

July 15, 2021

Patrick Fahn  
Director, Public Utilities Division  
North Dakota Public Service Commission  
600 East Boulevard; Department 408  
Bismarck, ND 58505-0480

Re: PU-14-813 - Basin Electric Power Cooperative - North Killdeer Loop Phase I 345-kV  
Transmission Line - Notice of Noncompliance

Dear Mr. Fahn:

This letter is in response to your letter dated June 15, 2021 enumerating two items of apparent noncompliance regarding order provisions in the above-captioned case. Basin Electric Power Cooperative's (**Basin Electric's**) explanation and proposed corrective action for each item is presented below.

Item 1.

Response: According to our records, the required information was submitted to the North Dakota Public Service Commission (**Commission or NDPSC**) by Basin Electric employee Mr. Cris Miller on February 16, 2018. A copy of the submittal is attached for your reference. Basin Electric believes this meets the requirements to Order Provision paragraph 33. While Basin Electric does not have a copy of the CD that was sent in 2018, for your convenience, we have included the electronic files on the enclosed USB flash drive that were likely included on that CD.

Item 2.

Response: On August 16, 2017, Mr. Cris Miller submitted an "Initial" (or Partial) Tree/Shrub Mitigation Plan (**Plan**) which is docketed as item 109 in the above-captioned case. The Plan indicated that the total number of trees/shrubs removed was estimated at 1,129 (requiring 2,258 replacements) on nineteen landowner parcels, and that ten of the nineteen landowners had requested replacements totaling 1,534. The Plan also provided that the replacements were to be combined with the replacement efforts required under NDPSC Case PU-11-696 (AVS to Neseet 345-kV transmission line) because this Project and the AVS to Neseet 345-kV Transmission Project were occurring simultaneously in some of the same areas. A copy of the August 16, 2017 correspondence is also attached for your convenience. It appears that report was never approved by the Commission.

350 PU-11-696 Filed 07/15/2021 Pages: 66  
Response to 15 June 2021 Notice of Noncompliance  
Basin Electric Power Cooperative  
Kevin Solie, P.E.

120 PU-14-813 Filed 07/15/2021 Pages: 66  
Response to 15 June 2021 Notice of Noncompliance  
Basin Electric Power Cooperative  
Kevin Solie, P.E.

On February 21, 2018, Mr. Miller submitted an update on tree and shrub planting in PU-11-696 detailing Basin Electric's efforts to identify planting opportunities with local and state entities.

Further, on October 20, 2020, I submitted a report in docket PU-11-696, detailing a summary of Basin Electric's replacement efforts in western North Dakota:

**Table 1. Tree and shrub summary.**

County	Public Plantings	Landowner Plantings	Planting Dates (Year)	Notes
McKenzie	0	7,117	2017, 2018, 2019	1,606 replants 2018/2019
Mercer	4,529	2,129	2016, 2018	
Mountrail	622	0	2018	
Stark	16,540	0	2019	1,000 replants 2020
Williams	5,097	1,513	2017, 2018, 2019	1,750 replants planned for 2021
<b>Totals</b>	<b>26,788</b>	<b>10,759</b>		

While the report didn't specifically include reference to docket PU-14-813, the table did include total tree plantings for replacement trees in both the North Killdeer Loop Project and the AVS-Neset Project. Between the two projects, a total of 37,078 replacements would need to be accounted for. Basin Electric has planted approximately 37,547 trees in western North Dakota (with 7,117 planted in McKenzie County, the location of the North Killdeer Loop Phase I Project), as well as spent hundreds of thousands of dollars on tree/shrub mitigation efforts to date.

As detailed in the filings to the NDPSC on this issue, tree/shrub mitigation efforts under both this docket and PU-11-696 have been complicated by the lack of landowner and community desire for replants and that planting/replanting efforts have occurred over a period of close to five years. Thus, Basin Electric appreciates the opportunity to request compliance with the NDPSC's March 13, 2019 simplified version of the Tree and Shrub Mitigation Specifications and asks the Commission to amend the April 29, 2015 Order to incorporate the March 13<sup>th</sup> version of the Commission's Tree and Shrub Mitigation Specifications.

For the reasons identified above, Basin Electric would also request compliance with the NDPSC's March 13, 2019 simplified version of the Tree and Shrub Mitigation Specifications and asks the Commission to amend the original April 23, 2014 Order to incorporate the March 13<sup>th</sup> version of the Commission's Tree and Shrub Mitigation Specifications in the PU-11-696 docket.

Basin Electric believes the significant planting (and replanting) efforts undertaken since 2017 would meet the intent of and purpose of the NDPSC's updated Tree and Shrub Mitigation Specifications, that is to provide plantings that will provide a long-term benefit to landowners, farmers and ranchers, the community, wildlife, and the environment.

In conclusion, Basin Electric proposes to provide a combined final report to be sent by October 31, 2021, which will address the requirements of paragraphs five and two in the updated Tree and Shrub Mitigation Specifications in both the PU-14-813 and PU-11-696 dockets.

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Please contact me at [ksolie@bepc.com](mailto:ksolie@bepc.com) or 701.202.5096 if you have any questions or require additional information.

Sincerely,

A handwritten signature in blue ink, appearing to read "K. Solie".

Kevin L. Solie, P.E.  
Senior Environmental Compliance Administrator

/kls  
Enclosures



February 16, 2017

Darrell Nitschke  
Executive Director  
North Dakota Public Service Commission  
600 East Boulevard; Dept. 408  
Bismarck, ND 58505-0480

Re: Basin Electric Power Cooperative  
North Killdeer Loop Phase I 345-kV Transmission Project As-Build Submittal  
PU-14-813

Dear Mr. Nitschke:

Enclosed is Basin Electric Power Cooperative's North Killdeer Loop Phase I 345-kV Transmission Project's final Structure Location, Plan and Profile and Design Specifications. A CD containing the electronic files is also enclosed. Due to the file size, the files cannot be updated directly to the Docket.

The Project was placed into electrical service in September 2016. The reclamation effort was completed in late November 2016. The grassland areas that require re-vegetation will be seeded in spring 2017. The re-vegetated areas will be monitored for final acceptance by Basin Electric staff.

For inquiries regarding the application, please call Cris Miller, Senior Environmental Project Specialist at (701) 557-5635.

Sincerely,

A handwritten signature in black ink that reads "Cris Miller".

Cris Miller  
Senior Environmental Project Specialist

/ser  
Enclosures

cc: Casey Jacobson  
Amanda Wangler

# 20170214 - ENG - NKL Phase 1 - Patent Gate to Kummer Ridge - 345kV Transmission Line Project Design Criteria Report

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## Design Criteria Report

**June 2015**

BASIN ELECTRIC POWER COOPERATIVE

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<b>TRANSMISSION LINE DESIGN DATA SUMMARY</b>		<b>I. GENERAL INFORMATION</b>					
		BORROWER:				DATE:	
		LINE IDENTIFICATION: North Killdeer Loop Phase 1 345 kV Transmission Line Project					
		VOLTAGE			LENGTH		
		TRANSMISSION	ADD'L CIRCUIT	TRANSMISSION	ADD'L CIRCUIT	TRANSMISSION	ADD'L CIRCUIT
		345 kV		28.69 miles			
		TYPE OF TANGENT STRUCTURE: Single Steel Pole			BASE POLE: 115 HT. _____ CL		
DESIGNED BY: Basin Electric Power Cooperative							
<b>II. CONDUCTOR DATA</b>							
Note: Add'l circuit by Mountrail Williams Electric Cooperative	SIZE (kcmil or IN.)	2312.0	7/16 EHS	71/571			
	STRANDING	76/19	7	15			
	MATERIAL	ACSR	EHS	Alum. Clad Steel			
	DIAMETER (IN)	1.802	0.435	0.571			
	WEIGHT (LB/FT.)	2.526	0.399	0.411			
	ULTIMATE STRENGTH (LBS.)	56,700	20,800	20,546			
<b>III. DESIGN LOADS (Wire)</b>							
		TRANSMISSION (LBS/FT)	OHGW (LBS/FT)	OPGW (LBS/FT)	ADD'L CIRCUIT (LBS/FT)		
NESC: <u>HEAVY</u> LOADING DISTRICT							
a. ICE: <u>1/2</u> IN.	Vertical.	3.958	0.981	1.075			
b. WIND ON ICED CONDUCT. <u>4</u> PSF	Transverse	0.934	0.478	0.524			
c. CONSTANT K <u>0.3</u>	Resultant + K	4.367	1.391	1.496			
HEAVY ICE (NO WIND) <u>1.25</u> IN.	Vertical.	7.272	3.019	3.241			
HIGH WIND (NO ICE) <u>31</u> PSF	Transverse	4.660	1.124	1.475			
EXTREME HIGH WIND/ICE							
ICE: <u>1/2</u> IN.	Vertical.	3.958	0.981	1.075			
WIND ON ICED CONDUCT. <u>9.2</u> PSF	Transverse	2.148	1.100	1.204			
<b>IV. SAG &amp; TENSION DATA</b>							
SPANS	AVERAGE (EST)	<u>800-950</u> FT.	MAXIMUM (EST).	<u>1200</u> FT.	RULING (EST.)	<u>950</u> FT	
SOURCE OF SAG-TENSION DATA: ALCOA SAG 10		TRANSMISSION	OHGW	OPGW	(ESTIMATED)		
<b>TENSIONS (% RATED STRENGTH)</b>		INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
NESC HEAVY (0°F, 1/2 IN, 4.00 PSF, 0.30 LB/F)		39.2	34.5	28.5	27.7	32	30.4
MAXIMUM ICE 1.25 IN (32°F)		53.3		47.1		51.3	
HIGH WIND 31 PSF (60°F, 0 IN)		39.3		24.2		30	
UNLOADED LOW TEMPERATURE (-40°F)		32.7		14.0		17.3	
<b>SAGS (FT)</b>							
NESC DISTRICT LOADED (0°F)			25.3		27.37		27.17
UNLOADED HIGH TEMP (212°F) (120°F FOR OHGW & OP)			35.5		23.63		24.49
MAXIMUM ICE 1.25 IN (0°F)			28.6		35.0		34.92
LOADED 1/2" ICE, NO WIND (32°F)			26.7		25.55		25.74
<b>V. CLEARANCES</b>							
MINIMUM CLEARANCES TO MAINTAINED AT: 212°F, FINAL SAG							
CLEARANCES IN FEET	RAILROADS	HIGHWAY	CULTIVATED FIELDS	RURAL ROADS		ADD. ALLOW. FOR TEMPLATE	
TRANSMISSION	38	30	30	30		--	
ADD'L CIRCUIT						--	
<b>VI. RIGHT OF WAY</b>							
WIDTH	150 FT (MIN.)			150 FT. (MAX.)			

VII. CONDUCTOR MOTION DATA						
HISTORY OF CONDUCTOR GALLOPING: MINIMAL TO RARE						
HISTORY OF AEOLIAN VIBRATION: YES - DAMPER REQUIRED						
a. TYPE OF VIBRATION DAMPERS USED (IF ANY)			STOCKBRIDGE (conductor) SPIRAL (OHGW and OPGW)			
b. TYPE OF ARMOR RODS USED (IF ANY)			PREFORMED AGS			
VIII. INSULATION						
NO. OF THUNDERSTORM DAYS/YR - <u>30</u> ELEV.ABOVE SEA LEVEL (MIN, MAX, FT) <u>2000 - 2500</u>						
CONTAMINATION EXPECTED? <u>minimal</u> MAX EST. FOOTING RESISTANCE <u>25</u> Ω SHIELD ANGLE <u>20</u> °						
STRUCTURE TYPE	STRUCTURE DESIGNATION	NO. OF BELLS PIN OR POST	60 HZ DRY FLASHOVER	INSULATOR SIZE	M&E RATING / CANTILEVER STR	OTHER
TANGENT		18	965 kV	5-3/4 X 10	30K M&E	
STRAIN STRUC		19 (double string)	1050 kV	5-3/4 X 10	30K M&E	
IX. INSULATOR SWING						
CRITERIA: (1) <u>6</u> PSF ON BARE CONDUCTOR AT <u>40</u> °F (6 psf MIN) FOR <u>76</u> IN. CLEARANCE						
(2) <u>31</u> PSF HIGH WIND ON BARE CONDUCTOR AT <u>60</u> °F FOR <u>30</u> IN. CLEARANCE						
(3) <u>0</u> PSF ON BARE CONDUCTOR AT <u>60</u> °F FOR <u>104</u> IN. CLEARANCE						
(4) <u>9</u> PSF ON BARE CONDUCTOR AT <u>60</u> °F FOR <u>76</u> IN. CLEARANCE						
ALLOWABLE SWING ANGLE			ANGLE IN DEGREES			
NAME OF STR.	STRUCTURE TYPE	NO. OF INSULATORS.	(1) 6 PSF MIN WIND	(2) HIGH WIND	(3) 0 PSF WIND, 60°F	(4) 9 PSF WIND, 60°F
3ST	TANGENT	18	47° Max	72° Max	24° Max	47° Max
3SA	ANGLE	19				
3SDA	DEADEND	19 (38)				
X. ENVIRONMENTAL AND METEOROLOGICAL DATA						
TEMPERATURE: MIN <u>-50</u> ° MAX. <u>110</u> ° AVERAGE YEARLY LOW <u>-30</u> °			EXTREME WIND VELOCITIES (MPH): 10 YR. <u>60</u> 50 YR. <u>    </u> 100 YR <u>80</u> 90 mph 3-second gust (maximum recorded)			
MAXIMUM HEIGHT OF SNOW ON THE GROUND UNDER THE CONDUCTOR(F7): <u>2.0</u>			DESCRIBE TERRAIN AND CHARACTERISTICS OF SOIL:			
CORROSIVENESS OF ATMOSPHERE: MINIMAL			1. Rolling hills and plains dissected by streams. 2. Soils comprised of lean clays, silt soils, and sandy clays/silts overlaying sandy lean clay glacial till with cobbles and boulders.			
XI. STRUCTURE DATA						
SPECIES OF WOOD: <u>N/A</u>			DESIGNATED BENDING FIBER STRESS <u>N/A</u>			
SPANS (F7) FOR TANGENT TYPE <u>3ST</u>			BASE POLE <u>115</u> FT	OTHER HEIGHTS/CLASSES AND BRACING		
LEVEL GROUND SPAN			950'			
MAX. HORIZON. SPAN LIMITED BY STRUCTURE STRENGTH			1200'			
MAX. VERTICAL SPAN LIMITED BY STRUCTURE STRENGTH			1400'			
MAX. HORIZONTAL SPAN LIMITED BY COND. SEPARATION			>1200'			
MAX. SPAN LIMITED BY UNDERBUILD			--			
MAX. SPAN LIMITED BY GALLOPING			>1200'			
EMBEDMENT DEPTH: Concrete Pier Foundations				PRESERVATIVE: <u>N/A</u> (TYPE & RETENTION) <u>N/A</u>		
GUYING: TYPE OF ANCHORS: <u>n/a</u> GUY SIZE AND R.B.S.: <u>n/a</u>						
XII. LINE DESCRIPTION						
TANGENTS <u>70</u> %		LIGHT ANLES <u>5</u> %		AVERAGE NUMBER OF LINE ANGLES PER MILE <u>0.3</u>		
MEDIUM ANGLES <u>15</u> %		DEADEND & HEAVY ANGLES <u>10</u> %		MAXIMUM DISTANCE BETWEEN FULL DEADENDS (IN MILES) <u>5</u> MILES		

## A. INTRODUCTION

Basin Electric Power Cooperative is a consumer-owned, regional cooperative headquartered in Bismarck, North Dakota. Basin Electric is proposing construction of a 345kV transmission line in northwest North Dakota that will run approximately 30 miles from the Patent Gate Substation near Arnegard, North Dakota to the Kummer Ridge Substation near Johnson's Corner, North Dakota.

The proposed transmission line will be constructed using steel single-pole structures.

A location map is shown in the Appendix.

## B. CLIMATE

The semi-arid climate for the transmission line is characterized by cold, dry winters and moderately hot summers. The area is subject to large annual variations in temperature because it is near the center of the North American land mass. Arctic air moves into the region from the north and northwest during the winter, causing periods of extreme cold alternating with milder temperatures. Summer temperatures are usually warm, but some hot spells and occasional cool days can be expected. The transmission line design will incorporate the following climate conditions.

### 1. Temperature

Temperature extremes: Lowest: -50°F (12/23/1983) Highest: 110°F (07/05/1936)

Mean lowest daily minimum temperature: -6.1°F

Mean annual temperature: 41.9°F

### 2. Wind

Basic Wind Speed: 90 mph (from NESC Figure 250-2)

Coldest month mean wind velocity: 9.7 mph (December)

Prevailing wind direction for coldest month: NW

### 3. Precipitation

Average annual precipitation: 14.3 inches

Expected maximum 24-hour snow accumulations: 15 inches

### 4. Isokeraunic Level

The Isokeraunic level for the area is 30.

### 5. Frost Depth

The average depth for frost penetration is 5 feet.

## C. ELEVATION

Elevation ranges from 2000 feet to 2500 feet above sea level.

## D. CODES AND STANDARDS

This transmission line will be constructed in accordance with Rural Utilities Service (RUS) Standards. In addition, design, materials, and construction will conform to the latest revision of the following:

1. NESC – National Electrical Safety Code
2. ASTM – American Society for Testing and Materials
3. ANSI – American National Standards Institute

4. AISC – American Institute of Steel Construction
5. IEEE – Institute of Electrical and Electronic Engineers
6. ASCE – American Society of Civil Engineers
7. AWS – American Welding Society
8. NEMA – National Electrical Manufacturers Association
9. OSHA – Occupational Safety and Health Act
10. ASME – American Society of Mechanical Engineers

All federal, state, local, and municipal government requirements will also be adhered to.

#### E. GENERAL CRITERIA

##### 1. Nominal Voltage

The nominal phase-to-phase voltage is 345 kV.

##### 2. Structure Type

Steel single-pole structures on concrete foundations will be used. A comprehensive structure design criteria is contained in the Appendix.

##### 3. Line Access and Structure Numbers

Special access may be required to some structures. Gates will be provided in existing fences. Structure numbers will be provided at the top of every 5<sup>th</sup> structure, in addition to deadends, angles, and crossings..

##### 4. Thermal Capacity

Basin Electric Power Cooperative has had satisfactory electric operation using a single 2306.2 MCM ACSR conductor per phase at 345 kV. The electrical operating characteristic of this line will be similar with the single 2312 MCM ACSR conductor. The maximum summer current rating is 1810 amperes at 100°C and at 2 feet per second crosswind. The maximum winter current rating is 2525 amperes at 100°C and at 2 feet per second crosswind. Thermal capacity is not a limiting factor for this transmission line.

##### 5. Electrical Effects Analysis

Basin Electric's experience with 345 kV transmission lines indicates that they do not produce objectionable levels of audible noise, television interference, electric or magnetic fields off the right-of-way. Therefore, no specific study for such electrical effects is planned for this project.

##### 6. Transposition Structures

Due to the delta configurations on tangents and deadends, and the stacked configurations from the angles, transposition structures will not be necessary.

## F. INSULATION COORDINATION

### 1. Insulation Requirements for Power Frequency

Power frequency voltages rarely control insulation design except in highly contaminated conditions. For this 345 kV line, the 60 hertz wet line crest voltage is (1.05 x 345 kV):

$$\frac{362}{\sqrt{3}} \times \sqrt{2} = 295 \text{ kV}$$

Seven (7) standard 5 $\frac{3}{4}$ " x 10" suspension insulators would be sufficient. However, a reduction in flashover voltage is caused by rain and is further decreased by contaminants within the rainwater. To compensate for the contaminated conditions, the leakage distance (the distance along the surface of the insulator) has to be increased. Even for very lightly contaminated areas, RUS recommends a total leakage distance of up to 1 inch per kV (RMS line to ground). On that basis, a leakage distance of 209 inches or a minimum of 18 insulators would be required. The insulation design must obviously withstand the power frequency voltage during all weather conditions including the high wind condition. A power frequency air gap of 30 inches shall be maintained during maximum insulator swing condition.

### 2. Insulation for Switching Surge

It is assumed that the maximum per unit switching surge for the 345 kV line will be kept below a level of 2.8 by using surge arresters. For design purposes the switching surge voltage is:

$$\frac{262}{\sqrt{3}} \times \sqrt{2} \times 2.8 = 826 \text{ kV to ground}$$

The basic insulation level of the line is the withstand value of the impulse voltage of the insulator string which can successfully withstand the expected switching surge.

### 3. Insulation for Lightning Surges

Insulator strings with 18 units on steel and wood structures have proven satisfactory lightning performance. Angle structures may have additional units to maintain clearance. Angle and Deadend Structures will have 19 (38) units per string. To prevent the near certainty of flashover due to a lightning strike, the following criteria will be maintained:

Minimum OHGW Shielding Angle	20 degrees
Maximum Grounding Resistance	25 ohms

### 4. Insulator-Hardware Assemblies

The hardware and components of insulator assemblies shall withstand the following loading conditions based upon the appropriate conductor tensions.

	<u>MAXIMUM PERCENT OF RATED STRENGTH</u>
NESC	40
1 $\frac{1}{4}$ " Ice	70

Tangent and small angle suspensions will use 30,000 lb single-string insulators. For medium angles, 30,000 lb single-string insulators will be used. For large running angles and deadends, 30,000 lb double-string insulators will be used. Single-string assemblies may also need to be doubled at significant crossings. Insulators will be standard 5¾-inch x 10-inch glass

Armor grip suspension (AGS) units will be used for conductor and OPGW. Suspension shoes with armor rod will be used for OHGW. Hardware for assemblies will be suitable for hot line maintenance. Corona free clamps and armor rods will be used. Corona rings will not be needed.

Internally fired dead-ends and mid-span splices (AMP Type) will not be considered.

## G. CLEARANCES

### 1. Phase Spacing

Phase spacing for design ruling span will be 28 feet, but may vary for special ruling spans and specific cases.

### 2. Crossing Clearances (Vertical)

The following minimum clearances will be used for the line design:

CROSSING TYPE	CLEARANCE @ 100°C (ft)
A. Agricultural Land	30.0
b. Rural Roads	30.0
c. Highways and Paved County Roads	30.0
d. Railroads	38.0
e. Communication Lines	15.0
f. Waterways, lakes, ponds, rivers, and streams	34.0 or as required by the Corps of Engineers or other agency
g. Power Lines:	
0 to 69 kV	15.0
to 138 kV	16.0
to 161 kV	17.0
to 230 kV	18.0
to 345 kV	19.0
h. Buildings	18.0

Vertical clearances over special crossings should be provided as the situation demands. The sag of existing conductors and wires will be neglected in order to allow adequate clearances during galloping conductor conditions.

3. Minimum Horizontal Clearances at Crossings

No structure will be located within the right-of-way of another utility, except under special circumstances as approved by the utility. Horizontal clearances from transmission structures are given below:

<u>Distance From</u>	<u>Recommended Clearance (ft)</u>
Communication lines	50.0
Distribution line	50.0
Pipelines	50.0
Railroad Centerline	Structures to be located off right-of-way
Roads & Highways	Structures to be located off right-of-way

4. Right-of-Way Width

A right-of-way width of 150 feet has been chosen per the requirements of NESC Rule 234, which governs clearance requirements from the conductor to structures (buildings, towers, antenna, etc.) directly on the edge of the right-of-way. The right-of-way width provides additional room for construction and maintenance. Additional temporary construction easements may be obtained to provide working space at deadend and angle structure locations, as required to install conductor.

5. Clearance Between Conductor and Overhead Ground Wire

The OHGW vertical separation will be about 25 feet at the structure attachment points. Initial unloaded tension shall not exceed 25 percent of rated strength at 0°F and OHGW sags shall not exceed 80 percent of the final conductor sag at 60°F with no wind. During iced conductor and OHGW conditions, the conductor has a tendency to drop its ice first. If the OHGW has not dropped its ice, the reduced separation may result in a flashover from the conductor. To ensure adequate phase-to-ground clearance, the minimum vertical separation between conductor and OHGW during differential ice (½" ice at 32°F) conditions shall be 5 feet.

6. Insulator Swing

All tangent and angle structures for this project will utilize suspension insulators which are free to swing about their points of support. The amount of swing varies with such factors as conductor tension, temperature, wind velocity, and the ratio of the vertical to horizontal spans.

Insulator swing charts will be developed which show the allowable vertical span to horizontal span ratio for the tangent structures under the following three conditions (per RUS Bulletin 1724E-200, Table 7-1):

- a. The normal, no wind clearance at 60°F (final) shall be no less than 104 inches. Angle structures will be checked to verify the above criteria is maintained during minimum and maximum insulator swing conditions.
- b. A 9-pound wind at 60°F (Final) while maintaining a 76-inch lightning surge clearance.

- c. A 6-pound per square foot transverse wind ( $\approx 48$  mph) at  $-40^{\circ}\text{F}$  (Initial) while maintaining a 76-inch switching surge clearance to ground.
- d. A 31-pound per square foot transverse wind ( $\approx 90$  mph) at  $60^{\circ}\text{F}$  (Final) and maintaining the power frequency clearance of 30 inches.

H. CONDUCTOR

1. Selection

Conductor selection is based on load flow data and Basin Electric's past operating experience with 345 kV lines. A Thrasher 2312.0 MCM 76/19 ACSR conductor will meet the electrical load requirements for this project. The physical and electrical characteristics of the conductor are listed below:

2312.0 MCM 76/19 ACSR

Code Name	Thrasher
Overall Minimum Diameter	1.802 in.
Cross Sectional Area	1.9144 sq. in.
Weight Per 1,000 Feet	2.526 lbs.
Rated Strength, Standard	56,700 lbs.

Resistance (Ohm/Mile)

AC at $25^{\circ}\text{C}$	0.0457
AC at $75^{\circ}\text{C}$	0.0529

2. Tension Limitations

Sag-tension data for the conductor is based on the following limitations:

- a. Initial tension at the NESC heavy load shall not exceed 40 percent of rated strength.
- b. Initial bare tension at  $0^{\circ}\text{F}$  shall not exceed 28 percent of rated strength.
- c. Final bare tension at  $0^{\circ}\text{F}$  shall not exceed 23 percent of rated strength.
- d. Initial tension at  $1\frac{1}{4}$ " ice at  $0^{\circ}\text{F}$  shall not exceed 54 percent of rated strength.

Sag-tension data is provided for the NESC heavy loading condition as well as special loadings including the heavy ice load of  $1\frac{1}{4}$  inch at  $0^{\circ}\text{F}$ , Initial, and a 100 mph wind at  $60^{\circ}\text{F}$ , Final.

Ground clearance will be checked at a maximum temperature of  $100^{\circ}\text{C}$ . Uplift on suspension insulators will be checked at  $-40^{\circ}\text{F}$ .

3. Galloping Conductors

Galloping conductors have occurred within the project area and will be accounted for in the design. Fortunately, single-loop galloping rarely occurs in spans over 600 to 700 feet (Design Manual for High Voltage Transmission Lines, RUS 1724E-200). Galloping will be checked under a weather condition consisting of  $32^{\circ}\text{F}$ ,  $\frac{1}{2}$ " radial

ice, 2 psf wind, and final sag. Lissajous ellipses, which show the theoretical envelop of the galloping conductor, will be prepared for both conductor's designs as follows:

- a. Full loop analysis for spans up to 700 feet.
- b. Double loop analysis for spans 700 feet to maximum.

4. Vibration Protection

Conductor tension limitations have been selected to limit aeolian vibrations and conductor oscillation on the line. Stockbridge type dampers will be used to limit vibration and protect the conductors. Sprial type dampeners will be used for overhead groundwire and optical groundwire.

I. OVERHEAD GROUND WIRE AND GROUNDING

1. Selection

The overhead ground wire will be extra high strength (EHS) galvanized steel, strand, 7/16 inch, and 20,800 pounds minimum breaking strength.

The optical ground wire (OPGW) will be used to establish a fiber optic path for the entire line. Therefore, the single pole steel structures will have one OPGW and one galvanized steel wire. The OPGW sags will match those of the OHGW under normal loads.

2. Tension Limitations

a. Sag-tension data for the OHGW is based on the following limitations:

- 1) Not greater than 80 percent of conductor sag at 60°F, Final.
- 2) Initial bare tension at 0°F shall not exceed 15 percent of minimum breaking strength.
- 3) Initial 1¼-inch ice at 0°F .

b. Sag-tension data (not limiting conditions) is provided for the NESC heavy loading condition as well as the following special loadings:

- 1) 1¼ inch ice at 0°F
- 2) 110 mph wind at 60°F

c. Uplift on OHGW attachments will be checked at -40°F. Clearance between the ½" iced OHGW and bare conductor at 32°F will also be verified.

3. Shielding Angle

A shielding angle of 20 degrees will provide an adequate shielding angle to prevent lightning strikes to the conductor. Standard practice and calculated trip out rates substantiate the selected shield angle. Using an average span of 950 feet, an isokeraunic level of 30 and footing resistance of 25 ohms, calculations show the outage rate due to lightning will be under 0.5 per 100 miles per year for this project, well below the generally accepted limit.

4. Grounding

The lightning performance of the line is dependent upon the structure footing resistance. Since the lines lie in an area where the isokeraunic level is fairly high, a

25-ohm maximum design ground resistance has been chosen. Ground rods will be installed, as required, to provide a maximum resistance of 25-ohms.

Fences and gates within the transmission line right-of-way will be grounded to prevent electrostatic voltage build-up and electromagnetic shock hazards.

J. STRUCTURE LOADING CRITERIA

1. Structure Design Loads

The structures shall meet the strength requirements of the latest edition of the National Electric Safety Code (NESC). In addition, the structures will be designed to withstand a high wind condition and a heavy ice condition.

The extreme wind load was calculated per ASCE Manual 74, "Guidelines for Electrical Transmission Line Structural Loading." This standard is written for reliability-based design methods, and was updated in 2010.

The following table defines all load cases and overload factors to be applied:

Load Case	Overload Factors
<ul style="list-style-type: none"> <li>• NESC Heavy (0°F, ½" Ice, 4 psf wind, initial tension) NESC 250 B</li> </ul>	Vertical = 1.5 Transverse = 2.5 Tension = 1.65 Wind on structure = 2.5
<ul style="list-style-type: none"> <li>• Extreme Wind (60°F, bare, 31 psf wind, final tension) NESC 250 C</li> </ul>	Vertical = 1.1 Transverse = 1.1 Tension = 1.1 Wind on structure = 1.1
<ul style="list-style-type: none"> <li>• Extreme Ice with Concurrent Wind (15°F, ½" Ice, 9.2 psf wind, initial tension) NESC 250 D</li> </ul>	Vertical = 1.1 Transverse = 1.1 Tension = 1.1 Wind on structure = 1.1
<ul style="list-style-type: none"> <li>• Heavy Ice (0°F, 1 ¼ " Ice, no wind, initial tension)</li> </ul>	Vertical = 1.1 Transverse = 1.1 Tension = 1.1 Wind on structure = 1.1
<ul style="list-style-type: none"> <li>• Camber (40°F, bare, 2 psf wind, final tension)</li> </ul>	Vertical = 1.0 Transverse = 1.0 Tension = 1.0

	Wind on structure = 1.0
--	-------------------------

All load cases include tension components and insulator hardware. Some minor adjustment of load cases will be necessary based on type of structure used.

#### K. FOUNDATIONS

Drilled-pier concrete foundations will constitute the typical foundation system for all structures. Transmission foundations for single pole structures are subjected to significant lateral forces and overturning moments. Drilled-pier concrete foundations will utilize the use of steel reinforcement.

#### REFERENCES

1. Electric Power Research Institute (EPRI): "Transmission Line Reference Book 345 kV and Above", Project UHV, Pittsfield, Mass. 19

20170214 - ENG - NKL  
Phase 1 - Patent Gate to  
Kummer Ridge - 345kV  
Transmission Line Project  
Design Criteria Report

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Appendix

Project Location Map

# PATENT GATE SUBSTATION TO KUMMER RIDGE SUBSTATION 345KV TRANSMISSION LINE PROJECT

**LINE FEATURES:**

**LINE LENGTH**

PATENT GATE TO KUMMER RIDGE — 28.7 MILES

RIGHT OF WAY WIDTH — 150 FEET

**STRUCTURE TYPE**

PATENT GATE TO KUMMER RIDGE — GALV. STEEL SINGLE POLES  
(TOTAL 151 STRUCTURES)

DESIGN RULING SPAN — 1000 FEET

CONDUCTOR — 2312 KCMIL 76/19 ACSR THRASHER

OPTICAL GROUND WIRE — AC-71/671, .571 INCH DIAMETER, 36 FIBERS

PERMITTING AUTHORITY — ND PUBLIC SERVICE COMMISSION

EIS ENVIRONMENTAL IMPACT STATEMENT — WESTERN AND US FOREST SERVICE



VICINITY MAP



TANGENT STRUCTURE  
SINGLE POLE - 3ST2

FACILITY: TRANSMISSION SYSTEM MAINTENANCE		DESIGN BY: S. VASBINDER	6/25/15
LOCATION/LINE: 368-PATENT GATE TO KUMMER RIDGE 345KV LINE		DRAWN BY: S. BURGARD	6/25/15
CONTRACT/DESIGNATOR:		DESIGN OR:	
		DRAWN OR: J. BERNHARDT	7/16/15
TITLE SHEET		APPROVED:	
		SCALE: NONE	
		VENDOR/OBTAINED FROM:	
		DESIGN ORIGINATOR NO.:	ORIGINAL REV:
		DESIGN ORIGINATOR NO.:	REV. NO.:
		368-090-T1-001	0

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE
0	ISSUED	A. BURGARD	S. VASBINDER		7/16/15

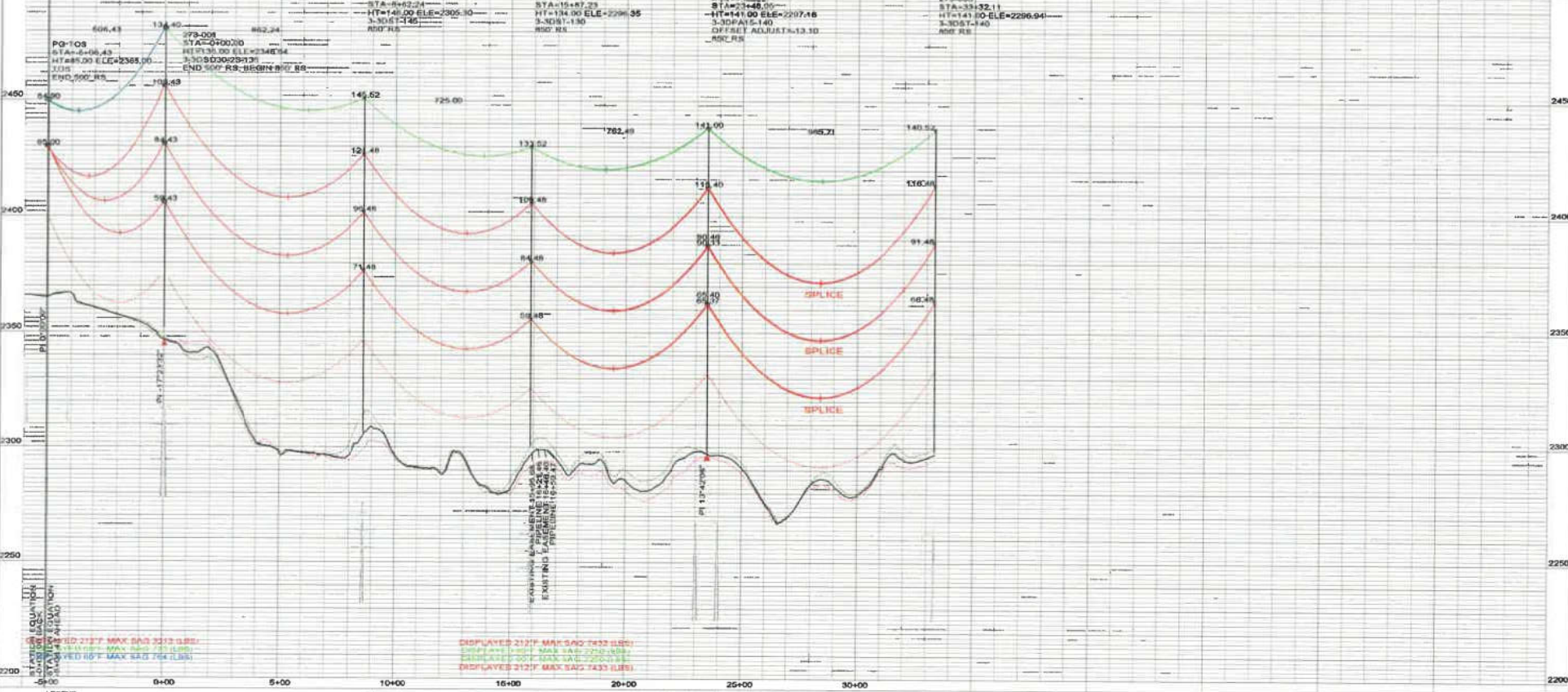
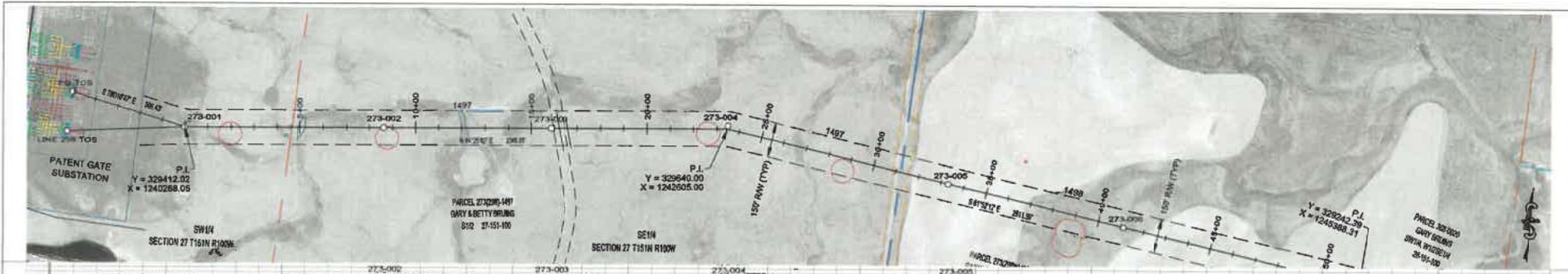


BASIN ELECTRIC POWER COOPERATIVE  
CASE NO. PU-14-813

ASBUILT  
PLAN AND PROFILES AND STRUCTURE LOCATIONS FOR  
NORTH KILLDEER LOOP PHASE 1  
345kV TRANSMISSION PROJECT

LINE 368 - PATENT GATE TO KUMMER RIDGE SEGMENT

NORTH DAKOTA PUBLIC SERVICE COMMISSION  
FEBRUARY 2017



**LEGEND**

	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINE

REV.	DESCRIPTION	DRWN	DSGN	APPO	DATE	OHGW
2	AS BUILT	CLK	SV	SV	12/19	
1	UPDATED OPGW INFORMATION	CLK	SV	SV	10/15	CONDUCT.
0	FOR CONSTRUCTION	CLK	SV	SV	08/15	OPGW

DESIGN INFORMATION			
DATE	08/15	DESIGNED BY	S. VASBINDER
DATE	08/15	DRAWN BY	C. KNOLL
DATE	08/15	CHECKED BY	S. WASEMAN
DATE	08/15	IN CHARGE	R. LANG
DATE	08/15	PROJECT	S. WASEMAN

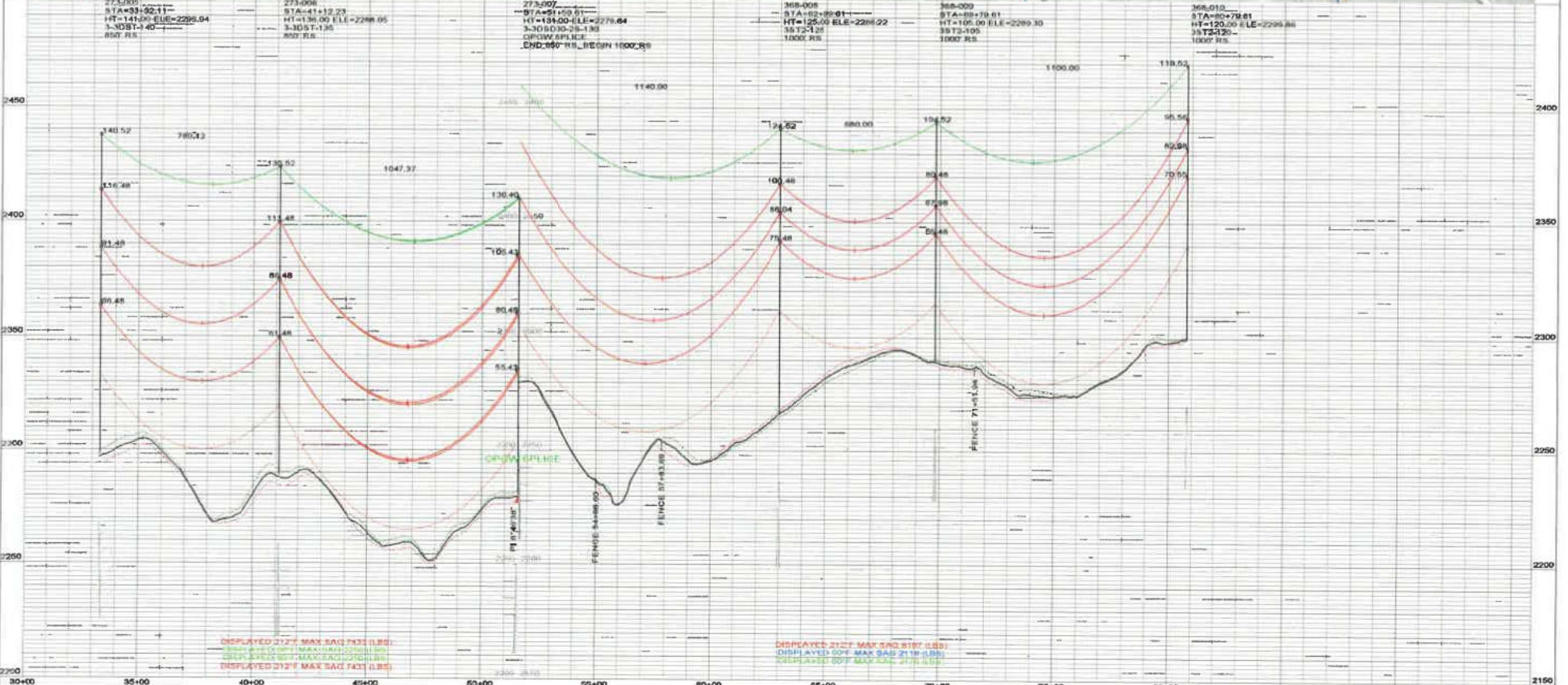
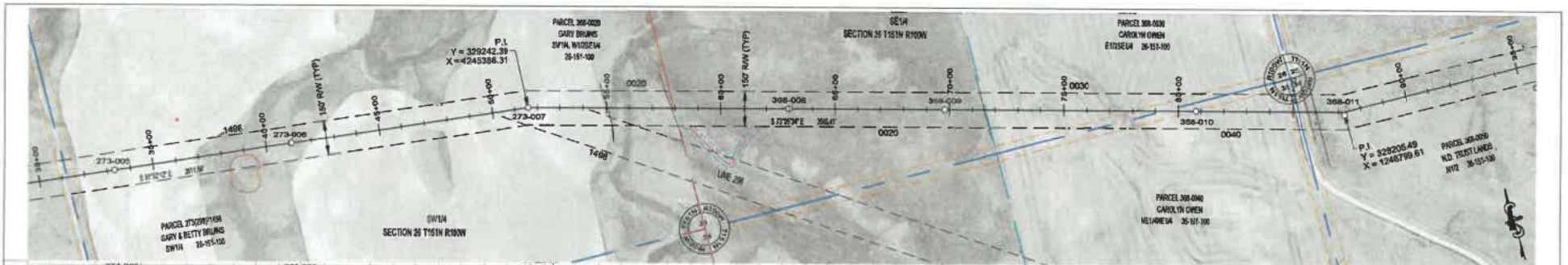
**PROJECT:** TRANSMISSION SYSTEM MAINTENANCE  
**LOCATION:** 35-PATENT GATE TO KUMMER RIDGE  
**CLIENT:** MCKENZIE

**BASIN ELECTRIC POWER COOPERATIVE**  
 A 100% FIDELITY ENERGY COOPERATIVE

**SCALE:** VERTICAL = 20 FT  
 HORIZONTAL = 200 FT

**PLAN AND PROFILES**  
**STATION: -1+00 TO 33+35**  
**STRUCTURE: PG TOS TO 273-005**

**DATE:** 08/15  
**PROJECT:** 368-090-T3-001  
**REV. NO.:** 2



**LEGEND**


REV	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW	CONDUCT.	APL	SPIN	TENSION	REPLY	REPLY	REPLY
2	AS BUILT	CLK	SV	SW	12/16								
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15		2812	KCMIL 79/19	10760	21906	30214	1000'	
0	FOR CONSTRUCTION	CLK	SV	SW	08/15		OPGW	57* 36 FIBER	2176	6633	10716	1000'	

**DESIGN INFORMATION**

DESIGNED BY: S. VASBINDER	DATE: 08/15
DRAWN BY: C. KNOLL	DATE: 08/15
CHECKED BY: S. WISEMAN	DATE: 08/15
APPROVED BY: R. LANG	DATE: 08/15
DATE: 08/15	DATE: 08/15

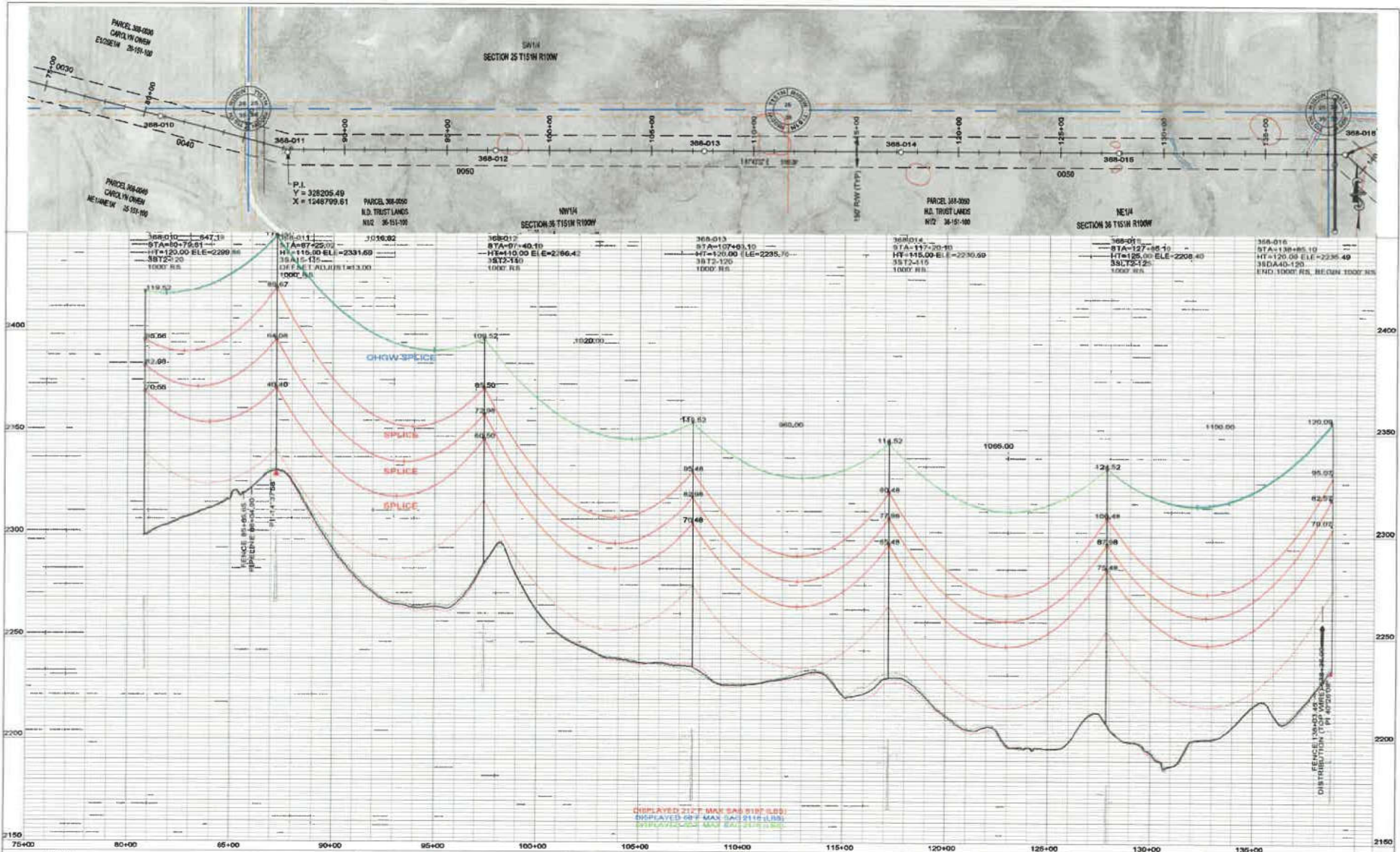
**PROJECT: TRANSMISSION SYSTEM MAINTENANCE**  
**365-PATENT GATE TO KUMMER RIDGE**  
**MCKENZIE**

**BASIN ELECTRIC POWER COOPERATIVE**  
 A YOUNG FARM ENERGY COOPERATIVE

**SCALE: VERTICAL = 20FT**  
**HORIZONTAL = 200FT**

**PLAN AND PROFILES**  
**STATION: 30+00 TO 80+83**  
**STRUCTURE: 273-005 TO 368-010**

**DATE: 08/15**  
**SCALE: 368-090-T3-002**  
**REV: 2**

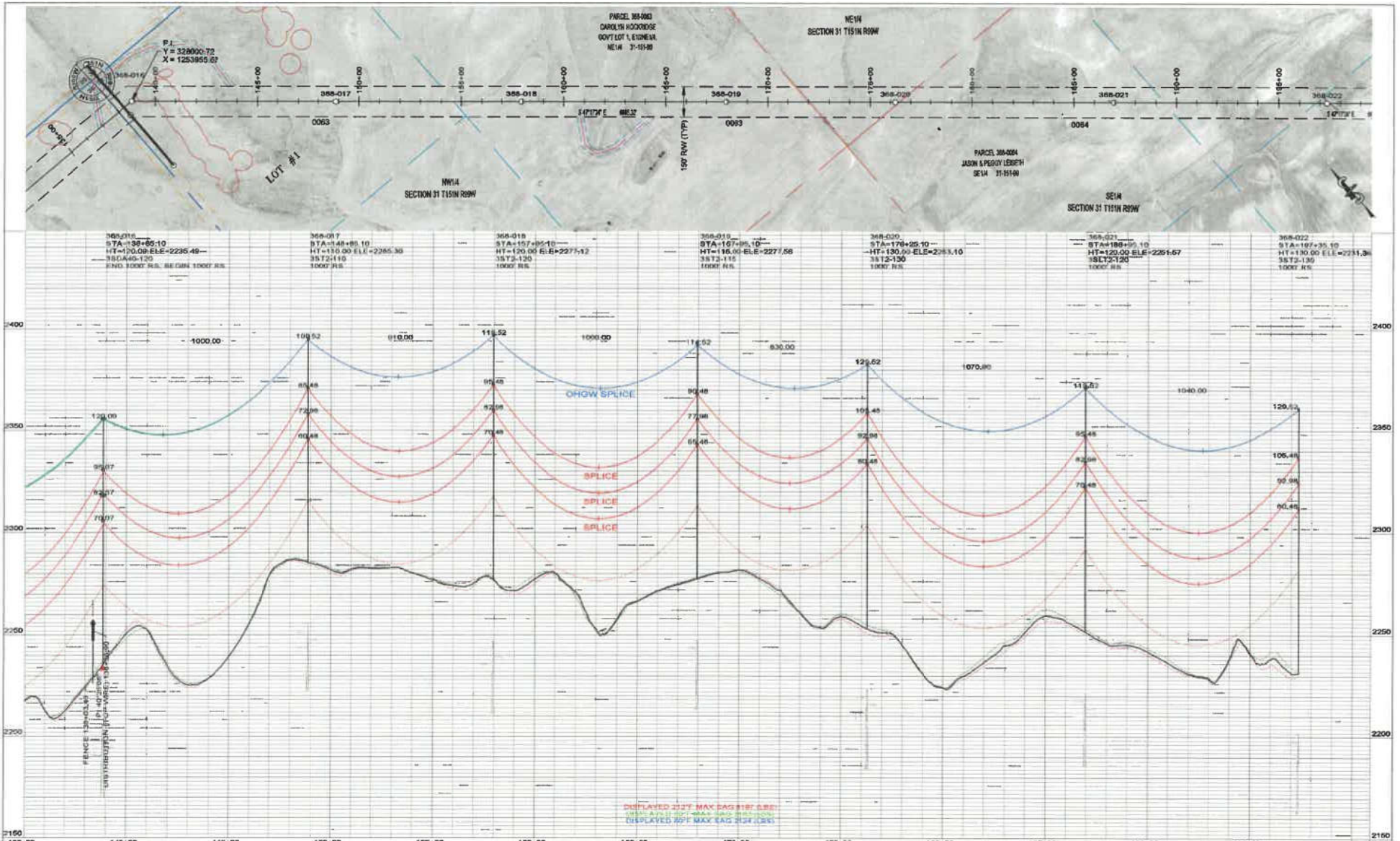


**LEGEND**

	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVER-HEAD UTILITY		ACCESS SIDELINES

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW	AFR	CONDUCT.	SIZE	SPNL TENSIL	REQ TENSIL	REQ WT	REQ LEN	REQ DIA	REQ WT
2	AS BUILT	CLK	SV	SW	12/10										
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15			CONDUCT.	2312 KCMIL 70/19 THRASHER	10760	21906	30214	1000'		
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OPGW	AFR		671' 36 FIBER	2176	5933	10718	1000'		
						OHGW			716 E14S	2118	5964	9063	1000'		

DESIGNER: S. VASBINDER CHECKER: C. KNOLL DESIGNER: S. WISEMAN ENGINEER: R. LANG APPROVER: S. WISEMAN	DATE: 08/15 DATE: 08/15 DATE: 08/15 DATE: 08/15 DATE: 08/15	PROJECT: TRANSMISSION SYSTEM MAINTENANCE CONTRACTOR: PATENT GATE TO KUMMER RIDGE OWNER: MCKENZIE	BASIN ELECTRIC POWER COOPERATIVE A TRANSMISSION COOPERATIVE
PLAN AND PROFILES STATION: 75+00 TO 138+85 STRUCTURE: 368-010 TO 368-018			SCALE: VERTICAL = 20FT HORIZONTAL = 200FT MAIN DRAWING 368-090-T3-003 REV. NO. 2



REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW	CONDUCT.	ARC	THRESH.	WIND	ICE	SPAN	REVISION	DATE
3	AS BUILT	CLK	SV	SV	12/16								B. VASBINDER	08/15
2	MOVED STR #368-022 BACK 10'	CLK	RN	SV	11/15								C. KNOLL	08/15
1	UPDATED OPGW INFORMATION	CLK	SV	SV	10/15		2312	10763	22004	30222	1000'		S. WISEMAN	08/15
0	FOR CONSTRUCTION	CLK	SV	SV	08/15	OPGW	.871" 36 FIBER	2183	8846	10729	1000'		R. LANG	08/15
													S. WISEMAN	08/16

**DESIGN INFORMATION**  
 B. VASBINDER  
 C. KNOLL  
 S. WISEMAN  
 R. LANG  
 S. WISEMAN

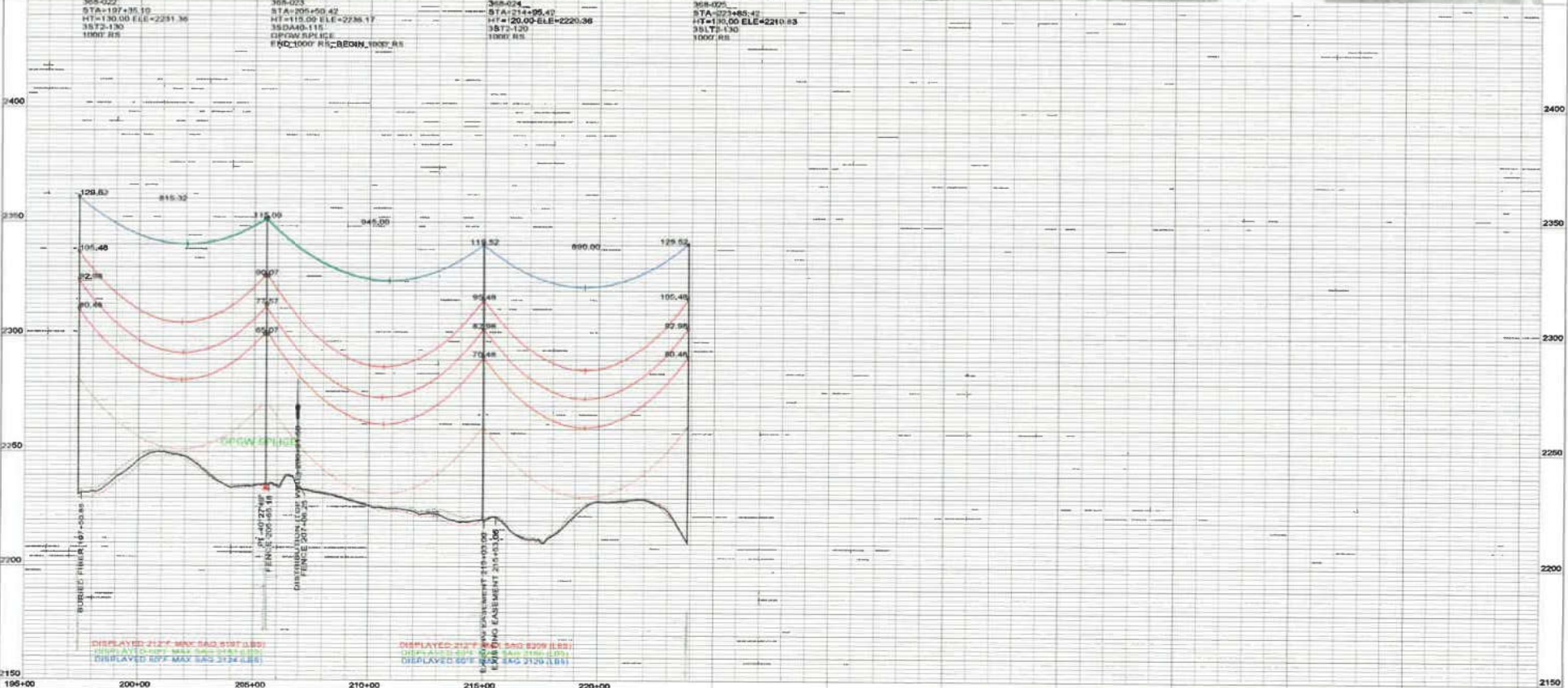
**PROJECT INFORMATION**  
 TRANSMISSION SYSTEM MAINTENANCE  
 PATENT GATE TO KUMMER RIDGE  
 MCKENZIE

**CLIENT**  
 BASIN ELECTRIC POWER COOPERATIVE  
 A TOUCHSTONE ENERGY COOPERATIVE

**SCALE**  
 VERTICAL = 20FT  
 HORIZONTAL = 200FT

**PLAN AND PROFILES**  
 STATION: 135+00 TO 197+38  
 STRUCTURE: 368-016 TO 368-022

**368-090-T3-004**  
 REV NO. 3



**LEGEND**

	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINES

3	AS BUILT	CLK	SV	SW	12/16
2	MOVED 5TH #368-022 BACK 10'	CLK	RN	SV	11/16
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15
0	FOR CONSTRUCTION	CLK	SV	SW	08/15
REV	DESCRIPTION	DRWN	DSGN	APPO	DATE

**DESIGN INFORMATION**

REV	DATE	BY	CHKD	APP'D
1	10/15	CONDUCT.	2312 KCMIL 75/19 THRAASHER	10760
2	08/15	OPGW	.571" 36 FIBER	2186
3	12/16	OHSW	7/16 EHS	2129

**DESIGNER**

DATE	BY	CHKD	APP'D
08/15	S. VASBRINDER	C. KNOLL	S. WISEMAN
08/15	S. WISEMAN	R. LANG	S. WISEMAN

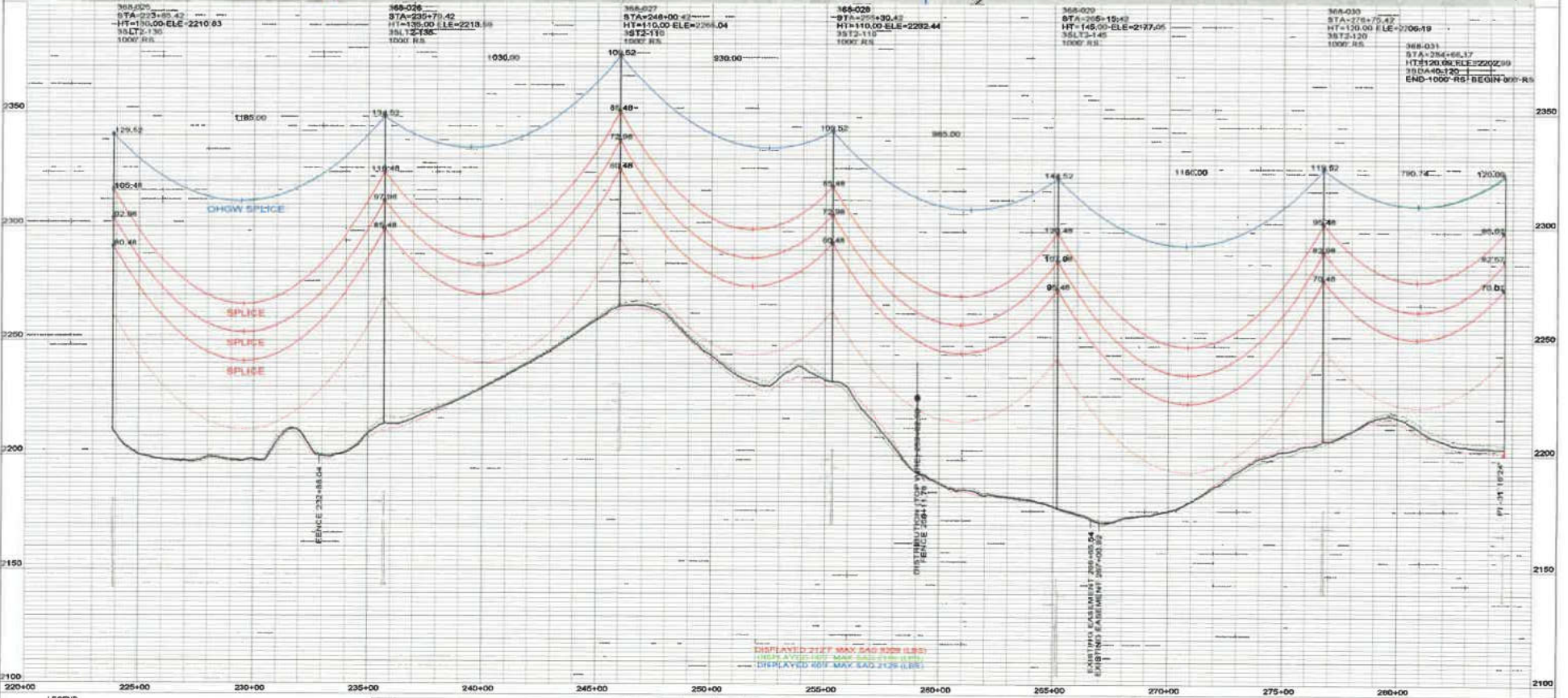
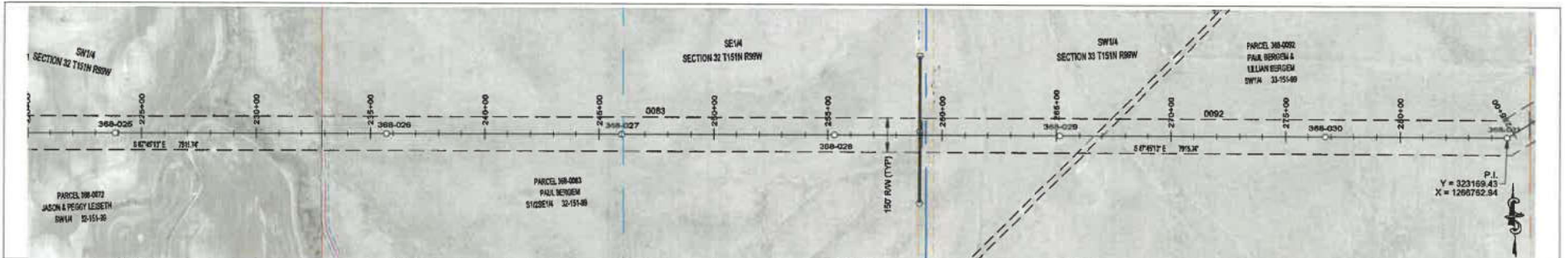
PROJECT: TRANSMISSION SYSTEM MAINTENANCE  
 LOCATION: 365-PATENT GATE TO KUMMER RIDGE  
 COUNTY: MCKENZIE

**PLAN AND PROFILES**  
 STATION: 195+00 TO 223+89  
 STRUCTURE: 368-022 TO 368-025

**BASIN ELECTRIC POWER COOPERATIVE**  
 A TOUCHSTONE ENERGY COMPANY

SCALE: VERTICAL = 20FT  
 HORIZONTAL = 200FT

DATE: 08/15  
 DRAWING NO: 368-090-T3-005  
 SHEET NO: 3



**LEGEND**

	CULTURAL / TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINES

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW	CONDUCT.	INSUL.	SPACING	SPIN	WIND	ICE	WIND	ICE	WIND	ICE
2	AS BUILT	CLK	SV	SW	12/16											
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15		CONDUCT.	2312	KCMIL	78/19	THRASHER	10788	22061	30274	1000'	
0	FOR CONSTRUCTION	CLK	SV	SW	08/15		OPGW	571	36	FIBER	2166	6651	10735	1000'		

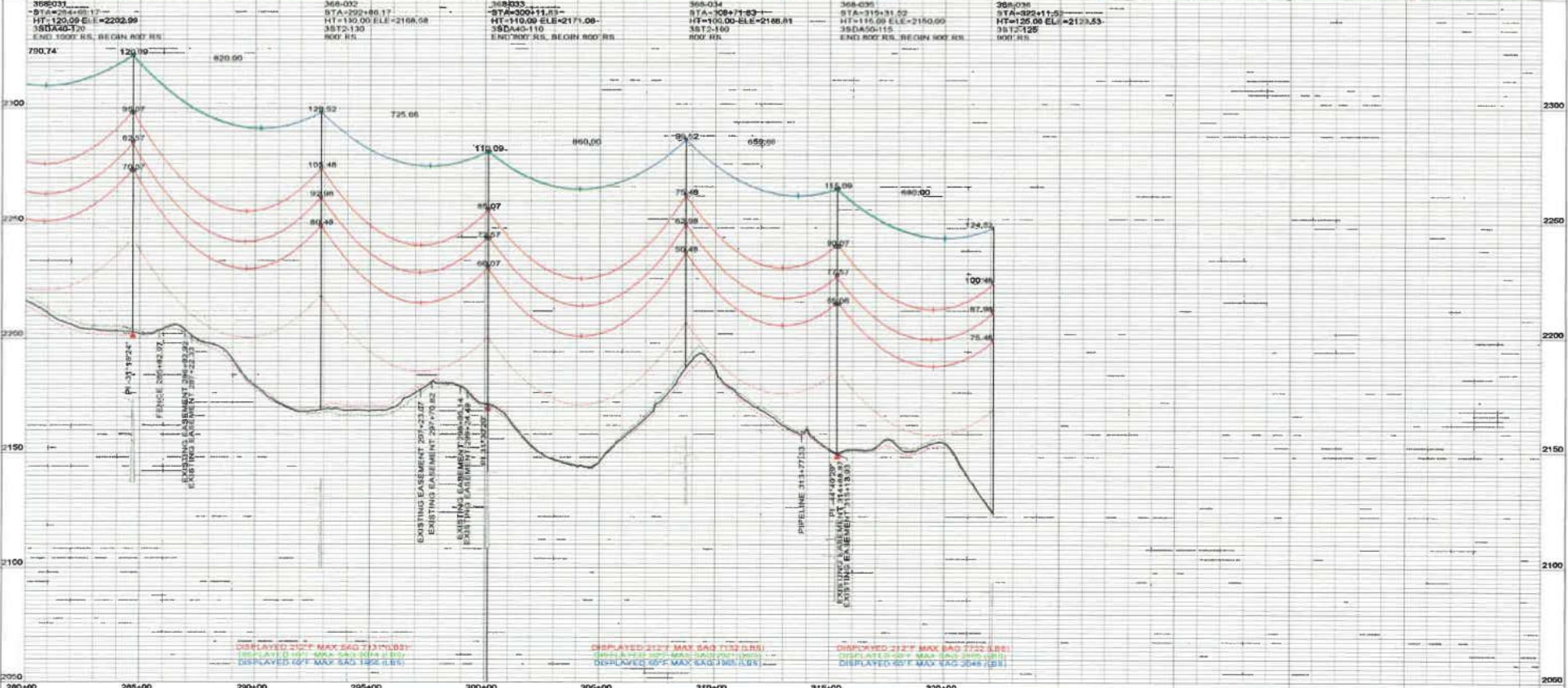
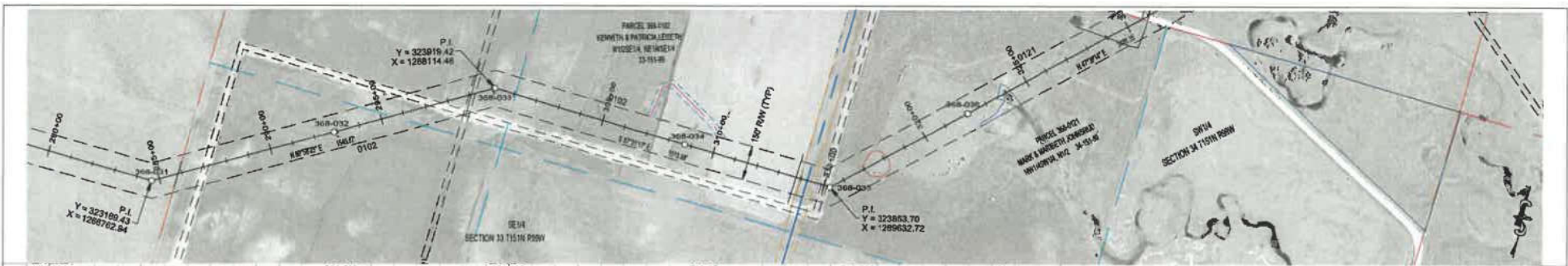
**DESIGN INFORMATION**

DESIGNED BY: S. VASBINDER  
 CHECKED BY: C. KNOLL  
 DRAWN BY: S. WISEMAN  
 DATE: 08/15

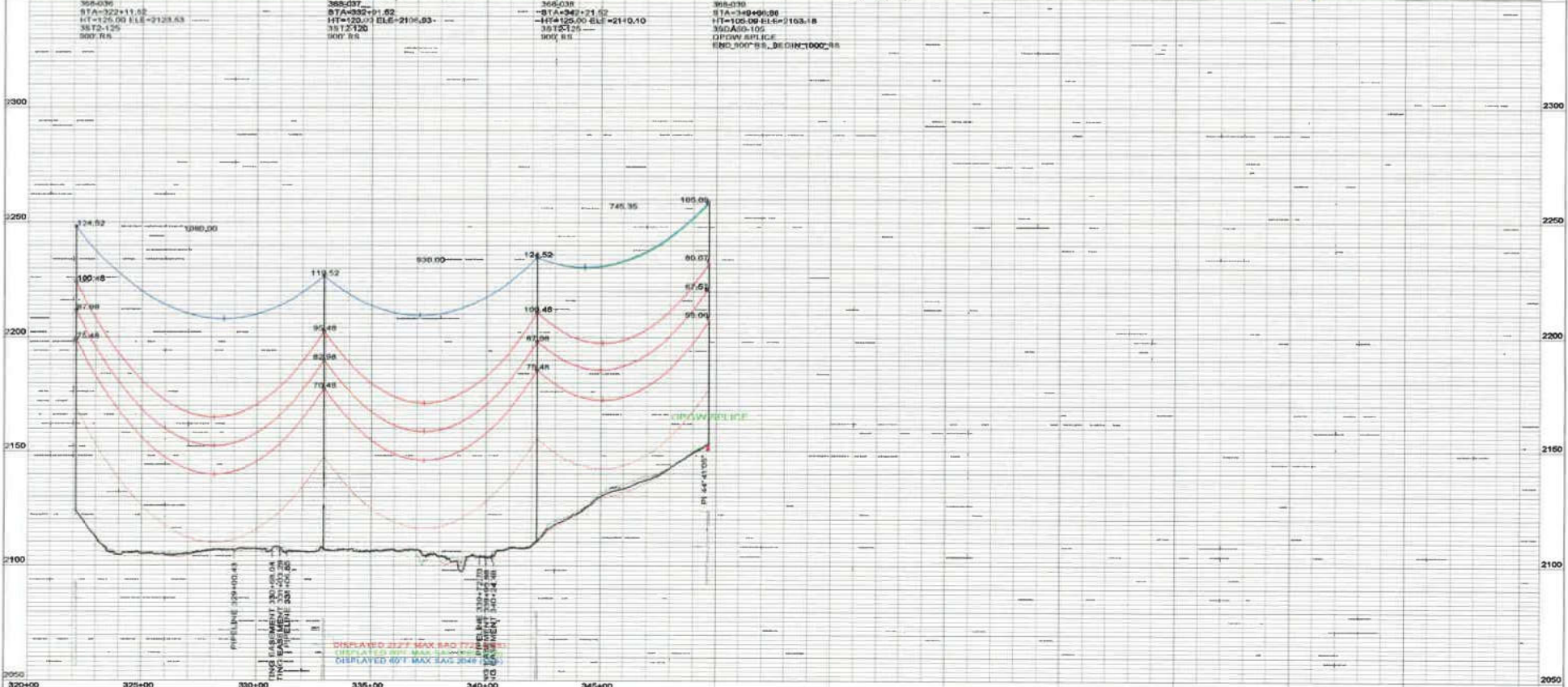
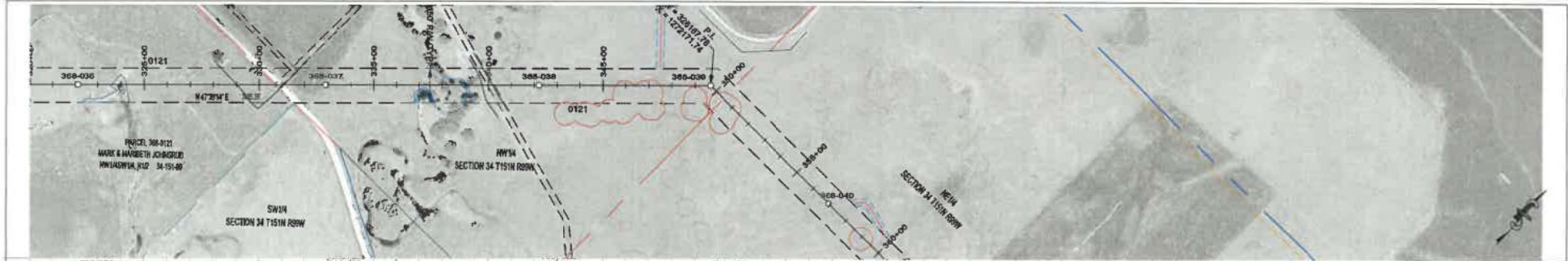
PROJECT: TRANSMISSION SYSTEM MAINTENANCE  
 365-PATENT GATE TO KUMMER RIDGE  
 MCKENZIE

SCALE: VERTICAL = 20FT  
 HORIZONTAL = 200FT

368-080-T3-006



LEGEND		DESIGN INFORMATION										DRAWN BY		DATE		PROJECT		SCALE	
	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE	DATE	7/18	DATE	12/18	DATE	08/15	DATE	08/15	S. VASBINDER	08/15	368-090-T3-007	08/15	TRANSMISSION SYSTEM MAINTENANCE	368-PATENT GATE TO KUMMER RIDGE	VERTICAL = 20FT	REV. NO.
	WETLAND AVOIDANCE		QUARTER SECTION LINE	DRWN	CLK	SV	SW	12/18	DATE	08/15	DATE	C. KNOLL	08/15	2	08/15	MCKENZIE	BASIN ELECTRIC POWER COOPERATIVE	HORIZONTAL = 200FT	REV. NO.
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE	DBGN	CLK	SV	SW	10/18	CONDUCT.	2312 KOMIL 70/19 THRUASHER	08/15	S. WAGEMAN	08/15		08/15		A TOUCHSTONE ENERGY COOPERATIVE		
	UNDERGROUND PIPELINE		PROPERTY LINE	APPD	CLK	SV	SW	08/15	OPGW	AFI .571" 36 FIBER	2021	R. LANG	08/15		08/15				
	UNDERGROUND UTILITY		ACCESS CENTERLINE	DATE	DATE	DATE	DATE	DATE	OHGW	7/18 EHS	1965	S. WISEMAN	08/15		08/15				
	OVER-HEAD UTILITY		ACCESS SIDELINE	DATE	DATE	DATE	DATE	DATE	OHGW	7/18 EHS	1965	S. WISEMAN	08/15		08/15				

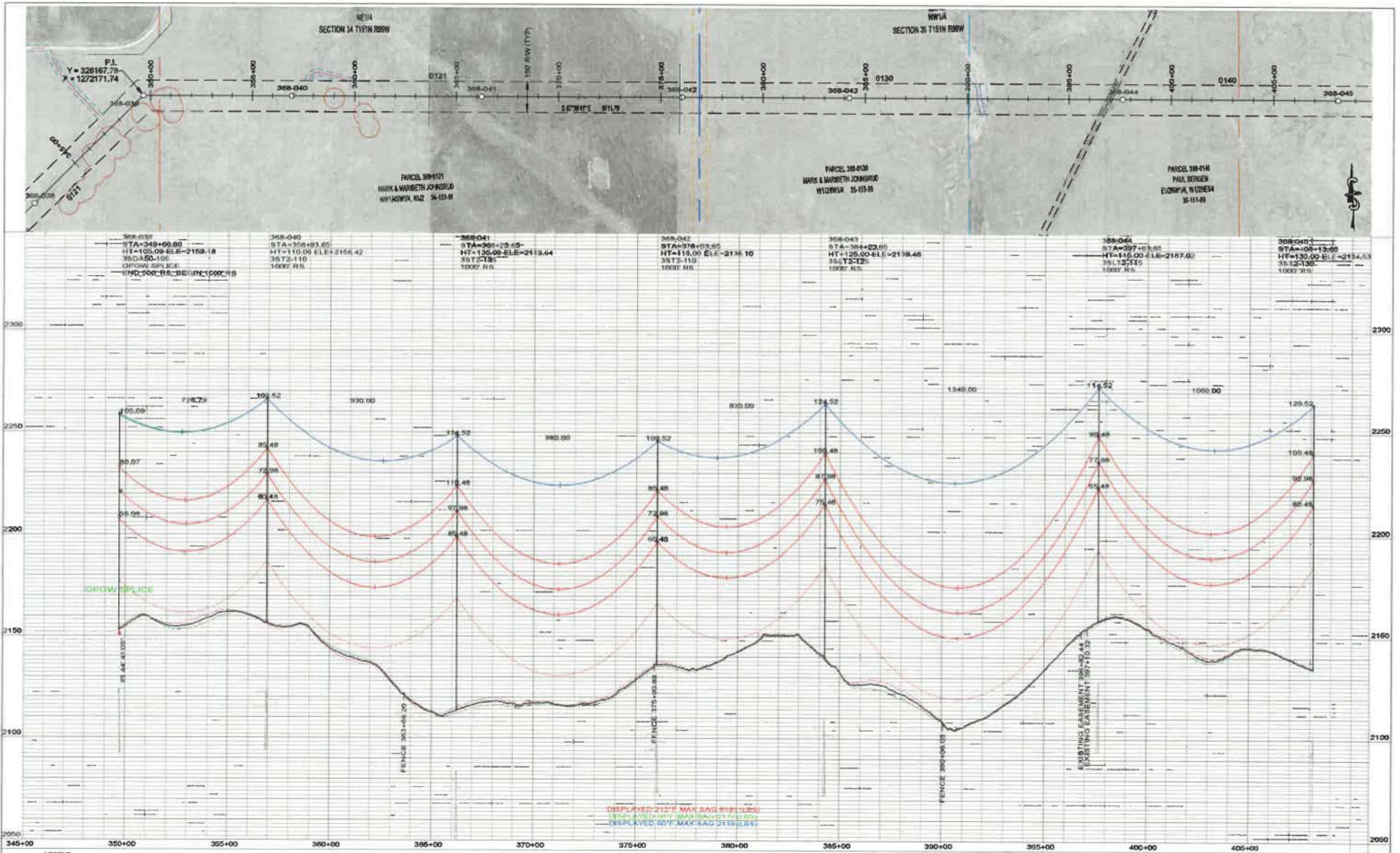


**LEGEND**

	CULTURAL / TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINES

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW	CONDUCT.	SPACING	SPIN	SPIN	SPIN	SPIN
2	AS BUILT	CLK	SV	SW	12/18							
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/18		CONDUCT.	2312 KCMIL 70/19 THUNDER	10475	21882	20513	900'
0	FOR CONSTRUCTION	CLK	SV	SW	08/15		OPGW	AFL .571 36 FIBER	2105	6336	10148	900'
								716 EHG	2048	5704	9414	900'

DESIGN BY: <b>D. VASBINDER</b>	DATE: 08/15	PROJECT: <b>TRANSMISSION SYSTEM MAINTENANCE 365-PATENT GATE TO KUMMER RIDGE MCKENZIE</b>		BASIN ELECTRIC POWER COOPERATIVE A TOUCHSTONE ENERGY COOPERATIVE
DRAWN BY: <b>C. KNOLL</b>	DATE: 08/15			
CHECKED BY: <b>S. WISEMAN</b>	DATE: 08/15	<b>PLAN AND PROFILES</b> <b>STATION: 320+00 TO 348+70</b> <b>STRUCTURE: 368-036 TO 368-039</b>		
DATE PLOTTED: <b>R. LANG</b>	DATE: 08/15			
APPROVED BY: <b>S. WISEMAN</b>	DATE: 08/15	SCALE: VERTICAL = 20FT HORIZONTAL = 200FT	BASIN DRAWING NO: <b>368-080-T3-008</b>	REV. NO: <b>2</b>



**LEGEND**

	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS R/W DELINE

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW
2	AS BUILT	CLK	SV	SW	12/16	
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	CONDUCT.
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OPGW

**DESIGN INFORMATION**

DESIGNER: S. VASBINDER	DATE: 08/15	PROJECT: TRANSMISSION SYSTEM MAINTENANCE
ENGINEER: C. KNOLL	DATE: 08/15	LOCATION: 368+PATENT GATE TO KUMMER RIDGE
DESIGNER: S. WISEMAN	DATE: 08/15	TOWNSHIP: MCKENZIE
REVIEWER: R. LANG	DATE: 08/15	
APPROVER: S. WISEMAN	DATE: 08/15	

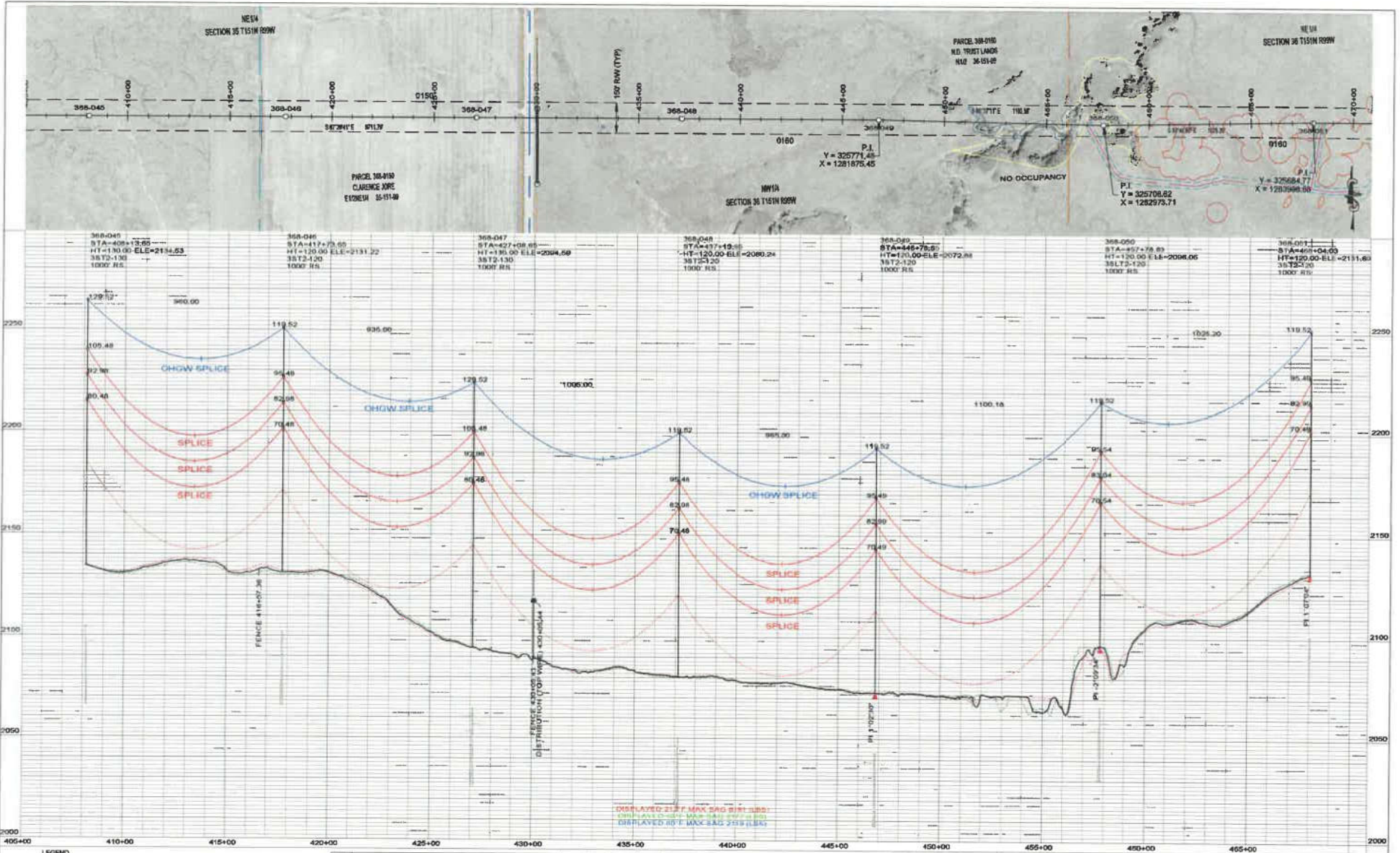
**BASIN ELECTRIC POWER COOPERATIVE**  
A TOUCHSTONE ENERGY COOPERATIVE

SCALE: VERTICAL = 20FT  
HORIZONTAL = 200FT

BASE DRAWING NO. 368-090-T3-009

REV. NO. 2

**PLAN AND PROFILES**  
STATION: 345+00 TO 405+17  
STRUCTURE: 368-039 TO 368-045

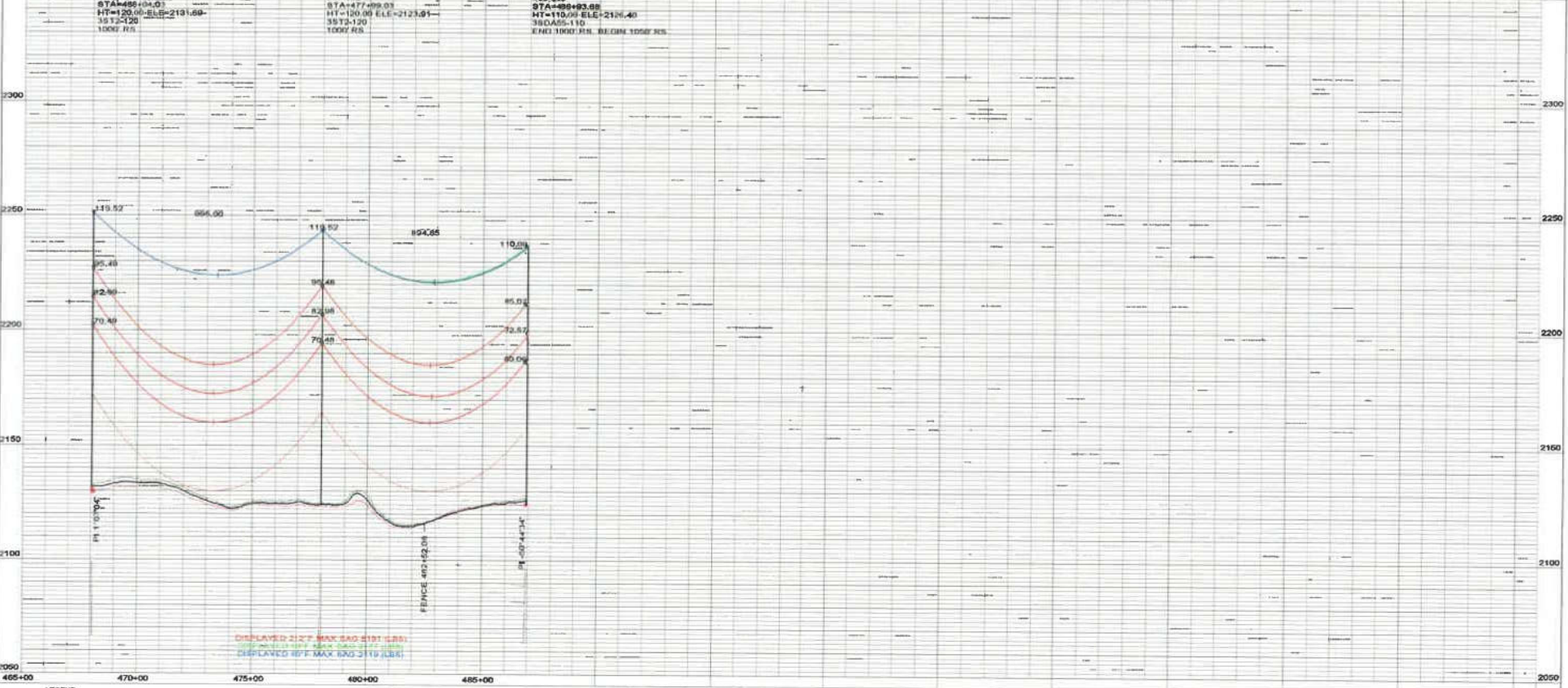
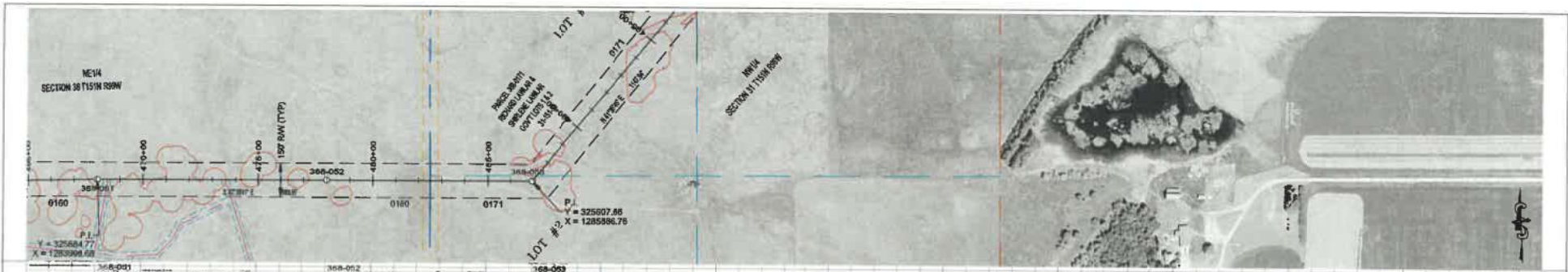


**LEGEND**

	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINES

DESIGN INFORMATION										
2	AS BUILT	CLK	SV	SW	12/15	SIZE	2312 KC/MIL 75/19 THUNDER	SPIN TENSION	10760	21066
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	CONDUCT.	AFI	2177	6636	10720
0	FOR CONSTRUCTION	CLK	SV	SW	08/16	OPGW	57' 36 FIBER	2177	6636	10720
REV.	DESCRIPTION	DRWN	DSGN	APPO	DATE	OHGW	716 EHS	2119	5965	1000'

DESIGNED BY: S. VASSINDER	DATE: 08/15		<b>BASIN ELECTRIC POWER COOPERATIVE</b> A TOUCHSTONE ENERGY COMPANY
DRAWN BY: C. KNOLL	DATE: 08/15		
DESIGNED BY: S. WISEMAN	DATE: 08/15	TRANSMISSION SYSTEM MAINTENANCE 166-PATENT GATE TO KUMMER RIDGE MCKENZIE	
DESIGNED BY: R. LANG	DATE: 08/16	<b>PLAN AND PROFILES</b> STATION: 405+00 TO 468+07 STRUCTURE: 368-045 TO 368-051	
DESIGNED BY: S. WISEMAN	DATE: 08/15	SCALE: VERTICAL = 20FT	HORIZONTAL = 200FT
		SHEET NO. 368-090-T3-010	2



**LEGEND**

- CULTURAL / TRIBAL AVOIDANCE
- WETLAND AVOIDANCE
- BARBED WIRE FENCE
- UNDERGROUND PIPELINE
- UNDERGROUND UTILITY
- OVERHEAD UTILITY
- SECTION LINE
- QUARTER SECTION LINE
- SIXTEENTH SECTION LINE
- PROPERTY LINE
- ACCESS CENTERLINE
- ACCESS SIDELINES

3	AS BUILT
2	UPDATED OPGW INFORMATION
1	MOVED STRUCTURE #53 BACK 30'
0	FOR CONSTRUCTION
REV.	DESCRIPTION

CLK	SV	SW	12/16	DESIGN INFORMATION
CLK	SV	SW	10/15	
CLK	SV	SW	10/15	CONDUCT, 2312 KCMIL 7919 THRASHER
CLK	SV	SW	08/15	OPGW .571" 36 FIBER
DRWN	DSGN	APPO	DATE	CHGW 7/18 EH6 2119 6995 9964 1000'

DESIGN BY: S. VASBINDER	DATE: 08/15
DESIGNED BY: C. KNOLL	DATE: 08/15
DESIGNED BY: S. WISEMAN	DATE: 08/15
DESIGNED BY: R. LANG	DATE: 08/15
DESIGNED BY: S. WISEMAN	DATE: 08/15

PROJECT: TRANSMISSION SYSTEM MAINTENANCE  
 365-PATENT GATE TO KUMMER RIDGE  
 COUNTY: MCKENZIE

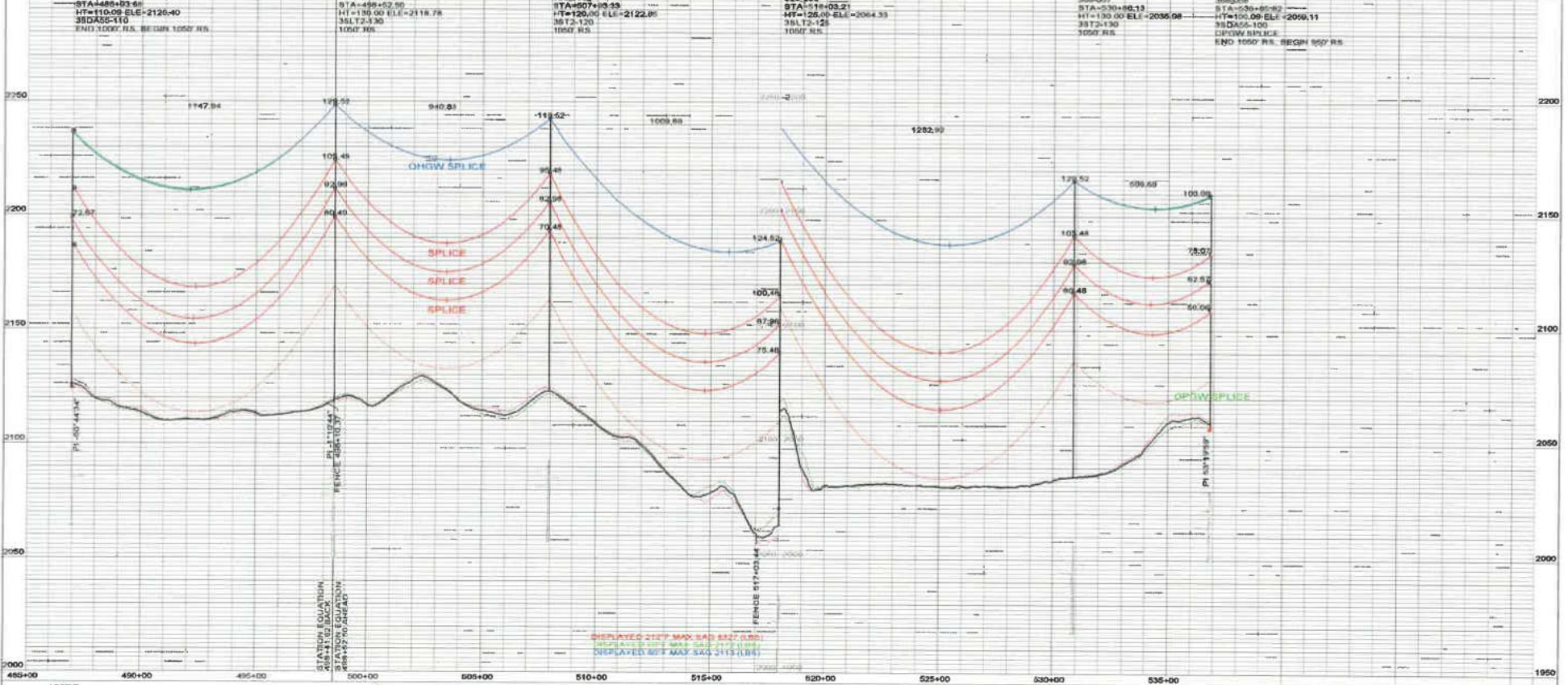
**PLAN AND PROFILES**  
 STATION: 465+00 TO 488+97  
 STRUCTURE: 368-051 TO 368-053

**BASIN ELECTRIC POWER COOPERATIVE**  
 A TOUCHSTONE ENERGY COOPERATIVE

SCALE: VERTICAL = 20FT  
 HORIZONTAL = 200FT

DRAWN BY: [Signature]  
 368-090-T3-011

REV. NO. 3



**LEGEND**

	CULTURAL / TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINES

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE
3	AS BUILT	CLK	SV	SW	12/18
2	UPDATED OPGW INFORMATION	CLK	SV	SW	10/18
1	MOVED #53 BACK 30', ADDED 6T EQ AT #54	CLK	SV	SW	10/15
0	FOR CONSTRUCTION	CLK	SV	SW	08/15

DESIGN INFORMATION											
DESIGNER	S. VASSINDER	DATE	08/15	PROJECT	TRANSMISSION SYSTEM MAINTENANCE / PATENT GATE TO KUMMER RIDGE						
DRAWN BY	C. KNOLL	DATE	08/15	CLIENT	BASIN ELECTRIC POWER COOPERATIVE						
CHECKED BY	S. WISEMAN	DATE	08/15	PROJECT	MCKENZIE						
APPROVED BY	R. LANG	DATE	08/15	CONDUCTOR	2312 KC/MIL 78/75 THIRASHER	RES	10712	NSC TENSION	21010	HEIGHT	30161
DATE	08/15	APL	.571" 35 FIBER	2172	6706	10928	1050'	BLANK SWAY	1050'	BLANK SWAY	1050'
DATE	08/15	APL	7/16 EHS	2113	6069	10150	1050'				

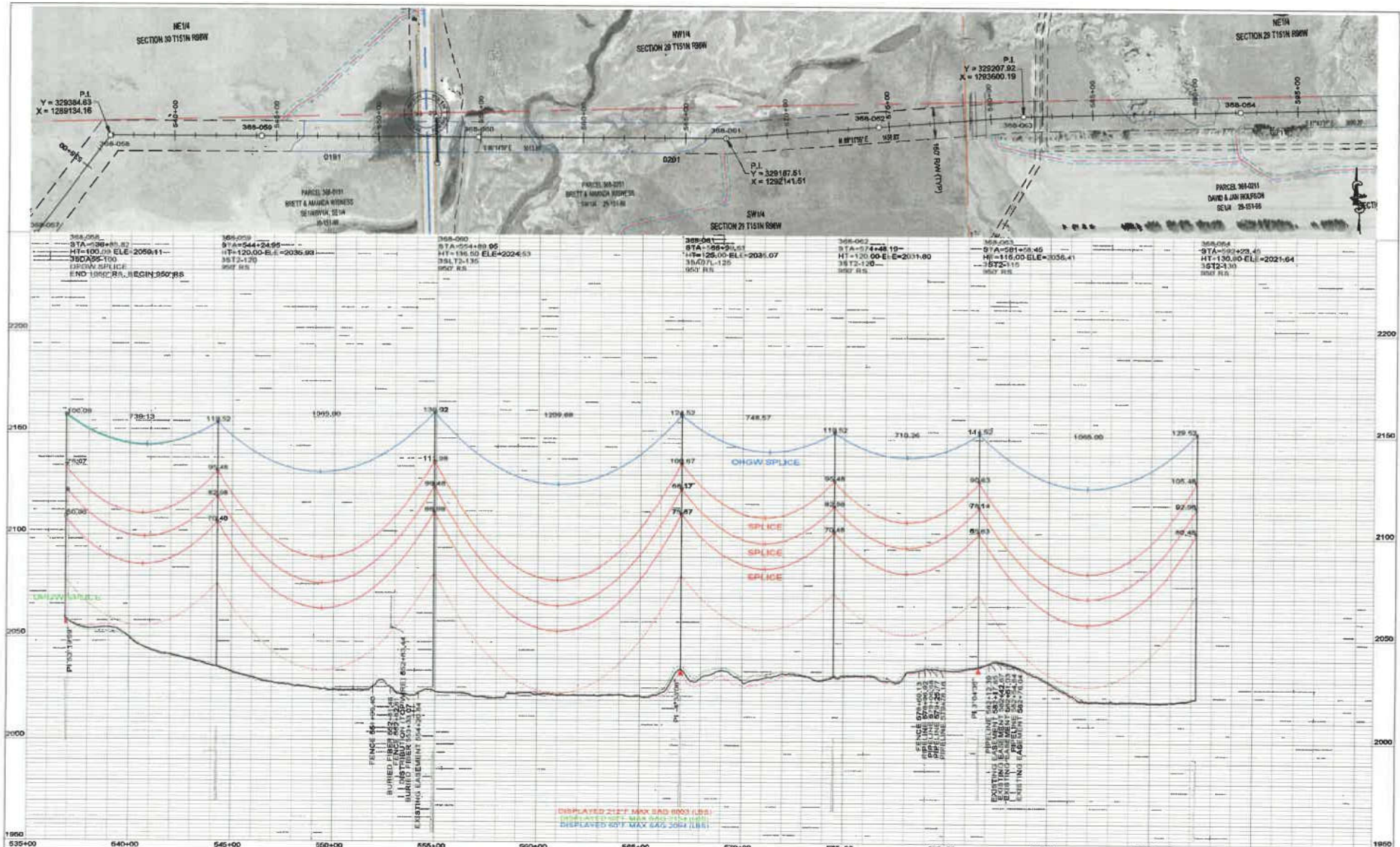
**PLAN AND PROFILES**  
 STATION: 485+00 TO 536+89  
 STRUCTURE: 368-093 TO 368-098

SCALE: VERTICAL = 20FT  
 HORIZONTAL = 200FT

BASIN ELECTRIC POWER COOPERATIVE  
 A TOUCHSTONE ENERGY COOPERATIVE

DATE: 08/15  
 DRAWN: 08/15  
 CHECKED: 08/15  
 APPROVED: 08/15

368-090-T3-012 3



**LEGEND**

- CULTURAL/TRIBAL AVOIDANCE
- WETLAND AVOIDANCE
- BARBED WIRE FENCE
- UNDERGROUND PIPELINE
- UNDERGROUND UTILITY
- OVERHEAD UTILITY
- SECTION LINE
- QUARTER SECTION LINE
- SIXTEENTH SECTION LINE
- PROPERTY LINE
- ACCESS CENTERLINE
- ACCESS SIDELINES

REV.	DESCRIPTION	DRWN	DESN	APPD	DATE	OHGW	CONDUCT.	AWL	AWL	AWL	AWL	AWL
2	AS BUILT	CLK	8V	8W	12/16							
1	UPDATED OPGW INFORMATION	CLK	8V	8W	10/15		CONDUCT.	2312	KCMIL	7019	THRASHER	10707
0	FOR CONSTRUCTION	CLK	8V	8W	08/15	OPGW		.571"	36	FIBER		
								716	EH6	2094	5866	8703

**DESIGN INFORMATION**

DESIGNED BY: S. VASBINDER	DATE: 08/15
DRAWN BY: C. KNOLL	DATE: 08/15
CHECKED BY: S. WISEMAN	DATE: 08/15
IN CHARGE: R. LANG	DATE: 08/15
APPROVED BY: S. WISEMAN	DATE: 08/15

**PROJECT: TRANSMISSION SYSTEM MAINTENANCE**  
**365-PATENT GATE TO KUMMER RIDGE**  
**MCKENZIE**

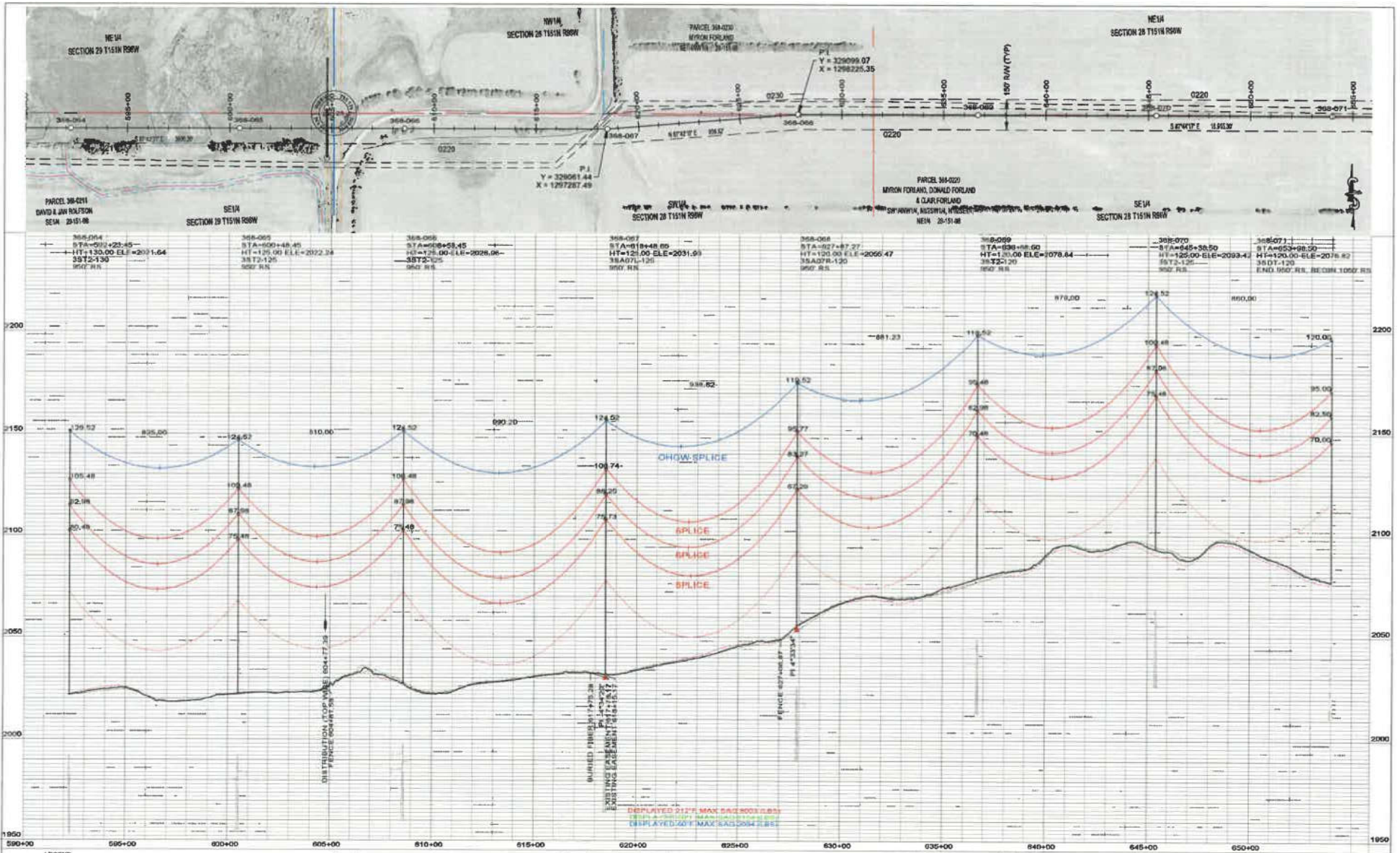
**PLAN AND PROFILES**  
**STATION: 535+00 TO 582+27**  
**STRUCTURE: 368-058 TO 368-064**

**BASIN ELECTRIC POWER COOPERATIVE**  
 A TOUCHSTONE ENERGY COOPERATIVE

SCALE: VERTICAL = 20FT  
 HORIZONTAL = 200FT

SHEET NO. 368-090-T3-013

DISPLAYED 21.2' MAX SAG (800 LBS)  
 DISPLAYED 507' MAX SAG (360 LBS)



**LEGEND**

	CULTURAL / TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS EASEMENT

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	CHKW
2	AS BUILT	CLK	SV	SW	12/16	
1	Moved #67 AHEAD 15' AND UPDATED DPGW INFO	CLK	SV	SW	10/15	
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	

**DESIGN INFORMATION**

SEC	2312	CONDUCT.	2312
SP	KCMIL 76/16	THRESHOLD	10707
APL	571* 35 FIBER	2154	6510
SP	2094	5668	9703

**DESIGNER**

DESIGNER	S. VASSINDER	DATE	09/15
DRAWN BY	C. KNOLL	DATE	08/15
CHECKED BY	S. WISEMAN	DATE	08/15
APPROVED BY	R. LANG	DATE	08/15
DATE	08/15		

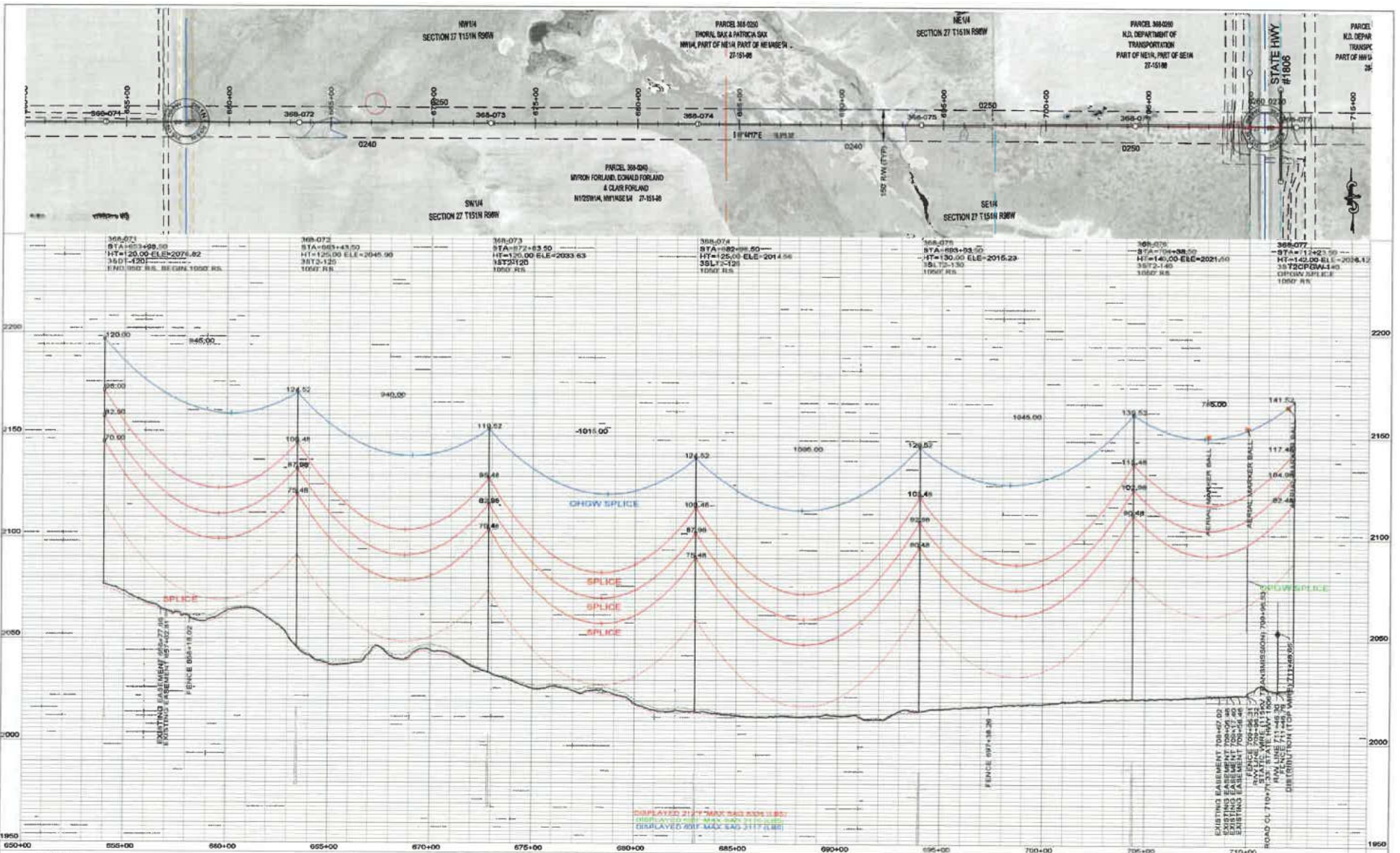
**PROJECT** TRANSMISSION SYSTEM MAINTENANCE  
**LOCATION** PATENT GATE TO KUMMER RIDGE  
**OWNER** MCKENZIE

**BASIN ELECTRIC POWER COOPERATIVE**  
 A TONGUE RIVER ENERGY COOPERATIVE

**SCALE** VERTICAL = 20FT  
 HORIZONTAL = 200FT

**PLAN AND PROFILES**  
**STATION: 590+00 TO 654+02**  
**STRUCTURE: 368-064 TO 368-071**

**DRAWING NO.** 368-090-T3-014  
**REV. NO.** 2

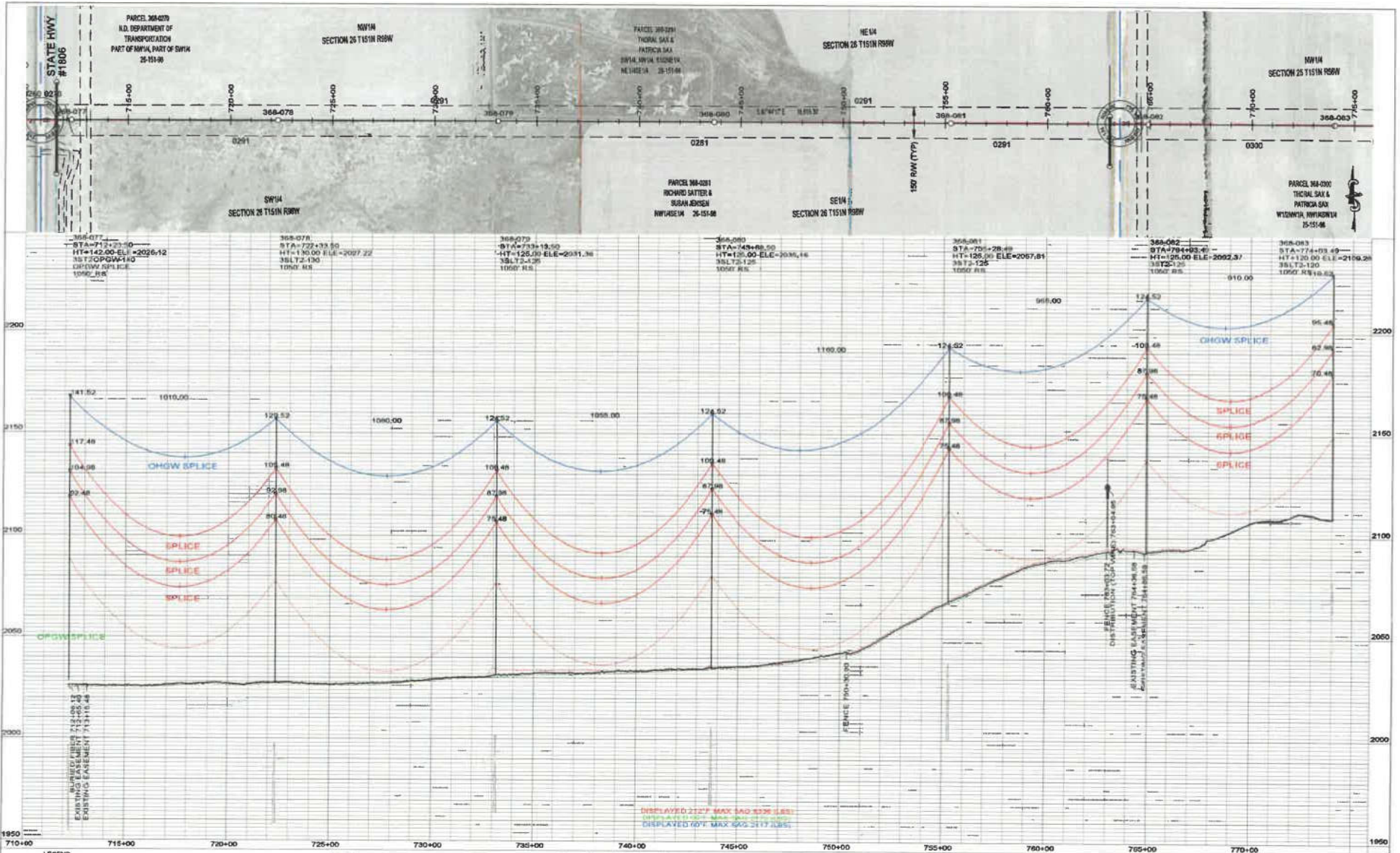


**LEGEND**

	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINES

DESIGN INFORMATION										
2	AS BUILT	CLK	SV	SW	12/16	SIZE	2512	2512	2512	2512
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	CONDUCT.	2512	2512	2512	2512
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OPGW	571	571	571	571
REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW	716	716	716	716

DESIGNED BY: S. VASBINDER CHECKED BY: C. KNOLL DRAWN BY: S. WISEMAN DATE: 08/15	PROJECT: TRANSMISSION SYSTEM MAINTENANCE LOCATION: 365-PATENT GATE TO KUMMER RIDGE COUNTY: MCKENZIE	DATE: 08/15 SHEET: 08/15 TOTAL SHEETS: 08/15	CLIENT: BASIN ELECTRIC POWER COOPERATIVE A TOUCHSTONE ENERGY COOPERATIVE
PLAN AND PROFILES STATION: 650+00 TO 712+27 STRUCTURE: 368-071 TO 368-077		SCALE: VERTICAL = 20FT HORIZONTAL = 200FT	SHEET NO.: 368-090-T3-015 REV. NO.: 2



REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE
3	AS BUILT	CLK	SV	SW	12/16
2	MOVED STR #82 AND 5' UPDATED OPGW INFORMATION.	CLK	SV	SW	10/15
1	MOVED STR #81 AND 36' AND STR #82 AND 50'	CLK	SV	SW	09/15
0	FOR CONSTRUCTION	CLK	SV	SW	08/16

DESIGN INFORMATION									
AGE	2312	KCMIL	70/10	THRASHER	10728	21648	30168	1050'	
CONDUCT.	AF1				2176	6711	10934	1050'	
OPGW									
OHGW	718	EHS	2117		8076	10165	1080'		

DESIGN BY	DATE	CHECKED BY	DATE
S. VASBINDER	08/15	C. KNOLL	08/15
S. WISEMAN	08/15	R. LANG	08/15
S. WISEMAN	08/15		

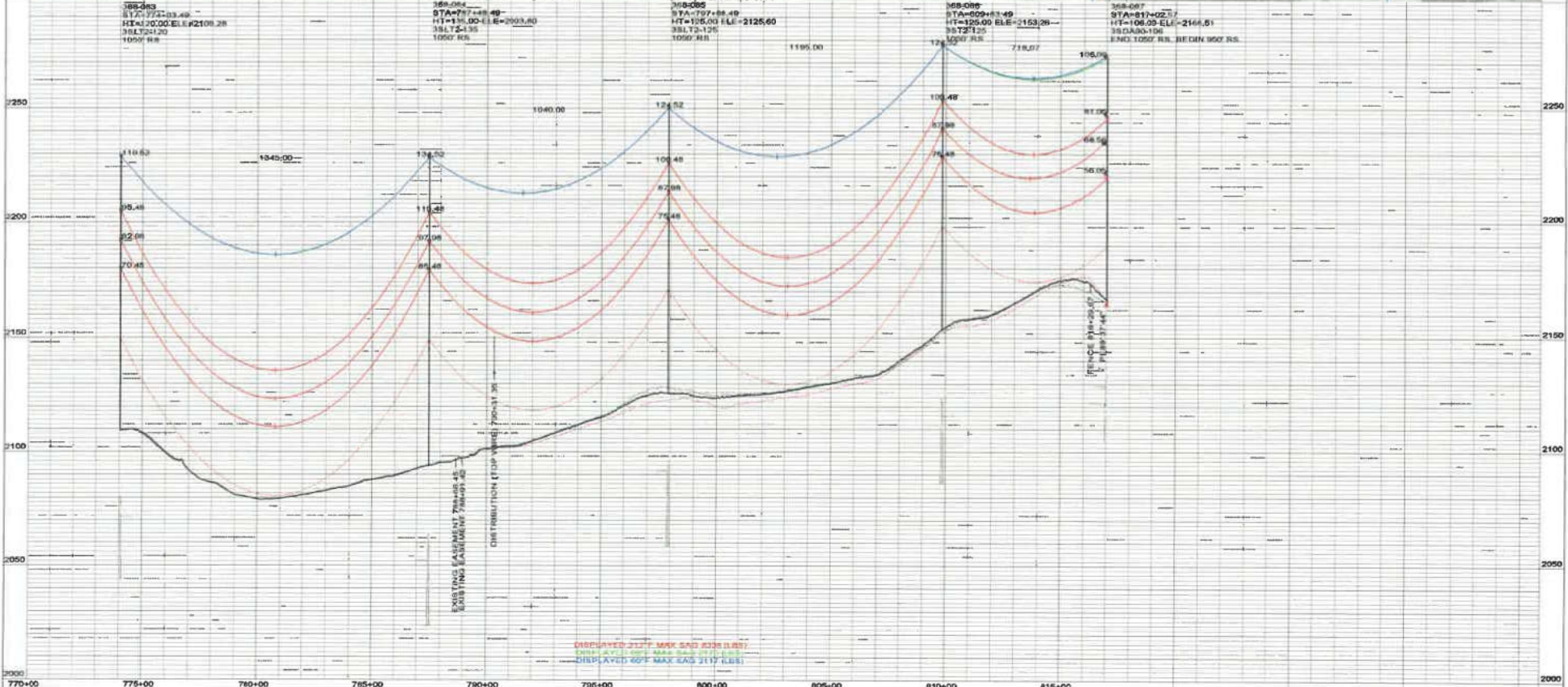
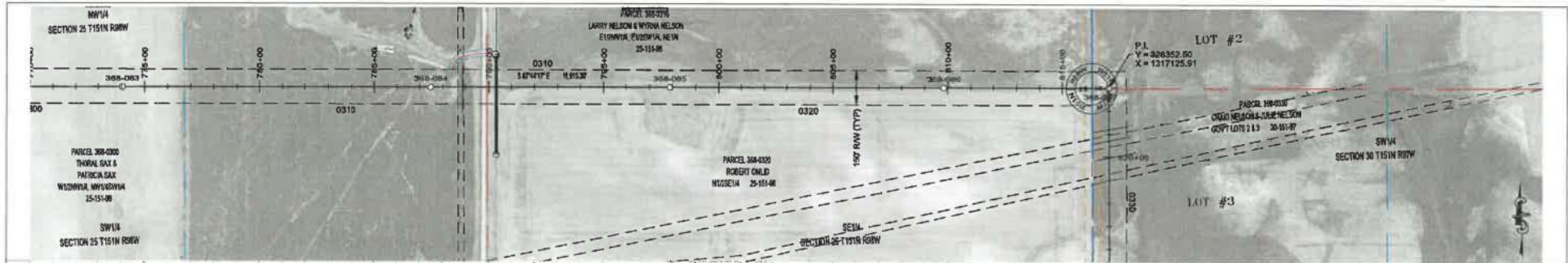
TRANSMISSION SYSTEM MAINTENANCE  
 PATENT GATE TO KUMMER RIDGE  
 MCKENZIE

**BASIN ELECTRIC POWER COOPERATIVE**  
 A TRUCKEER ENERGY COOPERATIVE

SCALE: VERTICAL = 20FT  
 HORIZONTAL = 250FT

PLAN AND PROFILES  
 STATION: 719+00 TO 774+07  
 STRUCTURE: 368-077 TO 368-083

368-090-T3-016 3



**LEGEND**

	CULTURAL / TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINES

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	QHWG	SIZE	# FINAL TURNS	REC TENSION	REC EC	RECY EC	RECY SPW	RECY SPW
2	AS BUILT	CLK	SV	SW	12/16								
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	CONDUCT.	2312 KCMIL 70/19 THRESHIR	10726	21648	30168	1050'		
0	FOR CONSTRUCTION	CLK	SV	SW	09/15	OPGW	AFI .671" 36 FIBER	2178	6711	10034	1050'		
							718 E4B	2117	6075	10155	1050'		

**DESIGN INFORMATION**

DESIGNED BY: S. VASBINDER  
 DRAWN BY: C. KNOLL  
 CHECKED BY: S. WISEMAN  
 DESIGNED BY: R. LANG  
 DRAWN BY: S. WISEMAN

DATE: 08/16  
 DATE: 08/15  
 DATE: 08/16  
 DATE: 08/16  
 DATE: 08/15

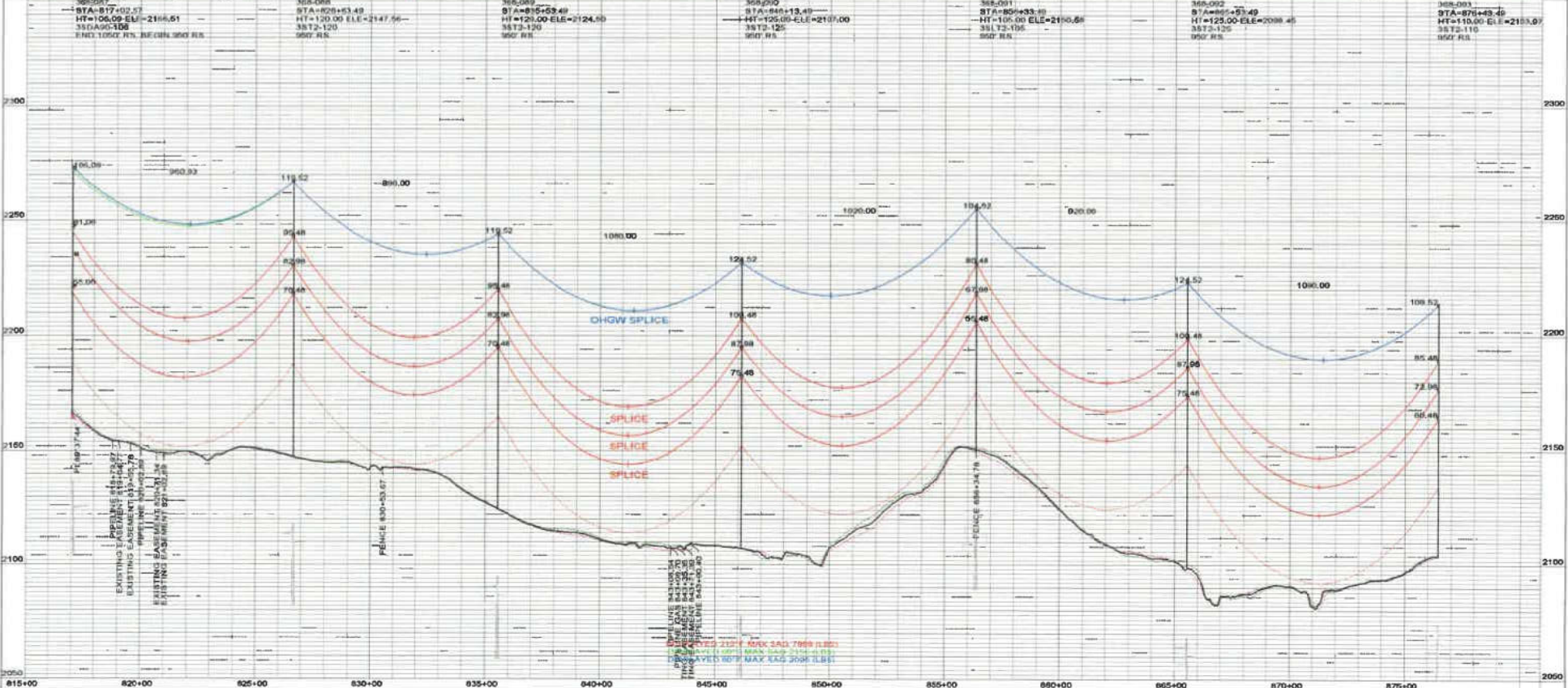
PROJECT: TRANSMISSION SYSTEM MAINTENANCE  
 LOCATION: 368-PATENT GATE TO KUMMER RIDGE  
 COUNTY: MCKENZIE

**BASIN ELECTRIC POWER COOPERATIVE**  
 A TOUCHSTONE ENERGY COOPERATIVE

SCALE: VERTICAL = 20FT  
 HORIZONTAL = 200FT

PLAN AND PROFILES  
 STATION: 770+00 TO 817+00  
 STRUCTURE: 368-083 TO 368-087

SHEET NO. 2



**LEGEND**

	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINES

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW
2	AS BUILT	CLK	SV	SW	12/16	
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	CONDUCT.
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OPGW

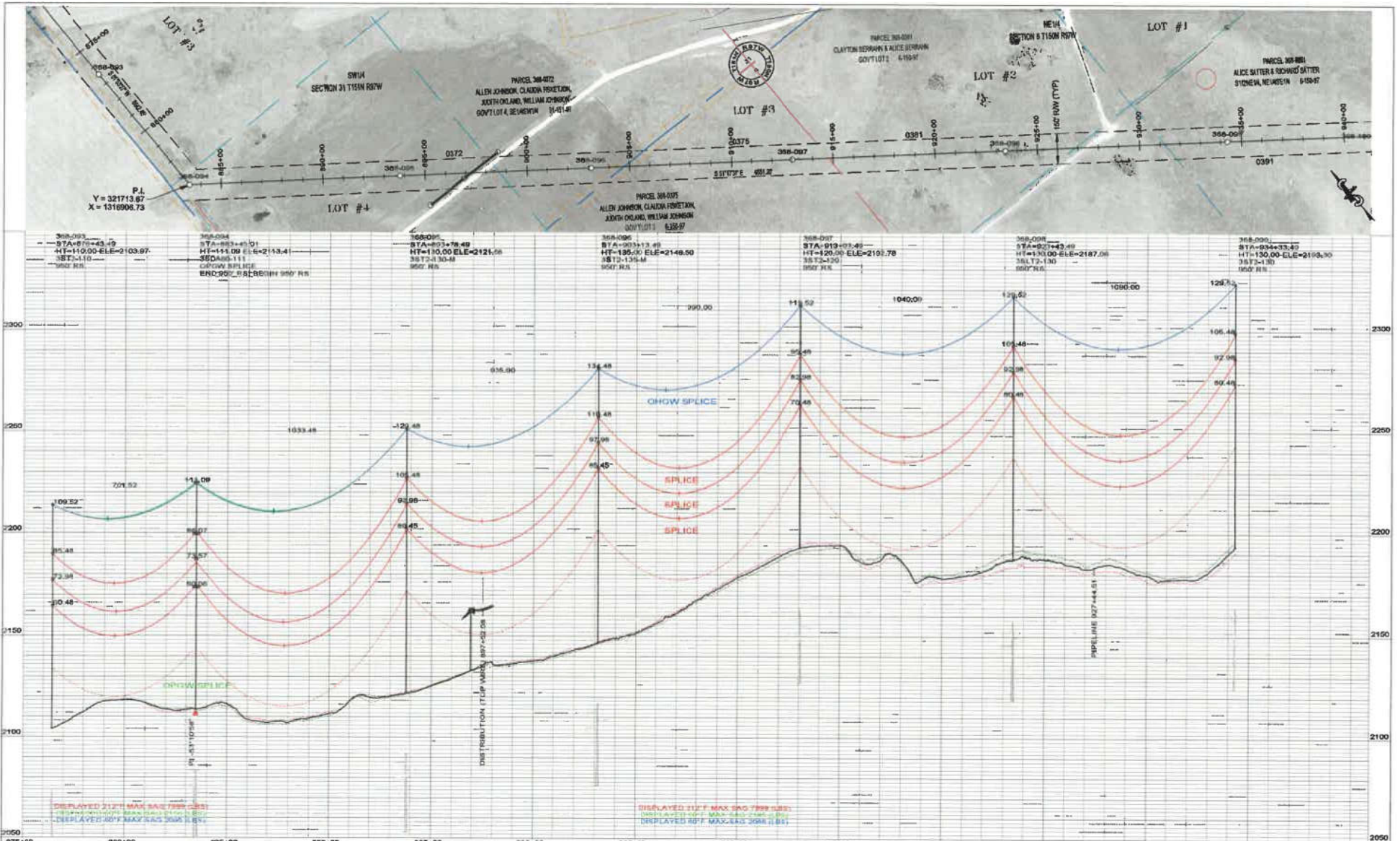
<b>DESIGN INFORMATION</b>				<b>DESIGNER</b> S. VASSINDER		<b>DATE</b> 08/15		<b>PROJECT</b> TRANSMISSION SYSTEM MAINTENANCE	
# OF PHASES	# OF PHASE TENSION	REQ. TENSION	NSGW	NSGW	NSGW	NSGW	NSGW	NSGW	NSGW
3	10699	22132	30037	950'	950'	950'	950'	950'	950'
<b>CLIENT</b> PATENT GATE TO KUMMER RIDGE				<b>CLIENT</b> MCKENZIE		<b>CLIENT</b> MCKENZIE		<b>CLIENT</b> MCKENZIE	
<b>CONTRACT</b> 716 EHS				<b>CONTRACT</b> 2095		<b>CONTRACT</b> 5870		<b>CONTRACT</b> 9705	
<b>DATE</b> 08/15				<b>DATE</b> 08/15		<b>DATE</b> 08/15		<b>DATE</b> 08/15	

**PLAN AND PROFILES**  
STATION: 815+00 TO 875+47  
STRUCTURE: 368-087 TO 368-093

**BASIN ELECTRIC POWER COOPERATIVE**  
A TOUCHSTONE ENERGY COOPERATIVE

SCALE: VERTICAL = 300FT  
HORIZONTAL = 200FT

DATE: 08/15  
DRAWING NO: 368-090-T3-018  
REV. NO: 2



REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW	7/16 EHS	2088	5855	9691	950'
3	AS BUILT	CLK	SV	SW	12/16						
2	MODIFIED STR 95 AND 96 FOR DIST. XING	CLK	SV	SW	12/16						
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	CONDUCT.	2312 KC/MIL 76/16 THREADED	10699	22132	30037	950'
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OPGW	AFL 57" 36 FIBER	2140	6494	10444	850'

**LEGEND**

	CULTURAL / TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINE

**DESIGN INFORMATION**

DESIGNER:	S. VASBINDER
DATE:	08/15
REVISION:	C. KNOLL
DATE:	08/15
REVISION:	S. WISEMAN
DATE:	08/15
REVISION:	R. LANG
DATE:	08/15
REVISION:	S. WISEMAN

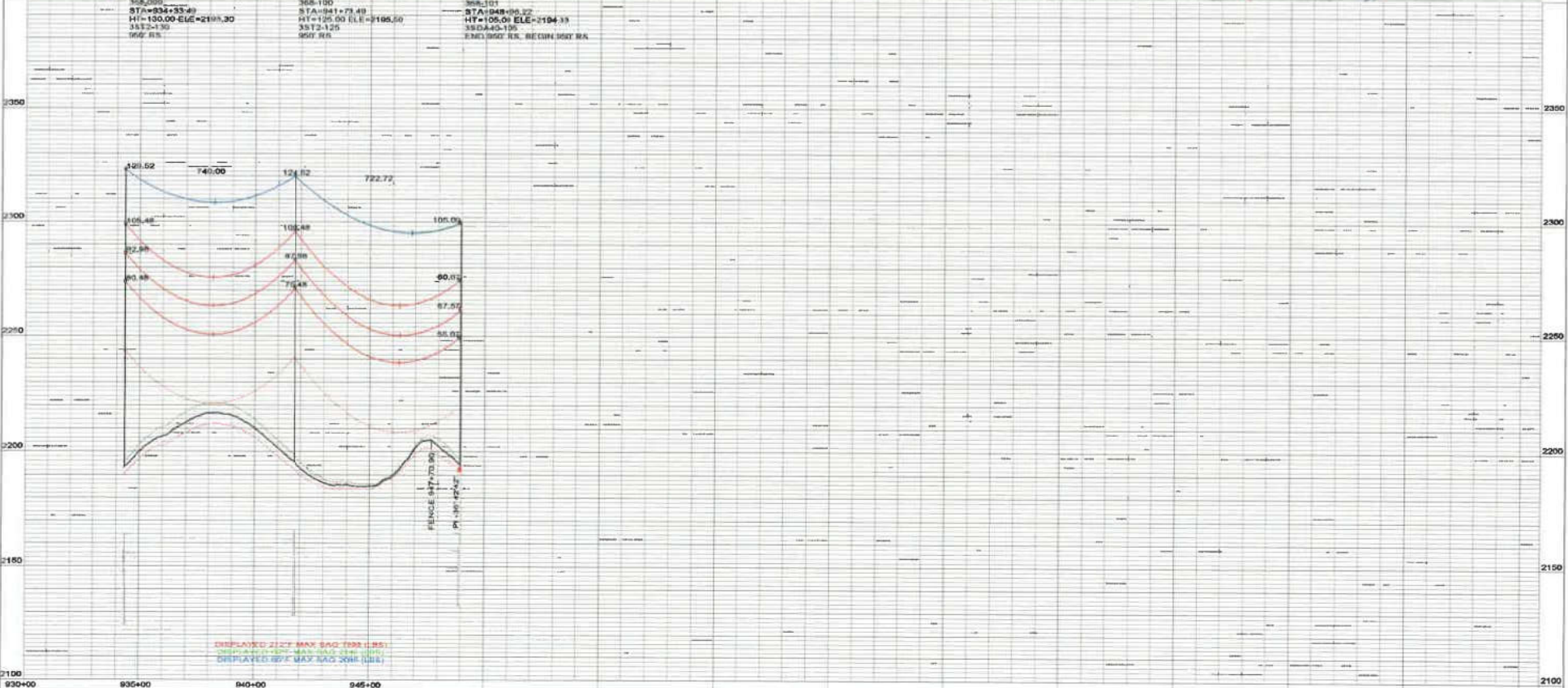
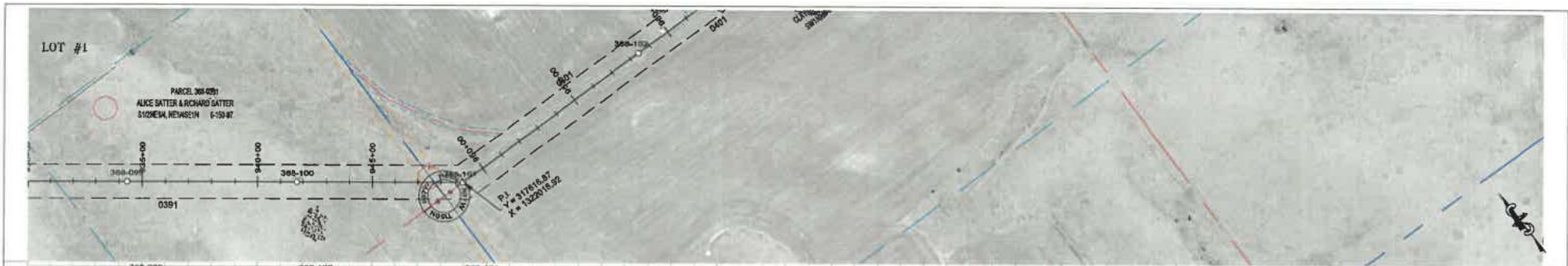
**TRANSMISSION SYSTEM MAINTENANCE**  
**35-FATENT GATE TO KUMMER RIDGE**  
**MCKENZIE**

**PLAN AND PROFILES**  
**STATION: 875+00 TO 934+37**  
**STRUCTURE: 368-093 TO 368-099**

**BASIN ELECTRIC POWER COOPERATIVE**  
 A TOUCHSTONE ENERGY COOPERATIVE

SCALE: VERTICAL = 200FT  
 HORIZONTAL = 200FT

DATE DRAWING NO. 368-090-T3-019  
 REV. NO. 3

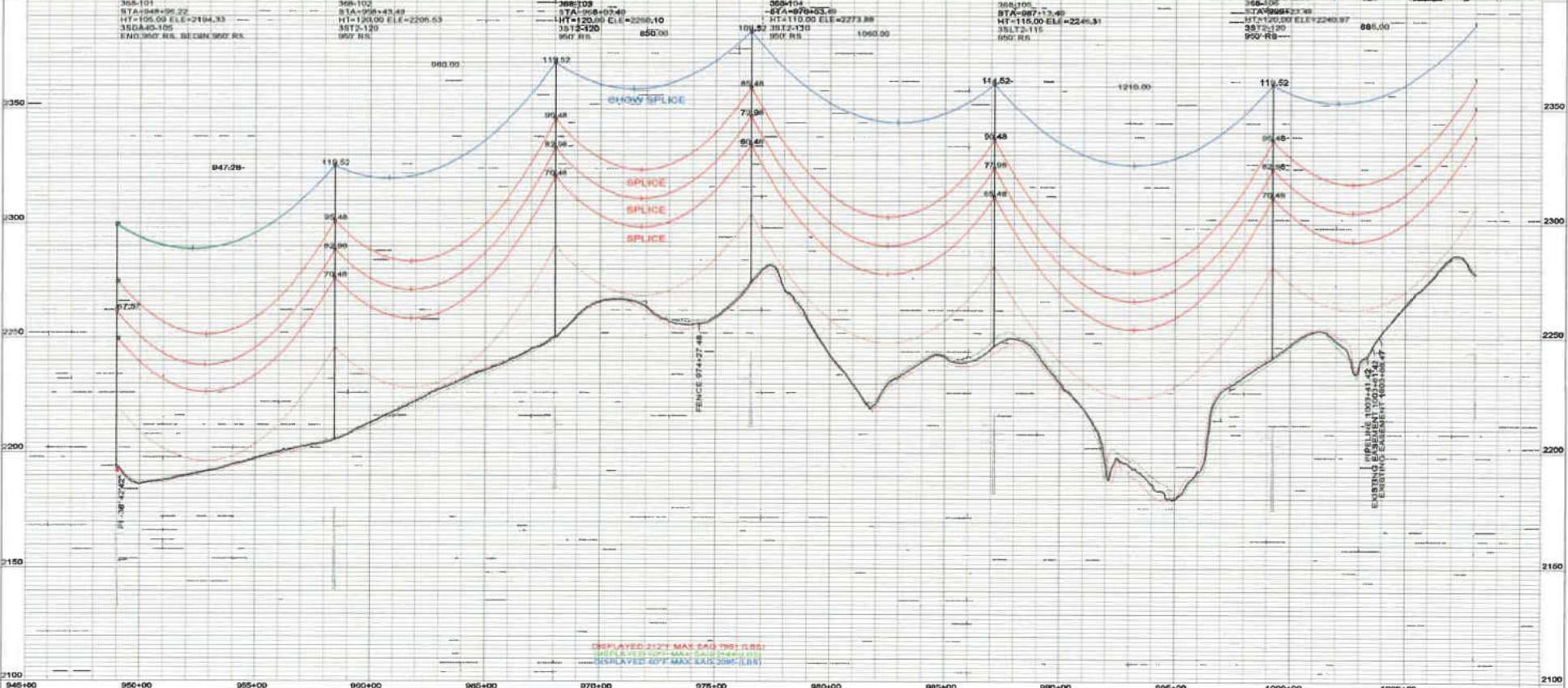
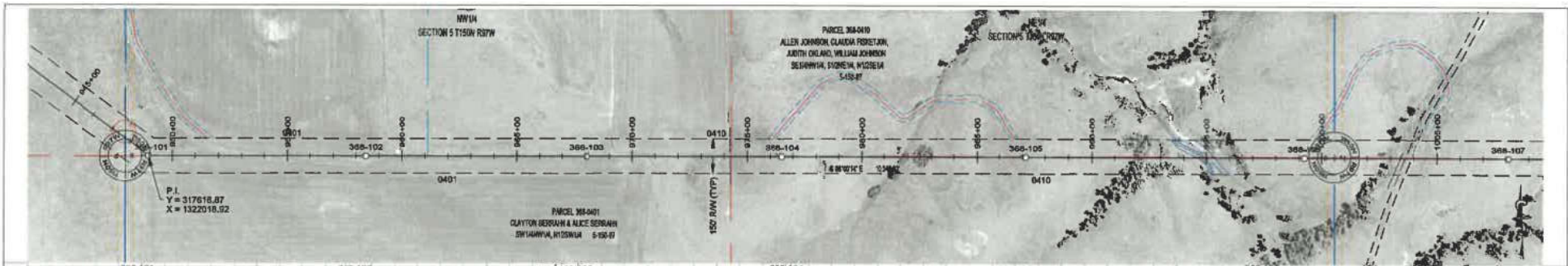


DISPLAYED 212' MAX SAG (30% (1.35))  
 DISPLAYED 1132' MAX SAG (3% (0.9))  
 DISPLAYED 807' MAX SAG (20% (1.8))

LEGEND	
	CULTURAL / TRIBAL AVOIDANCE
	WETLAND AVOIDANCE
	BARBED WIRE FENCE
	UNDERGROUND PIPELINE
	ACCESS CENTERLINE
	OVERHEAD UTILITY
	SECTION LINE
	QUARTER SECTION LINE
	SIXTEENTH SECTION LINE
	PROPERTY LINE
	ACCESS SIDELINES

DESIGN INFORMATION										
2	AS BUILT	CLK	SV	SW	12/16	SEC	# FEET TENSION	SEC TENSION	WIRE SIZE	SPAN SPAN
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	CONDUCT,	2312 KC/MIL 76/19 THIRASHER	10699	22132	30037 950'
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OPGW	AF1 .571' 36 FIBER	2148	6494	10444 950'
REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW	716 EH6	2088	6855	9691 950'

DRAWN BY: <b>D. VASBINDER</b> CHECKED BY: <b>C. KNOLL</b> DESIGNER: <b>S. WISEMAN</b> REVISIONS: <b>R. LANG</b> <b>S. WISEMAN</b>	DATE: 08/15 DATE: 08/15 DATE: 08/15 DATE: 08/15	FACILITY: TRANSMISSION SYSTEM MAINTENANCE OCCUPANCY: 368-PATENT GATE TO KUMMER RIDGE LOCALITY: MCKENZIE	 <b>BASIN ELECTRIC POWER COOPERATIVE</b> A TOUCHSTONE ENERGY COOPERATIVE
PLAN AND PROFILES STATION: 930+00 TO 948+99 STRUCTURE: 368-099 TO 368-101		SCALE: VERTICAL = 20FT HORIZONTAL = 200FT	DRAWING NO: <b>368-090-T3-02D</b> REV. NO: <b>2</b>



**LEGEND**

- CULTURAL / TRIBAL AVOIDANCE
- WETLAND AVOIDANCE
- BARBED WIRE FENCE
- UNDERGROUND PIPELINE
- UNDERGROUND UTILITY
- OVERHEAD UTILITY
- SECTION LINE
- QUARTER SECTION LINE
- SIXTEENTH SECTION LINE
- PROPERTY LINE
- ACCESS CENTERLINE
- ACCESS SIDELINES

REV	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW
2	AS BUILT	CLK	SV	SW	12/15	
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	CONDUCT.
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OPGW

**DESIGN INFORMATION**

SIZE	NO. TOWERS	NEC TOWERS	HEAVY EC	BULK MW
2312 KC/MIL 75/10 THROASHER	10681	22066	29998	950'
AFI	2144	8492	10440	950'
.571" 36 FIBER	2085	5853	9689	950'

DESIGNED BY: S. VASBINDER  
 CHECKED BY: C. KNOLL  
 DESIGN ENG: S. VASBINDER  
 DRAWING: R. LANG  
 PROJECT: S. VASBINDER

DATE: 08/15  
 DATE: 08/15  
 DATE: 08/15  
 DATE: 08/15

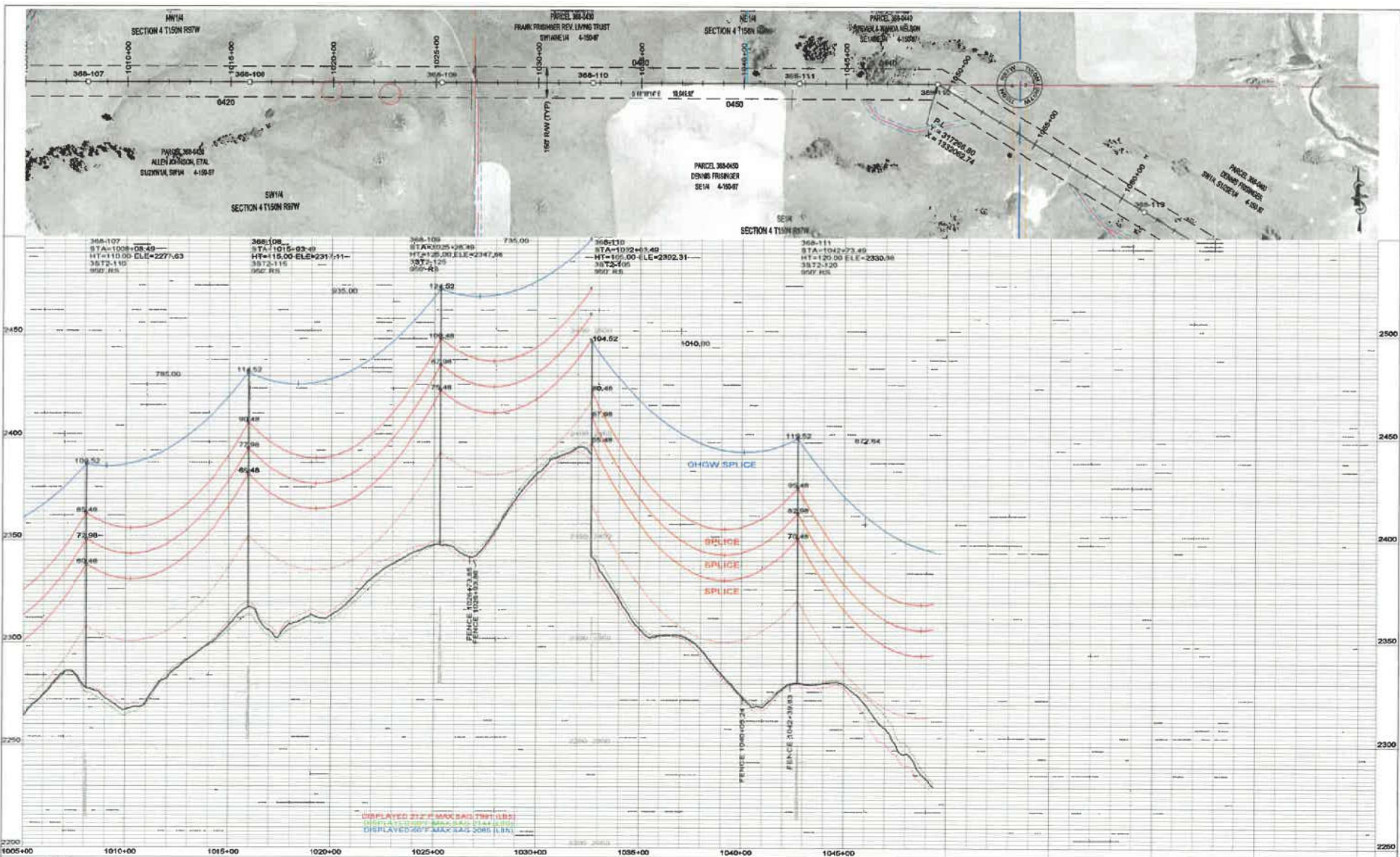
FACILITY: TRANSMISSION SYSTEM MAINTENANCE  
 LOCATION: 368-PATENT GATE TO KUMMER RIDGE  
 COUNTY: MCKENZIE

**BASIN ELECTRIC POWER COOPERATIVE**  
 A TOUCHSTONE ENERGY COOPERATIVE

**PLAN AND PROFILES**  
 STATION: 945+00 TO 1005+07  
 STRUCTURE: 368-101 TO 368-106

SCALE: VERTICAL = 20FT  
 HORIZONTAL = 200FT

DATE: 08/15  
 DRAWING NO: 368-090-T3-021  
 REV. NO: 2



**LEGEND**

	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS EIDELINES

REV	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW
2	AS BUILT	CLK	SV	8W	12/18	
1	UPDATED OPGW INFORMATION	CLK	SV	8W	10/15	
0	FOR CONSTRUCTION	CLK	SV	8W	08/15	OPGW

**DESIGN INFORMATION**

CONDUCT.	ACI	SP	WIND	ICE	SAFETY
2312 KCMIL 78/10 THRAASHER	.571" 35 FIBER	10081	22085	29990	950'
716 EHS		2085	5853	9589	950'

**PERSONNEL**

ROLE	NAME	DATE
DESIGNED BY	S. VASBINDER	08/16
CHECKED BY	C. KNOLL	08/16
DESIGNED BY	S. WISEMAN	08/15
DESIGNED BY	R. LANG	08/15
APPROVED BY	S. WISEMAN	08/15

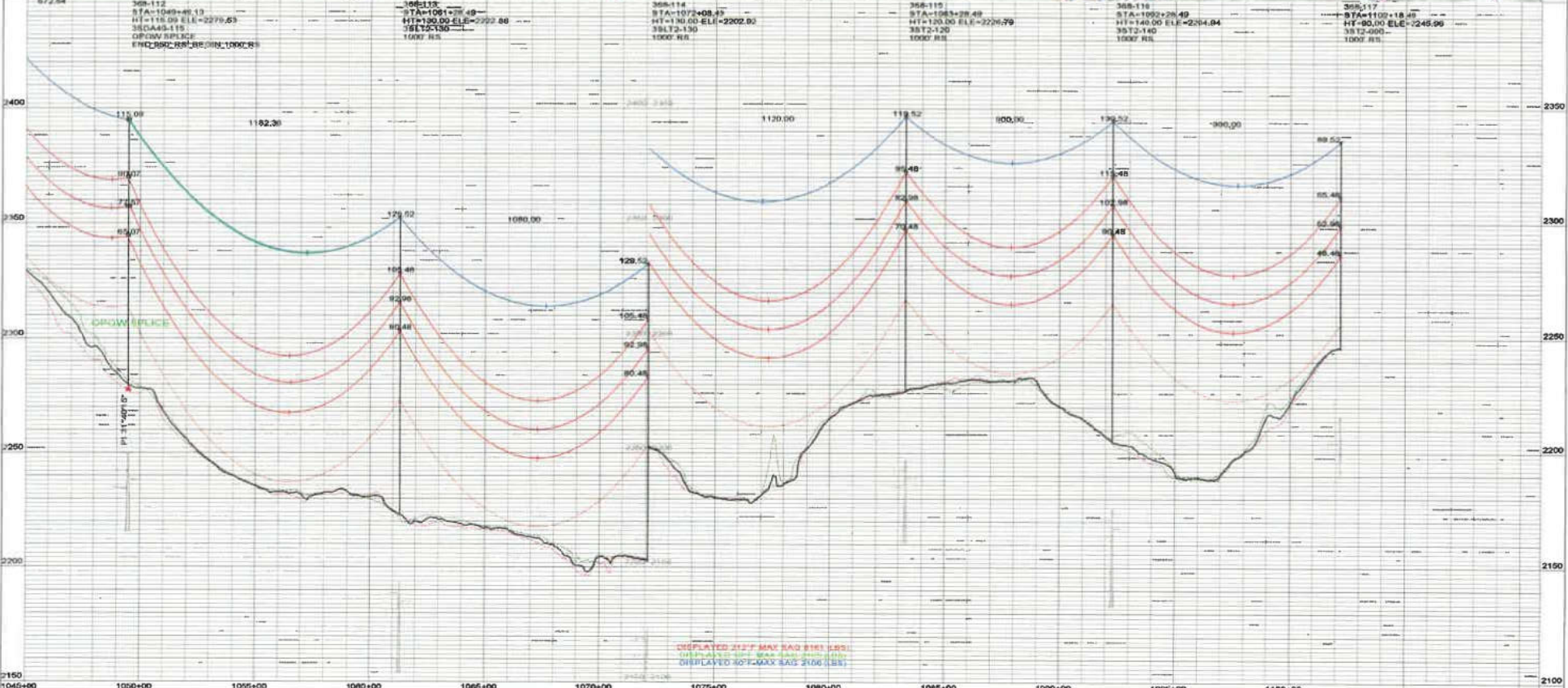
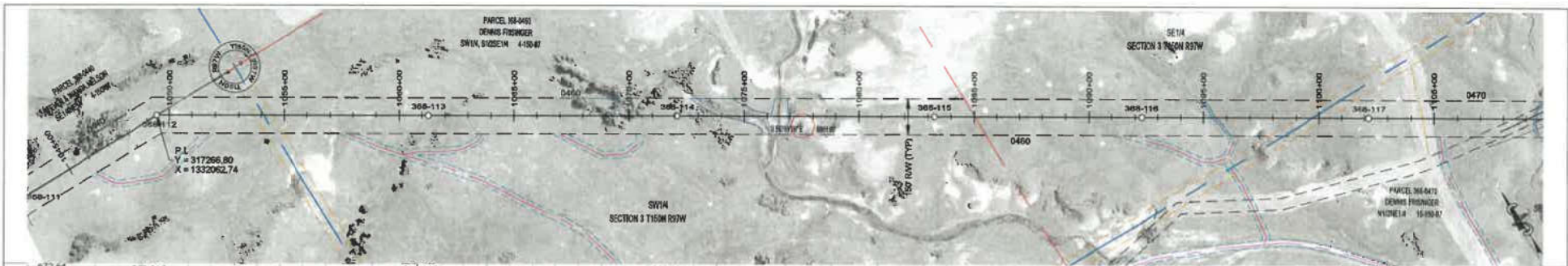
**TRANSMISSION SYSTEM MAINTENANCE**  
 368-PATENT GATE TO KUMMER RIDGE  
 MCKENZIE

**BASIN ELECTRIC POWER COOPERATIVE**  
 A TOUCHSTONE ENERGY COOPERATIVE

**SCALE:** VERTICAL = 20 FT  
 HORIZONTAL = 200 FT

**PLAN AND PROFILES**  
 STATION: 1005+00 TO 1049+39  
 STRUCTURE: 368-107 TO 368-111

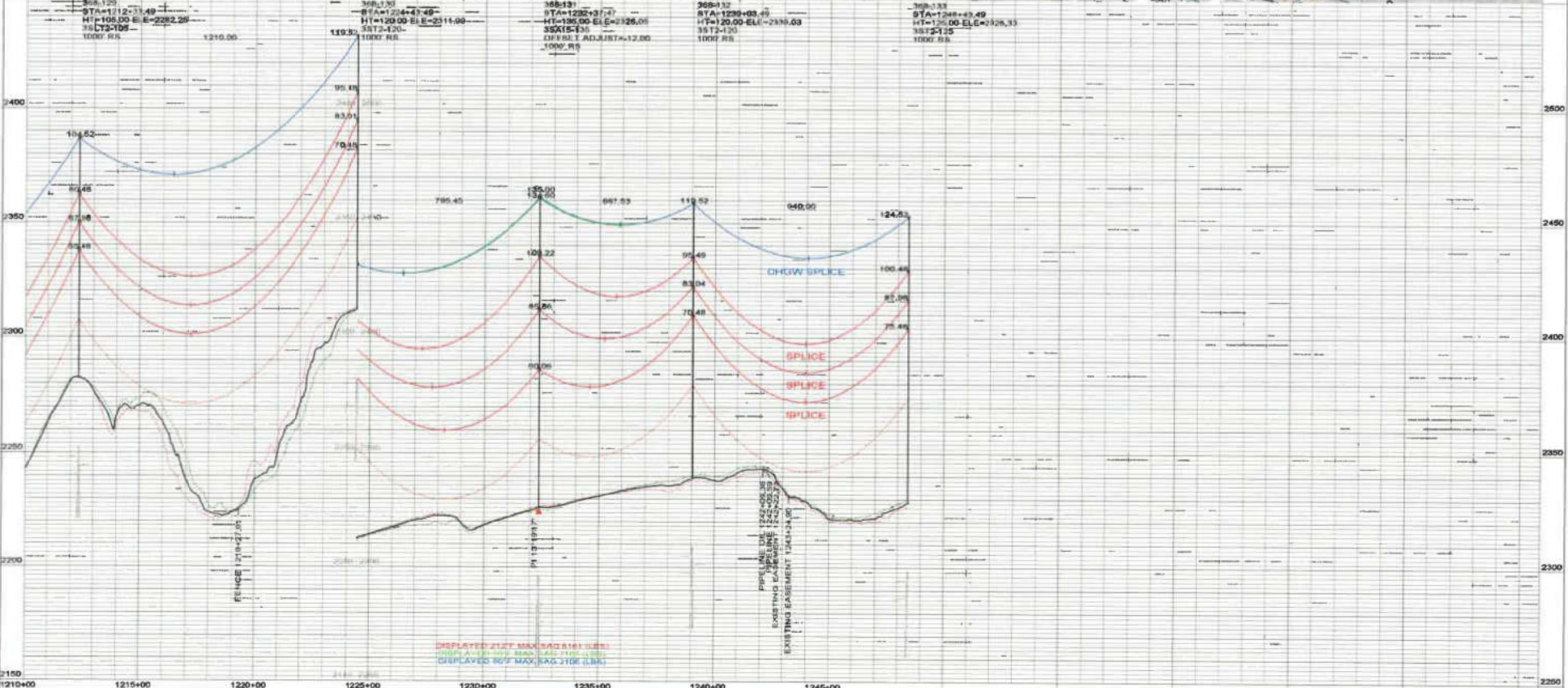
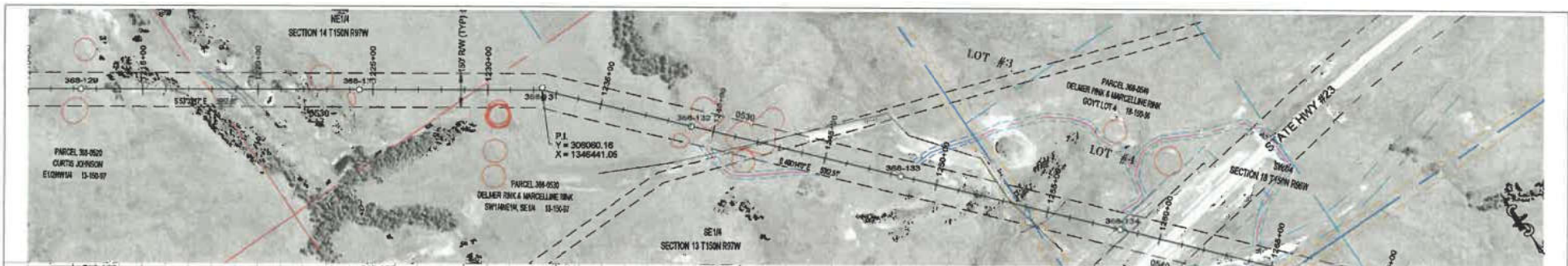
**DATE:** 08/15  
**REV. NO.:** 2



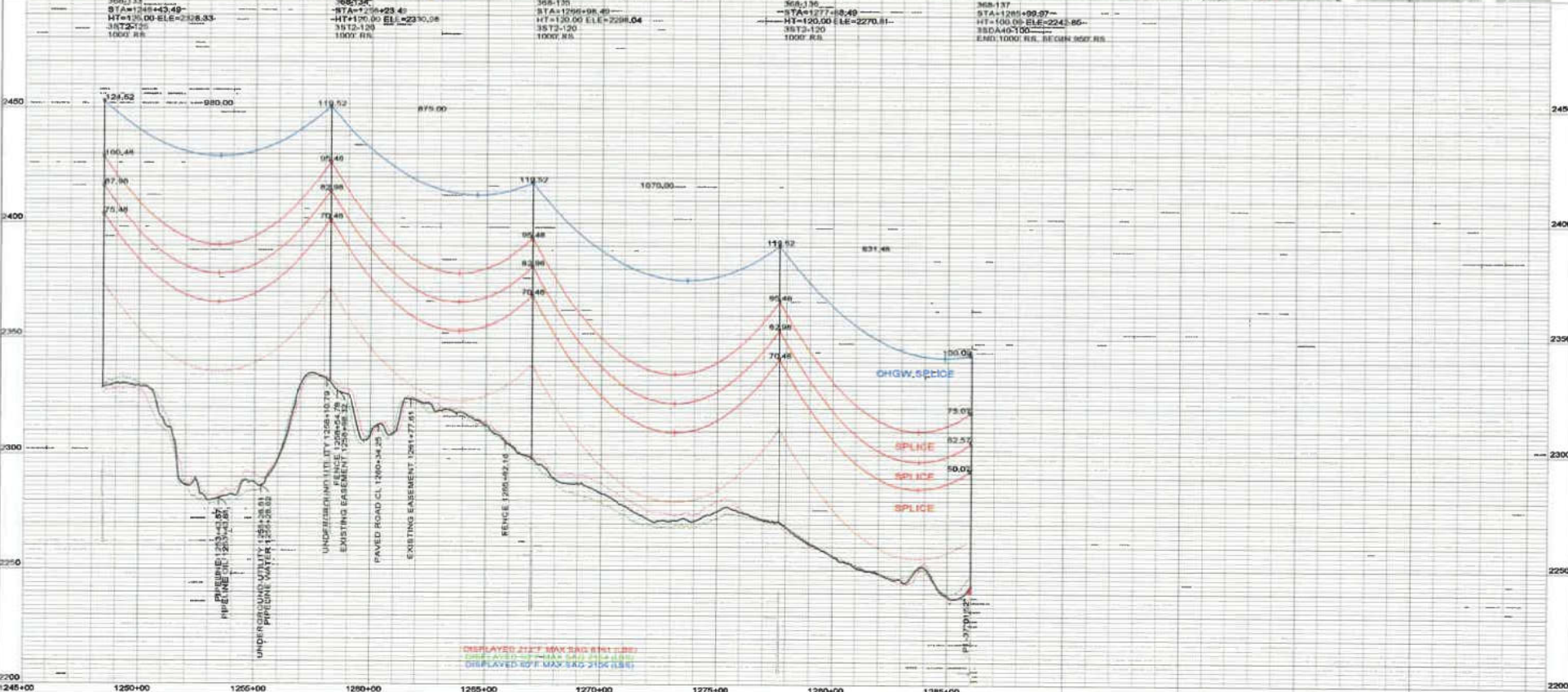
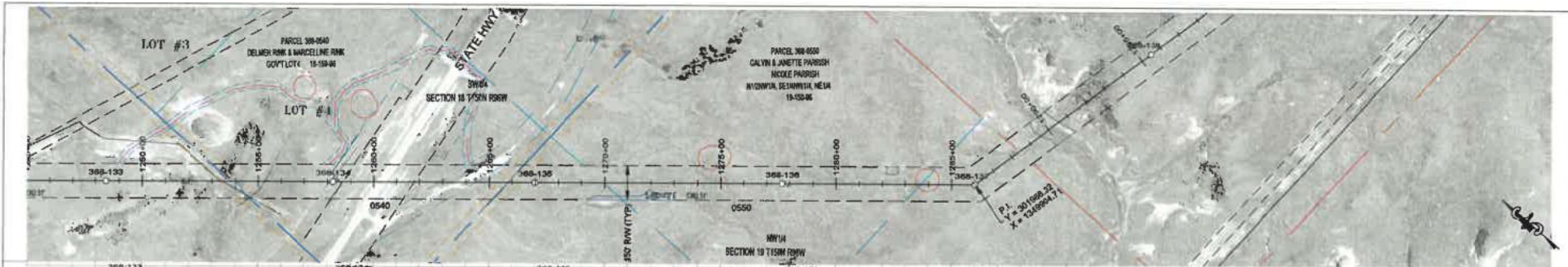
<b>LEGEND</b> CULTURAL / TRIBAL AVOIDANCE WETLAND AVOIDANCE BARBED WIRE FENCE UNDERGROUND PIPELINE UNDERGROUND UTILITY OVER-HEAD UTILITY		SECTION LINE QUARTER SECTION LINE SIXTEENTH SECTION LINE PROPERTY LINE ACCESS CENTERLINE ACCESS SIDELINES		<b>DESIGN INFORMATION</b> SIZE: 2312 KC/MIL 75/19 FIBER CONDUCTOR: 2165 6011 10699 1000' 716 EHS 2106 5974 9636 1000'						DESIGNER: S. VASBINDER CHECKER: C. KNOLL DESIGNER: S. WISEMAN SUPERVISOR: R. LANG PROJECT MANAGER: S. WISEMAN		DATE: 08/15 PROJECT: TRANSMISSION SYSTEM MAINTENANCE LOCATION: 365-PATENT GATE TO KUMMER RIDGE COUNTY: MCKENZIE		<b>BASIN ELECTRIC POWER COOPERATIVE</b> A TOWNWIDE ENERGY COOPERATIVE	
<b>REVISIONS</b> 2 AS BUILT 1 UPDATED OPGIW INFORMATION 0 FOR CONSTRUCTION		CLK CLK CLK	SV SV SV	SW SW SW	12/16 10/15 08/16	OPGIW OPGIW OPGIW	<b>PLAN AND PROFILES</b> STATION: 1045+00 TO 1102+22 STRUCTURE: 368-112 TO 368-117						SCALE: VERTICAL = 20'-1" HORIZONTAL = 200'-1" DRAWING NO: 368-090-T3-023 REV. NO: 2		







<b>LEGEND</b> CULTURAL / TRIBAL AVOIDANCE WETLAND AVOIDANCE BARBED WIRE FENCE UNDERGROUND PIPELINE UNDERGROUND UTILITY OVER-HEAD UTILITY		SECTION LINE QUARTER SECTION LINE SIXTEENTH SECTION LINE PROPERTY LINE ACCESS CENTERLINE ACCESS SIDELINES		<b>DESIGN INFORMATION</b> DESIGNED BY: S. VASBINDER DRAWN BY: C. KNOLL CHECKED BY: S. WISEMAN DATE: 08/15				FACILITY: TRANSMISSION SYSTEM MAINTENANCE LOCATION: 388-PATENT GATE TO KUMMER RIDGE COUNTY: MCKENZIE				<b>BASIN ELECTRIC POWER COOPERATIVE</b> A TOUCHSTONE ENERGY COOPERATIVE		
2	AS BUILT	CLK	SV	SW	12/15	SEE	2312 KCMIL 70/19 THUNDER	10090	21810	30056	1000'	DATE: 08/15	<b>PLAN AND PROFILES</b> STATION: 1210+00 TO 1248+47 STRUCTURE: 388-129 TO 388-133	SCALE: VERTICAL = 20FT HORIZONTAL = 200FT DRAWN BY: S. WISEMAN DATE: 08/15 PROJECT NO: 388-090-T3-026 SHEET NO: 2
1	UPDATED OHGW INFORMATION	CLK	SV	SW	10/15	CONDUCT.	7/16 EHS	2106	5974	9936	1000'			
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OHGW								
REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW								



**LEGEND**

- CULTURAL/TRIBAL AVOIDANCE
- WETLAND AVOIDANCE
- BARBED WIRE FENCE
- UNDERGROUND PIPELINE
- UNDERGROUND UTILITY
- OVERHEAD UTILITY
- SECTION LINE
- QUARTER SECTION LINE
- SIXTIETH SECTION LINE
- PROPERTY LINE
- ACCESS CENTERLINE
- ACCESS SIDELINES

REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	CHK	BY	DATE	REV	DESCRIPTION	DATE
1	AS BUILT	CLK	SV	SW	12/18						
2	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15						
3	FOR CONSTRUCTION	CLK	SV	SW	08/15						

**DESIGN INFORMATION**

DATE: 08/15  
 DRAWN BY: C. KNOLL  
 CHECKED BY: S. WISEMAN  
 DESIGNED BY: R. LANG  
 APPROVED BY: S. WISEMAN

**PROJECT INFORMATION**

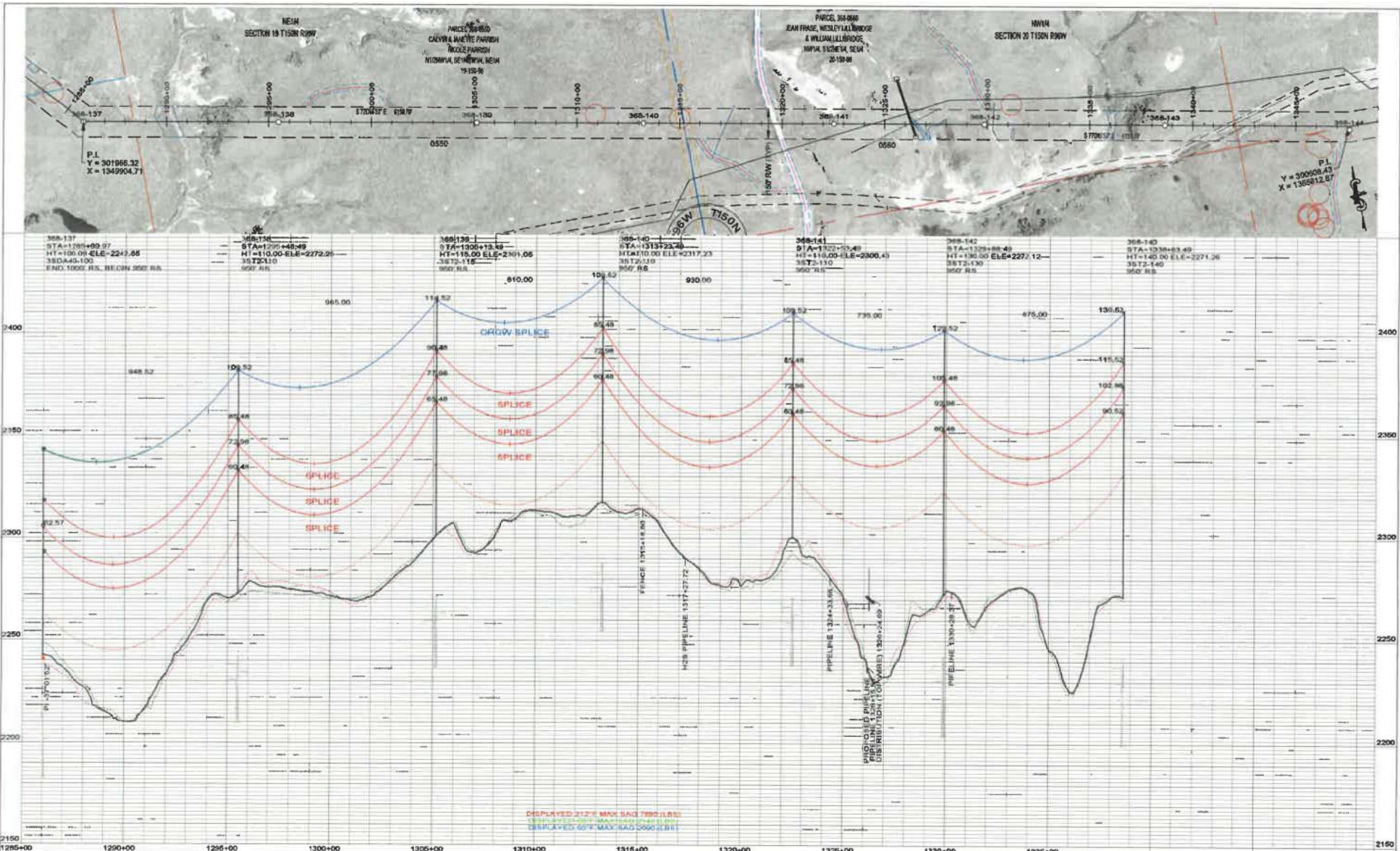
PROJECT: TRANSMISSION SYSTEM MAINTENANCE  
 LOCATION: PATENT GATE TO NUMMER RIDGE 345 KV LINE  
 COUNTY: MCKENZIE

**BASIN ELECTRIC POWER COOPERATIVE**  
 A VOLUNTARY MEMBER COOPERATIVE

**SCALE:** VERTICAL = 20FT  
 HORIZONTAL = 200FT

**STATION: 1245+00 TO 1285+03**  
**STRUCTURE: 368-133 TO 368-137**

FILE NO: 368-09D-T3-027  
 SHEET NO: 2

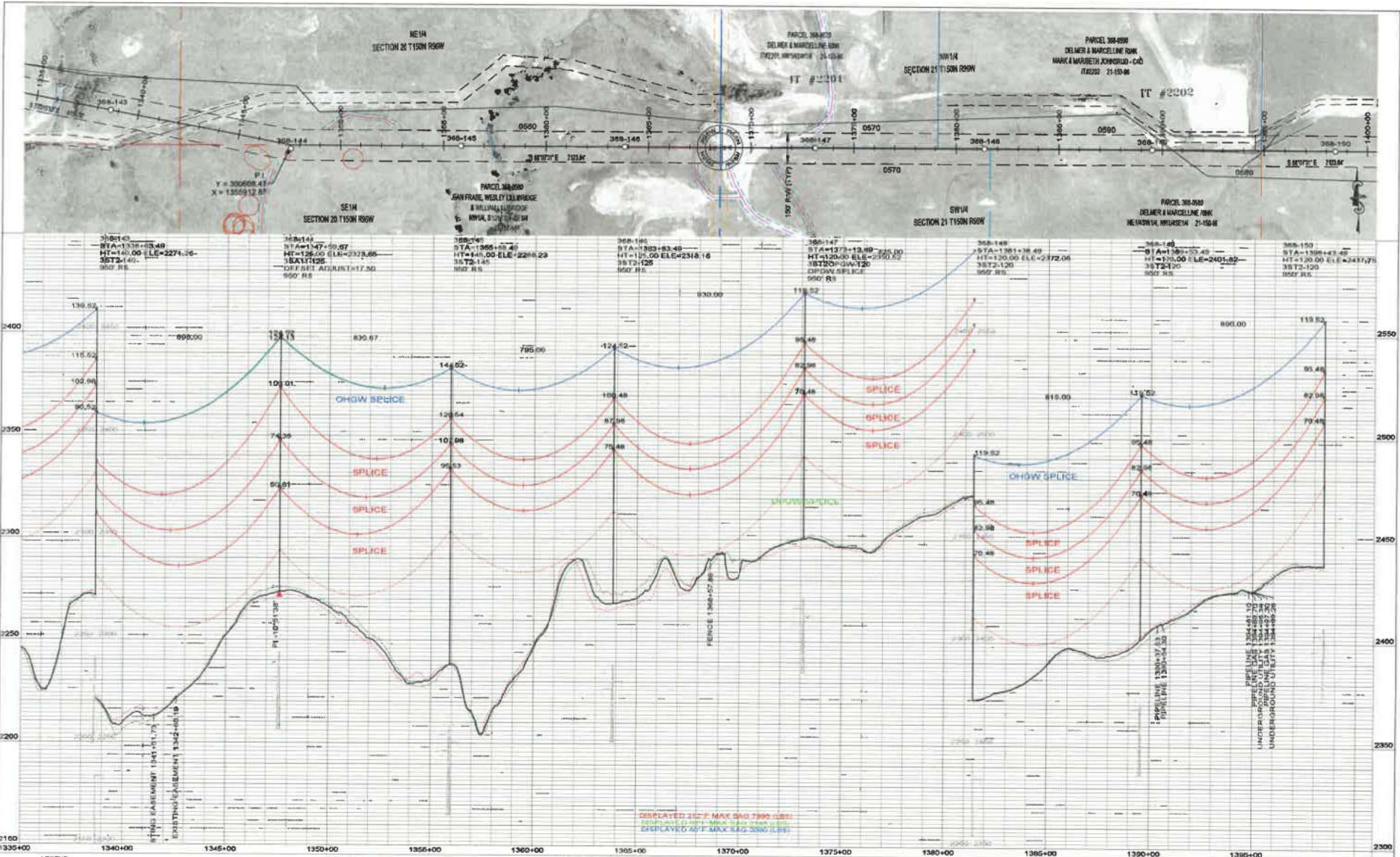


LEGEND		DESIGN INFORMATION										DRAWN BY		DATE		PROJECT		CLIENT			
	CULTURAL/TRIBAL AVOIDANCE	CLK	SV	SW	12/16	USE	2312 KC/MIL 78/19 THRAISHER	10668	22104	30014	950'	S. VASBINDER	08/15	TRANSMISSION SYSTEM MAINTENANCE		RABIN ELECTRIC POWER COOPERATIVE A TOUCHSTONE ENERGY COOPERATIVE	SCALE	VERTICAL = 20FT HORIZONTAL = 200FT	SHEET NO.	2	
	WETLAND AVOIDANCE	CLK	SV	SW	10/15	CONDUCT.	.571" 36 FIBER	2148	6500	10448	950'	C. KNOLL	08/15	355-PATENT GATE TO KUMMER RIDGE							
	BARBED WIRE FENCE	REV.	DESCRIPTION																		
	UNDERGROUND PIPELINE	0	FOR CONSTRUCTION																		
	UNDERGROUND UTILITY																				
	OVERHEAD UTILITY																				
	SECTION LINE																				
	QUARTER SECTION LINE																				
	SIXTEENTH SECTION LINE																				
	PROPERTY LINE																				
	ACCESS CENTERLINE																				
	ACCESS SIDELINES																				

DISPLAYED 212" MAX SAG 7850 LBS/L  
 DISPLAYED 60" MAX SAG 5000 LBS/L

PLAN AND PROFILES  
 STATION: 1285+00 TO 1335+00  
 STRUCTURE: 368-137 TO 368-143

SCALE VERTICAL = 20FT  
 HORIZONTAL = 200FT  
 SHEET NO. 368-090-T3-028  
 TOTAL SHEETS 2



**LEGEND**

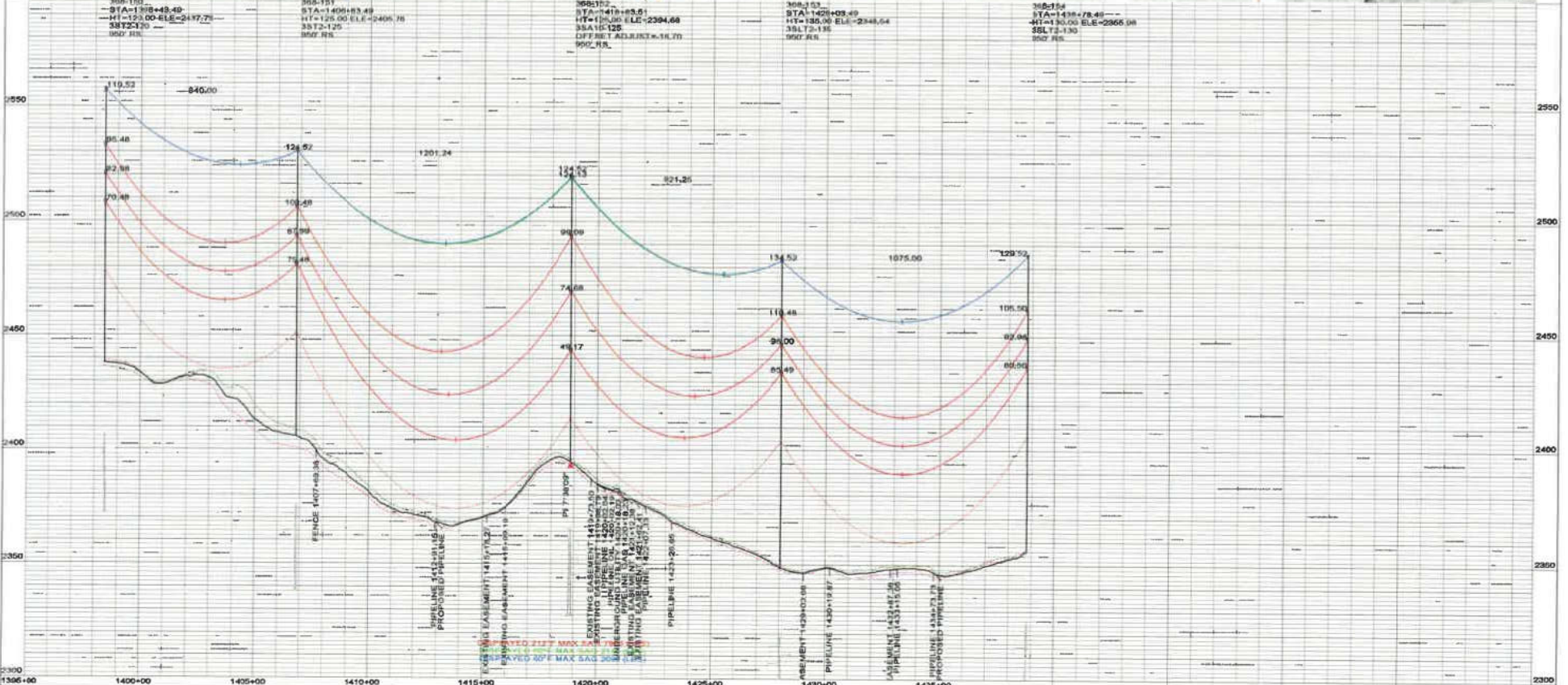
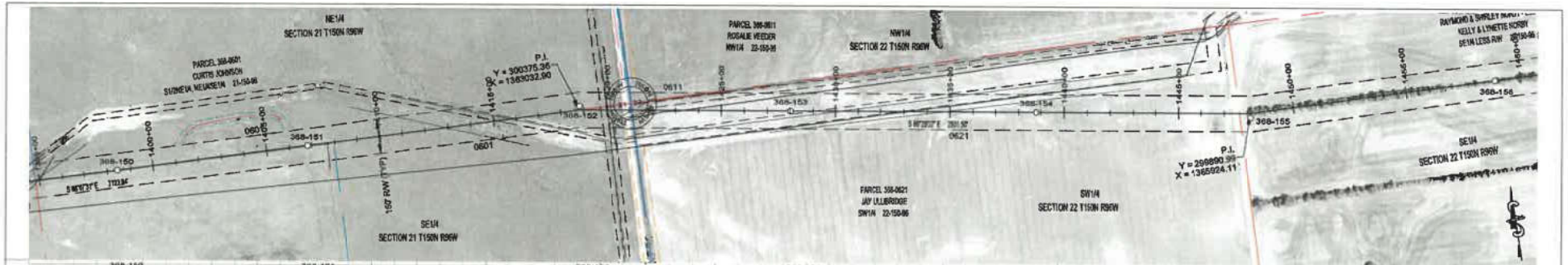
	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SIXTEENTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	UNDERGROUND UTILITY		ACCESS CENTERLINE
	OVERHEAD UTILITY		ACCESS SIDELINES

REV.	DESCRIPTION	DRWN	DSGN	APPO	DATE	QHW	W/F	W/F	W/F	W/F	W/F	W/F	W/F	W/F	W/F	W/F	W/F	W/F
3	AS BUILT	CLK	SV	SW	12/18													
2	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15													
1	MOVED STRUCTURE #148 AHEAD 20'	CLK	SV	SW	10/15	CONDUCT.	2312	KCMIL	70/19	THRASHER	10692	22104	30014	950'				
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OPGW	571	36	FIBER	2148	6500	10448	850'					

DESIGNED BY: <b>S. VASBINDER</b>	DATE: 08/15	PROJECT: <b>TRANSMISSION SYSTEM MAINTENANCE 36-PATENT GATE TO KUMMER RIDGE</b>	
DRAWN BY: <b>C. KNOLL</b>	DATE: 08/15		
CHECKED BY: <b>S. WISEMAN</b>	DATE: 08/15	CLIENT: <b>MCKENZIE</b>	SCALE: VERTICAL = 20FT HORIZONTAL = 200FT
APPROVED BY: <b>R. LANG</b>	DATE: 08/15	PROJECT MANAGER: <b>S. WISEMAN</b>	

**PLAN AND PROFILES  
STATION: 1335+00 TO 1398+47  
STRUCTURE: 368-143 TO 368-150**

368-090-T3-029 3

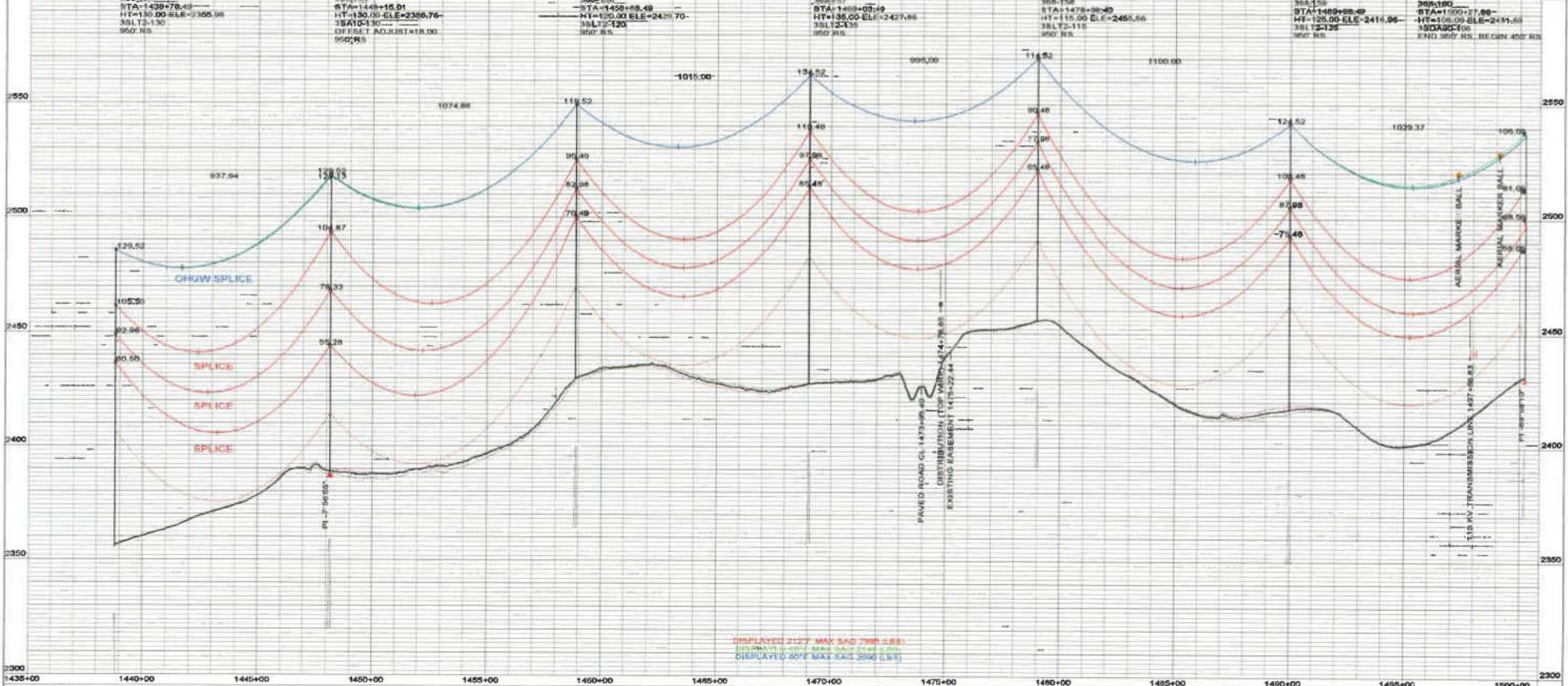


**LEGEND**

	CULTURAL/TRIBAL AVOIDANCE		SECTION LINE
	WETLAND AVOIDANCE		QUARTER SECTION LINE
	BARBED WIRE FENCE		SKIERTH SECTION LINE
	UNDERGROUND PIPELINE		PROPERTY LINE
	OVERHEAD UTILITY		ACCESS CENTERLINE
			ACCESS SIDELINES

DESIGN INFORMATION									
2	AS BUILT	CLK	SV	SW	12/16	DATE	2312	KCMIL	75/19
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	DATE	CONDUCT.	10680	22104
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	DATE	OPGW	571	36
REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	HOW	716	EHS	2090
							5600	10448	950
							9680	960	

DESIGNED BY: S. VASBINDER	DATE: 08/15	PROJECT: TRANSMISSION SYSTEM MAINTENANCE	
CHECKED BY: C. KNOLL	DATE: 08/15	LOCATION: 368-PATENT GATE TO KUMMER RIDGE	
DESIGNED BY: S. WISEMAN	DATE: 08/15	CITY: MCKENZIE	SCALE: VERTICAL = 20FT HORIZONTAL = 250FT
CHECKED BY: R. LANG	DATE: 08/16	PROJECT: 368-090-T3-030	
DESIGNED BY: S. WISEMAN	DATE: 08/15	STRUCTURE: 368-150 TO 368-154	REV. NO: 2



**LEGEND**

- CULTURAL / TRIBAL AVOIDANCE
- WETLAND AVOIDANCE
- BARBED WIRE FENCE
- UNDERGROUND PIPELINE
- UNDERGROUND UTILITY
- OVERHEAD UTILITY
- SECTION LINE
- QUARTER SECTION LINE
- SIXTEENTH SECTION LINE
- PROPERTY LINE
- ACCESS CENTERLINE
- ACCESS SIDELINES

DESIGN INFORMATION										
2	AS BUILT	CLK	SV	SW	12/18					
1	UPDATED OPGW INFORMATION	CLK	SV	SW	10/15	CONDUCT.	2312 KCMIL 70/19 THUNDER	10689	22104	30014
0	FOR CONSTRUCTION	CLK	SV	SW	08/15	OPGW	57' 36" FIBER	2148	8500	10448
REV.	DESCRIPTION	DRWN	DSGN	APPD	DATE	OHGW	7/16 EHS	2020	6860	9696

DESIGNED BY: S. VASBINDER  
 DRAWN BY: C. KNOLL  
 CHECKED BY: S. WISEMAN  
 PROJECT: TRANSMISSION SYSTEM MAINTENANCE  
 LOCATION: 365-PATENT GATE TO KUMMER RIDGE  
 COUNTY: MCKENZIE

DATE: 08/15  
 DATE: 08/15  
 DATE: 08/15  
 DATE: 08/16  
 DATE: 08/15

**PLAN AND PROFILES**  
 STATION: 1435+00 TO 1500+28  
 STRUCTURE: 368-154 TO 368-150

BASIN ELECTRIC POWER COOPERATIVE  
 A TRANSMISSION SYSTEM MAINTENANCE PROJECT

SCALE: VERTICAL = 20FT  
 HORIZONTAL = 200FT

368-080-T3-031

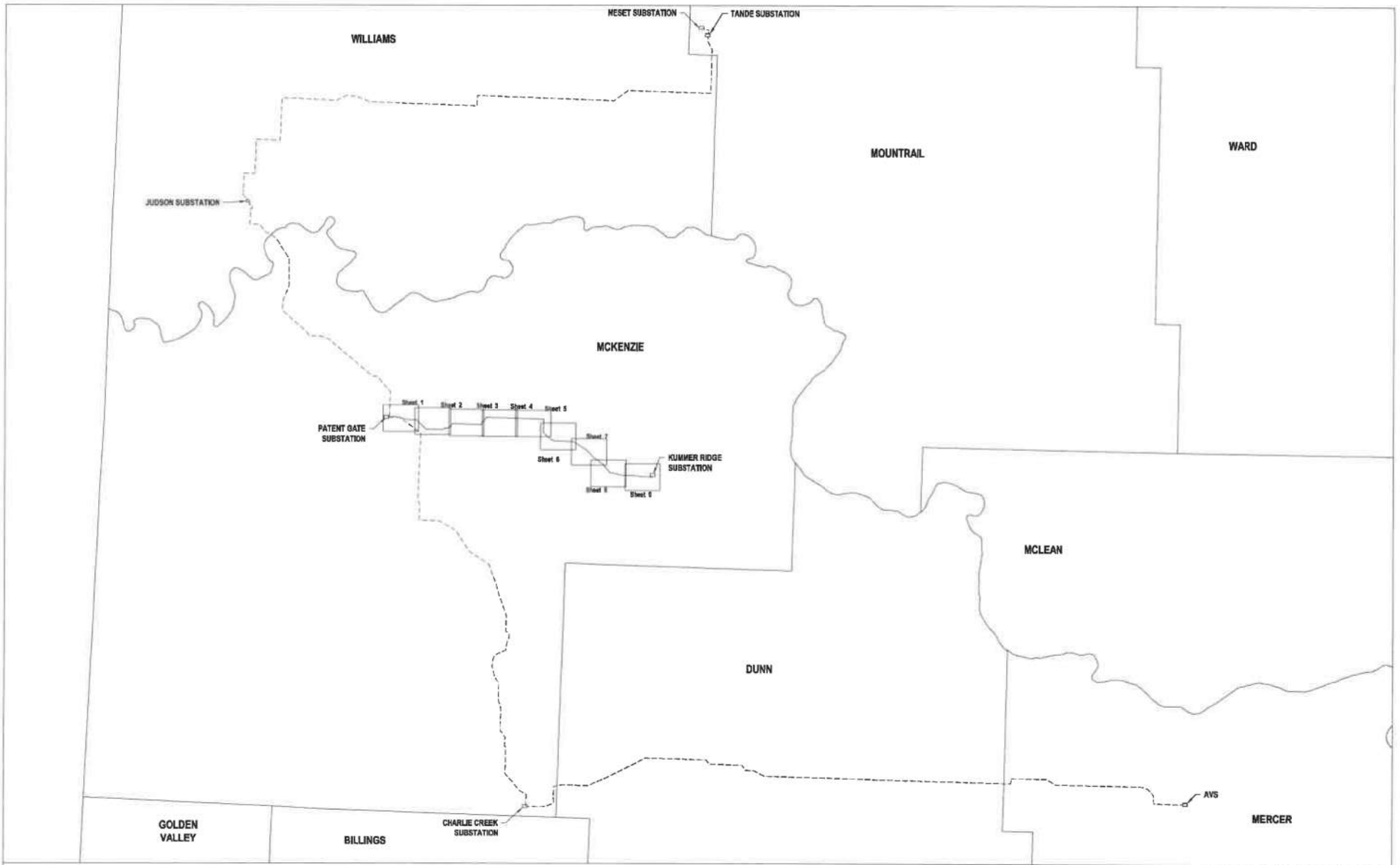


**BASIN ELECTRIC POWER COOPERATIVE  
CASE NO. PU-14-813**

**ASBUILT  
PLAN AND PROFILES AND STRUCTURE LOCATIONS FOR  
NORTH KILLDEER LOOP PHASE 1  
345kV TRANSMISSION PROJECT**

**LINE 368 - PATENT GATE TO KUMMER RIDGE SEGMENT**

**NORTH DAKOTA PUBLIC SERVICE COMMISSION  
FEBRUARY 2017**



ASBUILT STRUCTURE LOCATIONS  
CASE #PU-14-813  
SHEET INDEX MAP



A Touchstone Energy Cooperative



Basis of Bearing is NAD83 ND State Plane North Zone - International Foot. All distances are Ground Distance. Combined scale factor = 0.69986172

SEC. 26, 35 & 36 - T151N-R100W  
 SEC. 31 & 32 - T151N-R99W  
 MCKENZIE COUNTY, NORTH DAKOTA

NOTE:  
 ASBUILT STRUCTURE PLACEMENT AS OF 2-1-2017

PSC SUBMITTAL FOR LINE 368  
 CASE #PU-14-813  
 345KV TRANSMISSION LINE  
**BASIN ELECTRIC  
 POWER COOPERATIVE**  
 A Tractelco Energy Cooperative



Bearings of Bearing in NAD83 ND State Plane North Zone - International Feet. All distances are Ground Distances. Combined scale factor = 0.99985172

SEC. 32, 33, 34 & 35 - T151N-R99W  
MCKENZIE COUNTY, NORTH DAKOTA

NOTE:  
ASBULT STRUCTURE PLACEMENT AS OF 2-1-2017

PSC SUBMITAL FOR LINE 368  
CASE #PU-14-813  
345KV TRANSMISSION LINE  
BASIN ELECTRIC  
POWER COOPERATIVE  
A Touchstone Energy® Cooperative



Basis of Bearing is NAD83 ND State Plane North Zone - International Feet. All distances are Ground Distance. Combined scale factor = 0.99985172

SEC. 35 & 36 - T151N-R99W  
 SEC. 29, 30 & 31 - T151N-R98W  
 MCKENZIE COUNTY, NORTH DAKOTA

NOTE:  
 ASBUILT STRUCTURE PLACEMENT AS OF 2-1-2017

PSC SUBMITTAL FOR LINE 368  
 CASE #PU-14-813  
 34.5KV TRANSMISSION LINE  
 BASIN ELECTRIC  
 POWER COOPERATIVE  
 A "YouthShare Energy" Cooperative



Basis of Bearing is NAD83 ND State Plane North Zone - International Feet. All distances are Ground Distances. Combined scale factor = 0.99989172

SEC. 26, 27, 28 & 29 - T151N-R98W  
MCKENZIE COUNTY, NORTH DAKOTA

**NOTE:**  
ASBUILT STRUCTURE PLACEMENT AS OF 2-1-2017

PSC SUBMITTAL FOR LINE 368  
CASE #PU-14-813  
145KV TRANSMISSION LINE  
**BASIN ELECTRIC POWER COOPERATIVE**  
A Touchstone Energy® Cooperative

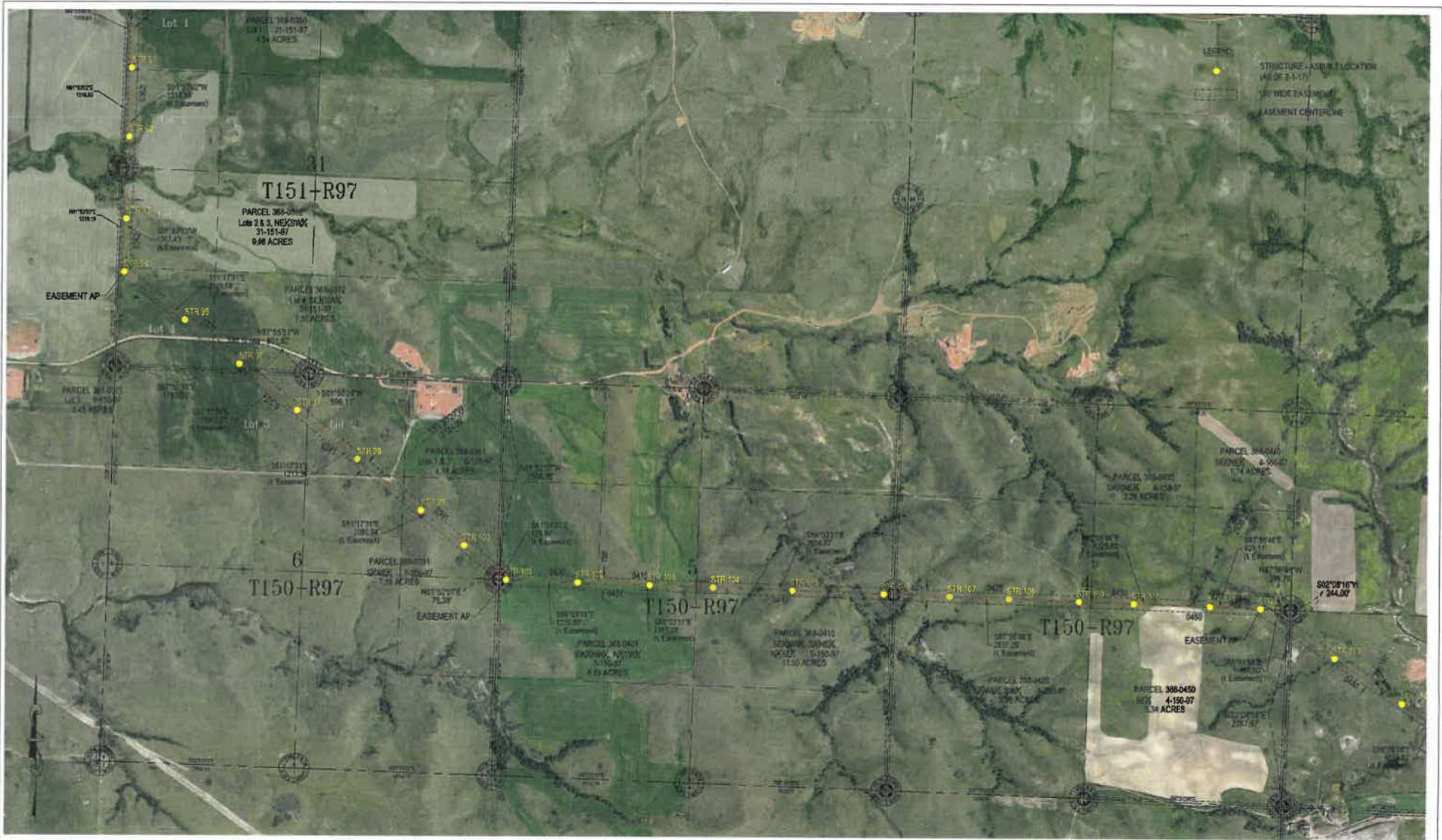


Back of Bearing is NAD83 ND State Plane North Zone - International Feet. All distances are Ground Distances. Combined scale factor = 0.99985172

SEC. 25 & 26 - T151N-R96W  
 SEC. 30 & 31 - T151N-R97W  
 MCKENZIE COUNTY, NORTH DAKOTA

NOTE:  
 ASBUILT STRUCTURE PLACEMENT AS OF 2-1-2017

PSC SUBMITTAL FOR LINE 368  
 CASE #PU-14-813  
 145KV TRANSMISSION LINE  
**BASIN ELECTRIC  
 POWER COOPERATIVE**  
 A Touchstone Energy Cooperative

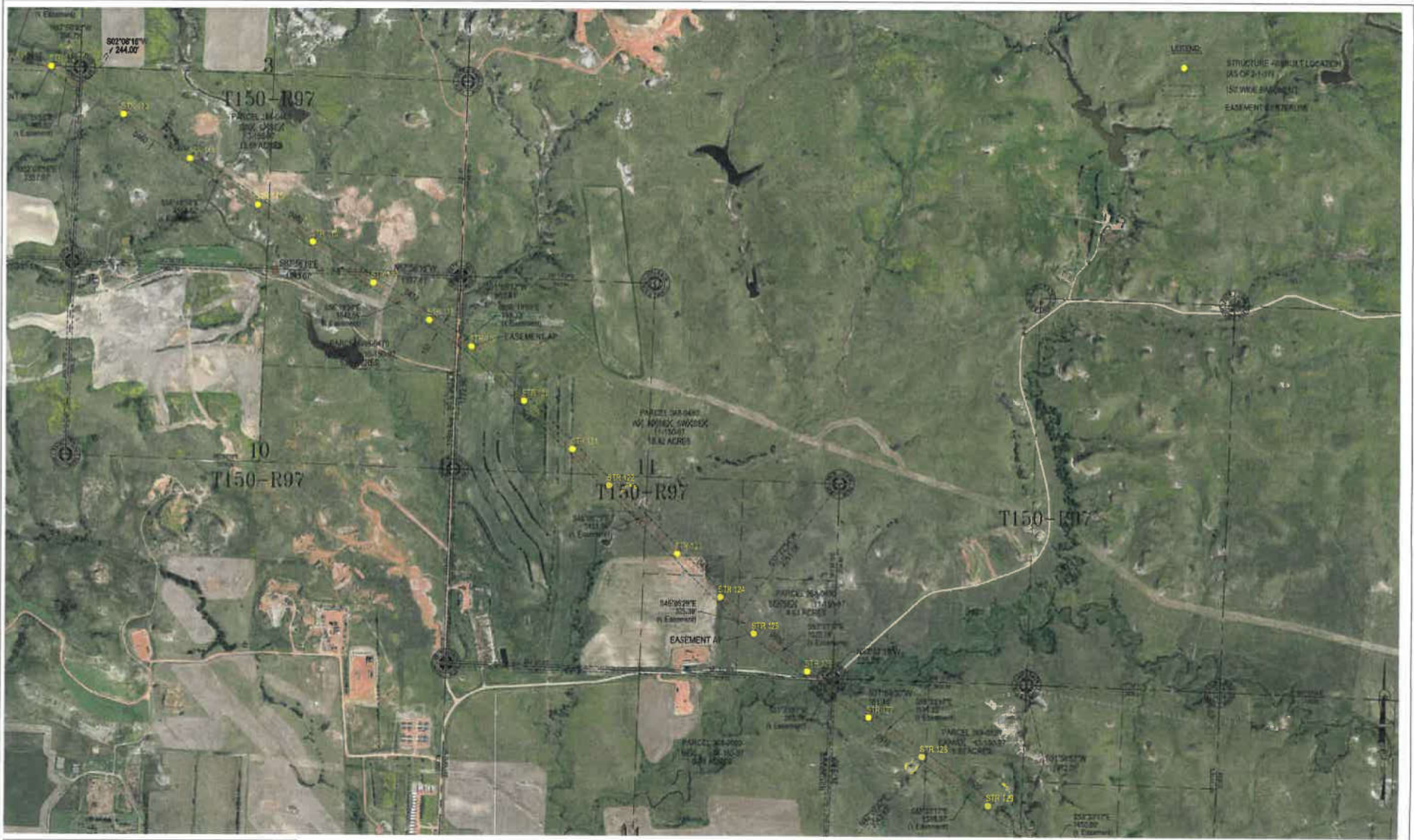


Basis of Bearing is NAD83 ND State Plane North Zone - International Feet. All distances are Ground Distances. Combined scale factor = 0.9995172

SEC. 3, 4, 5 & 6 - T150-R97W  
MCKENZIE COUNTY, NORTH DAKOTA

**NOTE:**  
ASBUILT STRUCTURE PLACEMENT AS OF 2-1-2017

PSC SUBMITTAL FOR LINE 368  
CASE #PU-14-813  
345KV TRANSMISSION LINE  
BASIN ELECTRIC  
POWER COOPERATIVE  
A Tracterra Energy Cooperative



Basis of Bearing is NAD83 ND State Plane North Zone - International Feet. All distances are Ground Distances. Combined scale factor = 0.99965172

SEC. 10, 11, 13 & 14 - T150N-R97W  
MCKENZIE COUNTY, NORTH DAKOTA

NOTE:  
ASBUILT STRUCTURE PLACEMENT AS OF 2-1-2017

PSC SUBMITTAL FOR LINE 368  
CASE #PU-14-813  
345KV TRANSMISSION LINE  
**BASIN ELECTRIC  
POWER COOPERATIVE**  
A Truist Energy Cooperative

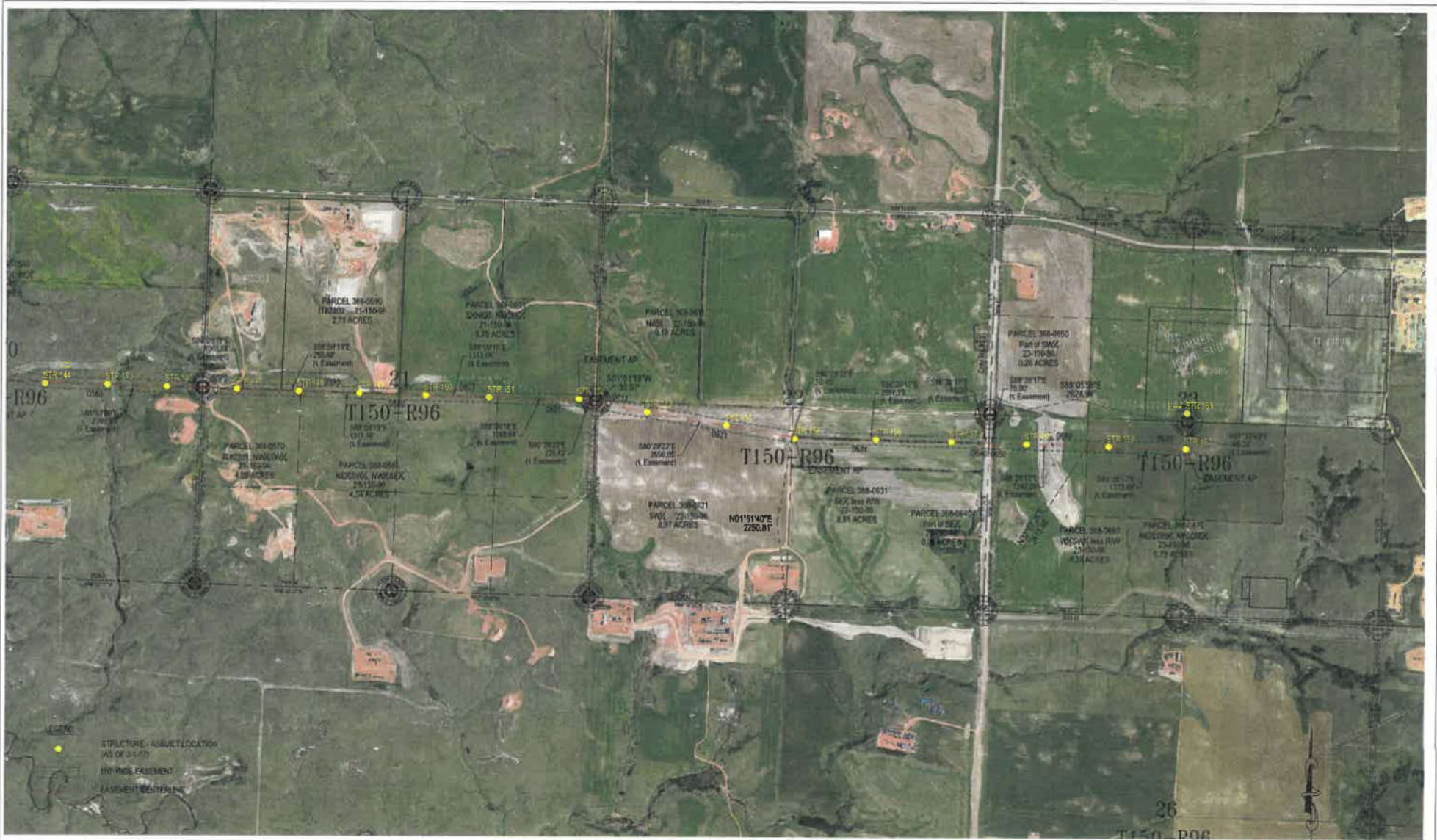


Scale of Drawing is NAD83 ND State Plane North Zone - International Feet. All distances are Ground Distances. Combined scale factor = 0.99985172

SEC. 18, 19, 20 & 21 - T150N-R96W  
 SEC. 13 - T150N-R97W  
 MCKENZIE COUNTY, NORTH DAKOTA

NOTE:  
 STRUCTURE PLACEMENT AS OF 2-1-2017

PSC SUBMITTAL FOR LINE 368 CASE #PU-14-813 345KV TRANSMISSION LINE <b>BASIN ELECTRIC          POWER COOPERATIVE</b> <small>A "Youthtime Energy" Cooperative</small>
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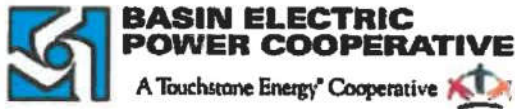


Base of Bearing is NAD83 ND State Plane North Zone - International Feet. All distances are Ground Distances. Combined scale factor = 0.99995172

SEC. 21, 22 & 23 - T150N-R96W  
MCKENZIE COUNTY, NORTH DAKOTA

NOTE:  
ASBUILT STRUCTURE PLACEMENT AS OF 2-1-2017

PSC SUBMITTAL FOR LINE 368  
CASE #PU-14-813  
345KV TRANSMISSION LINE  
**BASIN ELECTRIC  
POWER COOPERATIVE**  
A Redstone Energy Cooperative



August 16, 2017

Darrell Nitschke  
Executive Director  
North Dakota Public Service Commission  
600 East Boulevard - Dept. 408  
Bismarck, ND 58505-0480

Re: Case No. PU-14-813  
Basin Electric Power Cooperative  
North Killdeer Loop Phase I 345-kV Transmission Project  
Partial Tree/Shrub Mitigation Plan

Dear Mr. Nitschke:

As per conditions of the Tree and Shrub Mitigation Specifications in the North Dakota Public Service Commission ( ND PSC) Findings of Fact, Conclusions of Law and Order for the North Killdeer Loop Phase I 345-kV Transmission Project (Project) in Case No. PU-14-813, you will find Basin Electric Power Cooperative's (Basin Electric) initial Tree/Shrub Mitigation Plan (Plan). Because we have not identified all tree planting opportunities, this submittal represents the initial portion of the Project's overall tree/shrub Mitigation Plan. This Partial Tree/Shrub Mitigation Plan has been filed electronically to the PU-14-813 docket.

The Project was approximately 28 miles in length, located between the newly installed Patent Gate and Kummer Ridge Substations all located within McKenzie County. The transmission line was placed into electrical service in late September 2016.

Pre-project and post-project tree/shrub surveys were performed by our consultant. The total number of tree/shrubs removed is estimated to be 1,129 from nineteen landowners. Ten of the nineteen landowners have requested replacement plantings consisting of 1,534 (767 x 2) trees/shrubs.

The remaining obligation for tree/shrub replacement is 724 (362 x 2), of which Basin Electric's pursuit of planting opportunities continues. Because this Project and the AVS to Naset 345-kV Transmission Project (PU-11-696) are occurring simultaneously, the offer for trees/shrub planting opportunities that was offered to various city, county, state and federal agencies in the Project area in PU-11-696 are combined for that purposes.

The following describes our partial Tree/Shrub Mitigation Plan for the North Killdeer Loop Phase I 345-kV Transmission Project in specific terms when known and in general planning terms:

**Tree/Shrub Replacement Plan**

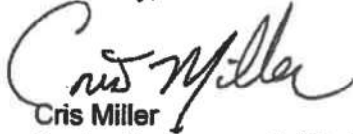
- **Pre-Planting Efforts**
  - Perform pre-project and post-project tree/shrub surveys that identifying species present and the quantification of tree/shrubs.
  - Identified landowners who requested replacement tree/shrubs on their property on a 2:1 replacement basis.
  
- **Landowner Tree/Shrub Planting Effort**
  - Communicated the landowner listings and the number of tree/shrub replacements required to the McKenzie County Soil Conservation Service (SCS) staff.
  - Basin Electric committed to be the funding source to the SCS to support the planting of the trees/shrubs on a 2:1 basis for 10 individual landowners.
  - SCS staff is coordinating with landowner to identify suitable lands for tree/shrub plantings and make recommendations for the specific tree/shrub varieties to enhance survivability.
  - Basin Electric committed to the additional cost of incorporating ground fabric in all tree/shrub planting projects. The placement of ground fabric is a strongly recommended by the SCS as it increases the survivability of the trees/shrubs.
  
- **Non-Landowner Tree/Shrub Planting Efforts -(Est. > 19,000 Tree/shrubs Required)**
  - Basin Electric will continue to identify Tree/Shrub replacement opportunities that create a public benefit by formal and informal communication with local, county, and state agencies.
    - Preference given for planting projects in the affected five counties, (Mercer, Dunn, McKenzie, Williams and Mountrail).
    - Formal communication to city, county and state agencies informing them of potential tree/shrub planting opportunities sent out March 2, 2017, as referenced in PU-11-696.

With the recent outreach effort to the various state, county and city agencies, numerous tree/shrub planting opportunities continue to be identified. When specific tree/shrub planting opportunities are identified and detailed planting plans developed, they will be submitted to the ND PSC for approval.

August 16, 2017  
Page 3

For inquiries regarding this initial Tree/Shrub Mitigation Plan, please contact me directly at 701 - 557-5635 or [cmiller@bepc.com](mailto:cmiller@bepc.com) .

Sincerely,

A handwritten signature in black ink that reads "Cris Miller". The signature is written in a cursive style with a large initial "C".

Cris Miller  
Senior Environmental Project Specialist

/ser  
Enclosures

cc: Casey Jacobson  
Amanda Wangler  
Mike Murray