Licking Valley RECC

Kentucky 56 Morgan

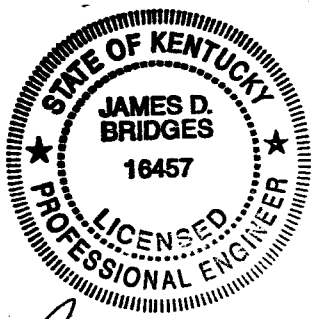
2012-2015 Construction Work Plan

February 2012

Prepared by:

Distribution System Solutions, Inc.
Walton, Kentucky

I hereby certify that this 2012-2015 CWP Report was prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the State of Kentucky. Registration No. 16457



Feb 16, 2012
Date

By: James D. Bridges, P.E.
James D. Bridges, P.E.

LICKING VALLEY
RURAL ELECTRIC COOPERATIVE CORPORATION
P. O. Box 605 • 271 Main Street
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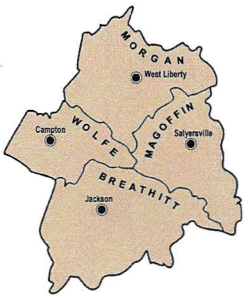

KERRY K. HOWARD
General Manager/CEO

RESOLUTION

WHEREAS, a four (4) year Construction Work Plan dated 2012-2015, has been prepared by Distribution System Solutions, Inc. in the amount of $19,743,901; and

RESOLVED, that the Board of Directors of Licking Valley Rural Electric Cooperative Corporation approve the 2012-2015 Construction Work Plan as a course of action to be followed, or until amended with the approval of the Rural Utilities Service;

BE IT, THEREFORE RESOLVED that this resolution was properly authorized and adopted on behalf of Licking Valley Rural Electric Cooperative Corporation by the Board during the duly regular monthly Board Meeting held at the West Liberty Headquarters Office on Thursday, February 16, 2012.

Signature of the Secretary

I, Ted A. Holbrook, certify that I am the Secretary/Treasurer of the Licking Valley Rural Electric Cooperative Corporation Board of Directors. I further certify that the above is a true excerpt from the minutes of a board meeting of this Board of Directors on the 16th day of February 2012, at which a quorum was present and the above portion of the minutes has not been modified or rescinded.

Ted Holbrook

TED A. HOLBROOK
Secretary/Treasurer

United States Department of Agriculture | Rural Economic and Community Development | Rural Utilities Service | Washington, DC 20250

February 16, 2012

2012-2015 Construction Workplan (CWP)

Kerry Howard, CEO
Licking Valley RECC

I have completed my review of the cooperative's 2012-2015 CWP, which was prepared by Distribution Systems Solutions, and find it to be generally satisfactory for loan contract purposes. Approval to proceed with the proposed distribution system construction is contingent upon RUS's review and approval of an Environmental Report (reference 7 CFR 1794).

You should make a special effort to inform all of the cooperative's employees and contractors, involved in the construction of utility plant of any commitments made in the Environmental Report covering the construction of the facilities recommended in the CWP.

Changes (line improvements, tie lines, extensions, substations, etc.) in the CWP will require RUS approval. The environmental acceptability of any such changes shall also be established in accordance with 7 CFR 1794. The procedure for satisfying these environmental requirements shall be the same as that used in connection with this CWP approval.

It is your responsibility to determine whether or not loan funds and/or general funds are available for the proposed construction. If general funds are used, the requirements as outlined in 7 CFR 1717 need to be followed.

The construction shall be accomplished in accordance with RUS requirements. Specific reference should be made to 7 CFR 1726, Electric System Construction Policies and Procedures.

Mike Norman

Mike Norman
RUS Field Representative

LICKING VALLEY RURAL ELECTRIC COOPERATIVE CORPORATION
2012 – 2015 CONSTRUCTION WORK PLAN REPORT

Kentucky 56 Morgan

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PURPOSE OF REPORT

This report documents the engineering analysis of, and summarizes the proposed construction for Licking Valley Rural Electric Cooperative Corporation (LVRECC) electric distribution system for the four-year planning period of 2012-2015.

The report also provides engineering support in the form of descriptions, costs and justifications of the required new facilities for a loan application to RUS in order to finance the proposed construction program.

GENERAL BASIS OF STUDY

The winter 2015/2016 projected total peak system load was taken from the LVRECC 2010 Load Forecast (LF) as approved by RUS. Residential and small commercial loads were grown at rates consistent with the LF.

From 2005-2009, the annual average increase in residential energy sales was 0.82%. This rate is projected to be 0.45% over the next four years. Small commercial sales are projected to increase at 1.60% over the next four years. Large Commercial / Industrial energy sales are projected to increase at 0.70% over the next four years.

System analysis models are based on non-coincidental (NC) system peaks that are outlined in the LF. The projected winter 2015/2016 NC peak (based on LF and GFR meeting) is 81,500 kW. The system annual load factor is projected to average 40.9% over the next two years.

Existing winter and summer growth models were examined for what is generally a winter-peaking system. The existing summer model was reviewed to ensure that any system deficiencies for the cooling load closely tracked the winter model.

The LVRECC 1998 Long Range Plan (LRP) load projections and improvement recommendations were reviewed to make sure that they generally agree with scope of the 2012-2015 construction work plan (CWP) recommendations. This was determined to be the case.

A RUS Operations and Maintenance Survey (FORM 300) has been completed with the RUS GFR. This survey is used to determine portions of the construction required to replace physically deteriorated equipment and material, upgrade areas of the system to conform to code or safety requirements, and improve the reliability and quality of service.

GENERAL BASIS OF STUDY (cont.)

A system analysis using RUS guidelines and the LVRECC Design Criteria was performed on all of the substations and distribution lines of the system. Milsoft Integrated Solutions' PC-Based Distribution Analysis Program – "Windmil" version 7.3 was used to analyze the existing system configuration that was modeled with the projected load growth.

For each deficiency that was found, alternate solutions were considered and economically evaluated.

SUMMARY - RESULTS OF PROPOSED CONSTRUCTION

Upon completion of the proposed construction, the system will provide adequate and dependable service to 16,999 residential customers as well as 6 industrial/large commercial loads and 1,254 small commercial loads. Average monthly residential usage is projected to be 1,024 kWh.

The new Hot Mix Road substation was energized replacing the West Liberty substation in 2012. Several projects in this CWP are needed to improve the mainline infrastructure of this new substation including the feeder that will serve a new school.

Also in the four year CWP period a new proposed mine will be energized near Crafts Creek. This 1.5MW mine will require a new substation to be built near Carty Branch. The 69/12.5kV - 11.2 MVA substation will relieve the Sublett substation. There is also a second mine that will develop within the CWP period near Bee Tree Creek. This will be an identical mining operation as Crafts Creek. The additional capacity produced by the offloading of the Sublett substation to the Carty Branch substation will be sufficient for the Sublett substation to serve this Bee Tree mine. See Substation Load Table Table II-E-1. Upgrades to the distribution system to serve these two proposed mines are included in the CWP.

18.4 miles of aged conductor on three-phase mainlines will be replaced in this CWP. Upon completion there will be approximately 41 miles of remaining three-phase aged conductor, most of which are three-phase taps off of mainlines.

43.5 total miles of site specific conductor replacement and conversion will take place in the four-year plan period. Additionally, 80 miles of single-phase overhead conductor will be selected for aged conductor replacement. These conductor replacement line sections will be selected based on conductor condition, operational experience and the number of customers served.

SERVICE AREA

Licking Valley RECC is an RUS-funded electric distribution cooperative. LVRECC is located in eastern Kentucky. LVRECC serves portions of Breathitt, Lee, Magoffin, Menifee, Morgan, and Wolfe Counties with a few members in two other surrounding counties. The headquarters are located in West Liberty, Kentucky (Morgan County) with an operation center in Malone. See Map on following page.

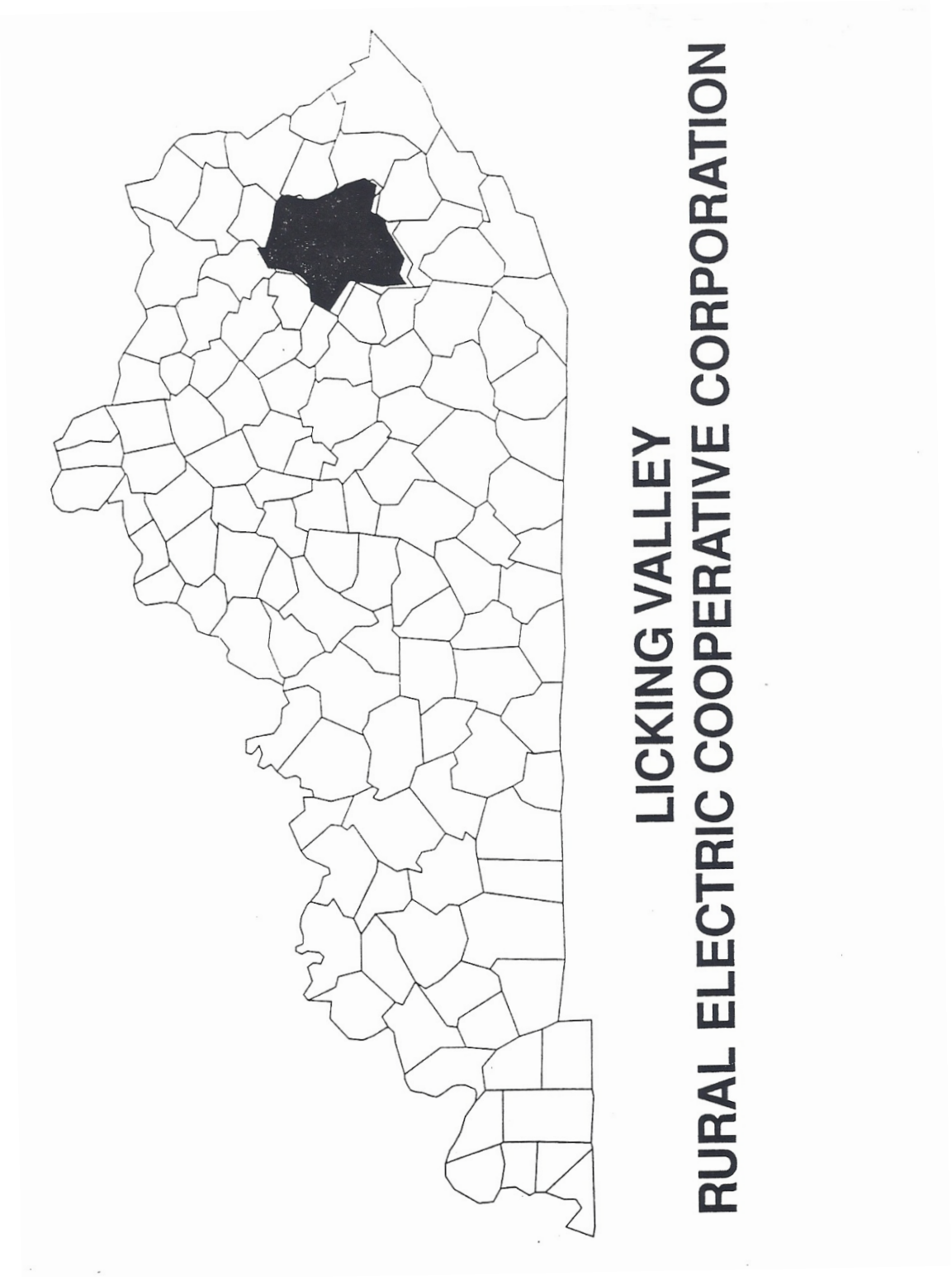
The principal counties served by LVRECC are rural with a high percentage of people relying on mining, timber, agricultural enterprises and manufacturing for income. Agricultural products include tobacco, corn, dairy, beef cattle and swine. A number of commercial and industrial loads are in the service territory. For the most part, level growth is projected for new commercial, small manufacturing and residential customers for this work plan period. A new school will be opening in Morgan County the winter of 2012/2013. There is a large meat packing plant, and two new mines developing during the course of the construction work plan within the LVRECC service territory.

The following data is from LVRECC's 12/10 RUS Form 7:

Total Services in Place	***21,436***
MWH Purchased	***293,032***
MWH Sold	***274,463***
Maximum MW Demand	***74.0***
Total Utility Plant	***$58,140,565***
Plant Dollars Per Active Member	***$2,712***
Consumers/Mile	***10.6***

LVRECC will operate 11 delivery points and distribute power at a primary voltage of 12.5/7.2 kV over approximately 2,030 miles of line at the end of the CWP.

LVRECC SERVICE AREA MAP



GENERATION and TRANSMISSION POWER SUPPLIER

East Kentucky Power Cooperative (EKP) provides all power and energy needs to LVRECC. EKP currently provides service to the ten distribution substations. EKP is located in Winchester, Kentucky.

The 2010 Load Forecast (LF) is a joint effort between LVRECC and EKP. LVRECC provides loading data and system growth predictions to EKP for use in the LF growth models.

All new distribution, transmission, and substation construction requirements are considered simultaneously as a "one system" concept - between LVRECC & EKP - for the orderly and economical development of the total system. All of the recommendations relative to power supply and delivery are discussed with EKP.

SUMMARY OF CONSTRUCTION PROGRAM AND COSTS

LVRECC's distribution system was analyzed in order to identify the construction requirements needed to adequately serve the projected CWP load of 81.5 MW. Improvements were identified based on voltage drop, conductor loading, system reliability improvements, economic conductor analysis and operational experience. A narrative list of system improvements is located in Section IV.

A breakdown of proposed construction projects by RUS 740C codes is listed below in Table I-C-1.

Table I-C-1
System Additions and Improvements Summary

RUS Form 740C Category	Category Name	Estimated Cost
100	**New Distribution Line**	**$2,941,460**
300	**Line Conversion & Replacement**	**$5,501,672**
600	**Misc. Equip. & Poles**	**$10,833,871**
700	**Outdoor Lights, AMR H/W & S/W**	**$466,899**
	2012-2015 CWP TOTAL	**$19,743,901**

100 – New Construction planned to serve 1,250 new services.

300 – 43.5 miles of conductor upgrading and replacement.

600 - Miscellaneous distribution equipment and pole changes. This includes aged conductor replacement, voltage regulators, switched capacitors, sectionalizing, automated meters, transformers, pole changes and increased service capacity upgrades.

700 – Other Distribution Items - Outdoor lighting, and software and hardware for AMI.

Licking Valley RECC 2012-2015 Construction Workplan
COST SUMMARY SPREADSHEET

NEW CONSTRUCTION – RUS CODE 100

ITEM	RUS CODE		AVE. $/CONSUMER	# CONS.		2012	2013	2014	2015	TOTAL
New Overhead Construction	100		$2,353	1,250		$663,936	$690,493	$777,956	$809,074	$2,941,460
			TOTAL CODE 100:	1,250		$663,936	$690,493	$777,956	$809,074	$2,941,460

LINE CONVERSION / REPLACEMENT - RUS CODE 300

SUB - SECTION	RUS CODE	Original Conductor	INST. COND/#-PH	$/MILES	# OF MILES	2012	2013	2014	2015	TOTAL
Helechewa 80940 - 81015	301	3 ph 4A CWC	3 ph 1/0 ACSR	$110,000	5.5	$0	$0	$0	$680,543	$680,543
Helechawa 84130 - 84173	302	3 ph 4A CWC	3 ph 336 ACSR	$145,000	2.8	$0	$0	$439,130	$0	$439,130
Helechawa 80874 - 80895	303	3 ph 4A CWC	3 ph 1/0 ACSR	$110,000	1.6	$0	$0	$190,362	$0	$190,362
Carty Branch	304		Getaways	$75,000	1.0	$0	$78,000	$0	$0	$78,000
Carty Branch sub to 92767	305	3 ph 1/0 ACSR	3 ph DCT 336ACSR	$195,000	0.4	$78,000	$0	$0	$0	$78,000
Carty Branch 92766 - 93441	306	3 ph 1/0 ACSR	3 ph 336 ACSR	$145,000	6.2	$899,000	$0	$0	$0	$899,000
Hot Mix 71158 - 71178	307	3 ph #2 ACSR	3 ph 336 ACSR	$145,000	1.7	$246,500	$0	$0	$0	$246,500
Hot Mix 70895-70900, 70901 - 70909	308	3 ph #2 ACSR	3 ph 336 ACSR	$145,000	1.2	$174,000	$0	$0	$0	$174,000
Hot Mix 72728 - 72748	309	1 ph 6A CWC	3 ph #2 ACSR	$80,000	0.5	$40,000	$0	$0	$0	$40,000
Index 67269 - 68033	310	3 ph #2 ACSR	3 ph 336 ACSR	$145,000	4.1	$0	$618,280	$0	$0	$618,280
Index 68472 - 68543	311	3 ph 6A CWC	3 ph 1/0 ACSR	$110,000	4.6	$0	$0	$0	$569,181	$569,181
Oakdale 90055 - 90119	312	1 ph 6A CWC	2 ph #2 ACSR	$50,000	3.2	$0	$0	$173,056	$0	$173,056
Sublett 94037 - 94132	313	3ph & 1 ph 6A CWC	3 ph 1/0 & #2 ACSR	$80,000	2.2	$0	$183,040	$0	$0	$226,720
Sublett 92557 - 92619	314	3 ph 1/0 ACSR	3 ph 336 ACSR	$145,000	4.1	$0	$618,280	$0	$0	$618,280
Sublett 93907 - 93945	315	1 ph 6A CWC	3 ph 1/0 ACSR	$110,000	1.9	$0	$217,360	$0	$0	$217,360
Zachariah 55102 - 55117	316	3 ph 4A CWC	3 ph 1/0 ACSR	$110,000	1.2	$0	$0	$142,771	$0	$142,771
Zachariah 55211 - 55219	317	3 ph 6A CWC	3 ph #2 ACSR	$80,000	0.7	$0	$0	$60,570	$0	$60,570
Zachariah 55133 - 55141	318	3 ph 6A CWC	3 ph #2 ACSR	$80,000	0.6	$0	$49,920	$0	$0	$49,920
			TOTAL CODE 300:		43.5	$1,437,500	$1,764,880	$1,005,888	$1,249,724	$5,501,672

MISCELLANEOUS DISTRIBUTION EQUIPMENT – RUS CODE 600's

ITEM	RUS CODE		4 YR. AVE. COST	# ITEMS		2012	2013	2014	2015	TOTAL
New Transformers	601		$1,359	593		$165,620	$182,844	$206,694	$250,788	$805,946
New Meters	601		$120	1,350		$33,696	$37,964	$42,520	$47,379	$161,559
Retrofit AMI Meters	601		$152	1,400		$50,232	$52,241	$54,331	$56,504	$213,308
New Polyphase Meters	601		$641	22		$2,392	$3,110	$3,881	$4,709	$14,092
Retrofit Polyphase AMI Meters	601		$847	10		$2,412	$2,508	$1,739	$1,809	$8,468
Service Upgrades	602		$2,525	176		$104,655	$108,841	$113,195	$117,723	$444,414
Sectionalizing	603					$250,000	$250,000	$250,000	$250,000	$1,000,000
Voltage Regulators	604					$108,000	$87,380	$99,600	$81,000	$375,980
Capacitors	605					$20,000	$0	$30,000	$10,000	$60,000
Pole Changes	606		$3,318	1,440		$1,125,072	$1,170,075	$1,216,878	$1,265,553	$4,777,578
Conductor Replacement (OH)	608			80 mi		$700,000	$728,000	$757,120	$787,405	$2,972,525
Radio Upgrade	615					$60,000	$0	$0	$0	$60,000
			TOTAL							
			MISC. CODE 600'S:			$2,562,079	$2,622,964	$2,775,958	$2,872,870	$10,833,871

OTHER DIST. ITEMS - RUS CODE 700

ITEM	RUS CODE		4 YR. AVE. COST	# ITEMS		2012	2013	2014	2015	TOTAL
Outdoor Lighting	701		$371	472		$41,234	$42,883	$44,599	$46,383	$175,099
AMI Equipment	705					$72,950	$72,950	$72,950	$72,950	$291,800
			TOTAL CODE 700:			$114,184	$115,833	$117,549	$119,333	$466,899

2012-2015 Kentucky 56 - Morgan	**CONSTRUCTION WORK PLAN TOTAL:**	**$19,743,901**

DISTRIBUTION SYSTEM DESIGN CRITERIA

Each of the following criteria items were reviewed and accepted by the RUS General Field Representative on November 18, 2011.

1) The minimum primary voltage (on a 120 volt base) is 118 volts after re-regulation. The source voltage is 126 volts.

2) Primary conductors will be evaluated for replacement, or alternative action, if they exceed 75% of their thermal rating.

3) The following line equipment will not be thermally loaded by more than the percentage shown:

	Winter	Summer
i. Distribution Transformers	130%	100%
ii. Voltage Regulators	130%	100%
iii. Reclosers / Line Fuses	70%	70%

4) Conductors and associated poles and hardware will be considered for replacement on a priority basis. Outage information, conductor type and conductor location are considerations.

5) Conversions to multiphase are to correct voltage drop and phase balance. Line sections with load current exceeding 45 amps will be considered for mulitphasing.

DISTRIBUTION LINE AND EQUIPMENT COSTS

Construction cost estimates for the four year planning period are shown in Table II-B-1. Cost summaries for distribution equipment are shown in Table II-B-2.

Table II-B-1
Line Construction Cost Estimates
Annual Projected Dollars/Mile

SIZE	TYPE	2012	2013	2014	2015
1/0 ACSR	CONV 3-PH	$110,000	$114,400	$119,000	$124,000
336.4 ACSR	CONV 3-PH	$145,000	$151,000	$157,000	$163,000
#2 ACSR	REPL 1-PH	$35,000	$36,400	$38,000	$39,400
#2 ACSR	CONV 2-PH	$50,000	$52,000	$54,100	$56,300
#2 ACSR	CONV 3-PH	$80,000	$83,200	$86,600	$90,000

Table II-B-2
Distribution Equipment Cost Estimates
Annual Projected Unit Costs

DEVICE	TYPE	2012	2013	2014	2015
V.Regulators (3)	219 amp	$54,000	$56,200	$58,400	$60,800
V.Regulators (3)	150 amp	$40,000	$41,600	$43,300	$45,000
V.Regulators (3)	100 amp	$32,000	$33,300	$34,600	$36,000
V.Regulators (1)	100 amp	$12,000	$12,480	$13,000	$13,500

STATUS OF PREVIOUS CWP ITEMS

All projects from the 2007-2011 CWP have been completed except the following:

740 C #	Project Description	Status
311-2	Oakdale to Coal Tipple / 3 ph 336 ACSR	Cancelled*

* Load at Coal Tipple did not expand to the amount where new circuit was warranted at this time.

ANALYSIS OF 1998 LONG RANGE PLAN

There were five new substations called for in the 1998 Long Range Plan (LRP). The B load block of the LRP was projecting a system Non-Coincident Peak (NCP) of 79.2MW, and the C load block was projecting a system NCP load of 107.5MW. The NCP projected by the end of the 2012-2015 CWP is 81.5MW. Four of the five substations called for in the LRP were proposed in the C load level. Since the projected peak of this CWP is only slightly above the B load block level of the LRP, the substations proposed in the C load level are not yet needed.

The **Bear Branch** substation was identified in the LRP to relieve the Sublett substation. This substation will actually be the Carty Branch substation which is proposed in the CWP. The substation will be located west of the Sublett substation. With the added load of the Crafts Creek and Bee Tree mines, the projected load on the Sublett substation will exceed the substation capacity. The Carty Branch substation will relieve the Sublett substation.

The four substations proposed in the C load level of the LRP are Long Branch, Vancleve, Cannel City, and Ezel.

The proposed **Long Branch** substation would be located to the Southeast of the Sublett substation. With the shift of load from the Sublett substation to the Carty Branch substation, the Long Branch substation is not needed to relieve the Sublett substation at this time. A set of downline voltage regulators on the Gunlock feeder help to sustain the voltage to the end of the feeder; therefore, voltage drop is not a concern that would dictate the need for the Long Branch substation at present.

The proposed **Vancleve** substation is located between Helechawa, Oakdale, and Campton substations. This substation is strategically positioned to improve the reliability in this area of the system by shortening feeder lengths of the three adjacent substations. To fully utilize the benefits of this substation location; there would need to be a number of large distribution projects that would be cost prohibitive at this time. Also the adjacent substations are not experiencing capacity issues by the end of the CWP.

The proposed **Cannel City** substation would be located south of the Index substation. This substation would relieve the Index and Helechewa substations which are not approaching overload by the end of the CWP.

The proposed **Ezel** substation is located Northwest of the Maytown substation. This substation would relieve the Maytown substation which is not approaching overload by the end of the CWP.

The LRP outlined a large amount of aged copper replacement. The CWP continues the initiative to replace aged conductor and is in-line with the LRP recommendations.

OPERATIONS & MAINTENANCE SURVEY

The current O&M Survey ("Review Rating Summary") was completed in February 2011.

LVRECC will have to closely monitor cable TV attachments in service territory to ensure code requirements are met. LVRECC is presently working to reconcile the reporting of idle services with billing and making any necessary adjustments.

SECTIONALIZING STUDIES

A sectionalizing study analyzes the existing overcurrent protection scheme and proposes changes to improve the overall effectiveness of the scheme.
Sectionalizing studies take place on a substation-by-substation basis.

The four main goals of a sectionalizing study are Safety, Reliability, Coordination, and Protection.

1. Safety – Sectionalizing devices should be able to detect and interrupt the full range of fault currents available in their zone of protection coverage. Calculated minimum fault current values should be detected and cleared by the protective device.

2. Reliability – Limit the outage hours per consumer by isolating or "sectionalizing" faulted portions of the circuit so that the minimum number of customers are interrupted. Additional devices – where needed – will further limit the overall outage hours.

3. Coordination – Good protective device coordination will ensure that the closest device to the fault opens. Fault locating is also enhanced. Miscoordination of protective devices can cause confusion and ultimately add to outage times.

4. Protection – A well designed protection scheme will minimize damage to the distribution system by limiting the time that damaging overcurrent is present on the faulted portion of the system.

Changes that can affect the coordination scheme include: load growth; substation transformer capacity increases; reconductoring distribution lines; single-phase to three-phase conversions; changes in the system's circuit configuration; and the addition of loads in specific locations.

The ongoing, substation-by-substation sectionalizing study will continue after the completion of the CWP report. General sectionalizing device cost projections will be listed in the "603" category in this report.

TABLE II-E-1
SUBSTATION LOAD TABLE

HISTORICAL AND FORECAST LOAD IN KVA

NAME	Installed Capability				Existing Winter		4 Year Winter Unimproved		4 Year Winter Improved		Existing Summer		
	Nameplate (kVA)	Cooling	Winter Rating (kVA)	Summer Rating (kVA)	NCP '10/11 (kVA)	% Load	NCP '14/15 (kVA)[1]	% Load	NCP '14/15 (kVA)	% Load	NCP '11 (kVA)	% Load	Notes
Campton	14,000	OA/FA-65C	17,100	13,620	11,680	68.30%	13,510	79.01%	13,624	79.67%	8,903	65.37%	
Crockett	11,200	OA-65C	13,700	11,070	4,664	34.04%	5,237	38.23%	5,218	38.09%	3,404	30.75%	
Helechawa	11,200	OA-65C	13,700	9,800	9,250	67.52%	11,150	81.39%	11,051	80.66%	7,580	77.35%	
Index	11,200	OA-65C	15,720	11,070	9,437	60.03%	10,159	64.62%	10,023	63.76%	8,102	73.19%	
Maggard	6,440	OA/FA-65C	8,340	6,260	6,080	72.90%	6,680	80.10%	6,674	80.02%	4,310	68.85%	
Maytown	11,200	OA-65C	13,700	9,800	5,361	39.13%	5,647	41.22%	5,798	42.32%	4,198	42.84%	
Oakdale	10,000	OA-55C	13,700	8,820	8,343	60.90%	8,758	63.93%	8,862	64.69%	6,513	73.84%	
Sublett	11,200	OA-65C	13,700	11,070	11,200	81.75%	14,526	106.03%	9,450	68.98%	8,539	77.14%	2
West Liberty	6,440	OA/FA-65C	8,340	6,260	6,883	82.53%	N/A	N/A	N/A	N/A	5,602	89.49%	3
Zachariah	11,200	OA-65C	5,400	4,900	3,572	66.15%	3,790	70.19%	3,851	71.31%	3,114	63.55%	
Hot Mix	11,200	OA-65C	15,720	11,070	N/A	N/A	8,403	53.45%	8,251	52.49%	N/A	N/A	3
Carty Branch	11,200	OA-65C	15,720	11,070	N/A	N/A	N/A	N/A	5,315	33.81%	N/A	N/A	

1. Loads grown based on feeder peak loading which result in a higher totalized substation load than actual season peak.
2. Craft Creek mine modeled at 1.5MW which is offloaded onto the proposed Carty Branch substation in 2013. Bee Tree Mine added for an additional 1.5MW load.
3. Hot Mix Road substation replaced West Liberty substation in 2012. Increase in load due to new school.

TABLE II-E-2
SUBSTATION CAPACITY LIMITS

CAPACITY LIMITS IN KVA

Substation Identification			Substation Voltage		Transformer				Regulator				High-Side Fuse					Limits			
CoopID	Prefix	MV90 Name	Primary	Secondary	Nameplate	Cooling	Summer	Winter	Nameplate	Cooling	Summer	Winter	Amps	Type	TCC	Summer	Winter	Summer		Winter	
56	E040	CAMPTON	69	12.47	14	OA/FA-65C	13.62	18.14	466	OA-65C	17.9	23.4	125	SMD1A	153-1	17.1	17.1	**13.62**	T	**17.10**	F
56	E089	CROCKETT	69	12.47	11.2	OA-65C	11.07	15.72	466	OA-65C	17.9	23.4	100	SMD1A	119-1	13.7	13.7	**11.07**	T	**13.70**	F
56	E009	HELECHAWA	69	12.47	11.2	OA-65C	11.07	15.72	333	OA-55C	9.8	15.1	100	SMD1A	119-1	13.7	13.7	**9.80**	R	**13.70**	F
56	E053	INDEX	69	12.47	11.2	OA-65C	11.07	15.72	466	OA-65C	17.9	23.4	125	SMD1A	119-1	17.1	17.1	**11.07**	T	**15.72**	T
56	E039	MAGGARD	69	12.47	6.44	OA/FA-65C	6.26	8.34	333	OA-55C	9.8	15.1	65	SMD1A	119-1	8.9	8.9	**6.26**	T	**8.34**	T
56	E065	MAYTOWN	69	12.47	11.2	OA-65C	11.07	15.72	333	OA-55C	9.8	15.1	100	SMD1A	119-1	13.7	13.7	**9.80**	R	**13.70**	F
56	E022	OAKDALE	69	12.47	10	OA-55C	8.82	14.94	333	OA-55C	9.8	15.1	100	SMD1A	119-1	13.7	13.7	**8.82**	T	**13.70**	F
56	E036	SUBLETT	69	12.47	11.2	OA-65C	11.07	15.72	466	OA-65C	17.9	23.4	100	SMD1A	119-1	13.7	13.7	**11.07**	T	**13.70**	F
56	E024	WEST LIBERT	69	12.47	6.44	OA/FA-65C	6.26	8.34	333	OA-55C	9.8	15.1	65	SMD1A	119-1	8.9	8.9	**6.26**	T	**8.34**	T
56	E008	ZACHARIAH	69	12.47	11.2	OA-65C	11.07	15.72	167	OA-55C	4.9	7.5	40	SMD1A	119-1	5.4	5.4	**4.90**	R	**5.40**	F

SERVICE RELIABILITY

The record of LVRECC's service interruptions for the past five years is shown in Table II-E-2. The five-year average outage hours per consumer is 18.71. This value is higher than typical because of the extreme winds produced by Hurricane Ike in the fall of 2008 and the ice storm of early 2009 which both caused widespread damage for utilities throughout the region. With this exception LVRECC's typical average outage hours are below the minimum level recommended by RUS. Ongoing system improvements and continued feeder sectionalizing studies will help to reduce this value even further.

SERVICE INTERUPTIONS (IN HOURS)
TABLE II-E-2

	Power Supplier	Extreme Storm	Prearranged	All Other	Total
2006					
OUTAGE HR/CONS	**0..04**	**0.10**	**1.15**	**2.29**	**3.58**
2007					
OUTAGE HR/CONS	**0.56**	**0.18**	**0.64**	**2.83**	**4.21**
2008					
OUTAGE HR/CONS	**0.94**	**3.80**	**0.49**	**1.63**	**6.86**
2009					
OUTAGE HR/CONS	**9.71**	**60.83**	**0.72**	**2.90**	**74.15**
2010					
OUTAGE HR/CONS	**0.87**	**0.51**	**0.68**	**2.70**	**4.76**
FIVE YEAR AVE.					
OUTAGE HR/CONS	**2.42**	**13.08**	**0.74**	**2.47**	**18.71**

NON-FUNDED SYSTEM IMPROVEMENTS

The following recommendations are based upon the review of the projected winter peak system; and the existing summer system. These recommendations do not affect the total dollar projections for the CWP, but are recommended for the LVRECC system to meet the design criteria.

Load Balance

The following feeders would benefit from balancing to alleviate excessive voltage drop or rise due to phase imbalance.

Substation	Feeder	Issue	Summer	Winter
Campton	Stillwater	Voltage drop		X
Campton	Vortex	Voltage drop		X
Crockett	Crockett	Voltage rise	X	
Crockett	Lenox	Voltage rise and drop	X	X
Helechawa	Cannel City	Voltage drop	X	X
Helechawa	Hazel Green	Voltage rise and drop	X	X
Hot Mix Road	Elk Fork	Voltage rise		X
Index	Caney	Voltage rise	X	
Index	Mize	Voltage drop	X	X
Maggard	Rockhouse	Voltage drop	X	X
Maggard	Flat Fork	Voltage drop	X	X
Maggard	Lick Creek	Voltage drop	X	X
Maytown	Hazel Green	Voltage rise	X	X
Oakdale	Highland	Voltage rise and drop	X	X
Oakdale	Elkatawa	Voltage drop	X	X
Oakdale	War Creek	Voltage drop	X	X
Sublett	Gunlock	Voltage rise	X	X

Switching recommendations

- Index/Maytown: Backfeed line section 69238 from 74537 at pole 9-86-24 and open at line section 69199 pole 9-77-3 to relieve overload on line section 69143.
- Oakdale: Change the tap beginning at pole 26-98-18 to feed from the Highland feeder line section 91965 instead of the Athol feeder line section 89507 to relieve overload on the tap beginning at pole 26-59-43 (Athol feeder). This should be done after the proposed voltage regulators have been added for the Highland feeder.

Additional Recommendations

- Helechawa, Hazel Green Feeder: The single phase tap beginning at pole 15-67-27 heading south to the town of Gilmore is constructed of newer single phase 1/0ACSR. This tap is heavily loaded. Monitor loading and consider multi-phasing in the future if cold load pickup becomes an issue.
- Helechawa, Cannel City Feeder: Remove the bypass of the two bypasses phases of the set of 150A voltage regulators at pole 16-64-41.
- Hot Mix Road, Zap feeder: This feeder is experiencing substantial overvoltage at the end of the feeder. Remove the set of capacitors at 3-77-28-1.
- Index Substation, Caney feeder: Monitor the end-of-line voltage on the single phase tap beginning at 16-25-23 during winter. If the voltage drop is below the criteria then add 1-100A voltage regulator at the beginning of this tap.

DATA RESOURCES

The following is a list of the basic data used for this analysis and report.

1. Updated circuit diagram map that indicates substations with present feeder configurations.

2. Monthly substation non-coincident peak (NCP) demands.

3. Billing system kW and kWh sales for last winter and summer peaks.

4. 2010 East Kentucky Power *Load Forecast.*

5. Five Year Outage Summary.

6. RUS Form 7 data.

7. Substation transformer ratings.

8. Substation Data Sheets.

9. Computerized circuit model databases with voltage drop calculations for each primary line section.

BASIC DATA AND ASSUMPTIONS

Design Load – The construction program in the CWP covers a four-year period to serve the 81.5 MW, January 2016 winter peak. The design load was derived after reviewing the *2010 Load Forecast* with the GFR.

Load Allocation – Individual areas of the system were grown as spot loads based on the potential for growth in that area. The total system design load was attained by allocating each substation's load to its consumers proportional to the kWh consumption of each residential consumer and billed demand for non-residential consumers. Peak summer and peak winter loading were modeled and analyzed. The system is generally winter peaking.

Voltage Drop – For the design load, an eight volt drop past one set of downline voltage regulators was assumed to be the maximum allowable end-of-line voltage drop.

Substation Voltage Regulation – Voltage regulation was assumed for each substation such that a 10% voltage drop could be experienced on the transmission system at peak load and 126 volts could still be supplied to the substation bus.

System Power Factor – System power factor values were assumed to coincide with the levels listed on the substation load data sheet.

Single-Phase Loading – On taps where more than 45 amps are served from a single-phase line, conversion to 3-phase was considered in order to provide greater system reliability and ease of coordination.

Inflation – An annual inflation rate of 4% was used in this CWP.

Construction Cost Estimates – Cost estimates for the various distribution equipment and conductor sizes are presented in Tables II-B-1 and II-B-2.

Computer Model of Distribution System – The system is modeled on Milsoft Integrated Solution's Windmil v. 7.3 analysis software. Downloading monthly billing computer data into the Windmil billing file directory was the framework for building the winter and summer models. Residential loads were allocated by the kWh Demand Table method. Commercial and industrial loads were allocated based on their billed kW demand. Projected models were analyzed for Design Criteria violations using an unbalanced voltage drop calculation.

Economic Conductor Analysis – Economic Conductor analysis includes the consideration of initial construction costs and the associated losses of the selected conductors. For two alternative conductors compared, there is generally a kW load level at which the fixed costs associated with construction plus the variable costs related to line losses are equal for both alternatives.

The following general recommendations were generated from the analysis:

1. New overhead single-phase line extensions will be constructed of #2 ACSR.
2. Replacements that are to remain single-phase should generally be constructed of #2 ACSR unless unacceptable voltage drop is likely, in which case 1/0 ACSR should be used.
3. While the economic conductor analysis shows #2ACSR as the least cost conductor selection for three-phase up to 2300kW, voltage drop and backfeeding considerations makes #2ACSR limited on this distribution system to be used for three phase radial taps. 1/0 ACSR is not shown as the least cost conductor for three phase conversion; but the impact of improved voltage drop characteristics over #2ACSR will reduce the need for future voltage regulators which have associated losses not considered in this analysis. Any converted mainline, three-phase conductors should be of 1/0 ACSR construction up to an initial load of 2400kW; and 336.4 ACSR for initial loads greater than 2,400 kW. Voltage drop, potential backfeed and reliability considerations may lower the initial kW level for the use of 336.4 ACSR.

The data table preceding the analysis graph lists the assumptions that were made in the conductor analysis. This analysis appears in the Appendices of this report.

FINANCIAL DATA

- ***Cost of Capital = 5.0%***
- ***Inflation = 4.0%***
- ***Present Worth Discount Factor = 5.0%***
- ***Depreciation = 3.20%***
- ***O&M = 5.94%***
- ***Tax & Ins = 1.30%***
- ***TOTAL ANNUAL FIXED CHARGE RATE = 15.44%***

TABLE III-B-1 Inflation = 4%
COST SUMMARY DATA (4% Annual Inflation) KY-56 Morgan

DESCRIPTION	ACTUAL 10-11	2012	2013	2014	2015	CWP TOTAL
New Member Extensions (100)						
1. New services constructed	512	300	300	325	325	1,250
2. Cost per Customer	$2,128	$2,213	$2,302	$2,394	$2,489	
3. Cost of New Customers	$1,089,536	$663,936	$690,493	$777,956	$809,074	$2,941,460
4. Total Wire Footage	135,330	79,295	79,295	85,903	85,903	330,396
5. Average Wire Footage per Customer	264					
New Transformers (601)						
1. New transformers added	200	130	138	150	175	593
2. Cost per Transformer	$1,225	$1,274	$1,325	$1,378	$1,433	
3. Cost of New Transformers	$245,000	$165,620	$182,844	$206,694	$250,788	$805,946
New Meters (601)						
1. New Meters added total	1,188	300	325	350	375	1,350
3. Cost per New Meter (TS2 enabled)	$108	$112	$117	$121	$126	
4. Cost of New Meters	$128,304	$33,696	$37,964	$42,520	$47,379	$161,559
Retrofit AMI Meters (601)						
1. New Meters added		350	350	350	350	1,400
2. Cost per Meter	$138	$144	$149	$155	$161	
3. Cost of New Meters		$50,232	$52,241	$54,331	$56,504	$213,308
New 3PH AMI Meters (601)						
1. New Meters added	8	4	5	6	7	22
2. Cost per Meter	$575	$598	$622	$647	$673	
3. Cost of New Meters	$4,600	$2,392	$3,110	$3,881	$4,709	$14,092
Retrofit 3PH AMI Meters (601)						
1. New Meters added		3	3	2	2	10
2. Cost per Meter		$804	$836	$870	$904	
3. Cost of New Meters		$2,412	$2,508	$1,739	$1,809	$8,468
Service Upgrades (602)						
1. Number of Service Upgrades	88	44	44	44	44	176
2. Cost per Service Upgrade	$2,287	$2,379	$2,474	$2,573	$2,676	
3. Cost of Service Upgrades	$201,260	$104,655	$108,841	$113,195	$117,723	$444,414
Pole Changes - Replacement (606)						
1. Poles Changed	719	360	360	360	360	1440
2. Cost per Pole Change	$3,005	$3,125	$3,250	$3,380	$3,515	
3. Cost of Pole Changes	$2,160,595	$1,125,072	$1,170,075	$1,216,878	$1,265,553	$4,777,578
Conductor Replacement OH (608)						
1. Miles of small conductor to be replaced		20	20	20	20	80
2. Cost per mile		$35,000	$36,400	$37,856	$39,370	
3. Total cost of small conductor replacement		$700,000	$728,000	$757,120	$787,405	$2,972,525
Radio Upgrade (615)						
1. Radio Hardware & Communications		$60,000	$0	$0	0	$60,000
Outdoor Lights (701)						
1. New Outdoor Lights Added	236	118	118	118	118	472
2. Cost per Outdoor Light	$336	$349	$363	$378	$393	
3. Cost of Outdoor Lights	$79,296	$41,234	$42,883	$44,599	$46,383	$175,099
AMI Equipment (705)						
1. Related Software and Hardware		$72,950	$72,950	$72,950	$72,950	$291,800

NEW MEMBER EXTENSIONS – RUS CODE 100

A total of 1,250 new services are anticipated. The total projected cost for new service construction is $2,941,460.
The average length of service per customer is 264 feet. The total projected length for the work plan period is approximately 63 miles.

Cost history and projections are shown in Table III-B-1.

SYSTEM IMPROVEMENTS – RUS CODE 300

LINE CONVERSION NARRATIVES

Helechawa Substation

Code 301

Estimated Cost: $680,543
Year: 2015

Description of Proposed Construction

Sections 80940 to 81015 – Replace 5.5 miles of three-phase 4A CWC with three-phase 1/0 ACSR. These line sections begin at pole number 16-58-8 on Hwy 1081 at Harper and ends at 16-89-3 on Hwy 134 at Kernie. The autoboosters at 16-69-18 can be removed once this replacement takes place. The bypassed phases of the voltage regulators at 16-64-41 should be taken off bypass.

Reason For Proposed Construction

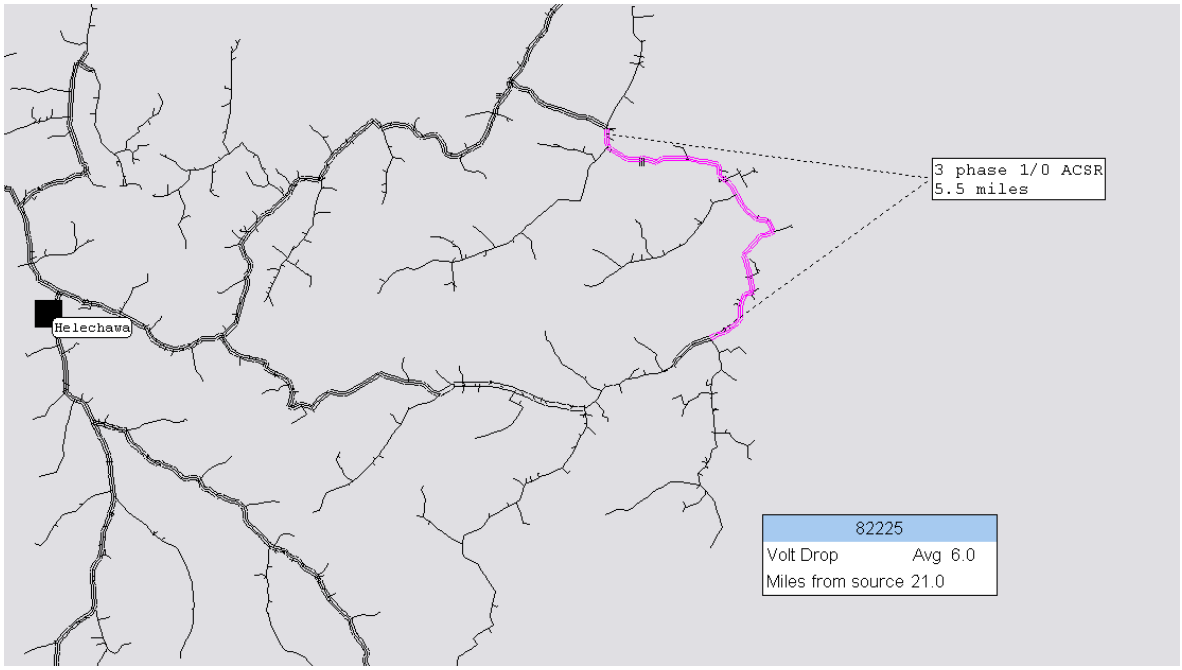
Design Criteria (DC) Items 1 & 4.

Results of Proposed Construction

DC Items 1 & 4 will be met.

Alternative Corrective Plan Investigated

These line sections were chosen due to aged deterioration. Therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

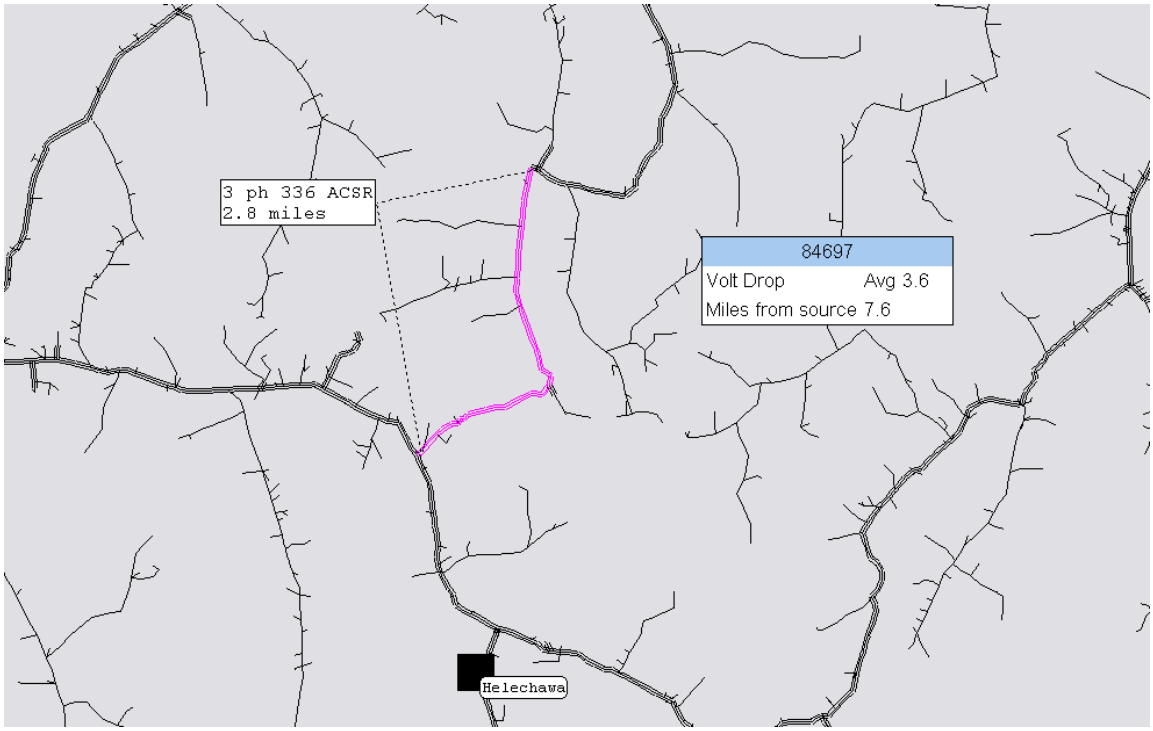
Helechawa Substation
Code 302
Estimated Cost: $439,130
Year: 2014

Description of Proposed Construction
Sections 84130 to 84173 – Replace 2.8 miles of three-phase 4A CWC with three-phase 336 ACSR. These line sections begin at pole number 15-68-1 at the Hwy 191 and Hwy 205 split, and end at 15-49-4 at the Hwy 205 and Hwy 705 split. This line serves as a mainline tie to the Index substation.

Reason For Proposed Construction
Design Criteria (DC) Item 4.

Results of Proposed Construction
DC Item 4 will be met.

Alternative Corrective Plan Investigated
These line sections serve as a mainline tie to Index substation. This replacement will improve the overall reliability to this service territory. Therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

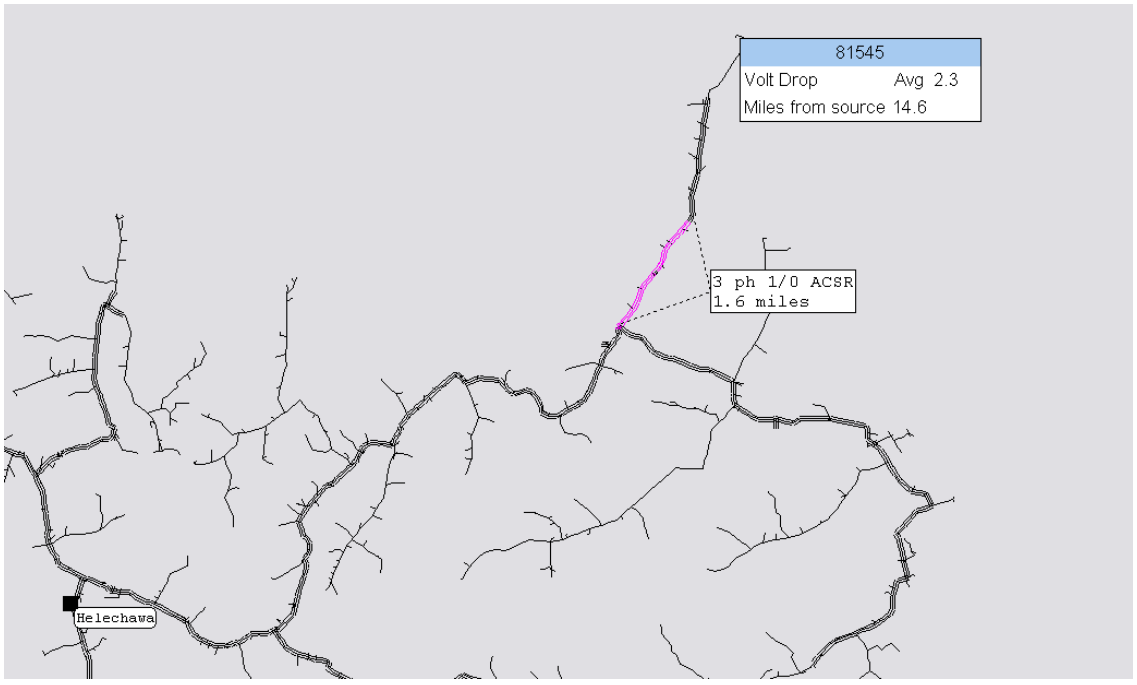
Helechawa Substation
Code 303
Estimated Cost: $190,362
Year: 2014

Description of Proposed Construction
Sections 80874 to 80895 – Replace 1.6 miles of three-phase 4A CWC with three-phase 1/0 ACSR. These line sections begin at pole number 16-57-19 on Hwy 1000 in Holliday and end at pole 16-38-3.

Reason For Proposed Construction
Design Criteria (DC) Item 4.

Results of Proposed Construction
DC Item 4 will be met.

Alternative Corrective Plan Investigated
These line sections were chosen due to aged deterioration. Therefore no viable alternatives exist.



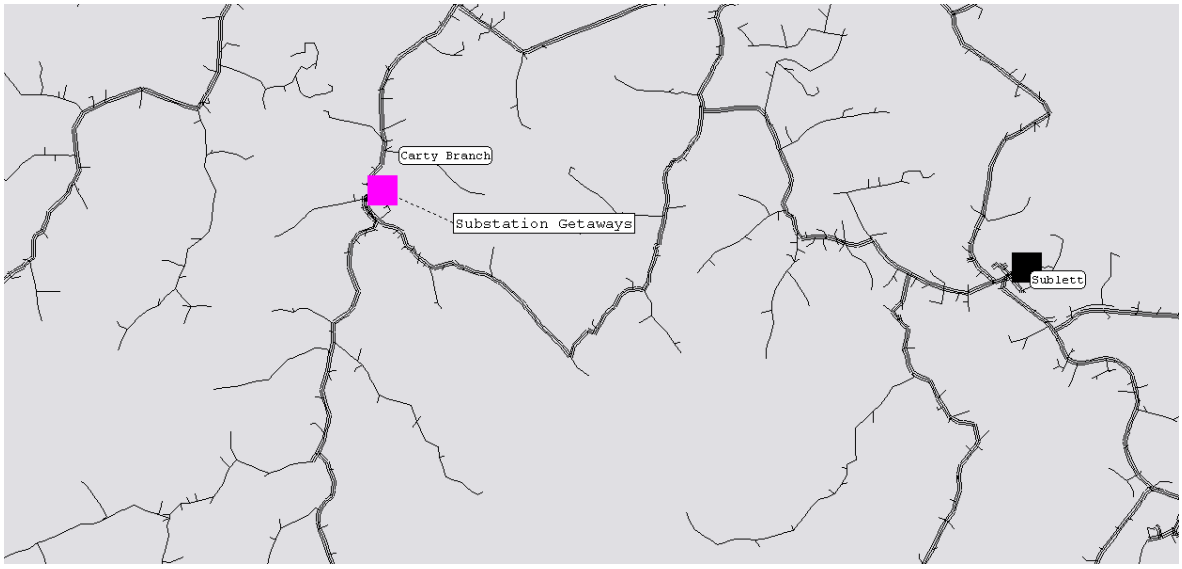
SYSTEM IMPROVEMENTS – RUS CODE 300

Carty Branch Substation
Code 304
Estimated Cost: $78,000
Year: 2013

Description of Proposed Construction
Substation getaways

Reason For Proposed Construction
Getaways needed for new substation.

Alternative Corrective Plan Investigated
Large power expansion will overload existing substation. No alternative exists.



SYSTEM IMPROVEMENTS – RUS CODE 300

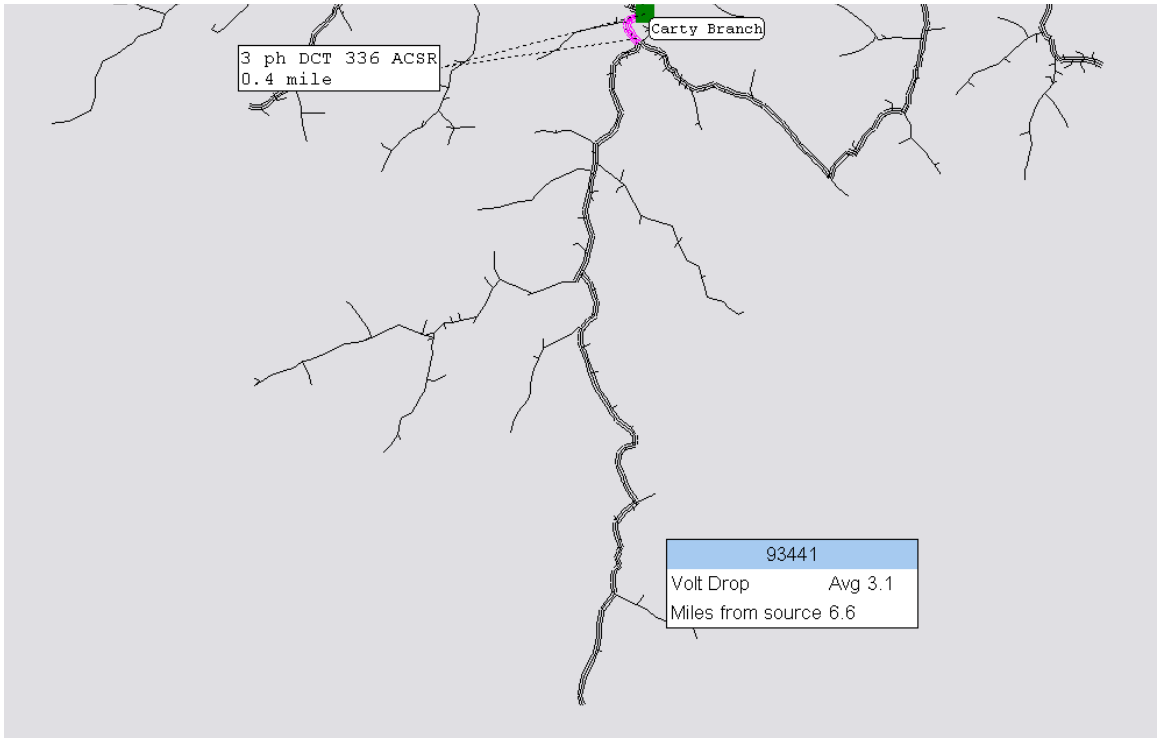
Carty Branch Substation
Code 305
Estimated Cost: $78,000
Year: 2012

Description of Proposed Construction
Sections Substation to 92767 – Replace 0.4 miles of three-phase 1/0 ACSR with three-phase DCT 336 ACSR. These line sections begin at the proposed Carty Branch substation and end at the three-phase spilt at pole 23-43-33.

Reason For Proposed Construction
Design Criteria (DC) Items 1 & 2.

Results of Proposed Construction
DC Items 1 & 2 will be met.

Alternative Corrective Plan Investigated
A new proposed mine will be added to the end of this feeder. The alternative would be a single circuit larger conductor, but would not improve the reliability to this area by limiting the exposure between the mine load and the remainder of the original feeder. Therefore the double circuit is the preferred solution.



SYSTEM IMPROVEMENTS – RUS CODE 300

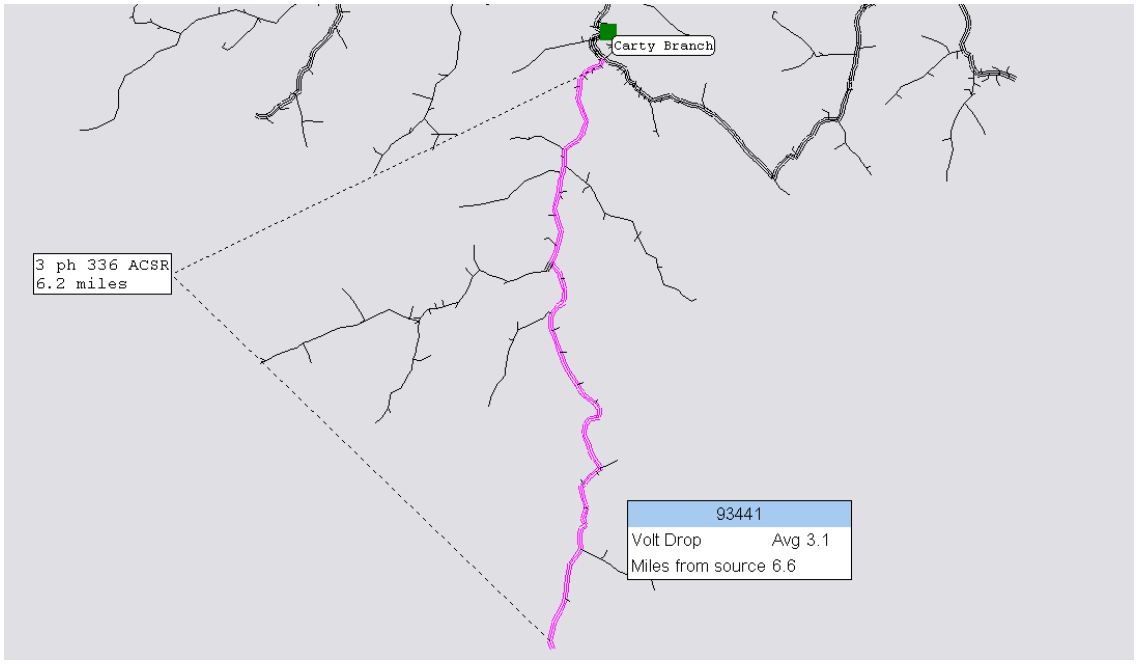
Carty Branch Substation
Code 306
Estimated Cost: $899,000
Year: 2012

Description of Proposed Construction
Sections 92766 to 93441 – Replace 6.2 miles of single -phase and three-phase 1/0 ACSR with three-phase 336 ACSR. These line sections begin at the three-phase spilt at pole 23-43-33 and end at the proposed Crafts Creek mine.

Reason For Proposed Construction
Design Criteria (DC) Items 1 & 5.

Results of Proposed Construction
DC Items 1 & 5 will be met.

Alternative Corrective Plan Investigated
A new proposed mine will be added to the end of this feeder. The alternative would be to reduce the three phase conductor to 1/0ACSR closer to the mine. However while the steady-state voltage would be above criteria, the smaller conductor would increase the likelihood of flicker caused by the cyclical nature of the mining operation. Therefore the larger conductor will provide a stiffer source thereby reducing the level of flicker on this feeder.



SYSTEM IMPROVEMENTS – RUS CODE 300

Hot Mix Road Substation

Code 307

Estimated Cost: $246,500
Year: 2012

Description of Proposed Construction

Sections 71158 to 71178 – Replace 1.7 miles of three-phase #2ACSR with three-phase 336 ACSR. These line sections begin at pole number 10-24-2 and end at 10-14-20 and run along Hot Mix Road to the foot of Wrigley Hill.

Reason For Proposed Construction

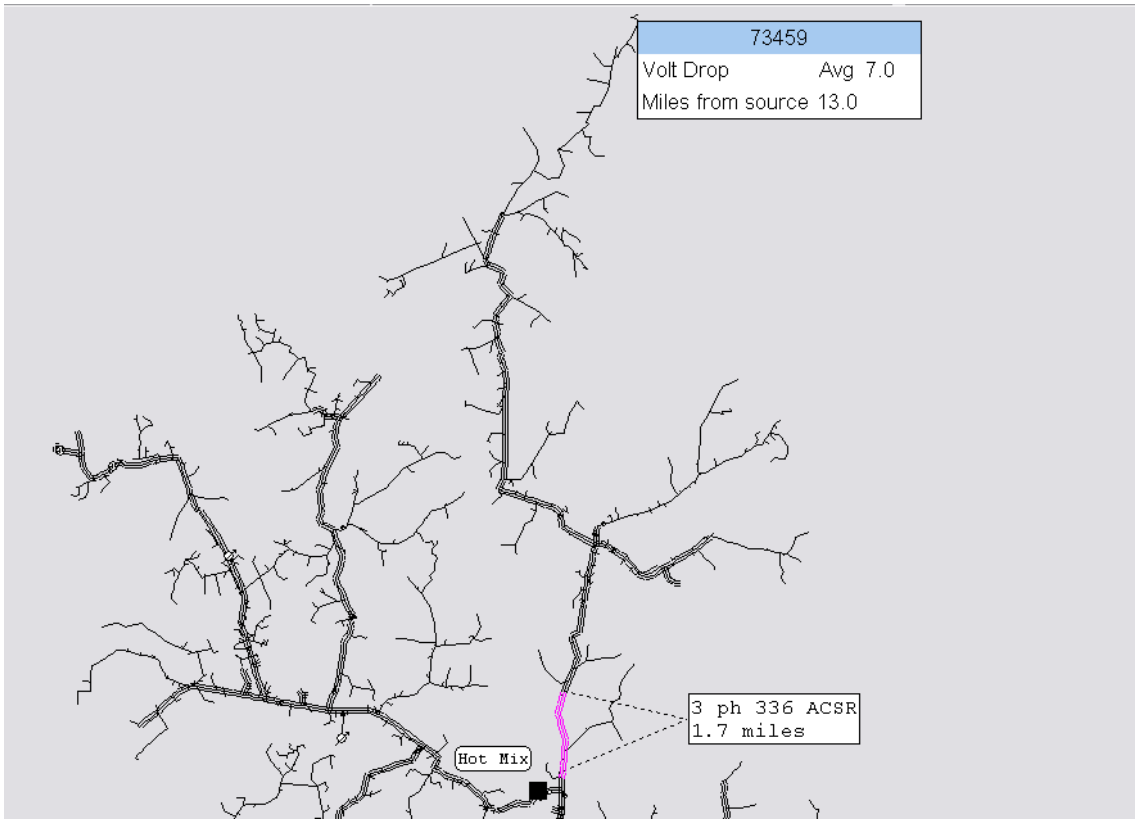
Design Criteria (DC) Items 1 & 2 are being violated.

Results of Proposed Construction

DC Items 1 & 2 will be met.

Alternative Corrective Plan Investigated

These line sections will serve as a main feeder out of the new Hot Mix Road substation and will serve a new school. Therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

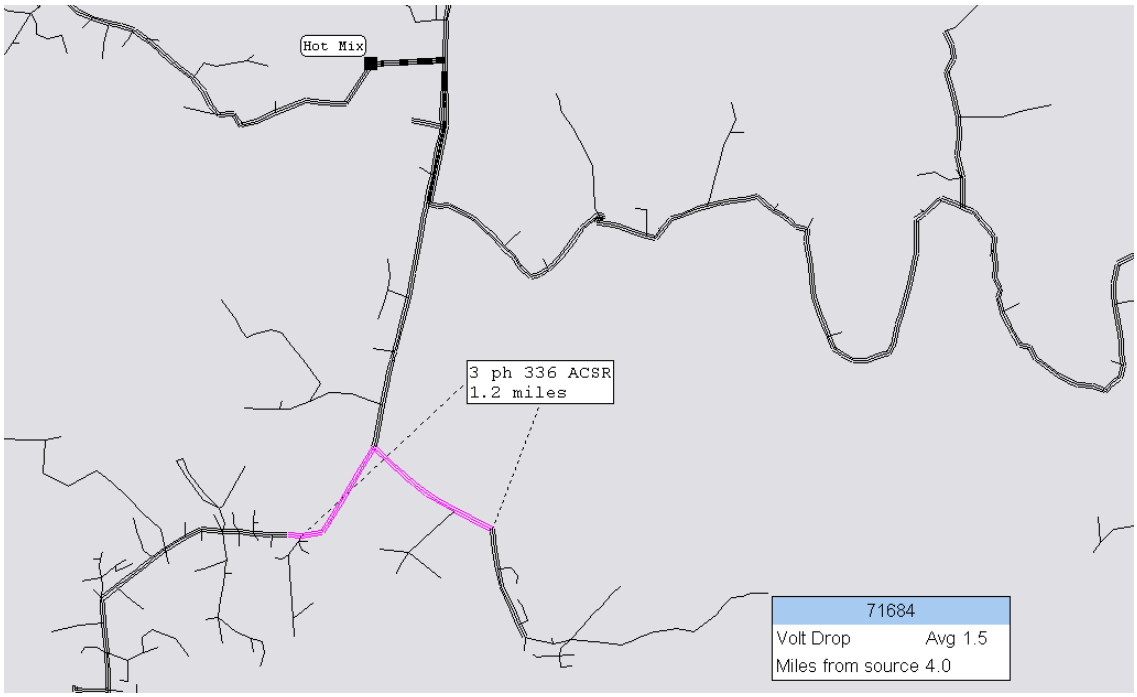
Hot Mix Rd Substation
Code 308
Estimated Cost: $174,000
Year: 2012

Description of Proposed Construction
Sections 70895 to 70900 and 70901 to 70909 – Replace 1.2 miles of three-phase #2ACSR with three-phase 336 ACSR. These line sections begin at the split at pole number 10-44-9 on Hwy 7, and end at 10-43-42 toward Liberty Road and 10-44-31 toward West Liberty.

Reason For Proposed Construction
Design Criteria (DC) Item 4 is being violated.

Results of Proposed Construction
DC Item 4 will be met.

Alternative Corrective Plan Investigated
These line sections are a continuation of the south mainline feeder out of the new Hot Mix Road substation. They will serve a new steel fabrication plant, and also serve as a mainline tie to Index substation. This replacement will improve the overall reliability to this service territory. Therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

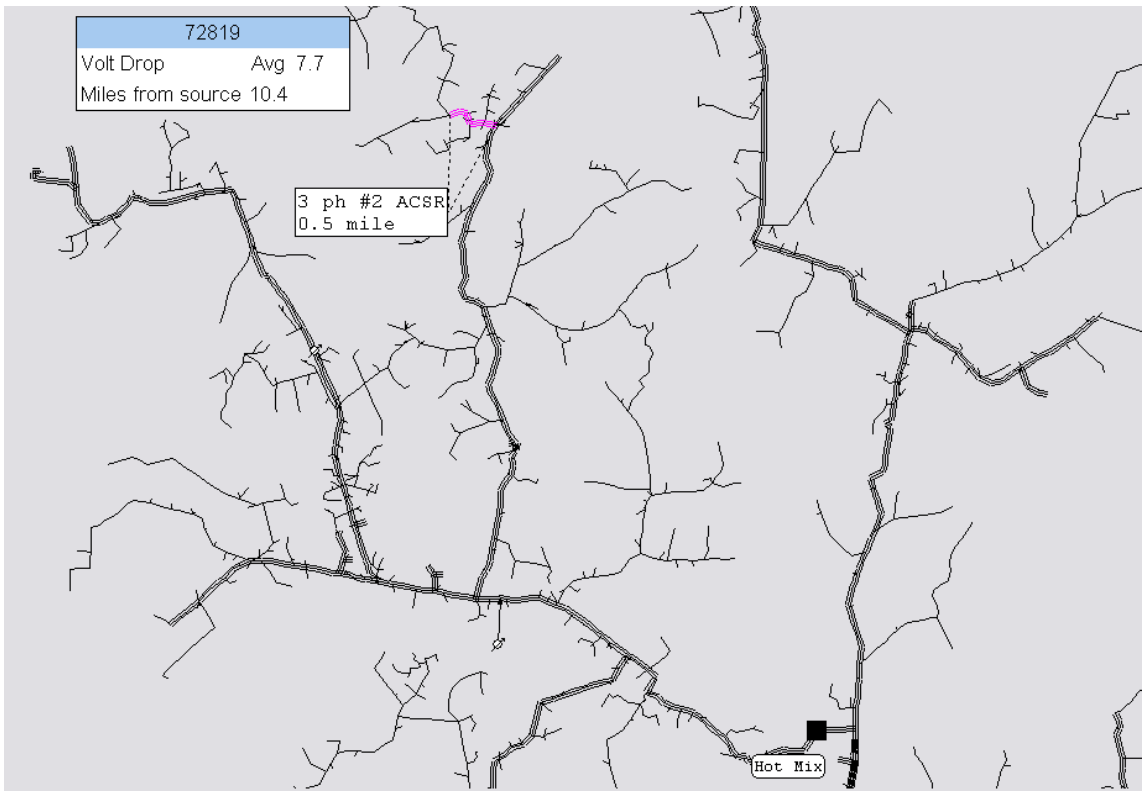
Hot Mix Rd Substation
Code 309
Estimated Cost: $40,000
Year: 2012

Description of Proposed Construction
Sections 72728 to 72748 – Convert 0.5 miles of single-phase 6A to three-phase #2 ACSR. These line sections begin at pole number 3-69-6 and end at 3-69-36 along Ditney Ridge Road.

Reason For Proposed Construction
Design Criteria (DC) Items 1 & 5 are being violated.

Results of Proposed Construction
DC Items 1 & 5 will be met.

Alternative Corrective Plan Investigated
This is a radial feed, therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

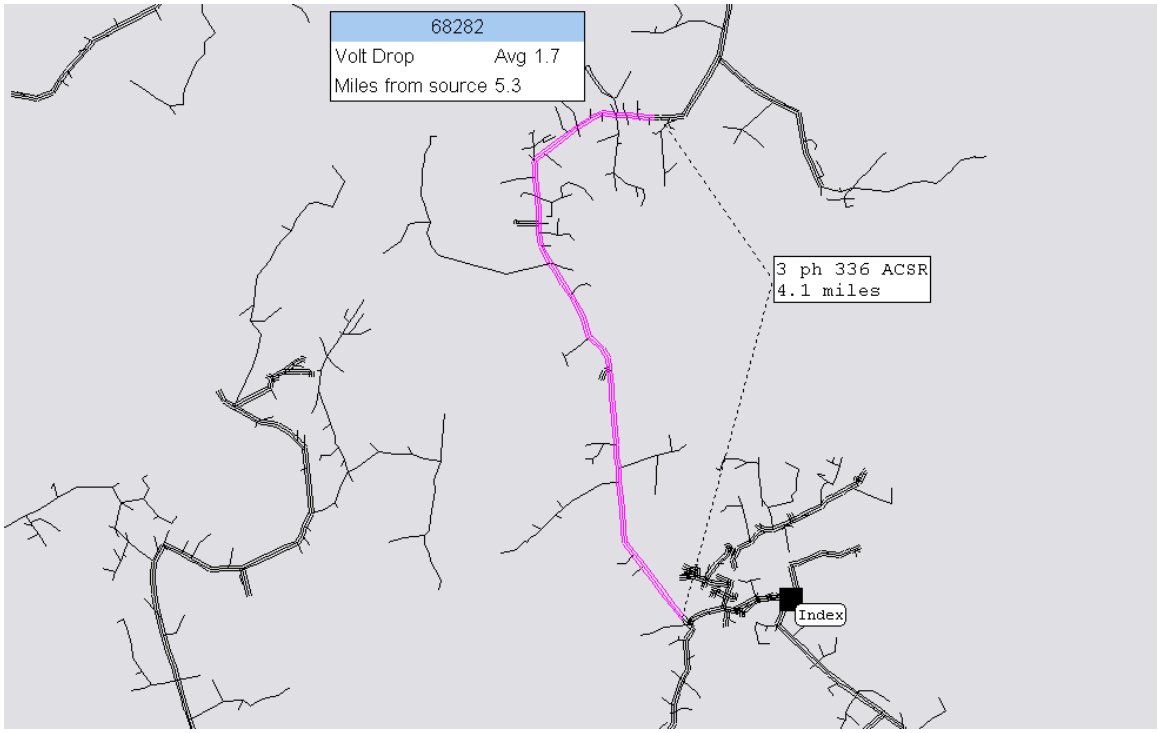
Index Substation
Code 310
Estimated Cost: $618,280
Year: 2013

Description of Proposed Construction
Sections 67296 to 68033 – Replace 4.1 miles of three-phase #2 ACSR with three-phase 336 ACSR. These line sections begin at pole number 10-84-11 on Hwy 460 near Index following Rt. 2498, and end at 10-43-42. These line sections serve as a mainline tie to Hot Mix Road substation.

Reason For Proposed Construction
Design Criteria (DC) Item 4.

Results of Proposed Construction
DC Item 4 will be met.

Alternative Corrective Plan Investigated
These line sections serve as a mainline tie to Hot Mix Road substation. This replacement will improve the overall reliability to this service territory, as well as provide a contingency feed to the new school. Therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

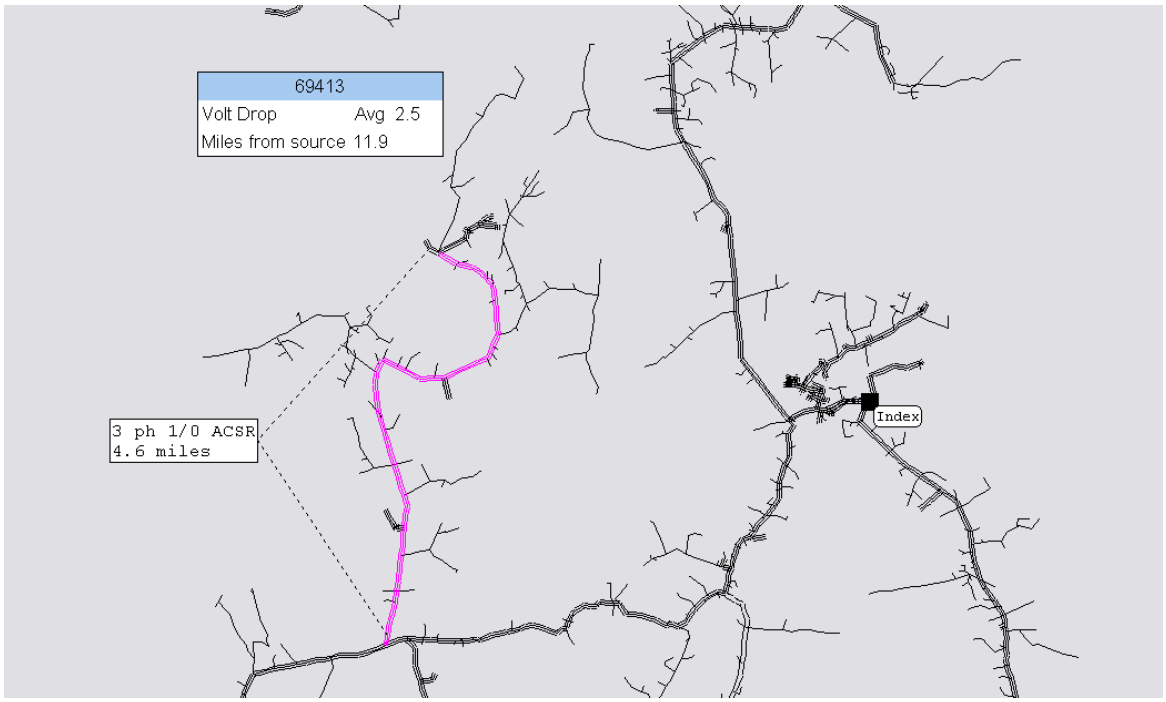
Index Substation
Code 311
Estimated Cost: $569,181
Year: 2015

Description of Proposed Construction
Sections 68472 to 68543 – Replace 4.6 miles of three-phase 6A CWC with three-phase 1/0 ACSR. These line sections begin at pole number 15-9-13 on Hwy 460 near Grassy Creek, and end at pole 9-69-28 on Hwy 705 near Woodsbend.

Reason For Proposed Construction
Design Criteria (DC) Items 1 & 4 are being violated.

Results of Proposed Construction
DC Items 1 & 4 will be met.

Alternative Corrective Plan Investigated
These line sections were chosen due to aged deterioration. Therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

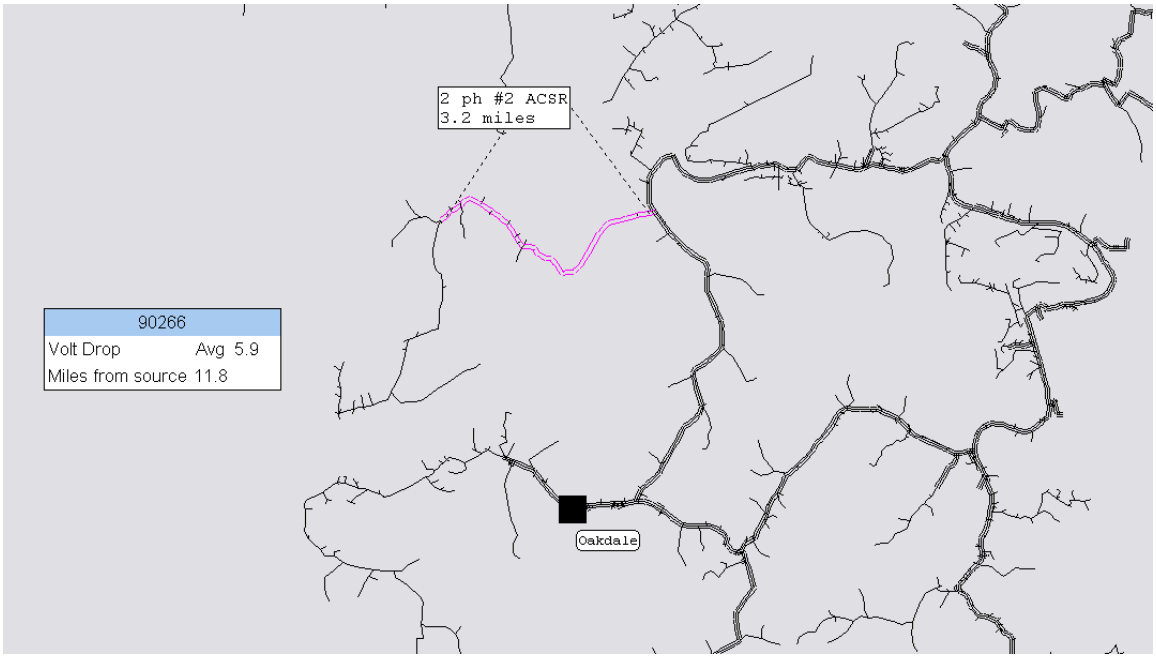
Oakdale Substation
Code 312
Estimated Cost: $173,056
Year: 2014

Description of Proposed Construction
Sections 90055 to 90119 – Convert 3.2 miles of single-phase 6A CWC with two-phase #2 ACSR. These line sections begin at pole 27-22-12 on War Creek-Rockfield-Filmore Road in War Creek, and end at pole 26-28-15. All consumers on the converted line sections should stay on A-phase, and the remaining single phase line should be switched to B-phase.

Reason For Proposed Construction
Design Criteria (DC) Items 1 & 5 are being violated.

Results of Proposed Construction
DC Items 1 & 5 will be met.

Alternative Corrective Plan Investigated
This is a radial feed, therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

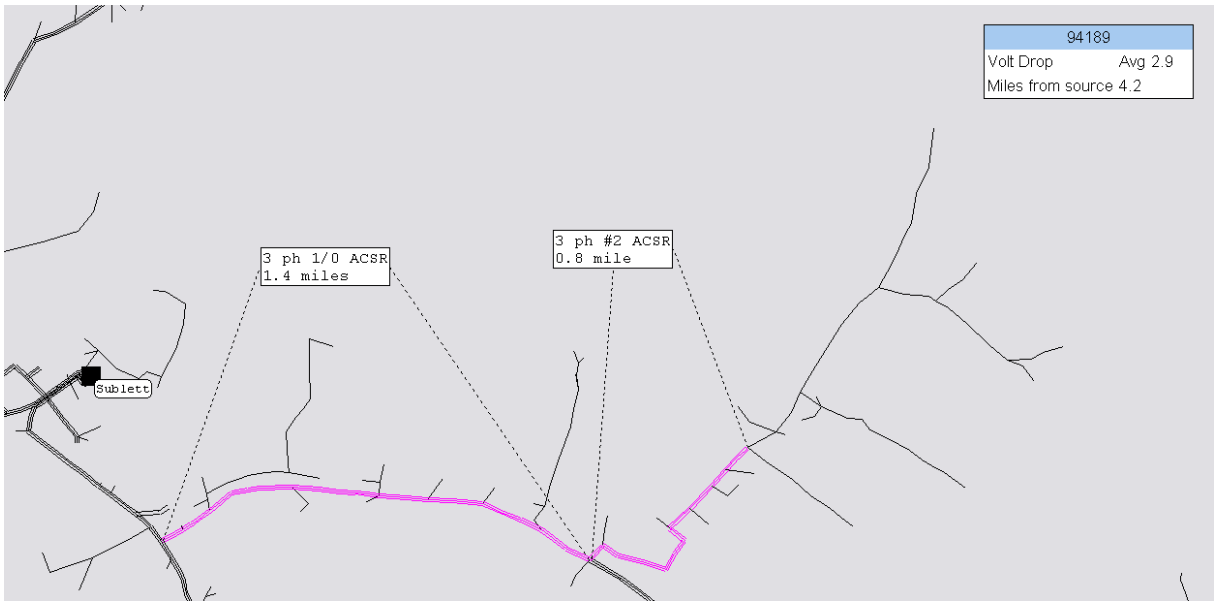
Sublett Substation
Code 313
Estimated Cost: $226,720
Year: 2013

Description of Proposed Construction
Sections 94037 to 94132 – Replace 1.4 miles of three-phase 6A with three-phase 1/0 ACSR and convert 0.8 miles of single-phase 6A to three-phase #2 ACSR. These line sections begin at pole number 23-58-98 and end at 24-52-18 along Hwy 867 / Gun Creek Road.

Reason For Proposed Construction
Design Criteria (DC) Item 4 & 5 is being violated.

Results of Proposed Construction
DC Items 4 & 5 will be met.

Alternative Corrective Plan Investigated
This is a radial feed, therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

Sublett Substation

Code 314

Estimated Cost: $618,280
Year: 2013

Description of Proposed Construction

Sections 92557 to 92619 – Replace 4.1 miles of three-phase 1/0 ACSR with three-phase 336 ACSR. These line sections will feed the proposed Bee Tree Mine.

Reason For Proposed Construction

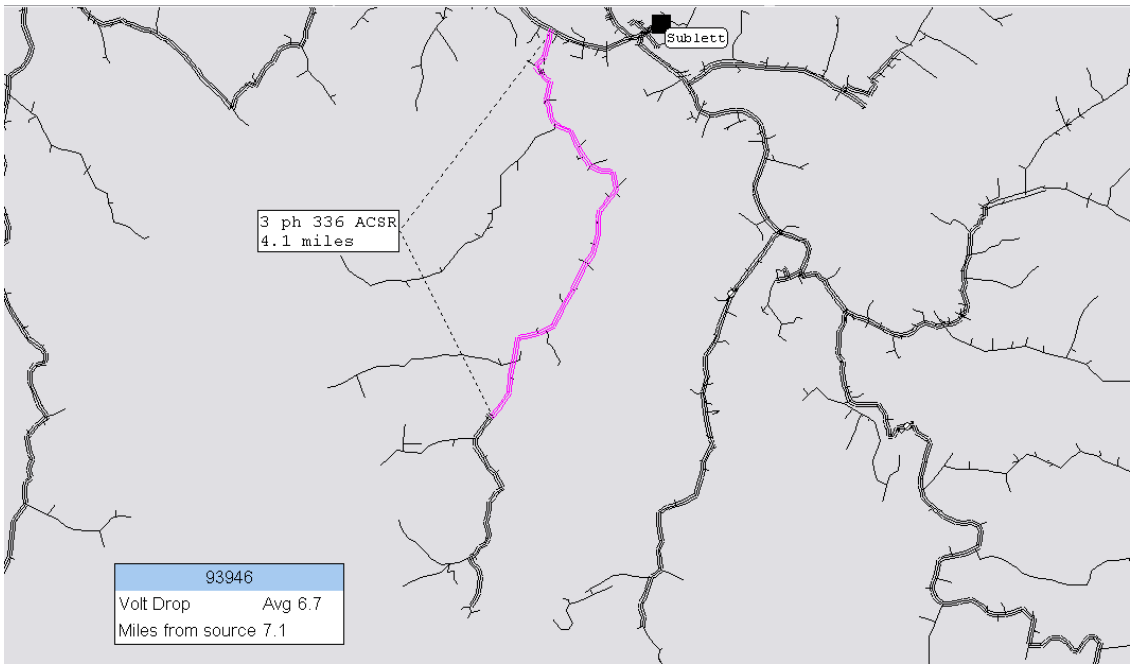
Design Criteria (DC) Item 1 & 5 is being violated.

Results of Proposed Construction

DC Items 1 & 5 will be met.

Alternative Corrective Plan Investigated

A new proposed mine will be added to the end of this feeder. The alternative would be to reduce the three phase conductor to 1/0ACSR closer to the mine. However while the steady-state voltage would be above criteria, the smaller conductor would increase the likelihood of flicker caused by the cyclical nature of the mining operation. Therefore the larger conductor will provide a stiffer source thereby reducing the level of flicker on this feeder.



SYSTEM IMPROVEMENTS – RUS CODE 300

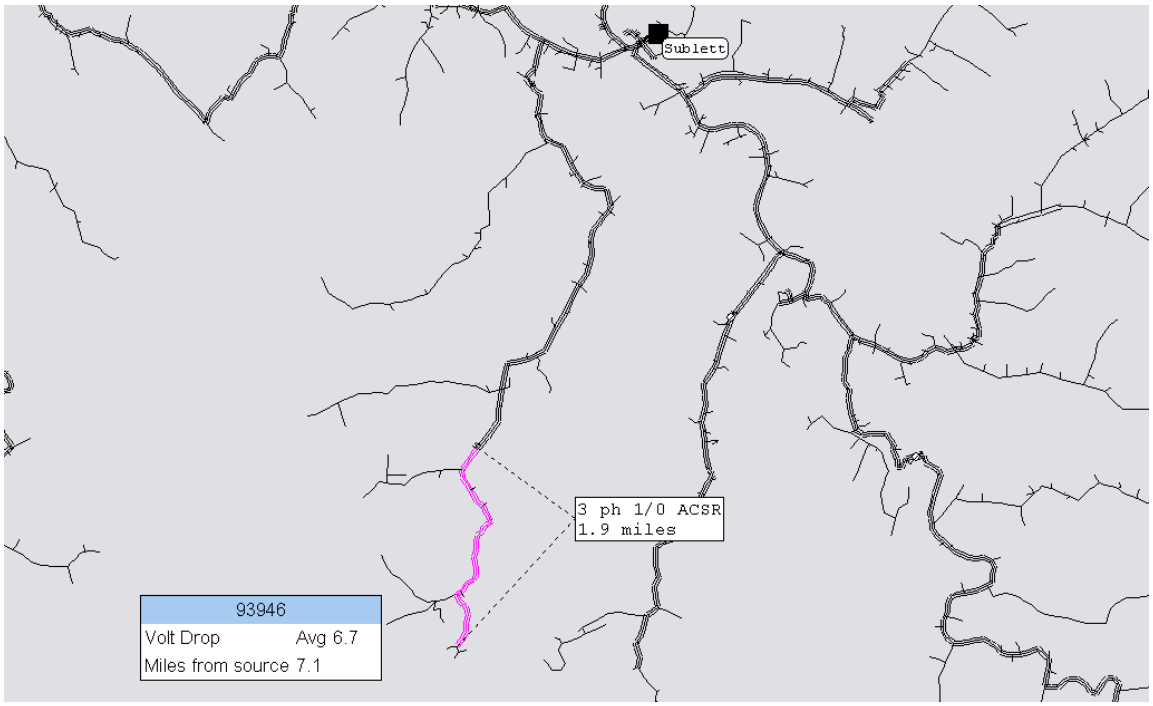
Sublett Substation
Code 315
Estimated Cost: $217,360
Year: 2013

Description of Proposed Construction
Sections 93907 to 93945 – Convert 1.9 miles of single-phase 6A to three-phase 1/0 ACSR. These line sections begin at pole 23-87-27 and end at 29-17-11 along Highway 1635. The washer plant at the Half Mountain Mine will be fed from this feeder and relieve the Gunlock circuit once this conversion is complete.

Reason For Proposed Construction
Design Criteria (DC) Item 1, 4, & 5 is being violated.

Results of Proposed Construction
DC Items 1, 4, & 5 will be met.

Alternative Corrective Plan Investigated
This is a radial feed. With the added load of the Washer Plant this conversion is necessary, and will improve the overall system reliability of this service territory.



SYSTEM IMPROVEMENTS – RUS CODE 300

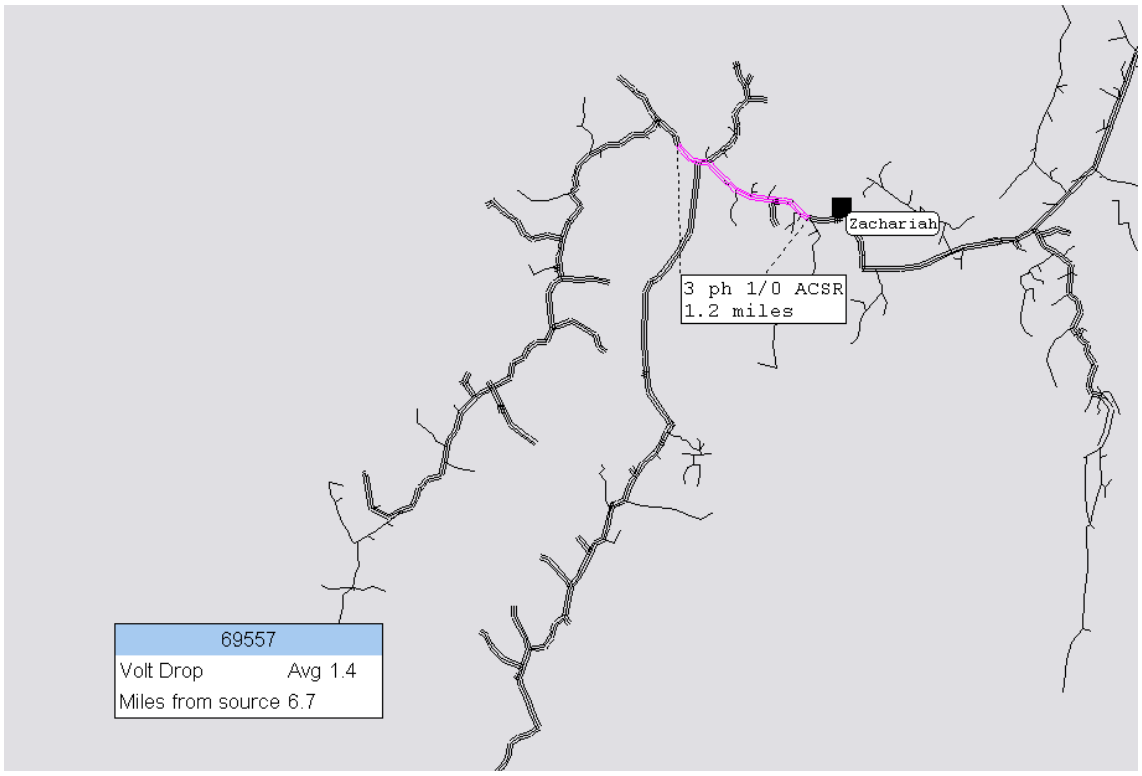
Zachariah Substation
Code 316
Estimated Cost: $142,771
Year: 2014

Description of Proposed Construction
Sections 55102 to 55117 – Replace 1.2 miles of three-phase 4A CWC with three-phase 1/0 ACSR. These line sections begin at pole number 19-38-6 at Hwy 1036 and Black Log Road, and end at pole 19-27-4 on Hwy 1036.

Reason For Proposed Construction
Design Criteria (DC) Item 4.

Results of Proposed Construction
DC Item 4 will be met.

Alternative Corrective Plan Investigated
These line sections were chosen due to aged deterioration. Therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

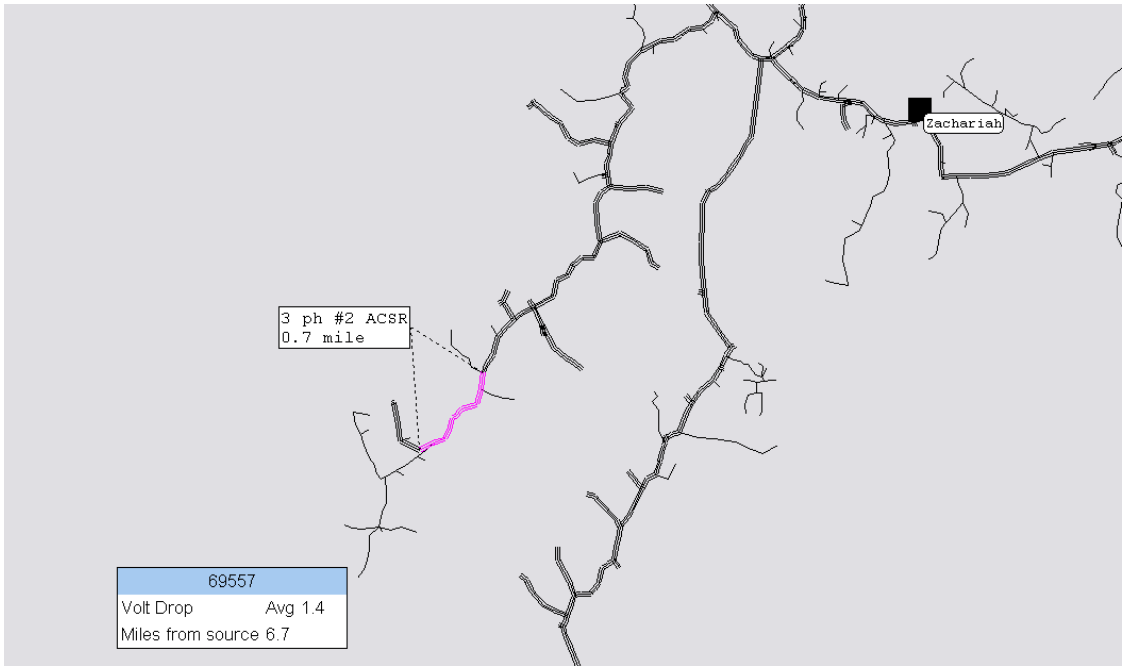
Zachariah Substation
Code 317
Estimated Cost: $60,570
Year: 2014

Description of Proposed Construction
Sections 55211 to 55219 – Replace 0.7 mile of three-phase 6A CWC with three-phase #2 ACSR. These line sections begin at pole number 19-56-1 on Hwy 1036, and end at pole 19-56-12 near Greeley.

Reason For Proposed Construction
Design Criteria (DC) Item 4.

Results of Proposed Construction
DC Item 4 will be met.

Alternative Corrective Plan Investigated
These line sections were chosen due to aged deterioration. Therefore no viable alternatives exist.



SYSTEM IMPROVEMENTS – RUS CODE 300

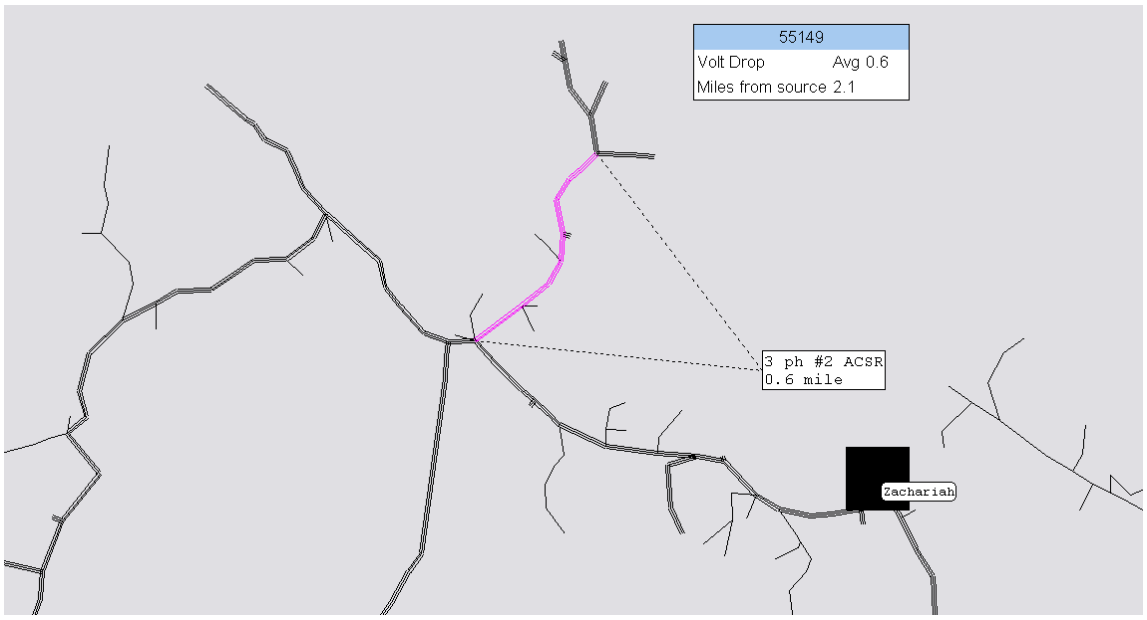
Zachariah Substation
Code 318
Estimated Cost: $49,920
Year: 2013

Description of Proposed Construction
Sections 55133 to 55141 – Replace 0.6 mile of three-phase 6A CWC with three-phase #2 ACSR. These line sections begin at pole number 19-28-3 at the intersection of Hwy 1036 and Big Bend Road following Big Bend Road to pole 19-28-16.

Reason For Proposed Construction
Design Criteria (DC) Item 4.

Results of Proposed Construction
DC Item 4 will be met.

Alternative Corrective Plan Investigated
These line sections were chosen due to aged deterioration. Therefore no viable alternatives exist.



MISCELLANEOUS DISTRIBUTION EQUIPMENT – RUS CODE 600's

Transformers – RUS Code 601

593 new transformers are projected at a cost of $805,946.

Meters – RUS Code 601

1,350 new single-phase AMI meters are projected at a cost of $161,559.
22 new three-phase AMI capable meters are projected at a cost of $14,092.

LVRECC will be converting their AMI metering system from the Hunt Technologies TS1 AMR system to the TS2 system. This will allow for two-communication to meters on the LVRECC system to allow for demand side management opportunities. Additional benefits of the TS2 meters include outage restoration validation, voltage readings and load profiles. Meters will be converted to TS2 meters on an as-needed basis.

1,400 retrofit single-phase AMI meters are projected at a cost of $213,308.
10 retrofit three-phase AMI capable meters are projected at a cost of $8,468.

Historical data was gathered for meters and transformers and is included in Table III-B-1.

Service Upgrades – RUS Code 602

There are 176 service upgrades projected at a total cost of $444,414. Historical data is included in Table III-B-1.

Sectionalizing – RUS Code 603

Overcurrent analysis is performed on an ongoing basis. Device changeouts, additional substation feeders, conductor multiphasing and load shifts require overcurrent device purchases.

Reclosers, fuses, switches, and cutouts are included in this category. Licking Valley has an ongoing effort to conduct system hardening initiative to improve reliability. A base cost of $250,000 for each of the four years has been allocated. The total projected cost for sectionalizing is $1,000,000.

- Continued on next page

MISCELLANEOUS DISTRIBUTION EQUIPMENT – RUS CODE 600's - continued

Voltage Regulators – RUS Code 604

The total cost for voltage regulators projected for the CWP is $375,980. Upon the completion of the proposed Carty Branch substation the voltage regulators at the following locations will no longer be needed: 23-36-44, 23-32-21 and 23-63-22.

CFR CODE	SUBSTATION	SECT/RATING	YEAR	COST
604-1	CAMPTON	LOC#20-8-4 / 3-219A	2012	$54,000
604-2	CAMPTON	LOC#20-49-3 / 3-150A	2013	$41,600
604-3	HELECHAWA	LOC#22-18-7 / 1-100A	2013	$12,480
604-4	HELECHAWA	LOC#27-18-29 / 1-100A	2014	$13,000
604-5	OAKDALE	LOC#27-55-16 / 3-219A	2012	$54,000
604-6	OAKDALE	LOC#27-82-5 / 3-150A	2015	$45,000
604-7	OAKDALE	LOC#33-2-23 / 3-100A	2015	$36,000
604-8	OAKDALE	LOC#27-33-27 / 3-150A	2014	$43,300
604-9	SUBLETT	LOC#24-82-63 / 3-100A	2013	$33,300
604-10	ZACHARIAH	LOC#20-3-5 / 3-150A	2014	$43,300

- 604-1: Add 3-219A voltage regulators on the Campton Stillwater feeder near pole 20-8-4 before the three-phase spilt. Placement of this voltage regulator is in conjunction with the phase balancing recommendation of this feeder.
- 604-2: Add 3-150A voltage regulators on the Campton Vortex feeder near pole 20-49-3 before the three-phase spilt. Placement of this voltage regulator is in conjunction with the phase balancing recommendation of this feeder.
- 604-3: Add 1-100A voltage regulator on the Helechawa Cannel City feeder near pole 22-18-7 to boost the voltage on the tap beginning with line section 81963. Placement of this voltage regulator is in conjunction with the phase balancing recommendation of this feeder.
- 604-4: Add 1-100A voltage regulator on the Helechawa Lee City feeder near pole 27-18-29 to boost the voltage on the tap beginning with line section 83892. This regulator will be needed upon completion of the balancing of the Lee City feeder.
- 604- 5: Replace the 3-150A voltage regulators on the Oakdale Elkatawa feeder at pole 27-55-16 with 3-219A. The recent and projected expansion of the coal tipple increases the loading beyond the 150A voltage regulator loading criteria.
- 604-6 & 604-7: Add 3-150A voltage regulators on the Oakdale Highland feeder at pole 27-82-5 and add 3-100A voltage regulators at pole 33-3-23. Remove the set of 3-150A voltage regulators at 32-9-2. There is too much voltage drop before the existing set of regulators; and increasing the conductor size of this feeder mainline is cost prohibitive at this time. Placement of this voltage regulator is in conjunction with the phase balancing recommendation of this feeder.

MISCELLANEOUS DISTRIBUTION EQUIPMENT – RUS CODE 600's - continued

Voltage Regulators – RUS Code 604 - continued

- 604-8: Add 3-150A voltage regulators on the Oakdale War Creek feeder at pole 27-33-27. Placement of this voltage regulator is in conjunction with the phase balancing recommendation of this feeder, and the multi-phase conversion on War Creek-Rockfield-Filmore Road.
- 604-9: Replace the 100A autoboosters at 24-82-63 on the Sublett Gunlock feeder with 3-100A voltage regulators. Remove the 50A autoboosters at 30-13-57. Placement of this voltage regulator is in conjunction with the phase balancing recommendation of this feeder.
- 604-10: Add 3-150A on the Zachariah Pine Ridge feeder near pole 20-3-5. This set of voltage regulators are needed to sustain downline voltage during summer loading.

Capacitor Banks – RUS Code 605

The total cost for capacitor banks projected for the CWP is $60,000. The capacitor bank on the Crockett substation, Crockett feeder at location 11-32-27 needs to be reduced or removed entirely. This substation has a leading power factor for most of the year. There are four other substations where capacitor banks should be considered during the summer season to reduce kVAR on the system. Also capacitors may be needed when the new proposed mines at Crafts Creek (Carty Branch substation) and Bee Tree Creek (Sublett substation) are energized.

CFR CODE	SUBSTATION	RATING	YEAR	COST
605-1	CARTY BRANCH*	600kVAR	2014	$10,000
605-2	CAMPTON	600kVAR	2014	$10,000
605-3	INDEX	300kVAR	2014	$10,000
605-4	OAKDALE	600kVAR	2012	$10,000
605-5	SUBLETT*	600kVAR	2015	$10,000
605-6	ZACHARIAH	600kVAR	2012	$10,000

*****Dependent on power factor of substation system once mines are operational.

MISCELLANEOUS DISTRIBUTION EQUIPMENT – RUS CODE 600's – continued

Pole Changes – RUS Code 606 Including Clearance Poles

There are 1,440 projected pole changes in the CWP. This includes all maintenance and clearance poles. The cost for the pole changes is projected to be $4,777,578. Historical cost data for pole changes may be found in Table III-B-1.

Conductor Replacements – RUS Code 608

The total cost for aged conductor replacement projected for the CWP is $2,972,525. This accounts for an average of 20 miles of aged conductor replacement per year. This includes replacement of conductor due to age, deterioration, and operation and maintenance recommendations. These conductors have not been specifically identified in the CWP, but will be recommended on an as-needed basis.

Radio Upgrades – RUS Code 615

LVRECC will be upgrading their radio system in this CWP. The upgrade will include upgrading mobile radios, new antennas for mobile units, upgrading to 100W repeaters, and all associated licensing changes and upgrades to three towers. This upgrade also enables LVRECC to meet the FCC requirement that by January 2013 all users must operate on narrowband frequencies.

The total projected cost for the radio upgrades in the CWP is $60,000.

RUS CODE 700

Outdoor Lighting – RUS Code 701

A total of 472 new outdoor lights are anticipated. The projected cost is $175,099.

Outdoor lighting cost history and projections are shown in Table III-B-1.

AMI Equipment – RUS Code 705

An amount of $291,800 is projected for this CWP for AMR equipment. This accounts for all of the required hardware and software necessary to complete the TS2 conversion. All of the LVRECC substations will be converted by the end of the CWP.

AMR equipment cost projections are shown in Table III-B-1.

APPENDIX A
Economic Conductor Analysis