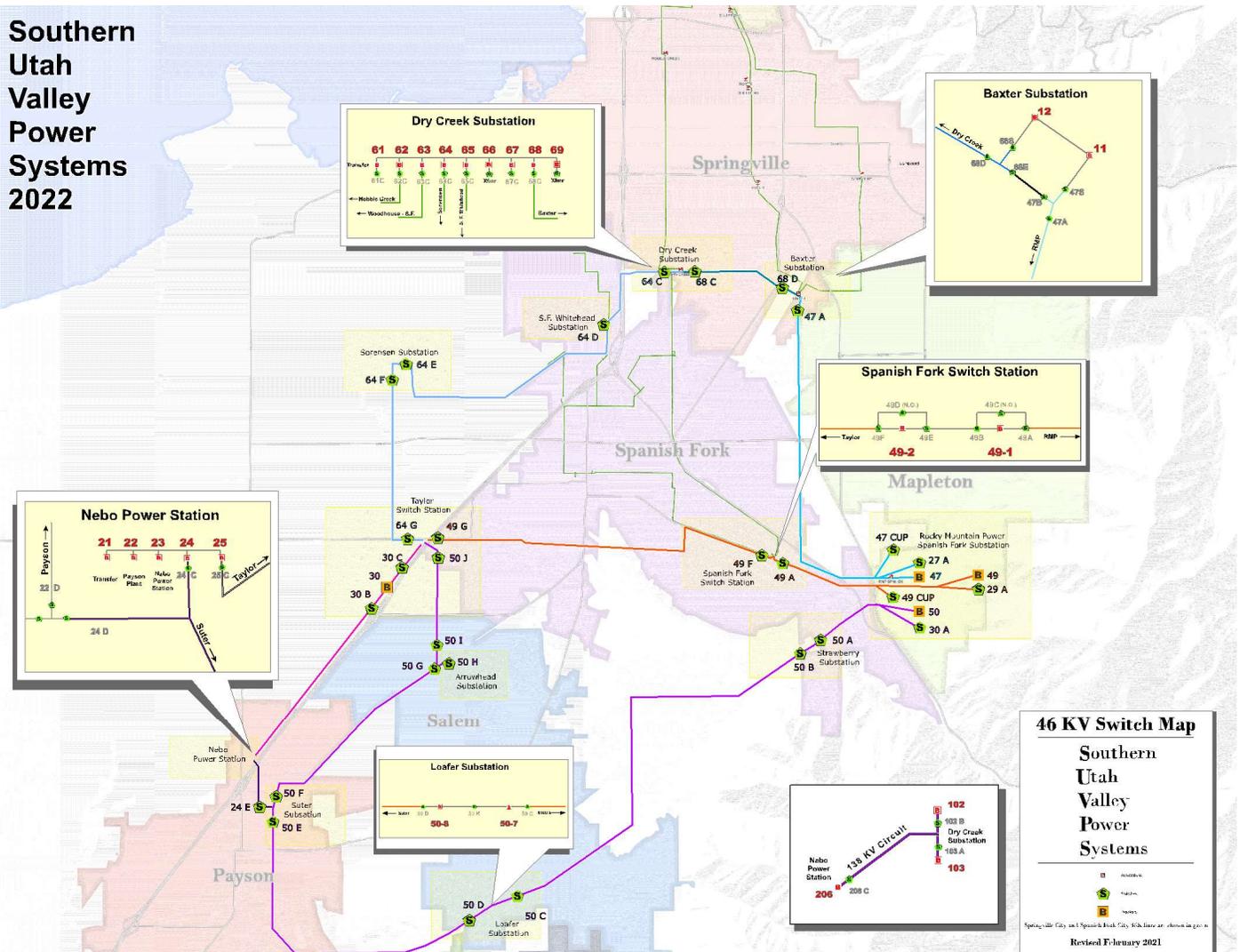


Figure 6. SUVPS System Map

Payson City owns five 46 kV-12.47 kV distribution substation transformers, two located at Industrial substation and one located in each other substation—Power Plant, Downtown and Racetrack substations.

The present total system substation transformer capacity is 49 MVA in normal operation. The distribution substations and their associated transformers, ratings, loading, and remaining capacities are listed in Table 2.

Table 2. Existing Substation Transformers

Substation	Transformer	Base Rating-- Capacity used for normal load (MVA)	Top Rating— Maximum Capacity used for “N-1” Contingency (MVA)	August 2023 Recorded Loading (MVA)	Remaining Transformer Capacity Available (MVA)
Downtown	T1	10	12	8.6	1.4
Racetrack	T1	10	10	11.6	-1.6
Power Plant	T1	5	5	6.57	-1.57
Industrial	T1	12	20	3.9	8.1
Industrial	T2	12	20	11.0	1.0
Total		49		41.67	7.33

2.1.2 Distribution System

From the Payson distribution substations there are twelve (12) 12.47/7.2 kV distribution feeders in service and two (2) spare feeders. Table 3 shows the recorded load on each of the active feeders in August 2023 and the remaining capacity available on each feeder.

These distribution feeders leaving the substations are generally constructed with 250 kcmil, 500 kcmil, or 1100 MCM aluminum (Al) underground cable, feeding 4/0 ACSR overhead conductor. The distribution feeders have rated capacity—270 to 450 amps (4.75 to 11.45 MVA). The ratings of the feeders are determined based on the limiting relay settings of the feeder protection. Rating limits are based on the conductor and the other equipment (e.g., reclosers, switchgear, elbows, bushings, connectors, etc.) in the main line of the system.

Table 3 Payson Feeder Loads

Payson City Substations and 2023 Peak Demand							
Substation	Feeder #	Conductor Size	Relay Settings	Rated Feeder MVA	2023 Feeder MW Peak	2023 Feeder MVA Peak (Calculated)	Remaining Capacity Available
Downtown Substation	310	250 MCM	380 amps	8.2	2.2	2.4	5.8
	320	250 MCM	380 amps	8.2	2.5	2.7	5.5
	330	250 MCM	380 amps	8.2	3.9	4.2	4
Race Track Substation	410	500 MCM	380 amps	8.2	4.4	4.7	3.5
	420	500 MCM	380 amps	8.2	2.7	2.9	5.3
	430	500 MCM	380 amps	8.2	4.5	4.8	3.4
Power Plant Distribution Substation	610	500 MCM	270 amps	5.8	3.45	3.7	2.1
	620	500 MCM	270 amps	5.8	3.12	3.3	2.5
Industrial Substation (two transformers)	510	500 MCM	380 amps	8.2	1.2	1.3	6.9
	520	500 MCM	380 amps	8.2	2.7	2.9	5.3
	530	(Spare)			Spare (un used)	Spare (un used)	
	710	1100 MCM	450 amps	9.7	2.8	3	6.7
	720	(Spare)			Spare (un used)	Spare (un used)	
	730	1100 MCM	450 amps	9.7	8.2	8.7	1
Total Feeder Rated Capacity				96.6 MVA	Total Remaining Capacity		52

Conductors for the distribution delivery system are either located overhead on utility poles or buried underground. Distribution is normally three-phase in order to serve all types of customers; residential, commercial, and industrial.

2.2 Design Criteria (Level of Service Standards)

The city plans, designs and operates its system based on the following criteria:

- Transformer ratings under varying load levels and loading conditions must remain below their base rating;
- The system must be able to adequately serve load under single contingency (N-1) situations, where “N” is power system elements such as a transformer or line;
- The system switching required under an N-1 contingency should remain as simplified as possible to ensure that switching orders not become unnecessarily complex;
- Distribution circuit loading criteria must remain below 90% of the circuit’s maximum current rating during normal operation;
- Primary circuit voltage must remain between 95% and 105% of its nominal value; and

- Distribution circuit main lines must be able to serve additional load under N-1 contingencies.

The above criteria were used to determine Payson’s future facility needs based on the amount of load (i.e., demand) placed on the existing system over a pre-determined CFP/IFFP planning horizon (e.g., one, three, six and ten years). This ensures that there is sufficient reserve capacity built in the system to maintain service during the loss of a substation transformer or feeder during the peak load season.

The system voltage design criteria of the Payson City Power Department are to maintain voltage within a range of +/- 5% of nominal value in normal operation, and within a range of -10% to +5% of nominal value during short-term emergency operation. Table 4 lists these loading and voltage design criteria.

Table 4. System Design Criteria (Level of Service)

Element	Normal System	During Emergency (“N-1” Contingency)
Substations transformer loading	100% of Base Rating	100% of Highest Nameplate Rating
Main line feeder Loading	90% of the conductor rating	100% of the conductor rating
Voltage	+/- 5% of nominal (0.95 p.u. to 1.05 p.u.)	+ 5% to -10% of nominal (0.90 p.u. to 1.05 p.u.)

Table 5. Conductor Design Criteria Ratings

Conductor	Use	Design Criteria Rating, 90% (amps)	100% Full Rating—Use during “N-1” Contingency Recovery (amps)
1000 or 1100 kcmil Aluminum	Underground mainline	540 amps	600 amps
500 kcmil Aluminum	Underground mainline	346 amps	385 amps
250 kcmil Aluminum	Underground mainline	229 amps	255 amps
4/0 URD Aluminum	Underground mainline	207 amps	230 amps
477 kcmil ACSR	Overhead mainline	540 amps	600 amps
4/0 ACSR	Overhead mainline	306 amps	340 amps

Being able to continuously operate at an acceptable N-1 contingency level means that the system can withstand the loss of any single system component (equipment, transmission line, source, etc.) while still providing service to its customers at an acceptable standard of service as defined in Table 4. In order to verify that the city maintains N-1 contingency for its current system as well as for the future growth, the system model was modified to remove electrical components from service. Single contingency (N-1) analysis was conducted for individual substation transformers, and certain critical main lines.

As an example, if one of the substation transformers fails, the load being fed from that transformer must be fed from any of a combination of the remaining substation transformers. This load is transferred over to neighboring substation transformers by use of substation bus ties or distribution switches at the 12.47kV level. The transfer of this load from one transformer to its neighbors necessitates that both the neighboring transformers have enough available capacity to serve this additional load and that the distribution system is robust

enough to support the transfer of the additional demand through the 12.47kV distribution system.

2.3 Peak Power Demand and Forecast

The coincident peak power demand of the Payson City power system was 33.793 megawatts (MW) in August 2023 (8/17/2023).

The Payson City historic peak power average growth rate is 2.7% per year over the seven-year period 2016 to 2023. Average typical load addition to the power system has historically been about 661 kW annually. The historic 2013-2021 peak power demand for Payson City—obtained from UAMPS annual reports—is shown on Figure 7, along with the projected peak power demand developed in this study for 2023-2032.

The projected peak shown on the chart shown in Figure 7 is calculated starting with the 2023 measured peak demand and applying a peak power demand growth rate of 1.24% annually, and the addition of estimated proposed loads of development through 2033 and the addition of 1.24% annual demand growth thereafter.

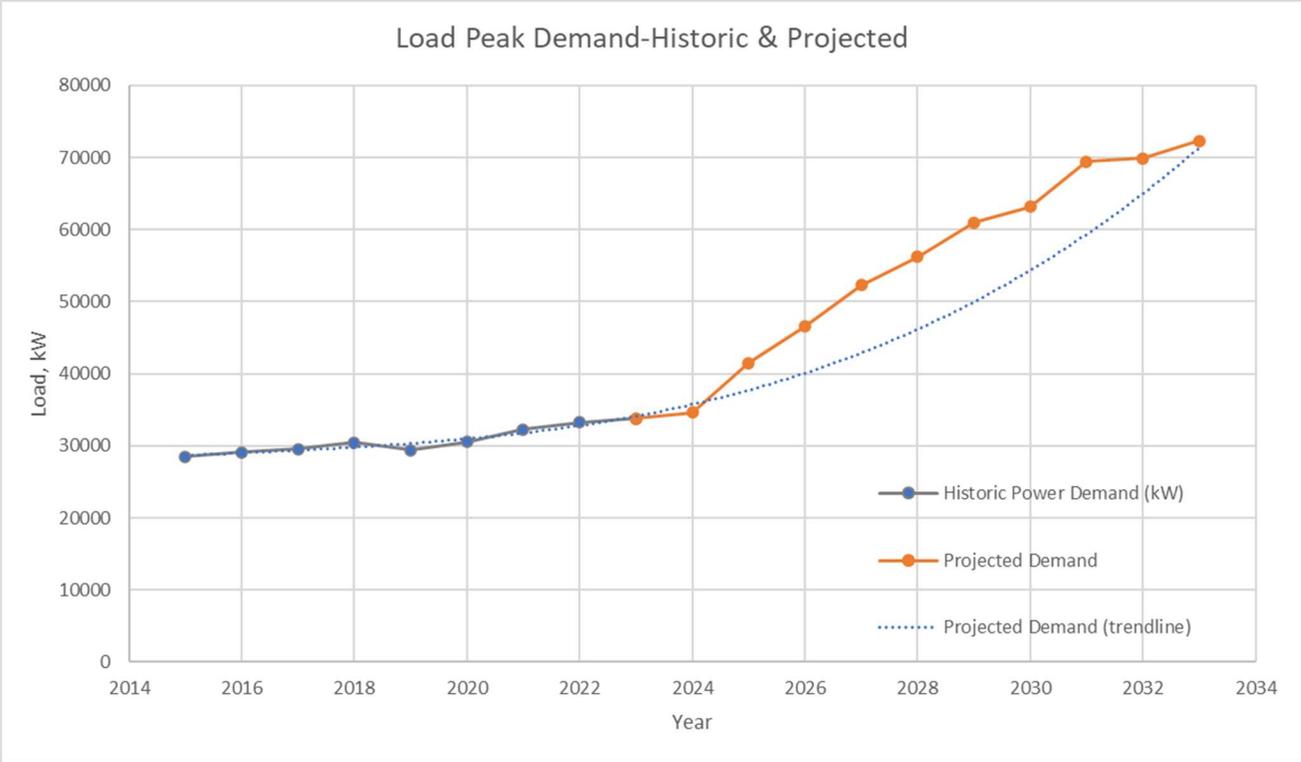


Figure 2. Power Peak Demand Chart

NOTE: Historic loads were obtained from UAMPS annual reports

Plans from developers that were mentioned in Sections 1.3 to 1.5 total an estimated load of about 26 MW. It is expected that the developer proposed new load will take 10 or more years before this full additional load will be seen on the system.

The known/proposed additions are combined with the normal demand growth forecast to estimate the total demand that could be expected. The results predict that about 16 to 26 MW will be added to the Payson Power system in the next 5 years.

The load forecast which was developed in cooperation with the Payson City Power Department for 2024 to 2033 at the substation level as shown in Table 6 was the load growth used in the study. The chart in Figure 7 and the load forecast in Table 6 reflect the estimates determined with the city power department. Table 6 shows the actual August 2023 and estimated 2024-2033 loading on the Payson substation transformers. A load forecast by feeder is in Appendix B.

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Table 6. Payson City Load Forecast

Payson Power Load Forecast		Transformer Summary												
		2023	to	2033										
Substation/Transformer	Growth Rate	Transformer Rating (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Utilization
Industrial		24 MVA												
Industrial-T1		12 MVA	4.20	4.29	9.39	11.13	11.38	11.44	11.49	11.55	11.60	11.66	11.72	98%
Industrial-T2		12 MVA	11.70	11.85	9.86	10.01	10.55	10.89	11.05	11.20	11.36	11.52	11.68	97%
Industrial Sub Total		MVA	15.90	16.14	19.25	21.14	21.93	22.33	22.54	22.75	22.97	23.18	23.40	
Power Plant		5 MVA												
Power Plant-T1		5 MVA	7.00	7.11	4.65	4.73	4.83	4.92	5.01	5.10	5.20	5.29	5.39	108%
Power Plant Sub Total		MVA	7.00	7.11	4.65	4.73	4.83	4.92	5.01	5.10	5.20	5.29	5.39	
Race Track		10 MVA												
Race Track T1		10 MVA	12.40	12.60	11.48	11.63	10.87	11.03	11.19	11.36	11.52	11.69	11.87	119%
Race Track Sub Total		MVA	12.40	12.60	11.48	11.63	10.87	11.03	11.19	11.36	11.52	11.69	11.87	
Downtown		10 MVA												
Downtown-T1		10 MVA	9.30	9.45	8.57	8.69	8.81	8.93	9.05	9.18	9.30	9.43	9.56	96%
Downtown Sub Total		MVA	9.30	9.45	8.57	8.69	8.81	8.93	9.05	9.18	9.30	9.43	9.56	
New North Arrowhead		12 MVA												
Arrowhead North-T1		12 MVA	0.00	0.00	3.30	4.51	6.29	7.82	7.97	7.97	10.89	10.89	10.89	91%
Arrowhead North Sub Total		MVA	0.00	0.00	3.30	4.51	6.29	7.82	7.97	7.97	10.89	10.89	10.89	
New South		12 MVA												
New South-T1		12 MVA	0.00	0.00	3.74	4.62	8.66	10.43	10.43	10.43	10.43	10.43	10.43	87%
New South Sub Total		MVA	0.00	0.00	3.74	4.62	8.66	10.43	10.43	10.43	10.43	10.43	10.43	
New West		12 MVA												
New West-T1		12 MVA	0.00	0.00	0.00	0.00	0.00	0.00	4.41	6.18	7.32	7.32	9.53	79%
New West Sub Total		MVA	0.00	0.00	0.00	0.00	0.00	0.00	4.41	6.18	7.32	7.32	9.53	
Grand Total	Forecast (Calculated, MVA)		44.6	45.3	51.0	55.3	61.4	65.5	70.6	73.0	77.6	78.2	81.1 MVA	
	Forecast (Calculated, MW @ 0.95 pf)		42.4	43.0	48.4	52.6	58.3	62.2	67.1	69.3	73.7	74.3	77.0 MW	

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3. STUDY SUMMARY

3.1 System Modeling

The Payson City power system modeling was performed using the EasyPower 11.0 software application for electrical power system analysis. The model of the Payson power system was created in EasyPower and used in this capital facilities plans. It was developed using power system maps and field information.

The 2023 system peak was recorded in August 2023 for the Payson Power system. This load was used as the base in the system model at the beginning of the study period. The August 2023 peak load, system load measurements, and major customer connection points established in the model were used to allocate the load in the model on the system feeders. The power flow analysis was performed to evaluate the system compliance with the design criteria for the base year to identify any existing current (conductor overload) and voltage (bus low voltage) deficiencies. Known upcoming load additions and load growth corresponding to the map in Section 1.5 were then added to the system over the study period until known developments are completed, assumed in 2033. The power flow analysis was then run on the system model. The system voltage and current (transformer or conductor) deficiencies were identified for various periods of load growth at multi-year intervals until 2033.

The system model was studied in both normal operation and multiple “N-1” scenarios. Analysis of the system was performed under the “N-1” scenarios of the loss of each substation transformer to determine what system improvements were needed in order to restore and serve the customers while maintaining the emergency design criteria limits in Table 4. In a substation with two transformers, loss of one transformer or loss of one feeder at a time was studied in the analysis as the worst case. As various system components are removed from service in the system model the areas of deficiency caused by “N-1” contingencies can be identified. These are instances where the substation transformer or feeder loading exceeds the “emergency” design criteria of 100% rated capacity, or when voltage drops below 90% of nominal voltage. The top transformer rating, and 100% of the conductor rating are the design criteria limits used for “N-1” scenarios.

Projects were identified for accommodating the load growth and fixing the deficiencies that were identified. Tables 7 through 10 list the deficiencies identified in normal operation and in “N-1” contingencies.

3.2 Existing Deficiencies

The August 2023 recorded load on the Power Plant substation transformer appears to have been over the 5 MVA base rated loading design criteria. In addition, the Racetrack substation transformer appears to have been over the 10 MVA base rated loading design criteria in August 2023.

The loading of the Power Plant substation transformer can be resolved by switching to transfer load off the Power Plant feeders.

To reduce the load on the Racetrack substation transformer a new south substation will need to be built with feeders that take some load off Racetrack feeders.

Table 7. Existing Deficiencies

Issue #	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% for normal, 100% for “N-1”)	Proposed Solution
2023-1	Power Plant substation transformer	2023 (34 MW)	7 MVA	140%	Transfer load off feeders 610 and Power Plant substation, to feeder 510—Industrial substation transformer T1.
2023-2	Racetrack substation transformer	2023 (34 MW)	12.4 MVA	124%	Transfer some load off of feeder 410, 430 and Racetrack substation, to feeder 710 and a new feeder from a new south substation.

3.3 Growth Caused Deficiencies

When the proposed load from the planned commercial and residential developments, and the anticipated load growth are added to the system model the deficiencies caused by growth can be identified. Each time a system deficiency was identified a project was assigned and assumed to be implemented before the next analysis was run. The criteria given in Table 4 and Table 5 were used to determine deficiencies caused by load growth. The following tables list the deficiencies identified as system load is increased. The tables are divided into the projected years the deficiencies are predicted.

3.3.1 2025 Deficiencies

The system load in 2025 is forecast to be about 48 MW (51 MVA), while the capacity of the power system transformers is 49 MVA (the sum of the transformers base ratings). The system load in 2025 is forecast to be 104% of the capacity of the power system transformers, indicating the need for additional substation transformer capacity in the system. It is assumed for 2025 that the new south substation is installed as a solution for the Racetrack substation transformer overloading issue.

There are three deficiencies during normal operating conditions in 2025.

Table 8. Deficiencies in 2025

Issue #	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is base rating, top rating for “N-1”)	Proposed Solution
2025-1	Power Plant substation transformer	2025 (48 _{MW})	8.2 MVA	164%	Build a new substation in the north near Arrowhead Trail to take about 3.2 MVA of the load off feeder 620 and Power Plant substation.

Issue #	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is base rating, top rating for “N-1”)	Proposed Solution
2025-2	Industrial transformer T2	2025 (48 _{MW})	13.23 MVA	110%	Build tie between feeder 730 and 510 about 1700 W 800 S, to off-load some of feeder 730 load and Industrial transformer T2
2025-3	Feeder 730 1100 MCM protective relay setting	2025 (48 _{MW})	450 amps	100%	Raise the protective relay minimum trip setting, or transfer some load off feeder 730 with a tie between feeder 730 and 510 (solution of issue 2025-2)

3.3.2 2027 Deficiencies

There are two related deficiencies during normal operating conditions in 2027 due to the growth in the southwest area of the system. Both issues have the same proposed solution—to move some load off feeder 510 to a new feeder from the new south substation.

The 2027 scenario assumes that the solutions to the 2025 issues have been implemented, specifically that a new south substation has been built.

Table 9. Deficiencies in 2027

Issue #	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria for sub transformer is 100% normal, 167% for “N-1”)	Proposed Solution
2027-1	Industrial Substation Transformer T1	2027 (58 _{MW})	14.8 MVA	123%	Feed the new development in the Red Bridge area with a new line from the new South substation.
2027-2	Feeder 510 500 MCM	2027 (58 _{MW})	555 amps	144%	Feed the new development in the Red Bridge area with a new line from the new South substation.

3.3.3 2029 Deficiencies

There are two deficiencies in 2029 during normal operation.

Table 10. Deficiencies in 2029

Issue #	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% normal, 100% for “N-1”)	Proposed Solution
2029-1	Downtown Substation Transformer T1	2029 (67 _{MW})	10.12 MVA	101%	Transfer some feeder 330 load (hospital/SR198) to a new feeder from the new substation in the north near Arrowhead Trail
2029-2	Feeder 510 500 MCM main line	2029 (67 _{MW})	398 amps	103%	Reconductor mainline 500 MCM with 1100 MCM

3.3.4 2033 Deficiencies

In 2030 the total system load is forecast at 73 MVA, the same at the substation transformer normal operation capacity (subject to the addition of substation transformers at Arrowhead and South substation). The total system load forecast is 81 MVA in 2033.

Table 11. Deficiencies in 2033

Issue #	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% normal, 100% for “N-1”)	Proposed Solution
2033-1	System substation transformation capacity	2033 (77 _{MW})	81.1 MVA	111%	In about 2030 add a new substation. A substation site in the southwest part of the system is assumed.

3.4 “N-1” Contingency Deficiencies

When the system experiences the loss of a critical component (an “N-1” contingency condition) such as the loss of a substation transformer or feeder main line, the system must be able to be configured to restore service to the customers. The criteria given in Table 4 and Table 5 were used to determine deficiencies caused by “N-1” contingency conditions. The following tables list the “N-1” contingency condition deficiencies identified as system load is increased. The tables are divided into the projected years the “N-1” deficiencies are predicted. Each time a system deficiency was identified a project was assigned and assumed to be implemented before the next analysis was run.

3.4.1 Existing “N-1” Deficiencies

There appear to be about 12 issues that arise from N-1 losses of substation transformers at peak when other feeders are used to pick up the load normally carried.

Table 12. Existing N-1 Deficiencies

Element Loss	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% for normal, 100% for “N-1”)	When Issues Occurs/Proposed Solution
Power Plant Sub	310 Getaway 250 kcmil	2023 (34 MW)	266 amps	104%	Using 330 to pick up 620 loads. Build a new substation in the north near Arrowhead Trail to carry load upon the loss of the Power Plant sub transformer or feeder 620.
Downtown Sub	Power Plant Sub	2023 (34 MW)	8.2 MVA	160%	Using 620 to pick up 330. Build a new substation in the north near Arrowhead Trail to carry load upon the loss of the Downtown sub transformer or feeder 330.
Downtown Sub	Racetrack substation transformer	2023 (34 MW)	14.85 MVA	145%	Using 410 to pick up 320. Off load the Racetrack substation transformer with the new south substation feeder to make capacity for picking up the 320 feeder load and other Downtown substation load.
Downtown Sub	I-15 crossing 2/0 at 200 North	2023 (34 MW)	243 amps	135% (of 180 amps)	Using I-15 crossing (610/510) fed from 510 to pick up 310. Reconductor the 2/0 OH on 510/610 to feed 310

Element Loss	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% for normal, 100% for “N-1”)	When Issues Occurs/Proposed Solution
Racetrack Sub	Downtown Substation transformer	2023 (34 MW)	12.1 MVA	101%	Using 320 to pick up part of 420 and 330 to pick up part of 420. Feed parts of 420 and 430 with the new south substation feeders.
Racetrack Sub	320 Getaway 250 kcmil, And 4/0 ACSR 300 S 200 W	2023 (34 MW)	340 amps	133%	Using 320 to pick up 410. Reconductor 320 mainline.
Racetrack Sub	330 Getaway 250 kcmil	2023 (34 MW)	316 amps	124%	Using 330 to pick up 420. Reconductor 4/0 Al UG on 500 E. Alternatively, Feed parts of 420 with the new south substation feeders.
Racetrack Sub	730 Getaway 1100 MCM	2023 (34 MW)	606 amps	101%	Using 730 to pick up 430. Feed parts of 430 with the new south substation feeders.
Racetrack Sub	730 mainline 250 kcmil Al	2023 (34 MW)	366 amps	144%	Using 730 to pick up 430. Feed parts of 430 with the new south substation feeders.
Industrial Sub T1 510 feeder	730 mainline 500 kcmil, 600 S	2023 (34 MW)	438 amps	114%	Using 730 to pick up 510. Is there switching to tie 710 to 510 for backup?

Element Loss	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% for normal, 100% for “N-1”)	When Issues Occurs/Proposed Solution
Industrial Sub T2 730 feeder	510 mainline 500 kcmil,	2023 (34 MW)	460 amps	119%	Using 510 to pick up 730. Feed parts of 730 with the new south substation feeders.
Loss of east 46 kV to Downtown and Racetrack	South Substation Transformer Feeder 510 mainline 500 kcmil Feeder 430 mainline fed from 830 Feeder 510 4/0 ACSR	2023 (34 MW)	21.5 MVA	108%	Using remaining substations—Industrial and South (assumes South sub and a 46 kV loop) to pick up load from Downtown and Racetrack (about 20 MVA) Build strong tie from 710 to 320 (100 South). Tie 840 to 410 from 1400 South to 800 South. Reconductor 510/610 I-15 crossing.
			484 amps	126%	
			300 amps	130%	
			426 amps	125%	
Loss of west 46 kV to Industrial Sub	South Substation Transformer Downtown Substation Transformer Feeder 320 mainline 500 kcmil Feeder 430 mainline fed from 830 Feeder 510 4/0 ACSR	2023 (34 MW)	20.4 MVA	102%	Using remaining substation to pick up load of Industrial (about 14 MVA) Build Arrowhead substation to feed 330. Build strong tie from 710 to 320 (100 South). Tie 840 to 410 to feed 730 from 1400 South to 800 South. Tie 810 to 510 to feed 510.
			15.2 MVA	127%	
			260 amps	130%	
			300 amps	125%	
			426 amps		

3.4.2 Growth Caused “N-1” Deficiencies

The N-1 deficiencies caused due to growth from 2027 to 2029 are listed in the Tables 13 and 14 in this section. There appear to be about 14 issues that arise from N-1 losses of substation transformers and main feeders at peak when other feeders are used to pick up the load normally carried.

Table 13. 2027 N-1 Deficiencies After new South substation, Arrowhead Sub, and other solutions

Element Loss	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% for normal, 100% for “N-1”)	Proposed Solution
Power Plant Sub	510/610 2/0 OH	2025-27 (48 MW)	276 amps	153%	Recond OH 2/0 610 from 510. 620 from Arrowhead feeder.
Downtown Sub	730 mainline 500 kCMIL, 600 S to 800 S	2027 (58 MW)	509 amps 246 amps after solution	132% 64% after	In picking up 320 from 730. Build 800 S to 1400 S tie to get South Sub Feeder to 800S. Or build strong tie from 710 to 320 on 100 South.
Downtown Sub	I-15 crossing 2/0 at 200 North	2027 (58 MW)	245 amps	136% (of 180 amps) 72% of 4/0 ACSR	Using I-15 crossing (610/510) fed from 510 to pick up 310 (close at Payson Market.) Reconductor the 610/510 I-15 crossing.
Racetrack Sub	730 mainline 500 kCMIL, 600 South to 800 South	2027 (58 MW)	454 amps 245 amps	118% 64%	Using 730 to pick up 410. Build 800 S to 1400 S tie to get South Sub Feeder to 800 South.

Element Loss	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% for normal, 100% for “N-1”)	Proposed Solution
Racetrack Sub	330 mainline 250 kcmil and 4/0 Al URD	2027 (58 MW)	302/299 amps 302/299	119%/130% 78%/78% of 500 kCMIL	Using 330 to pick up most of 420. Reconductor 250 kcmil UG getaway and 4/0 AL UG on 500 E. Or, switches to feed part of 420 from 320, then the 4/0 Al URD overloads.
South Sub	510 mainline 500 kcmil 4/0 ACSR mainline	2027 (58 MW)	552 amps 382 amps	143% 92% of 600 amp 1100 MCM 112% of 340 amps	Using 510 to pick up 810
South Sub	730 500 kcmil mainline	2027 (58 MW)	496 amps	128% 83% of 600 amp 1100 MCM	Using 730 to pick up 810 part and 840
Arrowhead Sub	Downtown Substation Transformer Feeder 330 mainline 250 kcmil, 2/0 Cu, and 4/0 URD and	2027 (58 MW)	15.1 MVA 442 amps	126% 173%	Using 330 to pick up Arrowhead Substation load. Build strong tie from 710 to 320 (100 South) and feed part of 320 load, making room for Arrowhead loads on the Downtown Sub Transformer. Reconductor 330 mainline to feed Arrowhead loads.

Table 14. 2029 N-1 Deficiencies After new South substation, Arrowhead Sub, and other solutions

Element Loss	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% for normal, 100% for “N-1”)	Proposed Solution
Downtown Sub	510 mainline 500 kCMIL,	2029 (67 _{MW})	430 amps	112% 72% of 1100 MCM	In picking up 320 from 810 requires transfer to 510 (So trans sub is 23 MVA). Recond 510 mainline to 1100 MCM. Or build strong tie from 710 to 320 (100 South) and feed 320 load from 710 (shifts 3 MVA from 840 to 710).
South Sub	Industrial Substation T2	2029 (67 _{MW})	24.8 MVA	124%	7 MVA of load on 810 overloads Industrial Substation T2. Requires new substation in the southwest area to back up the South substation.
South Sub	510 mainline 1100 MCM 510 4/0 ACSR	2029 (67 _{MW})	653 amps 484 amps	116% 142%	Using 510 to pick up 810 Move I-15 Crossing of 510 to 310.
South Sub	730 500 kcmil mainline	2029 (67 _{MW})	582 amps	150%	Using 730 to pick up 810 part and 840. Build new I-15 crossing of new 720 feeder from business park to 800 South 1000 West, pick up some load from 730.

Element Loss	Element Over Design Criteria	Year (load level MW)	Loading (MVA or amps)	Percent of Rating (Design criteria is 90% for normal, 100% for “N-1”)	Proposed Solution
Arrowhead Sub	Downtown Substation Transformer Feeder 330 mainline 250 kcmil, 2/0 Cu, and 4/0 URD and	2029 (67 MW)	16.5 MVA 583 amps	138% 229%	Using 330 to pick up Arrowhead Substation load. Build new North substation to backup Arrowhead sub transformer loss
Feeder 730	Feeder 510 mainline 500 kcmil	2029 (67 MW)	466 amps	121%	Using 510 to pick up 730

4. CAPITAL PLAN PROJECTS

This section lists all the capital projects included in the Payson City Capital Projects Plan. Fifteen projects are identified in Table 15 to resolve the issues listed in Tables 7-14 that come up from analysis of the current system and load, and analysis of the system model and forecast load. Additional capital projects identified by the Payson City Power department are listed also in Table 16. In addition, SUVPS transmission system capital projects for which Payson City is required to participate financially are listed in this section.

The opinion of probable cost for all projects does not include the cost of easements that might be needed.

4.1 Projects Identified by Power System Analysis

Table 15. Capital Plan Project List from System Analysis

Project #	Project Title	Project Description	Operation Improvement Result
1	Switch 610 to 510	In 2024, switch/install 3-phase overhead switch about 300 North, to transfer part of 610 load to 510.	Issue: 2023-1. 7 MVA on Power Plant Transformer (5 MVA rating). Benefit: Reduce loading of Power Plant Transformer to 3.7 MVA
2	Build South Substation, Transmission line and Feeders	In 2024, build South substation with 12/20 MVA transformer and four feeders. Build 46 kV transmission line 1.65 miles from Racetrack sub to new sub site.	Issue: 2023-2. 12 MVA on Racetrack Transformer (10 MVA rating). Benefit: Reduce loading of Racetrack Transformer to 8.5 MVA. New substation provides “N-1” contingency backup/recovery for the loss of Downtown or Racetrack subs.
3	Build North/Arrowhead Substation, Transmission line and Feeders	In 2025, build North/Arrowhead substation with 12/20 MVA transformer and four feeders. Build 46 kV transmission tap 0.5 miles off Power Plant-Downtown 46 kV line to new sub site.	Issue: 2025-1. 8.2 MVA on Power Plant substation transformer (5 MVA rating). Benefit: Reduce loading of Power Plant Transformer to 4.7 MVA. New substation provides “N-1” contingency backup/recovery for the loss of Power Plant or Downtown subs. Operational flexibility for normal and N-1 conditions.
4	Strong Tie Feeders 510 to 730	In 2025, build tie between feeder 730 and 510 about 1700 West 800 South, with switches as needed.	Issue: 2025-2 & 3. 13.2 MVA on Industrial substation transformer T2 (12 MVA rating). Benefit: Reduce loading of T2 transformer to 10 MVA. Operational flexibility for normal and N-1 conditions.
5	Rebuild/reconductor Feeder 510/610 I-15 crossing	In 2024, Reconductor/rebuild the 510/610 I-15 crossing about 200 North with about 0.4 miles (2,100 ft) with 260-amp capacity (min.) conductor.	Issue: 2023 “N-1” loss of Downtown, restoring feeder 310. #2/0 Al conductor loads to 248 amps (180 amp rating). Benefit: A strong tie between 310 and 510 crossing I-15. Operational flexibility for normal and N-1 conditions.
6	South substation feeder tie to 800 South along SR-198/500 West	In 2024, build South substation a feeder about 1.4 miles (7,350 ft) with 250-amp capacity (min.) conductor	Issue: 2023 “N-1” loss of Racetrack, restoring feeder 410, feeder 320 250 kcmil UG conductor loads to 349 amps (255 amp rating). Benefit: A strong tie between South substation and 410. Operational flexibility for normal and N-1 conditions.
7	Strong Tie Feeders 710 to 320	In 2024, build strong tie from 710 to 320, from 1000 West Utah Ave. to 200 West 100 South, about 0.83 miles (4,400 ft) with 200-amp capacity (min.) conductor.	Issue: 2023 “N-1” loss of 46 kV transmission line to Downtown and Racetrack, restoring feeder 320, South substation transformer goes to 21.5 MVA (20 MVA rating). Benefit: A strong tie between Industrial substation and Downtown. Operational flexibility for normal and N-1 conditions.

Project #	Project Title	Project Description	Operation Improvement Result
8	46 kV Transmission Loop to South substation	In 2025, build 46 kV transmission from Industrial substation to the South substation, about 3.6 miles (19,100 ft) with 795 ACSR conductor.	Issue: 2023 “N-1” loss of 46 kV transmission line to Downtown and Racetrack, restoring from South substation transformer requires a loop feed to South substation. Industrial substation transformers do not have combined available capacity enough (20 MVA available capacity) for picking up 26 MVA of load. Benefit: A 46 kV transmission loop, with appropriate 46 kV switches enables restoring substations for outage on sections of lines between substations. Operational flexibility for normal and N-1 conditions.
9	South substation feeder 810 tie to 510/730 (along 12000 South 4600 West, county)	In 2027 (for “N-0”, in 2024 for “N-1”, build a South substation feeder 810 to feeder 510/730 at 1700 West 1200 South about 2 miles (10,500 ft) with 600-amp (250-amp min.) capacity conductor (along 12000 South 4600 West, county).	Issue: 2027-1 and 2027-2 “N-0” and 2023 “N-1” loss of Industrial T1, restoring feeder 510, feeder 730 500 kcmil UG conductor loads to 438 amps (385 amp rating). Benefit: A strong tie between South substation and 510. Operational flexibility for normal and N-1 conditions.
10	Reconductor/rebuild 330 Mainline	In 2027, reconductor/rebuild feeder 330 getaway and mainline on Utah Ave. and 500 East about 0.14 miles (750 ft) to 440-amp capacity (min.) conductor	Issue: 2027 “N-1” loss of Racetrack substation or Arrowhead substation, restoring feeder 420 or Arrowhead feeder, feeder 330 250 kcmil UG conductor loads to 303 amps (255 amp rating). Benefit: A higher capacity getaway and mainline on 330. Operational flexibility for normal and N-1 conditions.
11	Strong Tie Feeders Arrowhead 920 to 330	In 2029, build tie between 920 (from Arrowhead) to 330 with 340-amp capacity (min.) conductor along 700 East about 1 mile (5,150 ft) along 750/900 East to SR-198 (tie to 330).	Issue: 2029-1. 10.12 MVA on Downtown transformer (10 MVA rating). Benefit: A strong tie between Arrowhead and Downtown substations. Operational flexibility for normal and N-1 conditions.
12	Reconductor/rebuild 510 Mainline	In 2029 (for “N-0”, in 2027 for “N-1”, Reconductor 510 mainline 500 MCM with 1100 MCM and 4/0 ACSR with 477 ACSR about 1.7 miles (8,850 ft) from Industrial substation to 1700 West 1200 South (tie to feeder 810)	Issue: 2029-2 “N-0” and 2027 “N-1” loss of South substation, restoring feeder 810, feeder 510 500 kcmil UG conductor and 4/0 ACSR loads to 552 amps (385 amp rating) and 382 amps (340 amp rating on 4/0 ACSR). Benefit: A strong tie between South substation and 510. Operational flexibility for normal and N-1 conditions.
13	Reconductor/rebuild 730 Mainline	In 2029 (for “N-0”, in 2027 for “N-1”), Reconductor 730 mainline underground conductor about 0.9 miles (4,800 ft) with 1100 MCM from 500 S American Way to 1700 West 1200 South (tie to feeder 810).	Issue: 2029-2 “N-0” and 2027 “N-1” loss of South substation, restoring feeders 810 and 840, feeder 730 UG conductors load to 460-496 amps (330-385 amp ratings). Benefit: A strong tie between South substation and 730. Operational flexibility for normal and N-1 conditions.

Project #	Project Title	Project Description	Operation Improvement Result
14	Build Southwest area Substation and Feeders	In 2033 (for “N-0”, in 2029 for “N-1”), 2029, build Southwest area substation with 12/20 MVA transformer and four feeders. Build 46 kV transmission tap 0.5 miles off Industrial-South sub 46 kV line to new sub site.	Issue: 2033 “N-0” system substation loading goes to 81.1 MVA (total “N-0” capacity 73 MVA). Also, 2029 “N-1” loss of South substation, loads Industrial substation transformer T2 to 24.8 MVA (20 MVA rating). Benefit: New substation capacity becomes available in the southwest area for new growth there. Operational flexibility for normal and N-1 conditions.
15	Build new North area Substation and Feeders	In 2029, build North area substation with 12/20 MVA transformer and four feeders. Build 46 kV transmission tap 0.5 miles off Power Plant-Downtown 46 kV line to new sub site.	Issue: 2029 “N-1” loss of Arrowhead substation, loads Downtown substation transformer to 16.5 MVA (12 MVA rating). Benefit: New substation capacity becomes available in the north area for new growth there. Operational flexibility for normal and N-1 conditions.

4.2 Payson City Identified Capital Projects

The Payson City Power Department identified the capital projects listed in Table 16. These are projects that were specifically included in this report for completeness though they did not arise from the system modeling and analysis like the projects identified in Section 3.

Table 16. Payson City Power Project List

Project #	Project Title	Project Description	Operation Improvement Result
Payson-1	Peaking Generation Capacity—new 14.4 MW	Install new peaking generation capacity—six 2.4 MW gensets with generation building and substation.	Issue: Forecast loads will increase the amount of energy Payson will need to supply, by purchase or generation, during peak use periods. Benefit: New generation capacity to serve existing and new load provides operational flexibility for normal and peak use periods.
Payson-2	System Model, with linked OMS and Dispatch	Develop a Power System Model (such as using Mil Soft software) and link to a software system for OMS, and Dispatch.	Issue: Growth of the power system in size and complexity decreases system awareness, increases outage response time. Benefit: Increased system awareness for management and operations. Speeds outage response time. Provides means for rapid switching orders.

4.3 SUVPS Identified Capital Transmission Projects

Payson City relies upon SUVPS to serve the Payson substations through the SUVPS 46 kV transmission system. SUVPS owns, maintains, and upgrades portions of the 46 kV system. Capital projects on the SUVPS system are identified by SUVPS with its customers (e.g., Payson City Power, and other customer cities) and through system modeling and analysis. These projects are primarily driven by growth in demand of the cities, like Payson, that are served by the SUVPS 46 kV transmission system. The projects listed in Appendix E are the SUVPS Capital Transmission Projects that Payson City, as a member city, is obligated to financially participate in. The bond obligation for these SUVPS projects is shown on Table 18.

Table 17. SUVPS Capital Projects

Project #	Project Title	Project Location— Approx. Address	Project Description	Operation Improvement Result
SUVPS-1	SUVPS 46 kV Transmission System Capital Projects	Various	\$40,000,000 to \$50,000,000 Bond \$2,860,000 Bond payment per year. Payson portion: \$446,732 per year.	46 kV transmission capacity to serve growing load in member cities. Capability to continue 46 kV service upon “N-1” contingency recovery.

SUVPS anticipates obtaining a \$40-\$50 million bond to pay for the proposed SUVPS projects. The proposed bond period is 20 years, each SUPVS member’s payment per year will be based on their usage of the system. The following is the preliminary high-level estimate of the Payson City obligation for bond payments for 2024 through 2028. The actual costs will be firmed up when the bond is obtained.

The SUVPS \$50 million bond payment is \$2,750,000.00 per year. Payson’s projected payment obligation is based on their percent usage of the capacity on the SUVPS system, as follows:

2024 – 15.62% usage corresponds to \$446,732.00 payment

2025 – 15.62% usage corresponds to \$446,732.00 payment

2026 – 15.62% usage corresponds to \$446,732.00 payment

2027 – 15.62% usage corresponds to \$446,732.00 payment

2028 – 15.62% usage corresponds to \$446,732.00 payment

For 2028 to 2032 consider that the projected annual payment obligation will be \$446,732.00.

These numbers are all high-level estimates that will be firmed up after the bond amount, payment period and interest is confirmed when the bond is secured. The MVA ownership adjustment cost will be firmed up in October 2024 when actual usage, cost etc. are known.

5. CAPITAL PROJECTS SUMMARY

This section lists projects that were identified by analysis as being necessary over the planning window. It also lists the projects identified by the prior IFFP, by Payson City and SUVPS. These projects were broken down into five priority levels; High Priority, Moderately High Priority, Medium Priority and Low Priority, each level corresponds to a different implementation schedule. The physical location of future development was modeled as realistically as possible, however due to unpredictability of load growth in both scale and the location some projects may need to be implemented prior to the scheduled dates below and some can be postponed.

Project Priority Levels:

High Priority – Recommended to be completed within one year

Moderately High Priority- Recommended to be completed within three years

Medium Priority- Recommended to be completed within five years

Low Priority- Recommended to be completed within ten years

Projects to resolve the deficiencies identified in the study of the system model were identified and developed. The system improvement projects necessary due to growth were determined in this study are listed in Table 15, shown in Table 18, and details are provided in Appendix A of this report. Payson City Power projects and SUVPS system projects from Tables 16 and 17 are also included in Table 18.

The opinion of probable cost for all projects does not include the cost of easements that might be needed.

Table 18. Capital Projects List

Project # & Title	Implementation Year(s) Load Level, MW	Opinion of probable Cost ('24 \$)	Construct year prob. Cost
High Priority			
1. Switch 610 to 510	2024 34 MW	\$15,600	\$15,600
2. Build South Substation, Transmission line and Feeders	2024 34 MW	\$8,367,500	\$8,367,500
3. Build North/Arrowhead Sub, Transmission line, feeders	2025 48 MW	\$6,250,300	\$6,250,300
4. Strong Tie Feeders 510 to 730	2025 48 MW	\$205,300	\$205,300
5. Rebuild/reconductor Feeder 510/610 I-15 crossing	2024 34 MW	\$74,400	\$74,400
6. South sub feeder tie to 800 South along SR-198/500 W	2024 34 MW	\$244,100	\$244,100
7. Strong Tie Feeders 710 to 320	2024 34 MW	\$368,500	\$368,500
8. 46 kV Transmission Loop to South substation	2025 48 MW	\$2,448,700	\$2,448,700
9. South substation feeder 810 tie to 510/730	2024 34 MW	\$628,000	\$628,000
Moderately High Priority			
Payson-1 Peaking Generation Capacity—new 14.4 MW	2024 34 MW	\$33,000,000	\$33,000,000
10. Reconductor/rebuild 330 Mainline	2027 58 MW	\$328,800	\$369,900
11. Reconductor/rebuild 510 Mainline	2027 58 MW	\$316,300	\$355,800
12. Reconductor/rebuild 730 Mainline	2027 58 MW	\$544,500	\$612,500
Medium Priority			
13. Strong Tie Feeders Arrowhead 920 to 330	2029 67 MW	\$408,100	\$496,600
14. Build Southwest area Substation and Feeders	2029 67 MW	\$6,250,300	\$7,604,500
15. Build new North area Substation and Feeders	2029 67 MW	\$6,250,300	\$7,604,500
Low Priority			
Payson-2 System Model, with linked OMS and Dispatch	2033 77 MW	\$433,000	\$641,000
Bond Obligation			
SUVPS-1. Transmission System Capital Projects	2024-2033 34-77 MW	\$4,467,320	\$4,467,320
Total		\$70,601,020	\$73,754,520

The opinion of probable cost for these projects is in 2023 dollars. The opinion of probable cost for all projects does not include the cost of easements that might be needed.

As with most capital facilities plans, most of these projects are scheduled to occur in the earlier planning windows. However, growth in demand on the system generally happens in “groups” or “lumps” according to actual commercial and residential development. Some of the projects which were identified could be delayed until required by localized growth.

6. CONCLUSION

This study identifies 17 capital improvement projects and the SUVPS bond obligation that are recommended to continue to meet the needs of the Payson City electrical power system during the period 2024-2033. The projects are the result of analyzing the existing Payson City power system for its current capacity and analyzing the system under anticipated load growth and identifying deficiencies and solutions. The power flow analysis was performed on the Payson City power system model to evaluate the system compliance with the design criteria and to identify system capacity deficiencies at periods of 1 year, 3 years, 5 years, then at 10 years out. Projects included in this 2024-2029 5-Year Capital Plan are solutions that provide the system capacity needed for Payson City to serve its customers, that prevent system voltage and loading problems, and that provide for contingency operation.

7. APPENDIX A: PROJECT DETAIL SHEETS

Project detail sheets are included for the projects from Section 4. Project detail sheets are not included for the projects that were identified by Payson Power in Section 4.2, or for the SUVPS listed projects in Section 4.3.

The opinion of probable cost for projects does not include the cost of easements that might be needed.

Project # : 1	Project Title: Switch 610 to 510	Priority: High – 1 Year Load Level 34 MW
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Project Description: Switch/install 3-phase overhead switch about 300 North 500 West, to transfer part of feeder 610 load to feeder 510.

Issue(s): 1) In 2023, 7 MVA on Power Plant Transformer (5 MVA rating).

Design Criteria Violation:

Element	Normal or “N-1”	Measured or Modeled Value	Design Criteria Value
Power Plant Transformer	Normal	7 MVA (measured) 140% of rated capacity	5 MVA 100% rated capacity

Benefit(s) of Project: Reduce loading of Power Plant Transformer to 3.7 MVA, typically results in longer transformer life.

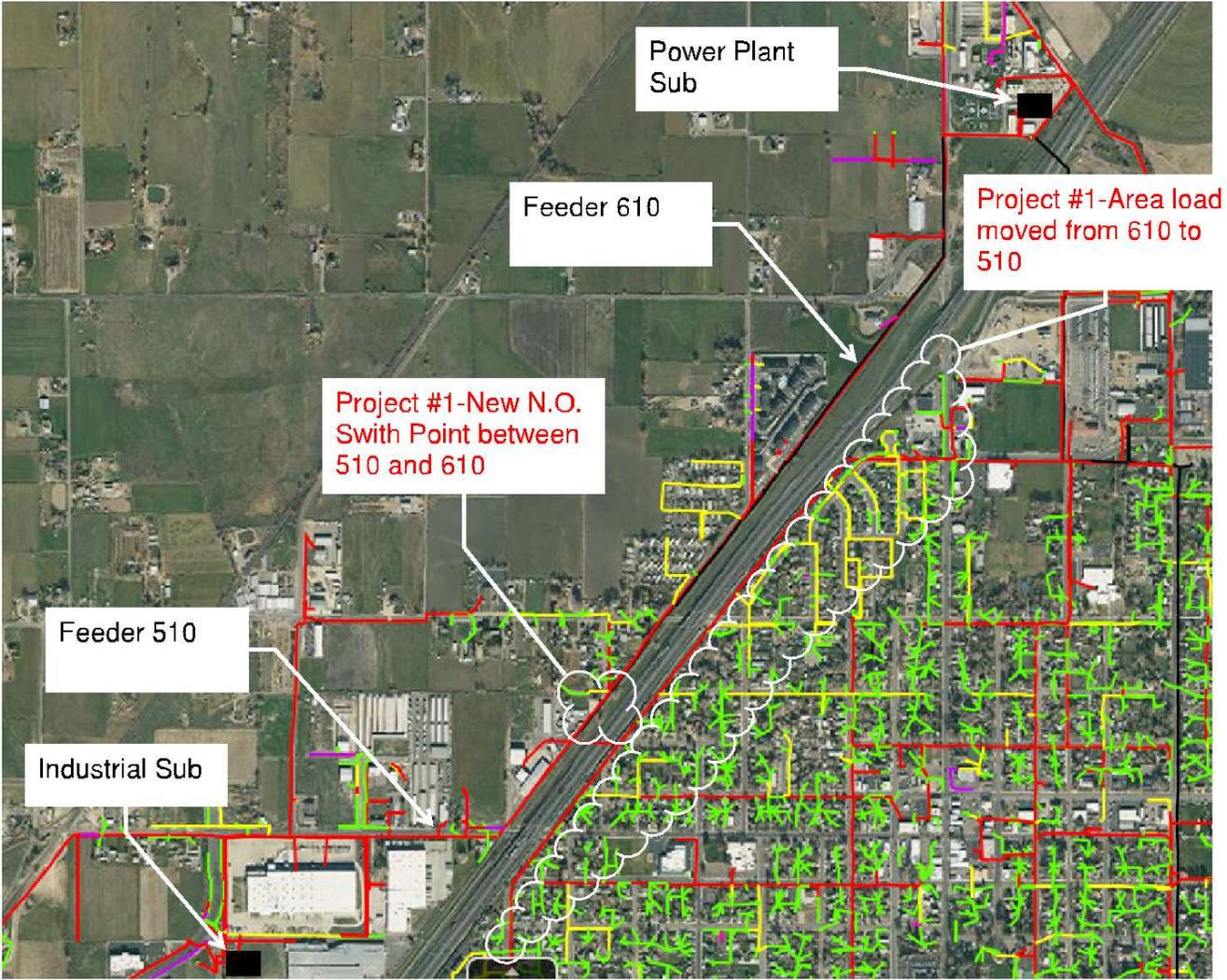
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Power Plant Transformer	Normal	3.7 MVA 74% of rated capacity	5 MVA 100% rated capacity

Opinion of Probable Cost: \$5,000

Risk Assessment: High normal loading on this 46 kV-12.47 kV transformer during peak periods leads to limitations serving the growing load and restoring outages on the system. With loading greater than the transformer rating for longer periods of time and more frequently the likelihood of transformer failure increases. Higher customer outage time and lower system resiliency are at risk.

Alternatives Considered: 1.) Replace the Power Plant substation transformer with a 10 MVA or larger transformer. The cost of the alternative is higher than switching to reduce the load on the existing transformer.

Project #1 Map



Project # : 2	Project Title: Build South Substation, Transmission line and Feeders	Priority: High – 1 Year Load Level 34 MW
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Project Description: Build South substation with 12/20 MVA transformer and four feeders. Build 46 kV transmission line 1.65 miles from Racetrack sub to new sub site.

Issue(s): 1) 12 MVA on Racetrack Transformer (10 MVA rating)

Design Criteria Violation:

Element	Normal or “N-1”	Measured or Modeled Value	Design Criteria Value
Racetrack Substation Transformer	Normal	12 MVA (measured) 120% of rated value	10 MVA 100% of rated capacity

Benefit(s) of Project: Reduce loading of Racetrack Transformer to 8.5 MVA. New South substation provides “N-1” contingency backup/recovery for the loss of Downtown or Racetrack subs.

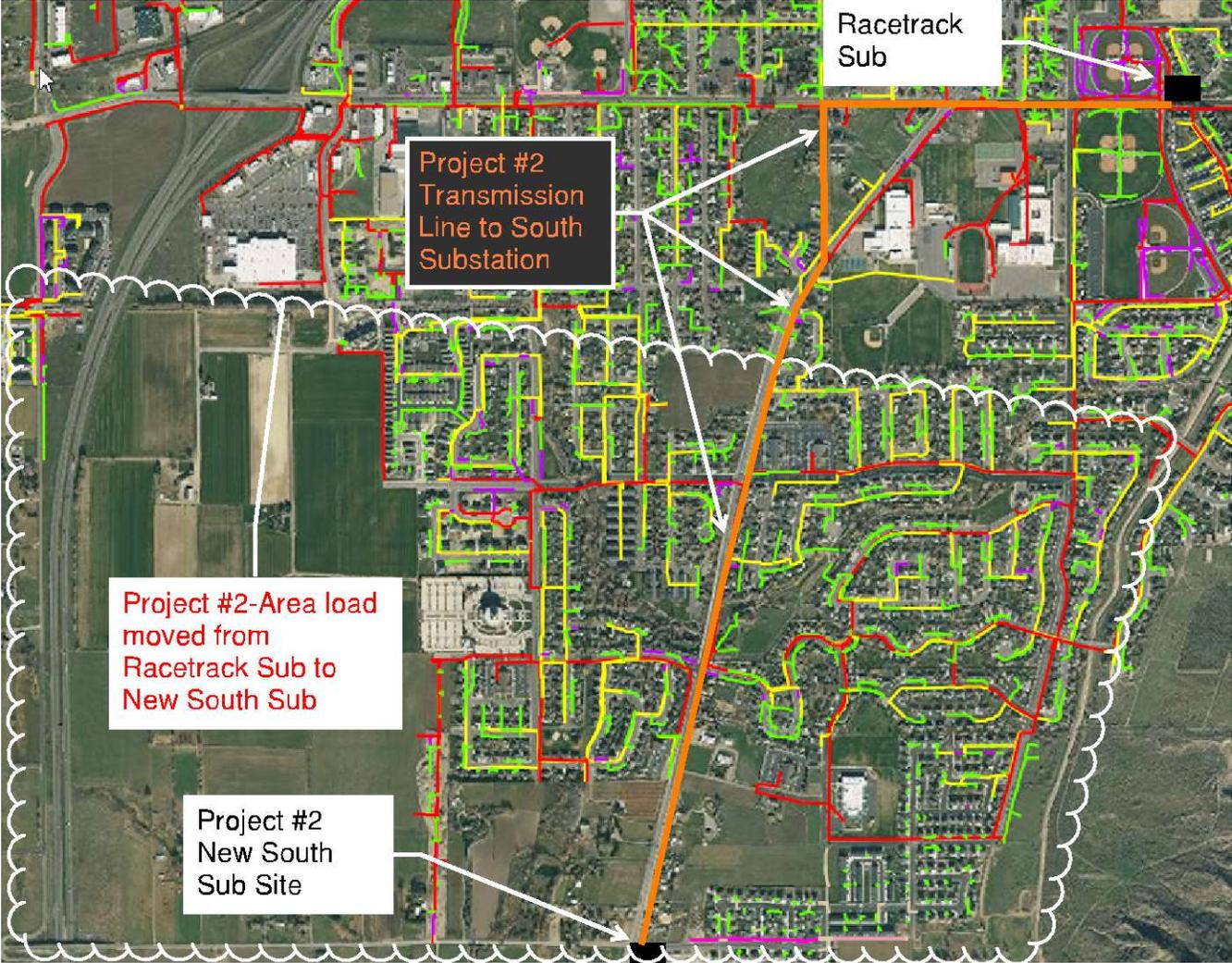
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Racetrack Substation Transformer	Normal	8.5 MVA (modeled) 85% of design value	10 MVA 100% of rated capacity

Opinion of Probable Cost: \$8,367,500 (does not include easements)

Risk Assessment: High normal loading on this 46 kV-12.47 kV transformer during peak periods leads to limitations serving the growing load and restoring outages on the system. With loading greater than the transformer rating for longer periods of time and more frequently the likelihood of transformer failure increases. Higher customer outage time and lower system resiliency are at risk.

Alternatives Considered: 1.) Replace the Racetrack substation transformer with a 12/20 MVA transformer. The alternative does not mitigate the “N-1” loss of the substation transformer with another substation transformer to pick up the load of the lost transformer.

Project #2 Map



Project # : 3	Project Title: Build North/Arrowhead Substation, Transmission line and Feeders	Priority: High – 1 Year Load Level 34 MW
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Project Description: Build the North/Arrowhead substation with a 12/20 MVA transformer and four feeders. Build 46 kV transmission tap 0.5 miles off Power Plant-Downtown 46 kV line to new sub site.

Issue(s): 1) 8.2 MVA on Power Plant substation transformer (5 MVA rating)

Design Criteria Violation:

Element	Normal or “N-1”	Measured or Modeled Value	Design Criteria Value
Power Plant substation transformer	Normal	8.2 MVA (modeled) 164% of rated capacity	5 MVA

Benefit(s) of Project: Reduce loading of Power Plant Transformer to 4.7 MVA. New substation provides “N-1” contingency backup/recovery for the loss of Power Plant or Downtown subs. Operational flexibility for normal and N-1 conditions.

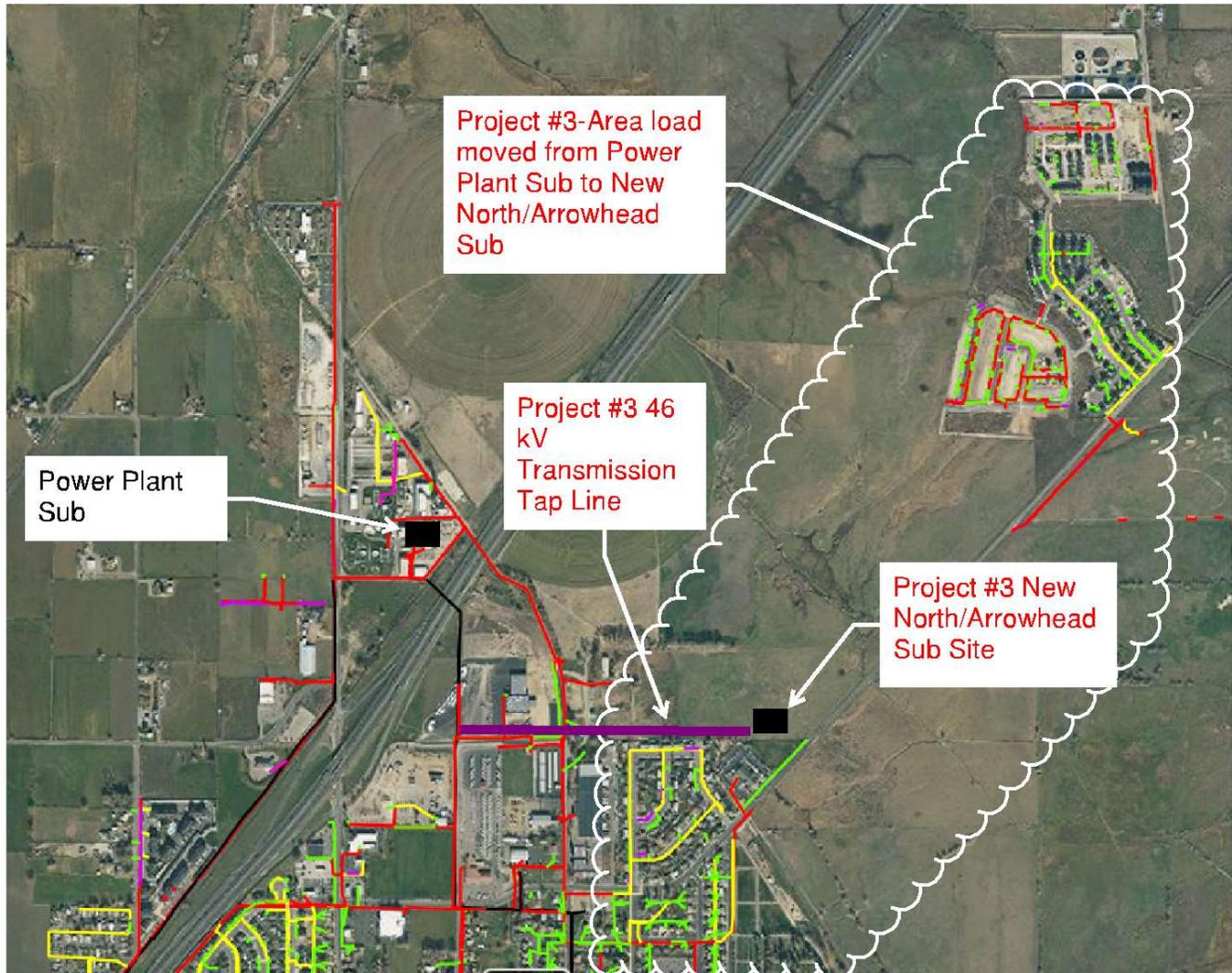
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Power Plant substation transformer	Normal	4.7 MVA (modeled) 94% of rated capacity	5 MVA

Opinion of Probable Cost: \$6,250,300 (does not include easements)

Risk Assessment: High normal loading on this 46 kV-12.47 kV transformer during peak periods leads to limitations serving the growing load and restoring outages on the system. With loading greater than the transformer rating for longer periods of time and more frequently the likelihood of transformer failure increases. Higher customer outage time and lower system resiliency are at risk.

Alternatives Considered: 1.) Replace the Power Plant substation transformer with a 10 MVA or larger transformer. The alternative does not mitigate the “N-1” loss of the substation transformer with another substation transformer to pick up the load of the lost transformer.

Project #3 Map



Project # : 4	Project Title: Strong Tie Feeders 510 to 730	Priority: High– 1 Year Load Level 34 MW
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Project Description: Build tie between feeder 730 and 510 about 1700 West 800 South, with switches as needed.

- Issue(s):**
- 1) In 2025, 13.2 MVA on Industrial substation transformer T2 (12 MVA rating).
 - 2) In 2025, Feeder 730 loads to 100% of its protective relay setting.

Design Criteria Violation:

Element	Normal or “N-1”	Measured or Modeled Value	Design Criteria Value
Industrial substation transformer T2	Normal	13.2 MVA (modeled) 110% rated capacity	12 MVA 100% rated capacity
Feeder 730 Protective Relay Setting	Normal	450 amp (modeled) 100% of relay setting	<100% of relay setting

Benefit(s) of Project: This proposed project would reduce the loading of T2 transformer to 10 MVA, and the load on feeder 730 to 310 amps. The new feeder tie provides operational flexibility for normal and N-1 conditions.

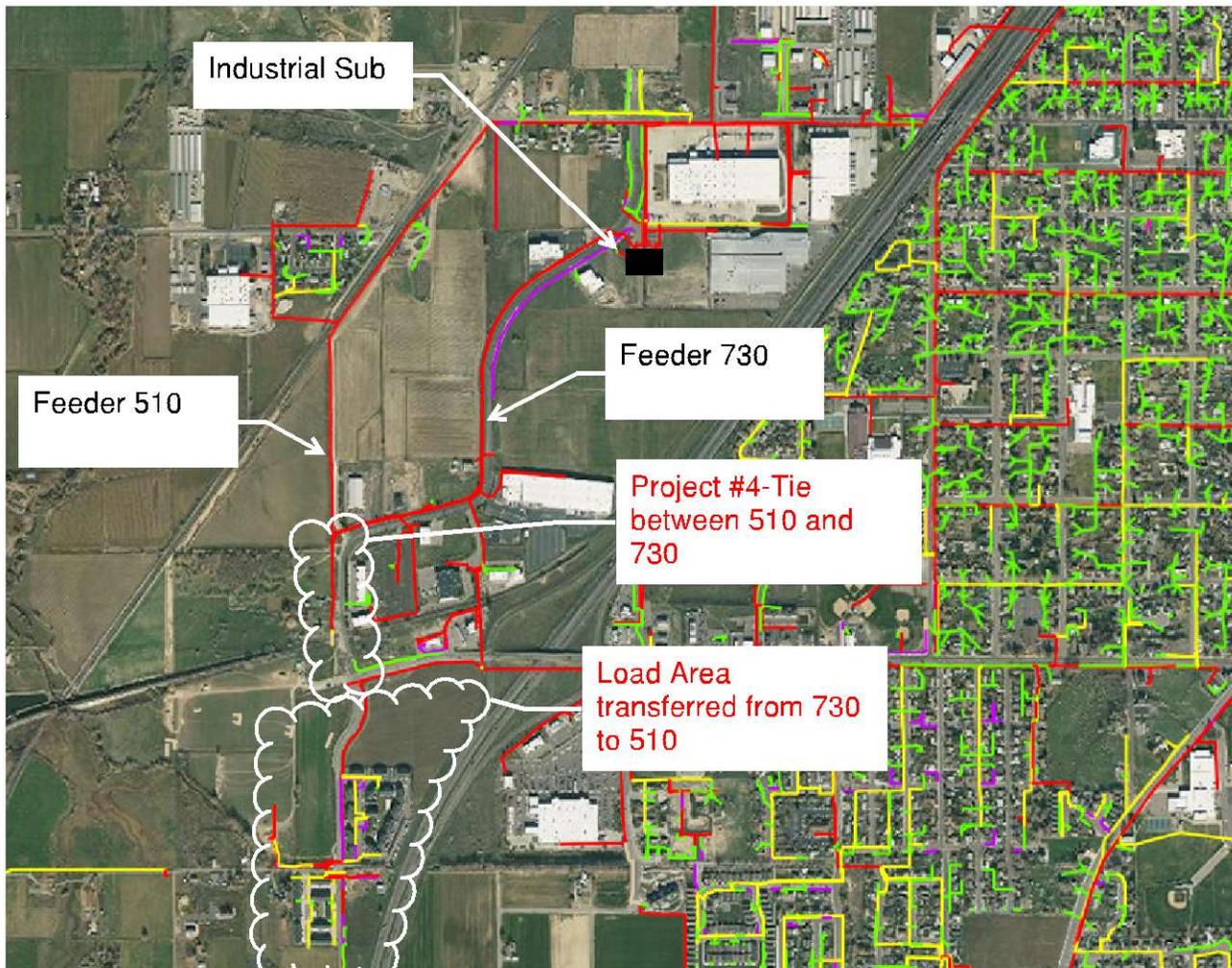
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Industrial substation transformer T2	Normal	10 MVA (modeled) 83% rated capacity	12 MVA 100% rated capacity
Feeder 730 Protective Relay Setting	Normal	310 amps (modeled) 69% rated capacity	<100% of relay setting

Opinion of Probable Cost: \$205,300 (does not include easements)

Risk Assessment: High normal loading on this 46 kV-12.47 kV transformer during peak periods leads to limitations serving the growing load and restoring outages on the system. With loading greater than the transformer rating for longer periods of time and more frequently the likelihood of transformer failure increases. Loading the feeder up to the protective relay setting could lead to unintended tripping of the feeder circuit breaker.

Alternatives Considered: Raise the protective relay setting—this does not reduce the loading on the transformer.

Project #4 Map



Project # : 5	Project Title: Rebuild/reconductor Feeder 510/610 I-15 crossing	Priority: High – 1 Year Load Level 34 MW
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Project Description: Reconductor/rebuild the 510/610 I-15 crossing about 200 North with about 0.4 miles (1,100 ft) with 300-amp capacity (min.) conductor.

Issue(s): 1) In 2023 “N-1” loss of Downtown substation, restoring feeder 310, #2/0 Al conductor loads to 248 amps (180 amp rating).

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
510/610 Feeder #2/0 Al overhead	N-1	248 amps 138% of rated capacity	180 amps 100% rated capacity

Benefit(s) of Project: Increased transmission system reliability and capacity of the Baxter to Compound 46 kV transmission line would be available for normal operation, for N-1 contingency outage restoration and for growth. Improved reliability with a rebuilt line and new, larger conductor.

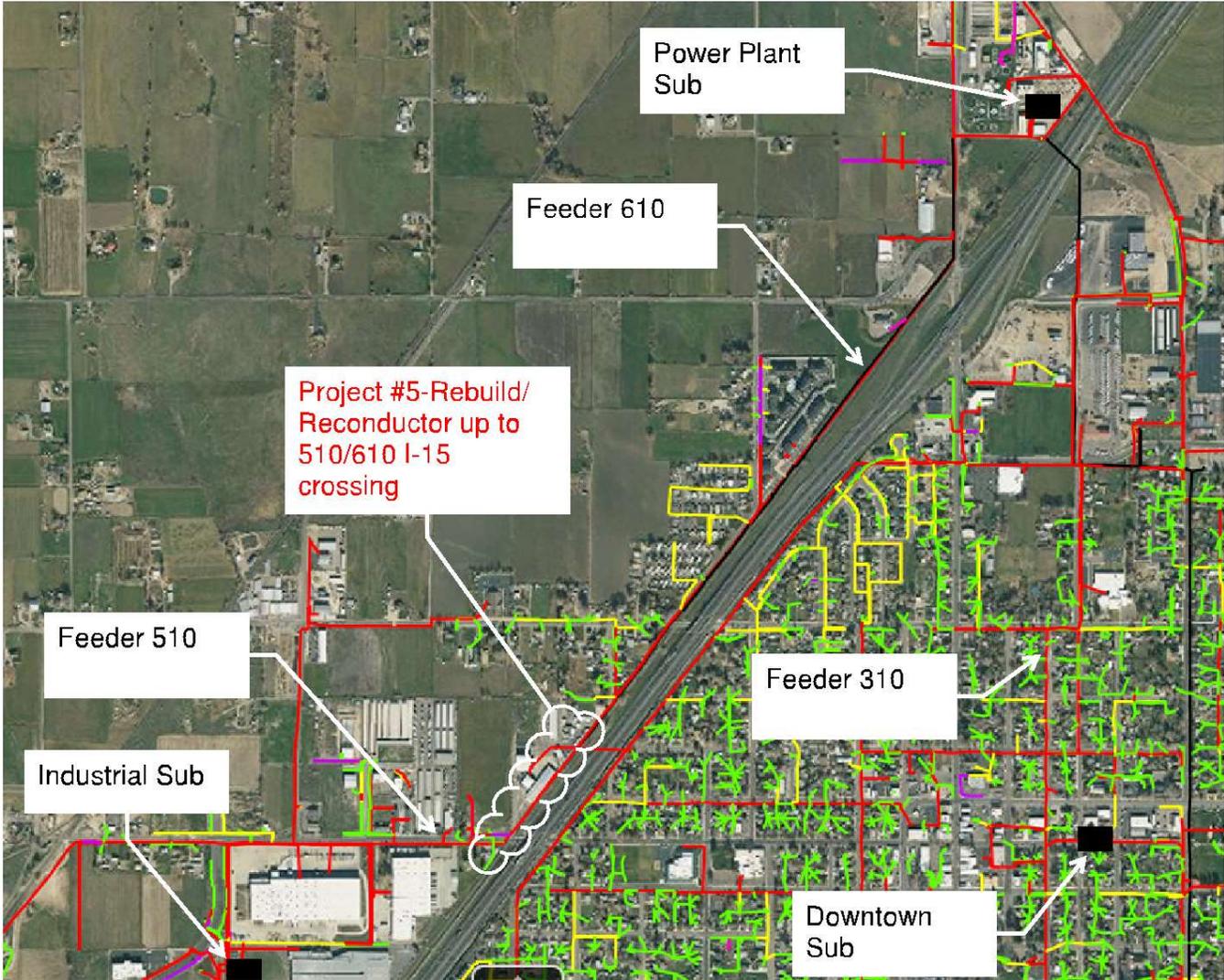
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
510/610 Feeder #4/0 Al ACSR overhead	N-1	248 amps 73% of rated capacity	340 amps 100% rated capacity

Opinion of Probable Cost: \$74,400

Risk Assessment: Restoration of customers on the 310 feeder would be limited by the capacity of the 510/610 conductor leading up to the I-15 crossing, upon the loss of the Downtown substation transformer.

Alternatives Considered: n/a

Project #5 Map



Project # : 6	Project Title: South substation feeder tie to 800 South along SR-198/500 West	Priority: High – 1 Year Load Level 34 MW
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Project Description: Build South substation a feeder about 1.4 miles (7,350 ft) to 800 South along SR-198/500 West with 250-amp capacity (min.) conductor. Underbuilt on new transmission line to South substation.

Issue(s): 1) In 2023 “N-1” loss of Racetrack, restoring feeder 410, feeder 320 250 kcmil UG conductor loads to 349 amps (255 amp rating).

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
320 Feeder Mainline	N-1	349 amps	255 amps
250 kcmil UG		137%	100% rated capacity

Benefit(s) of Project: A strong tie between South substation and 410. Operational flexibility for normal and N-1 conditions.

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
320 Feeder Mainline	N-1	186 amps	255 amps
250 kcmil UG		73%	100% rated capacity

Opinion of Probable Cost: \$244,100 (does not include easements)

Risk Assessment: Recovery from the loss of Racetrack substation transformer at peak load periods may not be possible without overloading Downtown substation feeder mainlines.

Alternatives Considered: n/a

Project #6 Map



Project # : 7	Project Title: Strong Tie Feeders 710 to 320	Priority: High– 1 Year Load Level 34 MW
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Project Description: Build strong tie from 710 to 320, from Industrial substation to 300 West 300 South, about 0.83 miles (4,400 ft) with 200-amp capacity (min.) conductor. (800’ underground; 4,760’ overhead)

Issue(s): 1) In 2023 “N-1” loss of 46 kV transmission line to Downtown and Racetrack, restoring feeder 320, South substation transformer goes to 21.5 MVA (20 MVA rating).

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
South substation transformer	N-1	21.5 MVA 108% highest nameplate rating	20 MVA 100% highest nameplate rating

Benefit(s) of Project: A strong tie between Industrial substation and Downtown. Operational flexibility for normal and N-1 conditions.

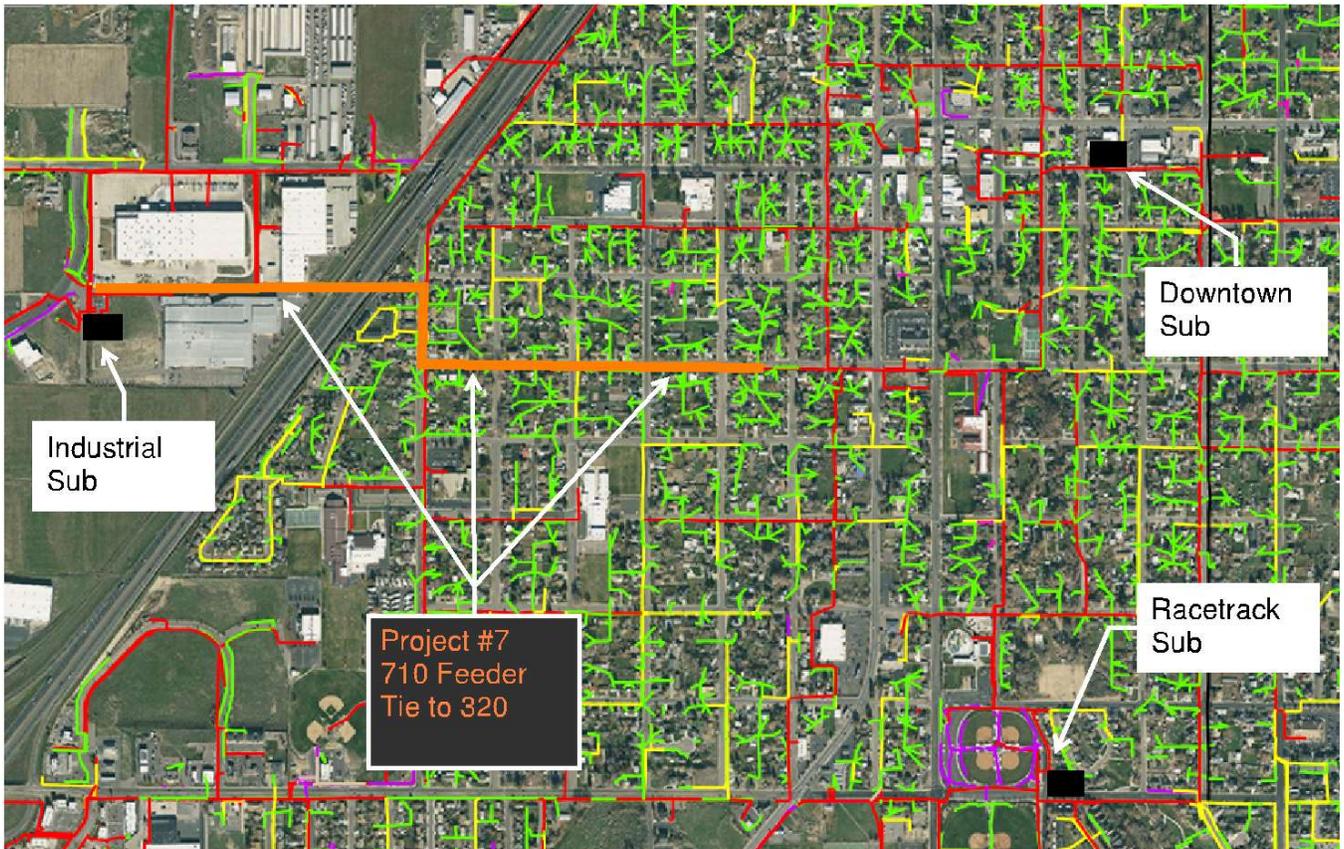
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
South substation transformer	N-1	15.2 MVA 76% highest nameplate rating MVA	20 MVA 100% highest nameplate rating

Opinion of Probable Cost: \$368,500 (does not include easements)

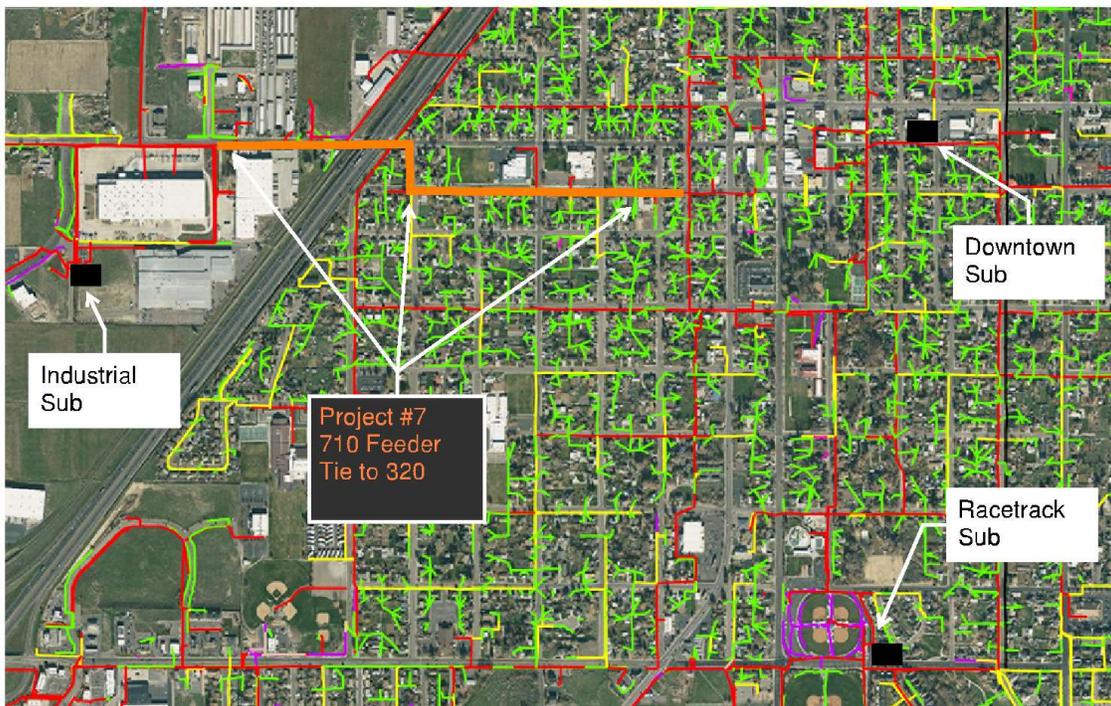
Risk Assessment: Recovery from the loss of the 46 kV line to Downtown and Racetrack substations at peak load periods may not be possible without overloading the South substation transformer.

Alternatives Considered: Build strong tie from 710 to 320, from 1000 W. Utah Ave. to 200 West 100 South. This alternative has longer underground under the Utah Ave. I-15 bridge.

Project # 7 Map



Project # 7 ALT. Map



Project # : 8	Project Title: 46 kV Transmission Loop to South substation	Priority: High– 1 Year Load Level 34 MW
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Project Description: Build 46 kV transmission from Industrial substation to the South substation, about 4 miles (21,000 ft) with 795 ACSR conductor.

Issue(s): 1) In 2023 “N-1” loss of 46 kV transmission line to Downtown and Racetrack, restoring from South substation transformer requires a loop feed to South substation. Industrial substation transformers do not have combine available capacity enough (20 MVA available capacity) for picking up 26 MVA of load.

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Industrial substation transformers	N-1	46 MVA 115% highest nameplate rating on two 12/20 MVA transformers at Industrial Sub	40 MVA 100% highest nameplate rating on two 12/20 MVA transformer

Benefit(s) of Project: A 46 kV transmission loop, with appropriate 46 kV switches enables restoring substations for outage on sections of lines between substations. Operational flexibility for normal and N-1 conditions.

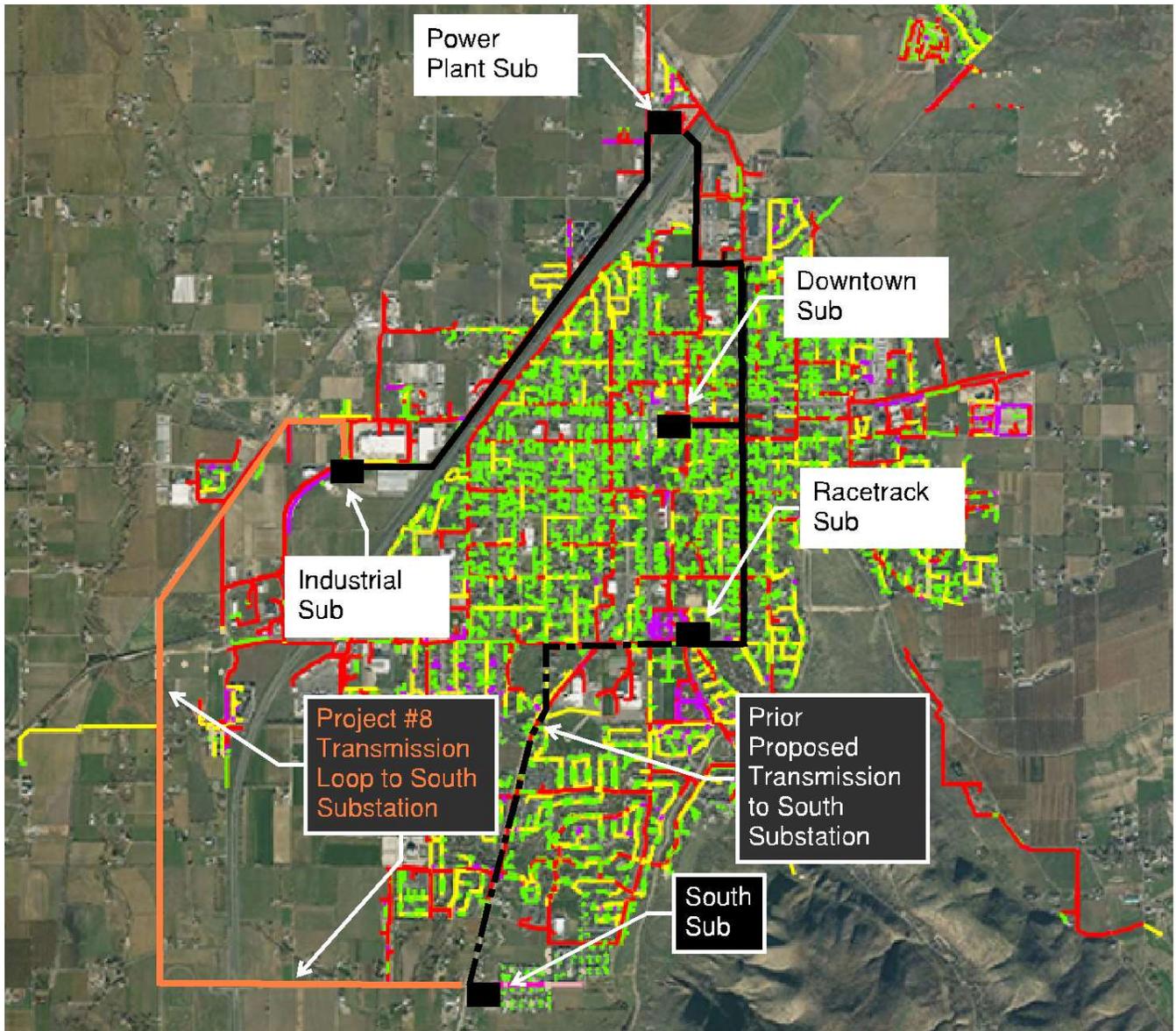
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Industrial substation transformers	N-1	30 MVA 75% highest nameplate rating on two 12/20 MVA transformers at Industrial Sub	40 MVA 100% highest nameplate rating on two 12/20 MVA transformer

Opinion of Probable Cost: \$2,448,700 (does not include easements)

Risk Assessment: During the loss of the 46 kV transmission line to Downtown, Racetrack and South substations, the load at peak periods may be higher than the capacity of the transformers at Industrial substation.

Alternatives Considered: n/a

Project # 8 Map



Project # : 9	Project Title: South substation feeder 810 tie to 510/730	Priority: High– 1 Year Load Level 34 MW
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Project Description: Build a South substation feeder 810 to feeder 510/730 at 1700 West 1200 South about 2.4 miles (12,900 ft) with 600-amp (250-amp min.) capacity conductor (along 12000 South 4800 West, county).

Issue(s): 1) In 2024 for “N-1” loss of Industrial T1, restoring feeder 510, feeder 730 mainline 500 kcmil UG conductor loads to 438 amps (385 amp rating).

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
730 Feeder Mainline	N-1	438 amps	385 amps
500 kcmil UG		114%	100% rated capacity

Benefit(s) of Project: A strong tie between South substation and 510. Operational flexibility for normal and N-1 conditions.

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
730 Feeder Mainline	N-1	244 amps	385 amps
500 kcmil UG		63%	100% rated capacity

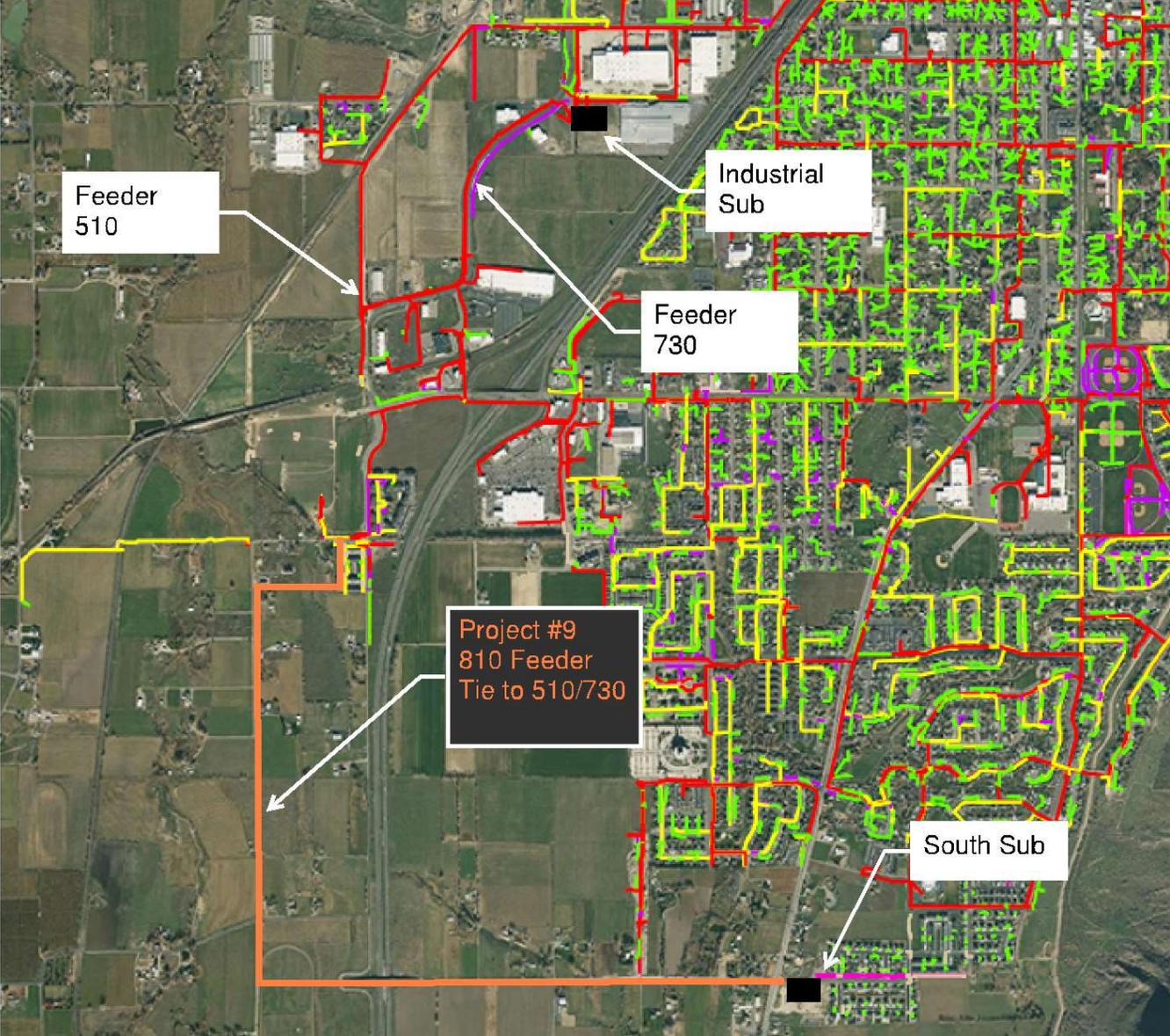
Benefit(s) of Project: A 600-amp tie with capacity to serve existing and new loads will be built. Operational flexibility for normal and N-1 conditions.

Opinion of Probable Cost: \$628,000 (does not include easements; assumes all OH, includes poles—may be underbuilt on 46 kV loop if that is built at the same time or before this line, then the cost of poles can be subtracted.)

Risk Assessment: n/a

Alternatives Considered: n/a

Project # 9 Map



Project # : 10	Project Title: Reconductor/rebuild 330 Mainline	Priority: Moderate High– 3 Year Load Level 58 MW
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Project Description: Reconductor/rebuild feeder 330 getaway and mainline on Utah Ave, 500 East, and 100 South about 0.56 miles (2,940 ft) to 440-amp capacity (min.) conductor. 1,960 UG 980 OH

Issue(s): 1) 2027 “N-1” loss of Racetrack substation or Arrowhead substation, restoring feeder 420 or Arrowhead feeder, feeder 330 250 kcmil UG conductor loads to 303 amps (255 amp rating).

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
330 Feeder Mainline	N-1	440 amps	255 amps
250 kcmil UG		173%	100% rated capacity

Benefit(s) of Project: A greater capacity mainline on feeder 330. Operational flexibility for normal and N-1 conditions.

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
330 Feeder Mainline	N-1	440 amps	480 amps
500 MCM Cu UG		92%	100% rated capacity

Opinion of Probable Cost: \$328,800 (\$369,900 in 2027 construction year)

Risk Assessment: Recovery from N-1 contingencies of Racetrack or Arrowhead feeders may overload the mainline of feeder 330.

Alternatives Considered: n/a

Project # 10 Map



Project # : 11	Project Title: Reconductor/rebuild 510 Mainline	Priority: Moderate High– 3 Year Load Level 58 MW
--------------------------	--	---

Project Description: Reconductor 510 mainline 500 MCM with 1100 MCM and 4/0 ACSR with 477 ACSR about 1.7 miles (8,850 ft) from Industrial substation to 1700 West 1200 South (tie to feeder 810).

Issue(s): 1) In 2027 “N-1” loss of South substation, restoring feeder 810, feeder 510 500 kcmil UG conductor and 4/0 ACSR loads to 552 amps (385 amp rating) and 382 amps (340 amp rating on 4/0 ACSR).

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Feeder 510 500 kcmil	N-1	552 amps	385 amps
UG conductor		143%	100% rated capacity

Benefit(s) of Project: A greater capacity mainline on feeder 510. Operational flexibility for normal and N-1 conditions.

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Feeder 510 1100 MCM	N-1	552 amps	600 amps
conductor		92%	100% rated capacity

Opinion of Probable Cost: \$316,300 (\$355,800 in 2027 construction year)

Risk Assessment: Recovery from N-1 contingencies of South substation feeders may overload the mainline of feeder 510.

Alternatives Considered: n/a

Project # 11 Map



Project # : 12	Project Title: Reconductor/rebuild 730 Mainline	Priority: Moderate High– 3 Year Load Level 58 MW
--------------------------	--	---

Project Description: Reconductor 730 mainline underground conductor about 0.9 miles (4,800 ft) with 1100 MCM from 500 S American Way to 1700 West 1200 South (tie to feeder 810).

Issue(s): 1) 2027 “N-1” loss of South substation, restoring feeders 810 and 840, feeder 730 UG conductors load to 460-496 amps (330-385 amp ratings).

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Feeder 730 500 kcmil	N-1	496 amps	385 amps
UG		129%	100% rated capacity

Benefit(s) of Project: A greater capacity mainline on feeder 730. Operational flexibility for normal and N-1 conditions.

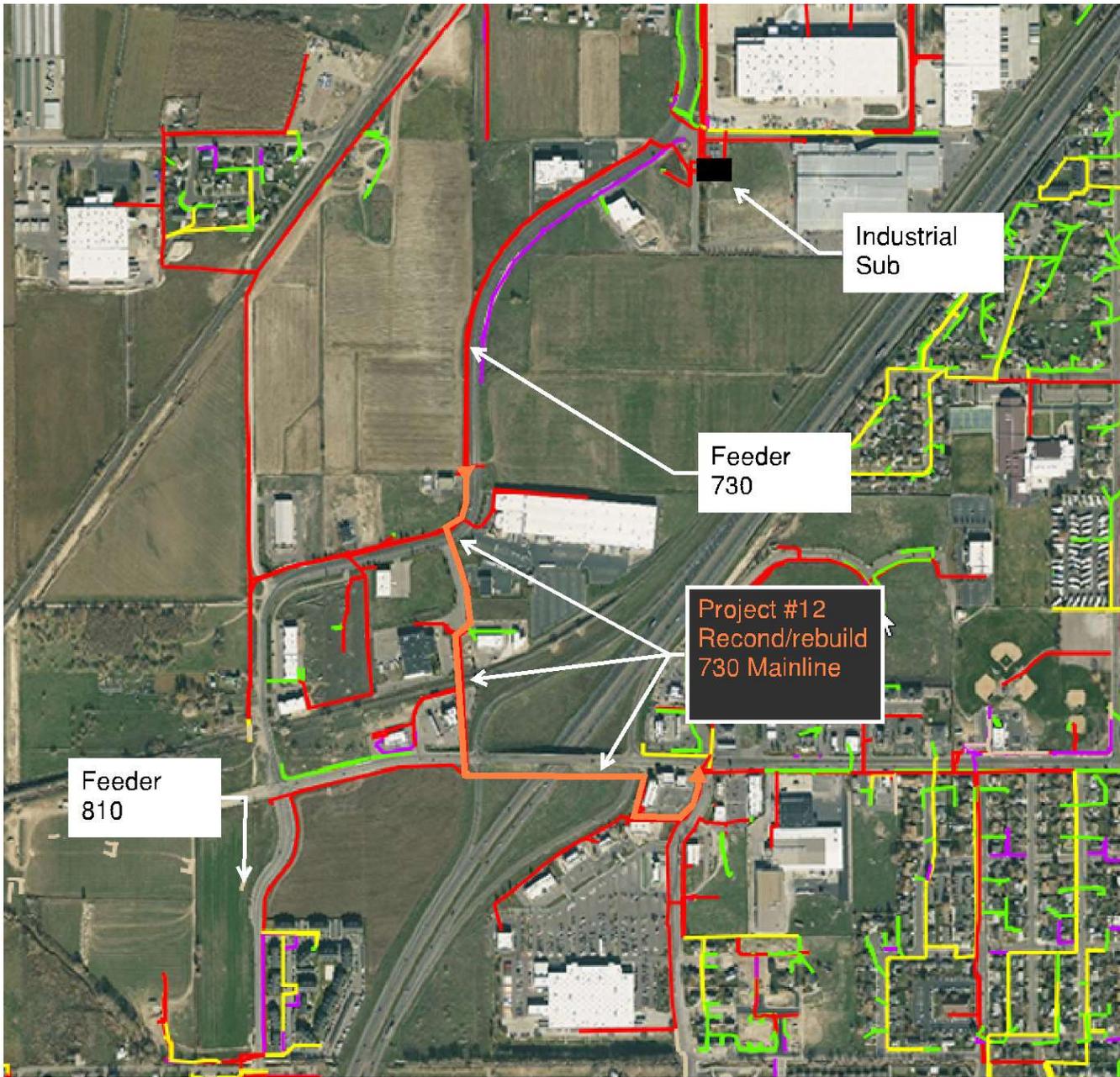
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Feeder 730 1100 MCM	N-1	496 amps	600 amps
UG		83%	100% rated capacity

Opinion of Probable Cost: \$544,500 (\$612,500 in 2027 construction year)

Risk Assessment: Recovery from N-1 contingencies of South substation feeders may overload the mainline of feeder 730.

Alternatives Considered: n/a

Project # 12 Map



Project # : 13	Project Title: Strong Tie Feeders Arrowhead 920 to 330	Priority: Medium– 5 Year Load Level 67 MW
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Project Description: Build tie between 920 (from Arrowhead) to 330 with 340-amp capacity (min.) conductor along 700 East about 1 mile (5,150 ft) along 700/900 East to SR-198 (tie to 330).

Issue(s): 1) 2029-1. 10.12 MVA on Downtown transformer (10 MVA rating)

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Downtown transformer	Normal	10.12 MVA 173%	10 MVA 100% rated capacity

Benefit(s) of Project: A strong tie between Arrowhead and Downtown substations. Operational flexibility for normal and N-1 conditions.

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Downtown transformer	Normal	7.19 MVA 72%	10 MVA 100% rated capacity

Opinion of Probable Cost: \$408,100 (\$496,600 in 2029 construction year)

Risk Assessment: Recovery from N-1 contingencies of Racetrack or Arrowhead feeders may overload the mainline of feeder 330.

Alternatives Considered: n/a

Project # 13 Map



Project # : 14	Project Title: Build Southwest area Substation and Feeders	Priority: Medium– 5 Year Load Level 67 MW
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Project Description: Build Southwest area substation with 12/20 MVA transformer and four feeders. Build 46 kV transmission tap 0.5 miles off Industrial-South sub 46 kV line to new sub site.

Issue(s):

- 1) 2029 “N-1” loss of South substation, loads Industrial substation transformer T2 to 24.8 MVA (20 MVA rating).
- 2) 2033 “N-0” system substation loading goes to 81.1 MVA (total “N-0” capacity 73 MVA).

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Industrial substation transformer T2	N-1	24.8 MVA 124%	20 MVA 100% highest nameplate rated capacity
System substation loading	Normal	81.1 MVA 111%	73 MVA 100% rated capacity

Benefit(s) of Project: New substation capacity becomes available in the southwest area for new growth there. Operational flexibility for normal and N-1 conditions.

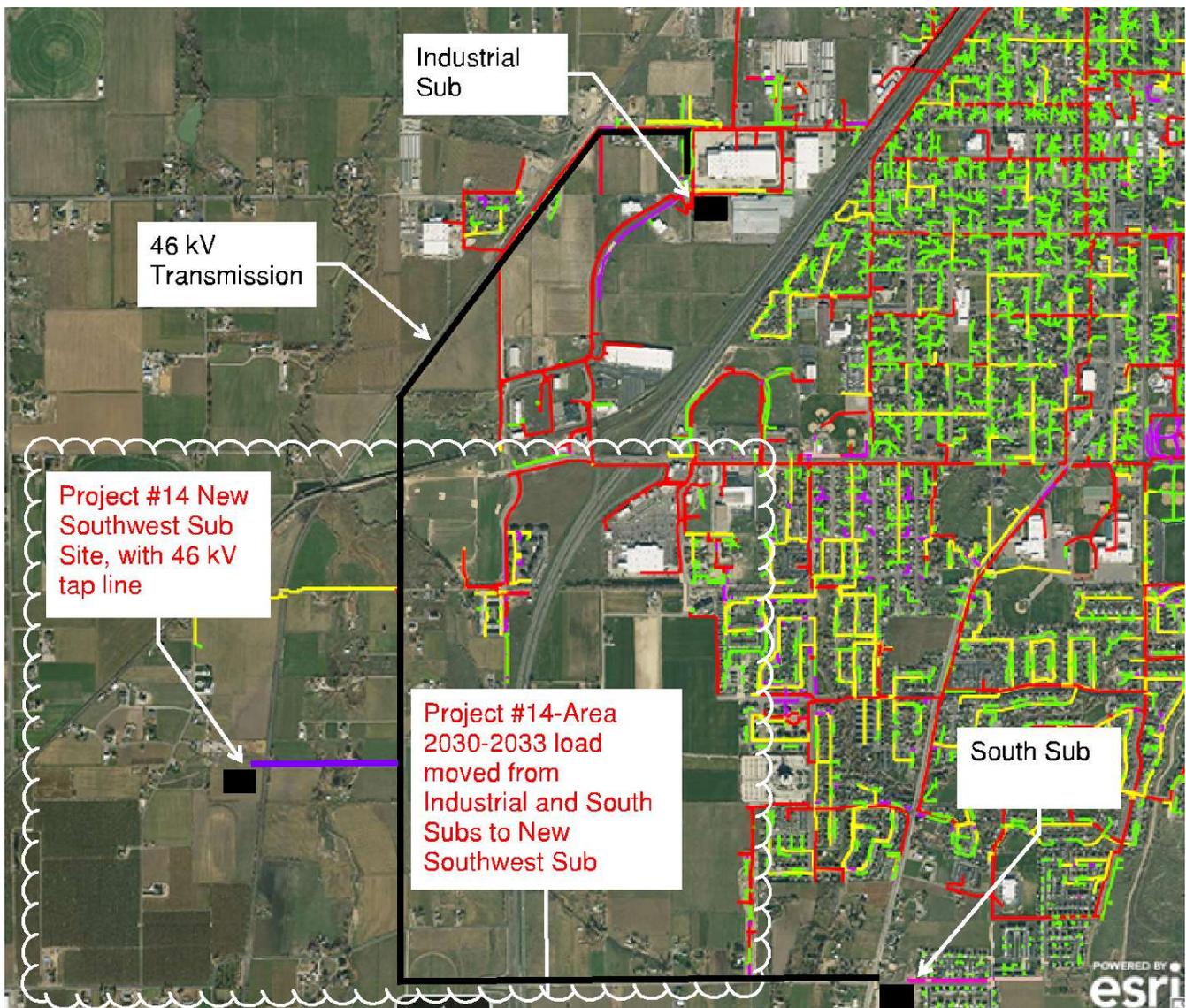
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Industrial substation transformer T2	N-1	7.67 MVA 38%	20 MVA 100% highest nameplate rated capacity
System substation loading	Normal	81.1 MVA 95%	85 MVA 100% rated capacity

Opinion of Probable Cost: \$6,250,300 (\$7,604,500 in 2029 construction year)

Risk Assessment: Normal loading in 2030-2033 and Recovery from N-1 contingencies of the South substation may overload the system and Industrial substation transformers.

Alternatives Considered: n/a

Project # 14 Map



Project # : 15	Project Title: Build new North area Substation and Feeders	Priority: Medium– 5 Year Load Level 67 MW
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Project Description: Build North area substation with 12/20 MVA transformer and four feeders. Build 46 kV transmission tap 0.5 miles off Power Plant-Downtown 46 kV line to new sub site.

Issue(s): 1) 2029 “N-1” loss of Arrowhead substation, loads Downtown substation transformer to 16.5 MVA (12 MVA rating).

Design Criteria Violation:

Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Downtown transformer	N-1	16.5 MVA 138%	12 MVA 100% highest nameplate rated capacity

Benefit(s) of Project: New substation capacity becomes available in the north area for new growth there. Operational flexibility for normal and N-1 conditions

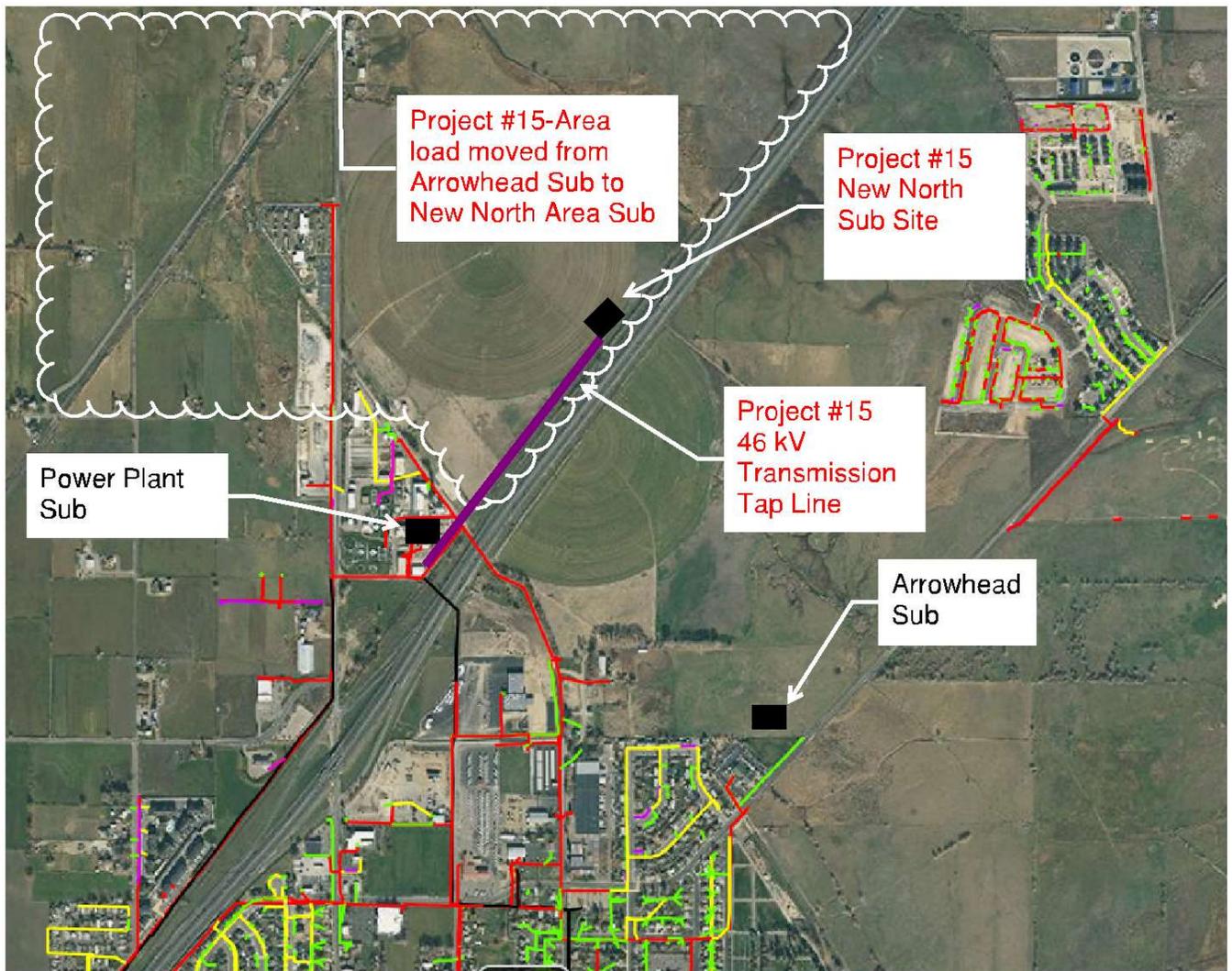
Element	Normal or “N-1”	Modeled Value	Design Criteria Value
Downtown transformer	N-1	10.2 MVA 85%	12 MVA 100% highest nameplate rated capacity

Opinion of Probable Cost: \$6,250,300 (\$7,604,500 in 2029 construction year)

Risk Assessment: Recovery from N-1 contingencies of Arrowhead substation may overload the Downtown transformer.

Alternatives Considered: n/a

Project # 15 Map



8. APPENDIX B: LOAD FORECAST BY FEEDER

**Payson Power
Load Forecast**

2023 to 2033

Substation/Circuit	New Load or Transfer	Growth Rate	Transformer/Circuit Rating (MVA/Amps)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Utilization
Industrial			24 MVA												
Industrial-T1			12 MVA	4.20	4.29	9.39	11.13	11.38	11.44	11.49	11.55	11.60	11.66	11.72	98%
	510 base yr. peak	1.24%	380 Amps	61	62	63	63	64	65	66	66	67	68	69	
	Transfer from 610					142									
	Transfer from 730					83									
	Hiatt Crk					9									
	Hiatt Crk						9								
	M-Tech Red Bridge						69								
	Hiatt Crk							9							
	Adjusted load		Amps	61	62	297	375	385	386	387	387	388	389	390	103%
	520 base yr. peak	1.24%	380 Amps	135	137	138	140	142	144	145	147	149	151	153	
	Adjusted load		Amps	135	137	138	140	142	144	145	147	149	151	153	40%
Industrial-T2			12 MVA	11.70	11.85	9.86	10.01	10.55	10.89	11.05	11.20	11.36	11.52	11.68	97%
	710 base yr. peak	1.24%	450 Amps	139	141	142	144	146	148	150	151	153	155	157	
	Adjusted load		Amps	139	141	142	144	146	148	150	151	153	155	157	35%
	720 base yr. peak	1.24%	450 Amps	0	0	0	0	0	0	0	0	0	0	0	
	Business Park							81							
	Adjusted load		Amps	0	0	0	0	81	81	81	81	81	81	81	18%
	730 base yr. peak	1.24%	450 Amps	403	408	413	418	423	429	434	439	445	450	456	
	Transfer to 810					-16									
	Transfer to 510					-83									
	Transfer to 840							-63							
	Hiatt Crk								9						
	Adjusted load		Amps	403	408	314	319	261	276	281	286	292	297	303	67%
Industrial Sub Total			MVA	15.90	16.14	19.25	21.14	21.93	22.33	22.54	22.75	22.97	23.18	23.40	
Power Plant			5 MVA												
Power Plant-T1			5 MVA	7.00	7.11	4.65	4.73	4.83	4.92	5.01	5.10	5.20	5.29	5.39	108%
	610 base yr. peak	1.24%	270 Amps	172	174	176	178	181	183	185	187	190	192	195	
	Transfer to 510					-142									
	Industrial					69									
	VA					20									
	Geneva Rock					21									
	Adjusted load		Amps	172	174	144	146	149	151	153	155	158	160	163	60%
	620 base yr. peak	1.24%	270 Amps	153	155	157	159	161	163	165	167	169	171	173	
	Transfer to 910					-86									
	Adjusted load		Amps	153	155	71	73	75	77	79	81	83	85	87	32%
Power Plant Sub Total			MVA	7.00	7.11	4.65	4.73	4.83	4.92	5.01	5.10	5.20	5.29	5.39	

**Payson Power
Load Forecast**

2023 to 2033

Substation/Circuit	New Load or Transfer	Growth Rate	Transformer/Circuit Rating (MVA/Amps)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Utilization
Race Track			10 MVA												
Race Track T1			10 MVA	12.40	12.60	11.48	11.63	10.87	11.03	11.19	11.36	11.52	11.69	11.87	119%
	410 base yr. peak	1.24%	380 Amps	218	221	223	226	229	232	235	238	241	244	247	65%
	Adjusted load		Amps	218	221	223	226	229	232	235	238	241	244	247	
	420 base yr. peak	1.24%	380 Amps	135	137	138	140	142	144	145	147	149	151	153	
	Transfer from 330						46								
	Adjusted load		Amps	135	137	184	186	188	190	191	193	195	197	199	52%
	430 base yr. peak	1.24%	380 Amps	223	226	229	231	234	237	240	243	246	249	252	
	Transfer to 830					-57									
	Transfer to 820					-48									
	Transfer to 840							-43							
	Adjusted load		Amps	223	226	124	126	86	89	92	95	98	101	104	27%
	Adjusted load		MVA	12.40	12.60	11.48	11.63	10.87	11.03	11.19	11.36	11.52	11.69	11.87	
Race Track Sub Total															
Downtown			10 MVA												
Downtown-T1			10 MVA	9.30	9.45	8.57	8.69	8.81	8.93	9.05	9.18	9.30	9.43	9.56	96%
	310 base yr. peak	1.24%	380 Amps	112	113	115	116	118	119	121	122	124	125	127	
	Adjusted load		Amps	112	113	115	116	118	119	121	122	124	125	127	33%
	320 base yr. peak	1.24%	380 Amps	125	127	128	130	131	133	135	136	138	140	141	
	Adjusted load		Amps	125	127	128	130	131	133	135	136	138	140	141	37%
	330 base yr. peak	1.24%	380 Amps	195	197	200	202	205	207	210	213	215	218	221	
	Transfer to 420					-46									
	Adjusted load		Amps	195	197	154	156	159	161	164	167	169	172	175	46%
Downtown Sub Total			MVA	9.30	9.45	8.57	8.69	8.81	8.93	9.05	9.18	9.30	9.43	9.56	
New North Arrowhead			12 MVA												
Arrowhead North-T1			12 MVA	0.00	0.00	3.30	4.51	6.29	7.82	7.97	7.97	10.89	10.89	10.89	91%
	910 base yr. peak	1.24%	600 Amps	0	0	0	0	0	0	0	0	0	0	0	
	Transfer from 620					86									
	Villages AH Park					8									
	Arrowhead Ranch					59									
	Villages AH Park						19								
	Arrowhead Ranch						37								
	Villages AH Park							26							
	Arrowhead Ranch							56							
	Villages AH Park								19						
	Arrowhead Ranch								52						
	Arrowhead Ranch									7					
	Adjusted load		Amps	0	0	153	209	291	362	369	369	369	369	369	62%
	920 base yr. peak	1.24%	600 Amps	0	0	0	0	0	0	0	0	0	0	0	
	Adjusted load		Amps	0	0	0	0	0	0	0	0	0	0	0	0%
	930 base yr. peak	1.24%	600 Amps	0	0	0	0	0	0	0	0	0	0	0	
	UVU											135			
	Adjusted load		Amps	0	0	0	0	0	0	0	0	135	135	135	23%
Arrowhead North Sub Total			MVA	0.00	0.00	3.30	4.51	6.29	7.82	7.97	7.97	10.89	10.89	10.89	

**Payson Power
Load Forecast**

2023 to 2033

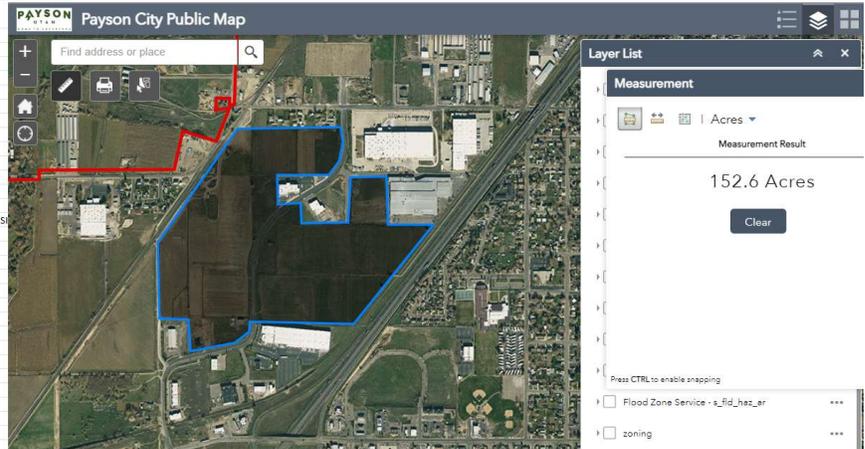
Substation/Circuit	New Load or Transfer	Growth Rate	Transformer/Circuit Rating (MVA/Amps)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Utilization
New South			12 MVA												
New South-T1			12 MVA	0.00	0.00	3.74	4.62	8.66	10.43	10.43	10.43	10.43	10.43	10.43	87%
810	base yr. peak	1.24%	600 Amps	0	0	0	0	0	0	0	0	0	0	0	
	Transfer from 730					16									
	Red Bridge					48									
	Red Bridge						37								
	Red Bridge							78							
	Adjusted load		Amps	0	0	64	101	179	261	261	261	261	261	261	44%
820	base yr. peak	1.24%	600 Amps	0	0	0	0	0	0	0	0	0	0	0	
	Transfer from 430					48									
	The Springs at Spring Lake					4									
	The Springs at Spring Lake						4								
	The Springs at Spring Lake							3							
	Adjusted load		Amps	0	0	52	56	59	59	59	59	59	59	59	10%
830	base yr. peak	1.24%	600 Amps	0	0	0	0	0	0	0	0	0	0	0	
	Transfer from 430					57									
	Adjusted load		Amps	0	0	57	57	57	57	57	57	57	57	57	10%
840	base yr. peak	1.24%	600 Amps	0	0	0	0	0	0	0	0	0	0	0	
	Transfer from 730							63							
	Transfer from 430							43							
	Adjusted load		Amps	0	0	0	0	106	106	106	106	106	106	106	18%
New South Sub Total			MVA	0.00	0.00	3.74	4.62	8.66	10.43	10.43	10.43	10.43	10.43	10.43	
New West			24 MVA												
New West-T1			12 MVA	0.00	0.00	0.00	0.00	0.00	0.00	4.41	6.18	7.32	7.32	9.53	79%
1010	base yr. peak	1.24%	600 Amps	0	0	0	0	0	0	0	0	0	0	0	
	Business Park									122					
	Red Bridge									82					
	Adjusted load		Amps	0	0	0	0	0	0	122	204	204	204	204	34%
1020	base yr. peak	1.24%	600 Amps	0	0	0	0	0	0	0	0	0	0	0	
	Red Bridge									82					
	Red Bridge											53			
	Business Park													102	
	Adjusted load		Amps	0	0	0	0	0	0	82	82	135	135	237	40%
New West Sub Total			MVA	0.00	0.00	0.00	0.00	0.00	0.00	4.41	6.18	7.32	7.32	9.53	

9. APPENDIX C: LOAD ESTIMATE BASIS FOR MAJOR DEVELOPMENTS

Residential Demand Growth		8 kVA per residential unit assumed										
Development Area	Year	Year										
		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
570 Lots & Townhome	Units/yr	0	160	100	150	140	20	0	0	0	0	
Arrowhead Ranch	Accum Units	0	160	260	410	550	570	570	570	570	570	570 Total Units
1260 N 1400 E	Load Inc/Yr kVA	0	1280	800	1200	1120	160	0	0	0	0	4560 Total kVA estimated
192 Lots & Townhome	Units/yr	0	22	50	70	50	0	0	0	0	0	
Villages at AH Park	Accum Units	0	22	72	142	192	192	192	192	192	192	192 Total Units
1420 N 1190 E	Load Inc/Yr kVA	0	176	400	560	400	0	0	0	0	0	1536 Total kVA estimated
1241 Units	Units/yr	0	129	100	210	220	220	220	142	0	0	
Red Bridge	Accum Units	0	129	229	439	659	879	1099	1241	1241	1241	1241 Total Units
1950 W 1130 S	Load Inc/Yr kVA	0	1041	807	1695	1775	1775	1775	1146	0	0	10015 Total kVA estimated
100 Units	Units/yr	0	25	25	25	25	0	0	0	0	0	
Hiatt Crk	Accum Units	0	25	50	75	100	100	100	100	100	100	100 Total Units
1950 W 1130 S	Load Inc/Yr kVA	0	202	202	202	202	0	0	0	0	0	807 Total kVA estimated
32 Lots	Units/yr	0	12	12	8	0	0	0	0	0	0	
The Springs at SL	Accum Units	0	12	24	32	32	32	32	32	32	32	32 Total Units
2000 S 600 W	Load Inc/Yr kVA	0	97	97	65	0	0	0	0	0	0	258 Total kVA estimated
All Developments	Units/yr	0	348	287	463	435	240	220	142	0	0	
Yearly	Accum Units	0	348	635	1098	1533	1773	1993	2135	2135	2135	2135 Grand Total Units
Impact/Increase	Load Inc/Yr kVA	0	2796	2306	3721	3497	1935	1775	1146	0	0	17176 Grand Total kVA estimated

Industrial Business Park			
Spatial Load Estimates DATA			
	2023 Load kVA	Acres	kVA/Acre
Existing			
RM ATV	511	11	46
Liberty Safe	1574	23	68
PPC Flex Packaging	1520	14.5	105
JSI Store Fixtures	358	13	28
From Data Above	Average kVA/Acre		61.75
	Max kVA/Acre		105
	Min kVA/Acre		28
Acres Available	152.6		
Est Load at Average kVA/Acre	9423 kVA		
Est Load at Max kVA/Acre	16023 kVA		
Est Load at Min kVA/Acre	4273 kVA		
Est Load at 47 kVA/Acre	7172 kVA		Value Used--Average of RM ATV, Liberty Safe, & JSI
Growth on 710,730 In Forecast	906 kVA		
Growth to add =	6266 kVA		(uses row 18, 7,172 kVA)
Add in '25	0 kVA		0 kW
Add in '27	1671 kVA		1587 kW
Add in '29	2506 kVA		2381 kW
Add in '33	2089 kVA		1984 kW

Payson City Utilities Public Map



10. APPENDIX D: PROJECT COST ESTIMATE TABLES

Project 1:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost
Underground Primary Cable Installation								
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	0	CKT FT	0.040	0	\$ -	\$ 50.00	\$ -	\$ -
Trenching								
Utility Trench for Single Conduit - Good Soil	0	LF	0.070	0	\$ -	\$ -	\$ -	\$ -
Conduit Installation								
New 6" PVC Conduit Installation	0	LF	0.040	0	\$ -	\$ 16.00	\$ -	\$ -
Switchgear Installation & Equipment								
Box Pad Base for - Three Phase Switch PME Switchgear	0	EA	5.000	0	\$ -	\$ 1,750.00	\$ -	\$ -
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	0	EA	32.000	0	\$ -	\$ 18,000.00	\$ -	\$ -
Overhead								
45' CL 2 Pole	1	EA	8.500	8.5	\$ 606.31	\$ 1,800.00	\$ 1,800.00	\$ 2,406.31
Guy & Anchor	0	EA	4.250	0	\$ -	\$ 275.00	\$ -	\$ -
Three Phase Primary Tangent Pole Top Assembly	0	EA	5.500	0	\$ -	\$ 475.00	\$ -	\$ -
Three Phase Primary Single Deadend Pole Top Assembly	1	EA	6.000	6	\$ 427.98	\$ 775.00	\$ 775.00	\$ 1,202.98
Three Phase Primary Conductor (477 kcmil ACSR)	0	CKT FT	0.044	0	\$ -	\$ 16.00	\$ -	\$ -
Three Phase - Primary Riser	0	EA	12.500	0	\$ -	\$ 1,375.00	\$ -	\$ -
Three Phase - Gang Operated Air Break Switch	1	EA	12.000	12	\$ 855.96	\$ 7,200.00	\$ 7,200.00	\$ 8,055.96
Total								\$ 11,665.25
Subtotals								
			Total Hours	26.5	Subtotal Material		\$ 9,775.00	
Avg. Labor Rate	\$ 71.33	Subtotal Labor		\$ 1,890.25	Subtotal Tax		\$ -	
Sales Tax Material	0.00%	Subtotal Labor, Material & Tax						\$ 11,665.25
Equipment & Trucks	\$ 40.00	Subtotal Equipment & Trucks						\$ 1,060.00
Contingency	15.00%	Subtotal Contingency						\$ 1,908.79
Engineering	8.00%	Subtotal Engineering						\$ 933.22
Total Budgetary Estimate								\$ 15,567.25

Project 2:

South Substation	Quantity		Labor Cost			Material Cost		Total
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost
	Substation Equipment and Installation							
46 kV -12.47 kV 12/20 MVA Transformer	1 EA		100.000	100	\$ 7,133.00	\$ 1,500,000.00	\$ 1,500,000.00	\$ 1,507,133.00
46 kV High Side Breaker	1 EA		20.000	20	\$ 1,426.60	\$ 67,600.00	\$ 67,600.00	\$ 69,026.60
46 kV GOAB Switch	1 EA		24.000	24	\$ 1,711.92	\$ 14,560.00	\$ 14,560.00	\$ 16,271.92
46 kV Relaying VT	3 EA		6.000	18	\$ 1,283.94	\$ 9,880.00	\$ 29,640.00	\$ 30,923.94
15 kV GOAB Switch	1 EA		16.000	16	\$ 1,141.28	\$ 5,620.00	\$ 5,620.00	\$ 6,761.28
15 kV Recloser	4 EA		16.000	64	\$ 4,565.12	\$ 8,530.00	\$ 34,120.00	\$ 38,685.12
15 kV VT	4 EA		4.000	16	\$ 1,141.28	\$ 2,080.00	\$ 8,320.00	\$ 9,461.28
15 kV 1 phase fused disconnect	16 EA		2.000	32	\$ 2,282.56	\$ 5,720.00	\$ 91,520.00	\$ 93,802.56
15 kV 1 phase Hookstick Switch	24 EA		2.000	48	\$ 3,423.84	\$ 1,250.00	\$ 30,000.00	\$ 33,423.84
Metering/Relaying	1 EA		120.000	120	\$ 8,559.60	\$ 95,000.00	\$ 95,000.00	\$ 103,559.60
Steel Structures	1 EA		266.000	266	\$ 18,973.78	\$ 370,000.00	\$ 370,000.00	\$ 388,973.78
Concrete Foundations	1 EA		212.000	212	\$ 15,121.96	\$ 429,700.00	\$ 429,700.00	\$ 444,821.96
Substation Bus & Material	1 EA		596.000	596	\$ 42,512.68	\$ 227,000.00	\$ 227,000.00	\$ 269,512.68
Substation Conduit & Cable	1 EA		487.000	487	\$ 34,737.71	\$ 119,100.00	\$ 119,100.00	\$ 153,837.71
Substation Grounding	1 EA		160.000	160	\$ 11,412.80	\$ 26,000.00	\$ 26,000.00	\$ 37,412.80
Substation Site Work	500 CUYD		0.100	50	\$ 3,566.50	\$ 60.00	\$ 30,000.00	\$ 33,566.50
Substation SCADA & Communications	1 EA		48.000	48	\$ 3,423.84	\$ 15,600.00	\$ 15,600.00	\$ 19,023.84
15 kV Distribution Feeders	4 EA		180.000	720	\$ 51,357.60	\$ 166,950.00	\$ 667,800.00	\$ 719,157.60
Substation Testing & Commissioning	1 EA		375.000	375	\$ 26,748.75	\$ 3,900.00	\$ 3,900.00	\$ 30,648.75
Underground Primary Cable Installation								
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	3,400	CKT FT	0.040	136	\$ 9,700.88	\$ 50.00	\$ 170,000.00	\$ 179,700.88
Trenching								
Utility Trench for Single Conduit - Good Soil	3,000	LF	0.070	210	\$ 14,979.30	\$ -	\$ -	\$ 14,979.30
Conduit Installation								
New 6" PVC Conduit Installation	3,000	LF	0.040	120	\$ 8,559.60	\$ 16.00	\$ 48,000.00	\$ 56,559.60
Switchgear Installation & Equipment								
Box Pad Base for - Three Phase Switch PME Switchgear	4 EA		5.000	20	\$ 1,426.60	\$ 1,750.00	\$ 7,000.00	\$ 8,426.60
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	4 EA		32.000	128	\$ 9,130.24	\$ 18,000.00	\$ 72,000.00	\$ 81,130.24
Overhead								
45' CL 2 Pole	4 EA		8.500	34	\$ 2,425.22	\$ 1,800.00	\$ 7,200.00	\$ 9,625.22
Guy & Anchor	4 EA		4.250	17	\$ 1,212.61	\$ 275.00	\$ 1,100.00	\$ 2,312.61
Three Phase Primary Tangent Pole Top Assembly	0 EA		5.500	0	\$ -	\$ 475.00	\$ -	\$ -
Three Phase Primary Single Deadend Pole Top Assembly	4 EA		6.000	24	\$ 1,711.92	\$ 775.00	\$ 3,100.00	\$ 4,811.92
Three Phase Primary Conductor (477 kcmil ACSR)	0	CKT FT	0.044	0	\$ -	\$ 16.00	\$ -	\$ -
Three Phase - Primary Riser	4 EA		12.500	50	\$ 3,566.50	\$ 1,375.00	\$ 5,500.00	\$ 9,066.50
Total								\$ 4,372,617.63
Subtotals								
			Total			Subtotal		
			Hours	4111		Material	\$ 4,079,380.00	
Avg. Labor Rate	\$ 71.33			Subtotal Labor	\$ 293,237.63			
Sales Tax Material	0.00%			Subtotal Tax	\$ -			
Subtotal Labor, Material & Tax								\$ 4,372,617.63
Equipment & Trucks	\$ 40.00			Subtotal Equipment & Trucks	\$ 164,440.00			
Contingency	15.00%			Subtotal Contingency	\$ 680,558.64			
Engineering	8.00%			Subtotal Engineering	\$ 349,809.41			
Total Budgetary Estimate								\$ 5,567,425.68
Plus T-Line								\$ 2,800,000.00
								\$ 8,367,425.68

Project 3:

North/Arrowhead Substation	Quantity		Labor Cost			Material Cost		Total	
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost	
Substation Equipment and Installation									
46 kV -12.47 kV 12/20 MVA Transformer	1 EA		100.000	100	\$ 7,133.00	\$ 1,500,000.00	\$ 1,500,000.00	\$ 1,507,133.00	
46 kV High Side Breaker	1 EA		20.000	20	\$ 1,426.60	\$ 67,600.00	\$ 67,600.00	\$ 69,026.60	
46 kV GOAB Switch	1 EA		24.000	24	\$ 1,711.92	\$ 14,560.00	\$ 14,560.00	\$ 16,271.92	
46 kV Relaying VT	3 EA		6.000	18	\$ 1,283.94	\$ 9,880.00	\$ 29,640.00	\$ 30,923.94	
15 kV GOAB Switch	1 EA		16.000	16	\$ 1,141.28	\$ 5,620.00	\$ 5,620.00	\$ 6,761.28	
15 kV Recloser	4 EA		16.000	64	\$ 4,565.12	\$ 8,530.00	\$ 34,120.00	\$ 38,685.12	
15 kV VT	4 EA		4.000	16	\$ 1,141.28	\$ 2,080.00	\$ 8,320.00	\$ 9,461.28	
15 kV 1 phase fused disconnect	16 EA		2.000	32	\$ 2,282.56	\$ 5,720.00	\$ 91,520.00	\$ 93,802.56	
15 kV 1 phase Hookstick Switch	24 EA		2.000	48	\$ 3,423.84	\$ 1,250.00	\$ 30,000.00	\$ 33,423.84	
Metering/Relaying	1 EA		120.000	120	\$ 8,559.60	\$ 95,000.00	\$ 95,000.00	\$ 103,559.60	
Steel Structures	1 EA		266.000	266	\$ 18,973.78	\$ 370,000.00	\$ 370,000.00	\$ 388,973.78	
Concrete Foundations	1 EA		212.000	212	\$ 15,121.96	\$ 429,700.00	\$ 429,700.00	\$ 444,821.96	
Substation Bus & Material	1 EA		596.000	596	\$ 42,512.68	\$ 227,000.00	\$ 227,000.00	\$ 269,512.68	
Substation Conduit & Cable	1 EA		487.000	487	\$ 34,737.71	\$ 119,100.00	\$ 119,100.00	\$ 153,837.71	
Substation Grounding	1 EA		160.000	160	\$ 11,412.80	\$ 26,000.00	\$ 26,000.00	\$ 37,412.80	
Substation Site Work	500 CUYD		0.100	50	\$ 3,566.50	\$ 60.00	\$ 30,000.00	\$ 33,566.50	
Substation SCADA & Communications	1 EA		48.000	48	\$ 3,423.84	\$ 15,600.00	\$ 15,600.00	\$ 19,023.84	
15 kV Distribution Feeders	4 EA		180.000	720	\$ 51,357.60	\$ 166,950.00	\$ 667,800.00	\$ 719,157.60	
Substation Testing & Commissioning	1 EA		375.000	375	\$ 26,748.75	\$ 3,900.00	\$ 3,900.00	\$ 30,648.75	
Underground Primary Cable Installation									
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	3,400 CKT FT		0.040	136	\$ 9,700.88	\$ 50.00	\$ 170,000.00	\$ 179,700.88	
Trenching									
Utility Trench for Single Conduit - Good Soil	3,000 LF		0.070	210	\$ 14,979.30	\$ -	\$ -	\$ 14,979.30	
Conduit Installation									
New 6" PVC Conduit Installation	3,000 LF		0.040	120	\$ 8,559.60	\$ 16.00	\$ 48,000.00	\$ 56,559.60	
Switchgear Installation & Equipment									
Box Pad Base for - Three Phase Switch PME Switchgear	4 EA		5.000	20	\$ 1,426.60	\$ 1,750.00	\$ 7,000.00	\$ 8,426.60	
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	4 EA		32.000	128	\$ 9,130.24	\$ 18,000.00	\$ 72,000.00	\$ 81,130.24	
Overhead									
45' CL 2 Pole	4 EA		8.500	34	\$ 2,425.22	\$ 1,800.00	\$ 7,200.00	\$ 9,625.22	
Guy & Anchor	4 EA		4.250	17	\$ 1,212.61	\$ 275.00	\$ 1,100.00	\$ 2,312.61	
Three Phase Primary Tangent Pole Top Assembly	0 EA		5.500	0	\$ -	\$ 475.00	\$ -	\$ -	
Three Phase Primary Single Deadend Pole Top Assembly	4 EA		6.000	24	\$ 1,711.92	\$ 775.00	\$ 3,100.00	\$ 4,811.92	
Three Phase Primary Conductor (477 kcmil ACSR)	0 CKT FT		0.044	0	\$ -	\$ 16.00	\$ -	\$ -	
Three Phase - Primary Riser	4 EA		12.500	50	\$ 3,566.50	\$ 1,375.00	\$ 5,500.00	\$ 9,066.50	
Total								\$ 4,372,617.63	
Subtotals									
			Total			Subtotal			
Avg. Labor Rate			\$ 71.33	Hours	4111	Material	\$ 4,079,380.00		
			Subtotal Labor	\$ 293,237.63					
Sales Tax Material			0.00%			Subtotal Tax	\$ -		
								Subtotal Labor, Material & Tax	\$ 4,372,617.63
Equipment & Trucks									
Equipment & Trucks			\$ 40.00			Subtotal Equipment & Trucks	\$ 164,440.00		
Contingency			15.00%			Subtotal Contingency	\$ 680,558.64		
Engineering			8.00%			Subtotal Engineering	\$ 349,809.41		
Total Budgetary Estimate								\$ 5,567,425.68	
								Plus T-Line	\$ 682,746.36
									\$ 6,250,172.05

Project 4:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost
Project 4 Tie 510 to 730								
Underground Primary Cable Installation								
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	1,450	CKT FT	0.040	58	\$ 4,137.14	\$ 50.00	\$ 72,500.00	\$ 76,637.14
Trenching								
Utility Trench for Single Conduit - Good Soil	1,450	LF	0.070	101.5	\$ 7,240.00	\$ -	\$ -	\$ 7,240.00
Conduit Installation								
New 6" PVC Conduit Installation	1,450	LF	0.040	58	\$ 4,137.14	\$ 16.00	\$ 23,200.00	\$ 27,337.14
Switchgear Installation & Equipment								
Box Pad Base for - Three Phase Switch PME Switchgear	2	EA	5.000	10	\$ 713.30	\$ 1,750.00	\$ 3,500.00	\$ 4,213.30
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	2	EA	32.000	64	\$ 4,565.12	\$ 18,000.00	\$ 36,000.00	\$ 40,565.12
Overhead								
45' CL 2 Pole	0	EA	8.500	0	\$ -	\$ 1,800.00	\$ -	\$ -
Guy & Anchor	0	EA	4.250	0	\$ -	\$ 275.00	\$ -	\$ -
Three Phase Primary Tangent Pole Top Assembly	0	EA	5.500	0	\$ -	\$ 475.00	\$ -	\$ -
Three Phase Primary Single Deadend Pole Top Assembly	0	EA	6.000	0	\$ -	\$ 775.00	\$ -	\$ -
Three Phase Primary Conductor (477 kcmil ACSR)	0	CKT FT	0.044	0	\$ -	\$ 16.00	\$ -	\$ -
Three Phase - Primary Riser	0	EA	12.500	0	\$ -	\$ 1,375.00	\$ -	\$ -
Total								\$ 155,992.70
Subtotals								
			Total Hours	291.5	Subtotal Material		\$ 135,200.00	
Avg. Labor Rate	\$ 71.33	Subtotal Labor		\$ 20,792.70	Subtotal Tax		\$ -	
Sales Tax Material	0.00%	Subtotal Labor, Material & Tax		\$ 155,992.70	Subtotal Equipment & Trucks		\$ 11,660.00	
Equipment & Trucks	\$ 40.00	Subtotal Contingency		\$ 25,147.90	Subtotal Engineering		\$ 12,479.42	
Contingency	15.00%	Subtotal Engineering		\$ 12,479.42	Total Budgetary Estimate		\$ 205,280.01	
Engineering	8.00%							
Total Budgetary Estimate								\$ 205,280.01

Project 5:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total	
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost	
Project 5 510-610 I-15 Xing									
Underground Primary Cable Installation									
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	0	CKT FT	0.040	0	\$ -	\$ 50.00	\$ -	\$ -	
Trenching									
Utility Trench for Single Conduit - Good Soil	0	LF	0.070	0	\$ -	\$ -	\$ -	\$ -	
Conduit Installation									
New 6" PVC Conduit Installation	0	LF	0.040	0	\$ -	\$ 16.00	\$ -	\$ -	
Switchgear Installation & Equipment									
Box Pad Base for - Three Phase Switch PME Switchgear	0	EA	5.000	0	\$ -	\$ 1,750.00	\$ -	\$ -	
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	0	EA	32.000	0	\$ -	\$ 18,000.00	\$ -	\$ -	
Overhead									
45' CL 2 Pole	7	EA	8.500	59.5	\$ 4,244.14	\$ 1,800.00	\$ 12,600.00	\$ 16,844.14	
Guy & Anchor	2	EA	4.250	8.5	\$ 606.31	\$ 275.00	\$ 550.00	\$ 1,156.31	
Three Phase Primary Tangent Pole Top Assembly	5	EA	5.500	27.5	\$ 1,961.58	\$ 475.00	\$ 2,375.00	\$ 4,336.58	
Three Phase Primary Single Deadend Pole Top Assembly	2	EA	6.000	12	\$ 855.96	\$ 775.00	\$ 1,550.00	\$ 2,405.96	
Three Phase Primary Conductor (477 kcmil ACSR)	1525	CKT FT	0.044	67.1	\$ 4,786.24	\$ 16.00	\$ 24,400.00	\$ 29,186.24	
Three Phase - Primary Riser	0	EA	12.500	0	\$ -	\$ 1,375.00	\$ -	\$ -	
Total								\$ 53,929.22	
Subtotals									
			Total Hours	174.6	Subtotal Material		\$ 41,475.00		
Avg. Labor Rate	\$ 71.33	Subtotal Labor		\$ 12,454.22	Subtotal Tax		\$ -		
Sales Tax Material	0.00%								
								Subtotal Labor, Material & Tax	\$ 53,929.22
Equipment & Contingency									
Equipment & Trucks	\$ 40.00	Subtotal Equipment & Trucks		\$ 6,984.00	Subtotal Contingency		\$ 9,136.98		
Contingency	15.00%	Subtotal Contingency		\$ 9,136.98	Subtotal Engineering		\$ 4,314.34		
Engineering	8.00%								
Total Budgetary Estimate								\$ 74,364.54	

Project 6:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost
Project 6 South Sub tie to 800 South--Underbuilt on transmission li								
Underground Primary Cable Installation								
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	0	CKT FT	0.040	0	\$ -	\$ 50.00	\$ -	\$ -
Trenching								
Utility Trench for Single Conduit - Good Soil	0	LF	0.070	0	\$ -	\$ -	\$ -	\$ -
Conduit Installation								
New 6" PVC Conduit Installation	0	LF	0.040	0	\$ -	\$ 16.00	\$ -	\$ -
Switchgear Installation & Equipment								
Box Pad Base for - Three Phase Switch PME Switchgear	0	EA	5.000	0	\$ -	\$ 1,750.00	\$ -	\$ -
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	0	EA	32.000	0	\$ -	\$ 18,000.00	\$ -	\$ -
Overhead								
45' CL 2 Pole	2	EA	8.500	17	\$ 1,212.61	\$ 1,800.00	\$ 3,600.00	\$ 4,812.61
Guy & Anchor	3	EA	4.250	12.75	\$ 909.46	\$ 275.00	\$ 825.00	\$ 1,734.46
Three Phase Primary Tangent Pole Top Assembly	25	EA	5.500	137.5	\$ 9,807.88	\$ 475.00	\$ 11,875.00	\$ 21,682.88
Three Phase Primary Single Deadend Pole Top Assembly	4	EA	6.000	24	\$ 1,711.92	\$ 775.00	\$ 3,100.00	\$ 4,811.92
Three Phase Primary Conductor (477 kcmil ACSR)	7350	CKT FT	0.044	323.4	\$ 23,068.12	\$ 16.00	\$ 117,600.00	\$ 140,668.12
Three Phase - Primary Riser	2	EA	12.500	25	\$ 1,783.25	\$ 1,375.00	\$ 2,750.00	\$ 4,533.25
Total								\$ 178,243.23
Subtotals								
			Total Hours	539.65	Subtotal Material		\$ 139,750.00	
Avg. Labor Rate	\$ 71.33	Subtotal Labor		\$ 38,493.23	Subtotal Tax		\$ -	
Sales Tax Material	0.00%	Subtotal Labor, Material & Tax						\$ 178,243.23
Equipment & Trucks	\$ 40.00	Subtotal Equipment & Trucks						\$ 21,586.00
Contingency	15.00%	Subtotal Contingency						\$ 29,974.39
Engineering	8.00%	Subtotal Engineering						\$ 14,259.46
Total Budgetary Estimate								\$ 244,063.08

Project 7:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total	
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost	
Project 7 Strong tie feeders 710 to 320									
Underground Primary Cable Installation									
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	850	CKT FT	0.040	34	\$ 2,425.22	\$ 50.00	\$ 42,500.00	\$ 44,925.22	
Trenching									
Utility Trench for Single Conduit - Good Soil	850	LF	0.070	59.5	\$ 4,244.14	\$ -	\$ -	\$ 4,244.14	
Conduit Installation									
New 6" PVC Conduit Installation	850	LF	0.040	34	\$ 2,425.22	\$ 16.00	\$ 13,600.00	\$ 16,025.22	
Switchgear Installation & Equipment									
Box Pad Base for - Three Phase Switch PME Switchgear	1	EA	5.000	5	\$ 356.65	\$ 1,750.00	\$ 1,750.00	\$ 2,106.65	
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	1	EA	32.000	32	\$ 2,282.56	\$ 18,000.00	\$ 18,000.00	\$ 20,282.56	
Overhead									
45' CL 2 Pole	21	EA	8.500	178.5	\$ 12,732.41	\$ 1,800.00	\$ 37,800.00	\$ 50,532.41	
Guy & Anchor	6	EA	4.250	25.5	\$ 1,818.92	\$ 275.00	\$ 1,650.00	\$ 3,468.92	
Three Phase Primary Tangent Pole Top Assembly	24	EA	5.500	132	\$ 9,415.56	\$ 475.00	\$ 11,400.00	\$ 20,815.56	
Three Phase Primary Single Deadend Pole Top Assembly	6	EA	6.000	36	\$ 2,567.88	\$ 775.00	\$ 4,650.00	\$ 7,217.88	
Three Phase Primary Conductor (477 kcmil ACSR)	4760	CKT FT	0.044	209.44	\$ 14,939.36	\$ 16.00	\$ 76,160.00	\$ 91,099.36	
Three Phase - Primary Riser	4	EA	12.500	50	\$ 3,566.50	\$ 1,375.00	\$ 5,500.00	\$ 9,066.50	
Total								\$ 269,784.40	
Subtotals									
			Total			Subtotal			
			Hours	795.94		Material	\$ 213,010.00		
Avg. Labor Rate	\$ 71.33			Subtotal Labor	\$ 56,774.40				
Sales Tax Material	0.00%					Subtotal Tax	\$ -		
								Subtotal Labor, Material & Tax	\$ 269,784.40
Equipment & Trucks									
Equipment & Trucks	\$ 40.00					Subtotal Equipment & Trucks	\$ 31,837.60		
Contingency	15.00%					Subtotal Contingency	\$ 45,243.30		
Engineering	8.00%					Subtotal Engineering	\$ 21,582.75		
								Total Budgetary Estimate	\$ 368,448.05

Project 8:

46 kV Transmission Line to South Sub Project 8 46 kV transmission line loop (west side)	Quantity		Labor Cost			Material Cost		Total
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost
Underground Primary Cable Installation								
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	0	CKT FT	0.040	0	\$ -	\$ 50.00	\$ -	\$ -
Trenching								
Utility Trench for Single Conduit - Good Soil	0	LF	0.070	0	\$ -	\$ -	\$ -	\$ -
Conduit Installation								
New 6" PVC Conduit Installation	0	LF	0.040	0	\$ -	\$ 16.00	\$ -	\$ -
Switchgear Installation & Equipment								
Box Pad Base for - Three Phase Switch PME Switchgear	0	EA	5.000	0	\$ -	\$ 1,750.00	\$ -	\$ -
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	0	EA	32.000	0	\$ -	\$ 18,000.00	\$ -	\$ -
Overhead								
Steel Transmission Pole incl. Eng. & Foundation	3	EA	34.000	102	\$ 7,275.66	\$ 175,000.00	\$ 525,000.00	\$ 532,275.66
70' CL H1 Pole	75	EA	17.000	1275	\$ 90,945.75	\$ 5,000.00	\$ 375,000.00	\$ 465,945.75
46 kV insulators	225	EA	2.000	450	\$ 32,098.50	\$ 200.00	\$ 45,000.00	\$ 77,098.50
Guy & Anchor	0	EA	4.250	0	\$ -	\$ 275.00	\$ -	\$ -
Three Phase Primary Tangent Pole Top Assembly	75	EA	5.500	412.5	\$ 29,423.63	\$ 475.00	\$ 35,625.00	\$ 65,048.63
Three Phase Primary Single Deadend Pole Top Assembly	5	EA	6.000	30	\$ 2,139.90	\$ 775.00	\$ 3,875.00	\$ 6,014.90
Three Phase Primary Conductor (795 ACSR)	21000	CKT FT	0.044	924	\$ 65,908.92	\$ 30.11	\$ 632,310.00	\$ 698,218.92
46 kV switches	2	EA	12.500	25	\$ 1,783.25	\$ 12,000.00	\$ 24,000.00	\$ 25,783.25
Total								\$ 1,870,385.61
Subtotals								
			Total Hours	3218.5		Subtotal Material	\$ 1,640,810.00	
Avg. Labor Rate	\$ 71.33			Subtotal Labor	\$ 229,575.61			
Sales Tax Material	0.00%			Subtotal Tax	\$ -			
Subtotal Labor, Material & Tax								\$ 1,870,385.61
Equipment & Trucks	\$ 40.00			Subtotal Equipment & Trucks	\$ 128,740.00			
Contingency	15.00%			Subtotal Contingency	\$ 299,868.84			
Engineering	8.00%			Subtotal Engineering	\$ 149,630.85			
Total Budgetary Estimate								\$ 2,448,625.29

Project 9:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost
Project 9 South Sub feeder 810 tie to 510/730								
Underground Primary Cable Installation								
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	0	CKT FT	0.040	0	\$ -	\$ 50.00	\$ -	\$ -
Trenching								
Utility Trench for Single Conduit - Good Soil	0	LF	0.070	0	\$ -	\$ -	\$ -	\$ -
Conduit Installation								
New 6" PVC Conduit Installation	0	LF	0.040	0	\$ -	\$ 16.00	\$ -	\$ -
Switchgear Installation & Equipment								
Box Pad Base for - Three Phase Switch PME Switchgear	1	EA	5.000	5	\$ 356.65	\$ 1,750.00	\$ 1,750.00	\$ 2,106.65
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	1	EA	32.000	32	\$ 2,282.56	\$ 18,000.00	\$ 18,000.00	\$ 20,282.56
Overhead								
45' CL 2 Pole	53	EA	8.500	450.5	\$ 32,134.17	\$ 1,800.00	\$ 95,400.00	\$ 127,534.17
Guy & Anchor	8	EA	4.250	34	\$ 2,425.22	\$ 275.00	\$ 2,200.00	\$ 4,625.22
Three Phase Primary Tangent Pole Top Assembly	48	EA	5.500	264	\$ 18,831.12	\$ 475.00	\$ 22,800.00	\$ 41,631.12
Three Phase Primary Single Deadend Pole Top Assembly	8	EA	6.000	48	\$ 3,423.84	\$ 775.00	\$ 6,200.00	\$ 9,623.84
Three Phase Primary Conductor (477 kcmil ACSR)	12900	CKT FT	0.044	567.6	\$ 40,486.91	\$ 16.00	\$ 206,400.00	\$ 246,886.91
Three Phase - Primary Riser	2	EA	12.500	25	\$ 1,783.25	\$ 1,375.00	\$ 2,750.00	\$ 4,533.25
Total								\$ 457,223.71
Subtotals								
			Total Hours	1426.1	Subtotal Material		\$ 355,500.00	
Avg. Labor Rate	\$ 71.33	Subtotal Labor		\$ 101,723.71	Subtotal Tax		\$ -	
Sales Tax Material	0.00%	Subtotal Labor, Material & Tax					\$ 457,223.71	
Equipment & Trucks	\$ 40.00	Subtotal Equipment & Trucks					\$ 57,044.00	
Contingency	15.00%	Subtotal Contingency					\$ 77,140.16	
Engineering	8.00%	Subtotal Engineering					\$ 36,577.90	
Total Budgetary Estimate								\$ 627,985.77

Project 10:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total	
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost	
Project 10 Recond/Rebuild 330 main line									
Underground Primary Cable Installation									
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	1,960	CKT FT	0.040	78.4	\$ 5,592.27	\$ 50.00	\$ 98,000.00	\$ 103,592.27	
Trenching									
Utility Trench for Single Conduit - Good Soil	1,960	LF	0.070	137.2	\$ 9,786.48	\$ -	\$ -	\$ 9,786.48	
Conduit Installation									
New 6" PVC Conduit Installation	1,960	LF	0.040	78.4	\$ 5,592.27	\$ 16.00	\$ 31,360.00	\$ 36,952.27	
Switchgear Installation & Equipment									
Box Pad Base for - Three Phase Switch PME Switchgear	2	EA	5.000	10	\$ 713.30	\$ 1,750.00	\$ 3,500.00	\$ 4,213.30	
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	2	EA	32.000	64	\$ 4,565.12	\$ 18,000.00	\$ 36,000.00	\$ 40,565.12	
Overhead									
45' CL 2 Pole	9	EA	8.500	76.5	\$ 5,456.75	\$ 1,800.00	\$ 16,200.00	\$ 21,656.75	
Guy & Anchor	2	EA	4.250	8.5	\$ 606.31	\$ 275.00	\$ 550.00	\$ 1,156.31	
Three Phase Primary Tangent Pole Top Assembly	6	EA	5.500	33	\$ 2,353.89	\$ 475.00	\$ 2,850.00	\$ 5,203.89	
Three Phase Primary Single Deadend Pole Top Assembly	2	EA	6.000	12	\$ 855.96	\$ 775.00	\$ 1,550.00	\$ 2,405.96	
Three Phase Primary Conductor (477 kcmil ACSR)	980	CKT FT	0.044	43.12	\$ 3,075.75	\$ 16.00	\$ 15,680.00	\$ 18,755.75	
Three Phase - Primary Riser	1	EA	12.500	12.5	\$ 891.63	\$ 1,375.00	\$ 1,375.00	\$ 2,266.63	
Total								\$ 246,554.71	
Subtotals									
			Total Hours	553.62		Subtotal Material	\$ 207,065.00		
Avg. Labor Rate	\$ 71.33			Subtotal Labor	\$ 39,489.71				
Sales Tax Material	0.00%					Subtotal Tax	\$ -		
								Subtotal Labor, Material & Tax	\$ 246,554.71
Equipment & Trucks	\$ 40.00					Subtotal Equipment & Trucks	\$ 22,144.80		
Contingency	15.00%					Subtotal Contingency	\$ 40,304.93		
Engineering	8.00%					Subtotal Engineering	\$ 19,724.38		
								Total Budgetary Estimate	\$ 328,728.82

Project 11:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total	
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost	
Project 11 Recond/Rebuild 510 main line (excl poles)									
Underground Primary Cable Installation									
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	880	CKT FT	0.040	35.2	\$ 2,510.82	\$ 50.00	\$ 44,000.00	\$ 46,510.82	
Trenching									
Utility Trench for Single Conduit - Good Soil	880	LF	0.070	61.6	\$ 4,393.93	\$ -	\$ -	\$ 4,393.93	
Conduit Installation									
New 6" PVC Conduit Installation	880	LF	0.040	35.2	\$ 2,510.82	\$ 16.00	\$ 14,080.00	\$ 16,590.82	
Switchgear Installation & Equipment									
Box Pad Base for - Three Phase Switch PME Switchgear	2	EA	5.000	10	\$ 713.30	\$ 1,750.00	\$ 3,500.00	\$ 4,213.30	
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	2	EA	32.000	64	\$ 4,565.12	\$ 18,000.00	\$ 36,000.00	\$ 40,565.12	
Overhead									
45' CL 2 Pole	0	EA	8.500	0	\$ -	\$ 1,800.00	\$ -	\$ -	
Guy & Anchor	3	EA	4.250	12.75	\$ 909.46	\$ 275.00	\$ 825.00	\$ 1,734.46	
Three Phase Primary Tangent Pole Top Assembly	18	EA	5.500	99	\$ 7,061.67	\$ 475.00	\$ 8,550.00	\$ 15,611.67	
Three Phase Primary Single Deadend Pole Top Assembly	4	EA	6.000	24	\$ 1,711.92	\$ 775.00	\$ 3,100.00	\$ 4,811.92	
Three Phase Primary Conductor (477 kcmil ACSR)	5025	CKT FT	0.044	221.1	\$ 15,771.06	\$ 16.00	\$ 80,400.00	\$ 96,171.06	
Three Phase - Primary Riser	2	EA	12.500	25	\$ 1,783.25	\$ 1,375.00	\$ 2,750.00	\$ 4,533.25	
Total								\$ 235,136.34	
Subtotals									
			Total Hours	587.85		Subtotal Material	\$ 193,205.00		
Avg. Labor Rate	\$ 71.33			Subtotal Labor	\$ 41,931.34				
Sales Tax Material	0.00%					Subtotal Tax	\$ -		
								Subtotal Labor, Material & Tax	\$ 235,136.34
Equipment & Contingency									
Equipment & Trucks	\$ 40.00					Subtotal Equipment & Trucks	\$ 23,514.00		
Contingency	15.00%					Subtotal Contingency	\$ 38,797.55		
Engineering	8.00%					Subtotal Engineering	\$ 18,810.91		
								Total Budgetary Estimate	\$ 316,258.80

Project 12:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost
Project 12 Recond/Rebuild 730 main line								
Underground Primary Cable Installation								
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	4,800	CKT FT	0.040	192	\$ 13,695.36	\$ 50.00	\$ 240,000.00	\$ 253,695.36
Trenching								
Utility Trench for Single Conduit - Good Soil	4,800	LF	0.070	336	\$ 23,966.88	\$ -	\$ -	\$ 23,966.88
Conduit Installation								
New 6" PVC Conduit Installation	4,800	LF	0.040	192	\$ 13,695.36	\$ 16.00	\$ 76,800.00	\$ 90,495.36
Switchgear Installation & Equipment								
Box Pad Base for - Three Phase Switch PME Switchgear	2	EA	5.000	10	\$ 713.30	\$ 1,750.00	\$ 3,500.00	\$ 4,213.30
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	2	EA	32.000	64	\$ 4,565.12	\$ 18,000.00	\$ 36,000.00	\$ 40,565.12
Overhead								
45' CL 2 Pole	0	EA	8.500	0	\$ -	\$ 1,800.00	\$ -	\$ -
Guy & Anchor	0	EA	4.250	0	\$ -	\$ 275.00	\$ -	\$ -
Three Phase Primary Tangent Pole Top Assembly	0	EA	5.500	0	\$ -	\$ 475.00	\$ -	\$ -
Three Phase Primary Single Deadend Pole Top Assembly	0	EA	6.000	0	\$ -	\$ 775.00	\$ -	\$ -
Three Phase Primary Conductor (477 kcmil ACSR)	0	CKT FT	0.044	0	\$ -	\$ 16.00	\$ -	\$ -
Three Phase - Primary Riser	0	EA	12.500	0	\$ -	\$ 1,375.00	\$ -	\$ -
Total								\$ 412,936.02
Subtotals								
			Total Hours	794		Subtotal Material	\$ 356,300.00	
Avg. Labor Rate	\$ 71.33			Subtotal Labor	\$ 56,636.02			
Sales Tax Material	0.00%			Subtotal Tax	\$ -			
Subtotal Labor, Material & Tax								\$ 412,936.02
Equipment & Trucks	\$ 40.00			Subtotal Equipment & Trucks	\$ 31,760.00			
Contingency	15.00%			Subtotal Contingency	\$ 66,704.40			
Engineering	8.00%			Subtotal Engineering	\$ 33,034.88			
Total Budgetary Estimate								\$ 544,435.30

Project 13:

Underground & Overhead Costs per 100 ft or 1 unit	Quantity		Labor Cost			Material Cost		Total	
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost	
Underground Primary Cable Installation									
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	1,750	CKT FT	0.040	70	\$ 4,993.10	\$ 50.00	\$ 87,500.00	\$ 92,493.10	
Trenching									
Utility Trench for Single Conduit - Good Soil	1,750	LF	0.070	122.5	\$ 8,737.93	\$ -	\$ -	\$ 8,737.93	
Conduit Installation									
New 6" PVC Conduit Installation	1,750	LF	0.040	70	\$ 4,993.10	\$ 16.00	\$ 28,000.00	\$ 32,993.10	
Switchgear Installation & Equipment									
Box Pad Base for - Three Phase Switch PME Switchgear	1	EA	5.000	5	\$ 356.65	\$ 1,750.00	\$ 1,750.00	\$ 2,106.65	
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	1	EA	32.000	32	\$ 2,282.56	\$ 18,000.00	\$ 18,000.00	\$ 20,282.56	
Overhead									
45' CL 2 Pole	16	EA	8.500	136	\$ 9,700.88	\$ 1,800.00	\$ 28,800.00	\$ 38,500.88	
Guy & Anchor	5	EA	4.250	21.25	\$ 1,515.76	\$ 275.00	\$ 1,375.00	\$ 2,890.76	
Three Phase Primary Tangent Pole Top Assembly	15	EA	5.500	82.5	\$ 5,884.73	\$ 475.00	\$ 7,125.00	\$ 13,009.73	
Three Phase Primary Single Deadend Pole Top Assembly	2	EA	6.000	12	\$ 855.96	\$ 775.00	\$ 1,550.00	\$ 2,405.96	
Three Phase Primary Conductor (477 kcmil ACSR)	3650	CKT FT	0.044	160.6	\$ 11,455.60	\$ 16.00	\$ 58,400.00	\$ 69,855.60	
Three Phase - Primary Riser	8	EA	12.500	100	\$ 7,133.00	\$ 1,375.00	\$ 11,000.00	\$ 18,133.00	
Total								\$ 301,409.26	
Subtotals									
			Total Hours	811.85		Subtotal Material	\$ 243,500.00		
Avg. Labor Rate	\$ 71.33			Subtotal Labor	\$ 57,909.26				
Sales Tax Material	0.00%					Subtotal Tax	\$ -		
								Subtotal Labor, Material & Tax	\$ 301,409.26
Equipment & Trucks	\$ 40.00					Subtotal Equipment & Trucks	\$ 32,474.00		
Contingency	15.00%					Subtotal Contingency	\$ 50,082.49		
Engineering	8.00%					Subtotal Engineering	\$ 24,112.74		
								Total Budgetary Estimate	\$ 408,078.49

Project 14:

Project 14 Southwest Substation	Quantity		Labor Cost			Material Cost		Total
	Unit	Unit	Hours per	Total	Total Cost	Cost per unit	total cost	Unit Cost
	Qty.	Meas.	Unit	Hours				
Substation Equipment and Installation								
46 kV -12.47 kV 12/20 MVA Transformer	1	EA	100.000	100	\$ 7,133.00	\$ 1,500,000.00	\$ 1,500,000.00	\$ 1,507,133.00
46 kV High Side Breaker	1	EA	20.000	20	\$ 1,426.60	\$ 67,600.00	\$ 67,600.00	\$ 69,026.60
46 kV GOAB Switch	1	EA	24.000	24	\$ 1,711.92	\$ 14,560.00	\$ 14,560.00	\$ 16,271.92
46 kV Relaying VT	3	EA	6.000	18	\$ 1,283.94	\$ 9,880.00	\$ 29,640.00	\$ 30,923.94
15 kV GOAB Switch	1	EA	16.000	16	\$ 1,141.28	\$ 5,620.00	\$ 5,620.00	\$ 6,761.28
15 kV Recloser	4	EA	16.000	64	\$ 4,565.12	\$ 8,530.00	\$ 34,120.00	\$ 38,685.12
15 kV VT	4	EA	4.000	16	\$ 1,141.28	\$ 2,080.00	\$ 8,320.00	\$ 9,461.28
15 kV 1 phase fused disconnect	16	EA	2.000	32	\$ 2,282.56	\$ 5,720.00	\$ 91,520.00	\$ 93,802.56
15 kV 1 phase Hookstick Switch	24	EA	2.000	48	\$ 3,423.84	\$ 1,250.00	\$ 30,000.00	\$ 33,423.84
Metering/Relaying	1	EA	120.000	120	\$ 8,559.60	\$ 95,000.00	\$ 95,000.00	\$ 103,559.60
Steel Structures	1	EA	266.000	266	\$ 18,973.78	\$ 370,000.00	\$ 370,000.00	\$ 388,973.78
Concrete Foundations	1	EA	212.000	212	\$ 15,121.96	\$ 429,700.00	\$ 429,700.00	\$ 444,821.96
Substation Bus & Material	1	EA	596.000	596	\$ 42,512.68	\$ 227,000.00	\$ 227,000.00	\$ 269,512.68
Substation Conduit & Cable	1	EA	487.000	487	\$ 34,737.71	\$ 119,100.00	\$ 119,100.00	\$ 153,837.71
Substation Grounding	1	EA	160.000	160	\$ 11,412.80	\$ 26,000.00	\$ 26,000.00	\$ 37,412.80
Substation Site Work	500	CUYD	0.100	50	\$ 3,566.50	\$ 60.00	\$ 30,000.00	\$ 33,566.50
Substation SCADA & Communications	1	EA	48.000	48	\$ 3,423.84	\$ 15,600.00	\$ 15,600.00	\$ 19,023.84
15 kV Distribution Feeders	4	EA	180.000	720	\$ 51,357.60	\$ 166,950.00	\$ 667,800.00	\$ 719,157.60
Substation Testing & Commissioning	1	EA	375.000	375	\$ 26,748.75	\$ 3,900.00	\$ 3,900.00	\$ 30,648.75
Underground Primary Cable Installation								
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	3,400	CKT FT	0.040	136	\$ 9,700.88	\$ 50.00	\$ 170,000.00	\$ 179,700.88
Trenching								
Utility Trench for Single Conduit - Good Soil	3,000	LF	0.070	210	\$ 14,979.30	\$ -	\$ -	\$ 14,979.30
Conduit Installation								
New 6" PVC Conduit Installation	3,000	LF	0.040	120	\$ 8,559.60	\$ 16.00	\$ 48,000.00	\$ 56,559.60
Switchgear Installation & Equipment								
Box Pad Base for - Three Phase Switch PME Switchgear	4	EA	5.000	20	\$ 1,426.60	\$ 1,750.00	\$ 7,000.00	\$ 8,426.60
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	4	EA	32.000	128	\$ 9,130.24	\$ 18,000.00	\$ 72,000.00	\$ 81,130.24
Overhead								
45' CL 2 Pole	4	EA	8.500	34	\$ 2,425.22	\$ 1,800.00	\$ 7,200.00	\$ 9,625.22
Guy & Anchor	4	EA	4.250	17	\$ 1,212.61	\$ 275.00	\$ 1,100.00	\$ 2,312.61
Three Phase Primary Tangent Pole Top Assembly	0	EA	5.500	0	\$ -	\$ 475.00	\$ -	\$ -
Three Phase Primary Single Deadend Pole Top Assembly	4	EA	6.000	24	\$ 1,711.92	\$ 775.00	\$ 3,100.00	\$ 4,811.92
Three Phase Primary Conductor (477 kcmil ACSR)	0	CKT FT	0.044	0	\$ -	\$ 16.00	\$ -	\$ -
Three Phase - Primary Riser	4	EA	12.500	50	\$ 3,566.50	\$ 1,375.00	\$ 5,500.00	\$ 9,066.50
Total								\$ 4,372,617.63
Subtotals								
			Total			Subtotal		
Avg. Labor Rate			\$ 71.33	4111		Material	\$ 4,079,380.00	
			Subtotal Labor	\$ 293,237.63				
Sales Tax Material			0.00%			Subtotal Tax	\$ -	
Subtotal Labor, Material & Tax								\$ 4,372,617.63
Equipment & Contingency								
Equipment & Trucks			\$ 40.00			Subtotal Equipment & Trucks	\$ 164,440.00	
Contingency			15.00%			Subtotal Contingency	\$ 680,558.64	
Engineering			8.00%			Subtotal Engineering	\$ 349,809.41	
Total Budgetary Estimate								\$ 5,567,425.68
Plus T-Line								\$ 682,746.36
								\$ 6,250,172.05

Project 15:

Project 15 New North Area Substation	Quantity		Labor Cost			Material Cost		Total
	Unit Qty.	Unit Meas.	Hours per Unit	Total Hours	Total Cost	Cost per unit	total cost	Unit Cost
Substation Equipment and Installation								
46 kV -12.47 kV 12/20 MVA Transformer	1	EA	100.000	100	\$ 7,133.00	\$ 1,500,000.00	\$ 1,500,000.00	\$ 1,507,133.00
46 kV High Side Breaker	1	EA	20.000	20	\$ 1,426.60	\$ 67,600.00	\$ 67,600.00	\$ 69,026.60
46 kV GOAB Switch	1	EA	24.000	24	\$ 1,711.92	\$ 14,560.00	\$ 14,560.00	\$ 16,271.92
46 kV Relaying VT	3	EA	6.000	18	\$ 1,283.94	\$ 9,880.00	\$ 29,640.00	\$ 30,923.94
15 kV GOAB Switch	1	EA	16.000	16	\$ 1,141.28	\$ 5,620.00	\$ 5,620.00	\$ 6,761.28
15 kV Recloser	4	EA	16.000	64	\$ 4,565.12	\$ 8,530.00	\$ 34,120.00	\$ 38,685.12
15 kV VT	4	EA	4.000	16	\$ 1,141.28	\$ 2,080.00	\$ 8,320.00	\$ 9,461.28
15 kV 1 phase fused disconnect	16	EA	2.000	32	\$ 2,282.56	\$ 5,720.00	\$ 91,520.00	\$ 93,802.56
15 kV 1 phase Hookstick Switch	24	EA	2.000	48	\$ 3,423.84	\$ 1,250.00	\$ 30,000.00	\$ 33,423.84
Metering/Relaying	1	EA	120.000	120	\$ 8,559.60	\$ 95,000.00	\$ 95,000.00	\$ 103,559.60
Steel Structures	1	EA	266.000	266	\$ 18,973.78	\$ 370,000.00	\$ 370,000.00	\$ 388,973.78
Concrete Foundations	1	EA	212.000	212	\$ 15,121.96	\$ 429,700.00	\$ 429,700.00	\$ 444,821.96
Substation Bus & Material	1	EA	596.000	596	\$ 42,512.68	\$ 227,000.00	\$ 227,000.00	\$ 269,512.68
Substation Conduit & Cable	1	EA	487.000	487	\$ 34,737.71	\$ 119,100.00	\$ 119,100.00	\$ 153,837.71
Substation Grounding	1	EA	160.000	160	\$ 11,412.80	\$ 26,000.00	\$ 26,000.00	\$ 37,412.80
Substation Site Work	500	CUYD	0.100	50	\$ 3,566.50	\$ 60.00	\$ 30,000.00	\$ 33,566.50
Substation SCADA & Communications	1	EA	48.000	48	\$ 3,423.84	\$ 15,600.00	\$ 15,600.00	\$ 19,023.84
15 kV Distribution Feeders	4	EA	180.000	720	\$ 51,357.60	\$ 166,950.00	\$ 667,800.00	\$ 719,157.60
Substation Testing & Commissioning	1	EA	375.000	375	\$ 26,748.75	\$ 3,900.00	\$ 3,900.00	\$ 30,648.75
Underground Primary Cable Installation								
3-Phase 15 kV Cable (1100 Al w/1/6 Con. Neutral)	3,400	CKT FT	0.040	136	\$ 9,700.88	\$ 50.00	\$ 170,000.00	\$ 179,700.88
Trenching								
Utility Trench for Single Conduit - Good Soil	3,000	LF	0.070	210	\$ 14,979.30	\$ -	\$ -	\$ 14,979.30
Conduit Installation								
New 6" PVC Conduit Installation	3,000	LF	0.040	120	\$ 8,559.60	\$ 16.00	\$ 48,000.00	\$ 56,559.60
Switchgear Installation & Equipment								
Box Pad Base for - Three Phase Switch PME Switchgear	4	EA	5.000	20	\$ 1,426.60	\$ 1,750.00	\$ 7,000.00	\$ 8,426.60
PME-9 Switchgear (2-600 Amp Sw. & 2-200 Amp Fused)	4	EA	32.000	128	\$ 9,130.24	\$ 18,000.00	\$ 72,000.00	\$ 81,130.24
Overhead								
45' CL 2 Pole	4	EA	8.500	34	\$ 2,425.22	\$ 1,800.00	\$ 7,200.00	\$ 9,625.22
Guy & Anchor	4	EA	4.250	17	\$ 1,212.61	\$ 275.00	\$ 1,100.00	\$ 2,312.61
Three Phase Primary Tangent Pole Top Assembly	0	EA	5.500	0	\$ -	\$ 475.00	\$ -	\$ -
Three Phase Primary Single Deadend Pole Top Assembly	4	EA	6.000	24	\$ 1,711.92	\$ 775.00	\$ 3,100.00	\$ 4,811.92
Three Phase Primary Conductor (477 kcmil ACSR)	0	CKT FT	0.044	0	\$ -	\$ 16.00	\$ -	\$ -
Three Phase - Primary Riser	4	EA	12.500	50	\$ 3,566.50	\$ 1,375.00	\$ 5,500.00	\$ 9,066.50
Total								\$ 4,372,617.63
Subtotals								
			Total Hours	4111	Subtotal Material		\$ 4,079,380.00	
Avg. Labor Rate	\$ 71.33	Subtotal Labor		\$ 293,237.63	Subtotal Tax		\$ -	
Sales Tax Material	0.00%	Subtotal Labor, Material & Tax						\$ 4,372,617.63
Equipment & Contingency								
Equipment & Trucks	\$ 40.00	Subtotal Equipment & Trucks		\$ 164,440.00	Subtotal Contingency		\$ 680,558.64	
Contingency	15.00%	Subtotal Engineering		\$ 349,809.41				
Engineering	8.00%	Total Budgetary Estimate						\$ 5,567,425.68
								Plus T-Line
								\$ 682,746.36
								\$ 6,250,172.05

Project Payson-2

SCADA		120000	(20k each of 5 subs, 20k engineering)			
OMS		100000				
Model		190000	(30k software, 150k field audit, 10k eng)			
Dispatch		23000				
	total	433000				

11. APPENDIX E: SUVPS PROJECTS FROM “SOUTHERN UTAH VALLEY JOINT STUDY REPORT, 2022”

Executive Summary and Project Summary Table included here.

1.0 EXECUTIVE SUMMARY

The 2022 Southern Utah Valley joint study was initiated to address significant system load growth projections for the area in one study that combines and coordinates the individual study efforts that have previously been performed by SUVPS, SUVPS members, UAMPS and PacifiCorp on their individual transmission systems.

This planning study is the product of representatives of the signatory organizations. The study establishes best system improvement recommendations to serve projected loads based on a single utility concept. The study does not establish the requirement for any party to fund projects or operational considerations. Further discussions regarding cost-sharing and the responsibilities of each party are ongoing and will continue on a project-by-project basis.

The local transmission system in the Southern Utah Valley area was analyzed with projected load from 2022 through 2036. Load projections from each utility were organized by year and imported into 15 corresponding load flow models. Each year has an associated “gross load” derived from the load flow cases, equal to the total load at SUVPS points of interconnection plus the total generation inside the SUVPS system. The gross load does not include other load in the Southern Utah Valley area. More information on load projections can be found in Section 5.

This study recommends projects that are to be constructed at or before a projected gross load level and associated year. Because that load estimation is representative of the system as a whole it is most accurate as a projection for larger system-wide projects, but the projected years and gross load levels may be earlier or later based on actual growth patterns. For this reason, the need for the recommended project should be reassessed by analyzing the conditions of the system with time to complete project procurement and construction. Timely execution of this analysis is necessary to enable completion of the project at or before its associated issue arises.

In addition, the project recommendations and estimated timing assume that every load will grow evenly. However, projects that address thermal and voltage issues occurring on local 46 kV transmission equipment will be more affected by variations in load growth between individual cities. The timing of these projects should therefore be reevaluated by the owners in each area if growth in that area deviates from projections. Further explanation of the issues that drive the need for each project can be found in the descriptions in Section 7.

Study recommendations to meet the projected conditions to 2036 are found in Table 1, organized by ascending load level where the driving issue is first observed:

Section	Project	Gross Load	Projected Year
7.1.1	Mercer-Spanish Fork 345 kV Line	215 MW	N/A
7.1.2	New SUVPS Point-of-Interconnection Substation at Spanish Fork (PacifiCorp)	215 MW	N/A
7.3.1	Build a new SUVPS POI-Taylor 138 kV Line	215 MW	2022
7.3.2	Build a new 138-46 kV source at Taylor	215 MW	2022
7.3.3	Build a new Nebo Power Station-Suter 46 kV Line	215 MW	2022
7.3.4	Install 46 kV Capacitor Bank at Canyon Road	215 MW	2022

Section	Project	Gross Load	Projected Year
7.2.1	New Distribution Capacity – 1900S, West (Salem), Leland, New Springville	243 MW	2023
7.3.5	Install 46 kV Capacitor Bank at Dry Creek	243 MW	2023
7.3.6	Reconductor Canyon Road-Taylor 46 kV Line	243 MW	2023
7.3.7	Reconductor Baxter-Dry Creek 46 kV Line	243 MW	2023
7.2.3	New Distribution Capacity – West (SESD), North (Spanish Fork), North West (Spanish Fork), Oberg (Spanish Fork)	270 MW	2024
7.2.2	Convert North Substation to 138 kV	270 MW	2024
7.2.4	New Distribution Capacity – Spanish Fork (PacifiCorp)	303 MW	2025
7.2.5	New Distribution Capacity – 1700 W (Payson), Veridian (Salem), Hamilton (SESD)	303 MW	2025
7.1.3	Loop Spanish Fork-Hale 138 kV Line into Dry Creek	303 MW	2025
7.2.6	New Distribution Capacity – Davis (Salem)	322 MW	2026
7.3.8	Install Third 138-46 kV Transformer at Dry Creek (Or Upgrade Existing Two)	322 MW	2026
7.3.9	Install 46 kV Capacitor Bank at Suter	322 MW	2026
7.3.10	Reconductor Strawberry-SUVPS POI 46 kV Line	337 MW	2027
7.3.11	Install 46 kV Capacitor Bank at Taylor	353 MW	2028
7.3.12	Reconductor Strawberry-Hamilton-Veridian 46 kV Line	353 MW	2028
7.3.13	Reconductor Dry Creek-New Springville 46 kV Line	385 MW	2030
7.3.14	Build new Nebo Power Station-Taylor 138 kV Line	403 MW	2031
7.3.15	Reconductor Payson 46 kV Lines	420 MW	2032
7.3.16	Reconductor Veridian-Davis Tap 46 kV Line	437 MW	2033
7.1.4	Create a Transfer-Trip Scheme for Dry Creek-Spanish Fork Outages	437 MW	2033
7.1.5	Reconductor Clover Tap-Nebo (PacifiCorp) 138 kV Line	455 MW	2034
7.3.17	Move Normal-Open Point from Whitehead to Woodhouse	472 MW	2035

Table 1 – Summary of Projects

Note: Estimated years for “Distribution Capacity” projects were furnished by each utility and not determined by this study.