TETRA TECH

October 4, 2019

Mr. Curtis B. Miller
Transmission Siting and Environmental Planner
Tri-State Generation and Transmission Association, Inc.
1100 W. 116th Ave.
Westminster, CO 80234

Re: **Traffic Memorandum**
Vollmer Transmission Line and Substation Project, El Paso County, Colorado

Dear Mr. Miller,

The purpose of this Traffic Memorandum is to analyze and document the traffic impacts of the proposed Vollmer Transmission Line and Substation Project (Project). Tri-State Generation and Transmission Association Inc. (Tri-State), in cooperation with member distribution cooperative Mountain View Electric Association (MVEA), is proposing to construct a new 115-kilovolt (kV) transmission line and a new 115/12.5kV substation (Vollmer Substation) near Falcon in El Paso County, Colorado. Collectively, the new transmission line and substation comprise the proposed Project. The Vollmer Substation will be located about 1 mile north of East Woodmen Road and about 0.7 mile east of the northern terminus of Mohawk Road (attached as Figure 1). The Project transmission line (Vollmer to Vollmer Tap 115kV transmission line) will tap Tri-State's existing Black Squirrel to Fuller 115kV transmission line, which is located a short distance east of the terminus of Falcon Meadows Boulevard, travels approximately 1.35 miles west within a 100-foot-wide right-of-way before terminating at the Vollmer Substation. No access currently exists to the Project area, but a new 0.7-mile temporary private access drive will be constructed within a 50-foot-wide easement beginning at the northern terminus of Mohawk Road and extending east to the Vollmer Substation site as part of Project construction. Tetra Tech prepared this Traffic Memorandum to analyze the peak construction traffic for the Project.

Project Construction Traffic Trip Generation

Construction Schedule and Activities

Tri-State and MVEA are currently working on Project permitting activities and final design of the proposed Project facilities. Construction is scheduled to begin approximately 12 to 15 months after an approval has been received through El Paso County's Areas and Activities of State Interest (1041) review process. Construction of Vollmer Substation is estimated to take 4 to 6 months to complete from contractor mobilization to energization, and construction of the transmission line is estimated to take 3 to 4 months. For this analysis, it was assumed that construction of the substation and transmission line will occur at the same time. The typical construction workday will see most workers arriving and departing during a common peak hour. The standard construction hours are anticipated to be 7:00 am to 7:00 pm. Most workers will arrive between 6:00 am and 7:00 am and depart between 6:00 pm and 7:00 pm at the construction sites. Construction will be limited to daylight hours.

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Project construction will generally include the following activities. Activities may vary based on construction phasing.

Substation Construction	Transmission Line Construction

• Mobilization
• Site preparation—clearing, grading, and staging area setup
• Construction
  ○ Access drive
  ○ Fencing
  ○ Equipment and material delivery
  ○ Foundations
  ○ Structures
  ○ Electrical equipment delivery and installation
  ○ Final grading and surfacing
  ○ Testing and commissioning of electrical equipment
• Landscaping
• Energization
• Cleanup and demobilization
	• Mobilization
	• Site preparation—staging area setup
	• Construction
	  ○ Foundations
	  ○ Transmission line structure delivery, erection, and installation
	  ○ Stringing of conductor and static wire
	• Testing and commissioning
	• Energization
	• Cleanup and demobilization

Haul Routes

Project traffic will include a combination of construction equipment, material delivery vehicles, construction workers, and job site personnel. Construction traffic will access the Vollmer Substation primarily from North Powers Boulevard and U.S. Highway 24 to Mohawk Road by way of East Woodmen Road. Similarly, primary access for traffic during construction of the transmission line will be from North Powers Boulevard and U.S. Highway 24 by way of East Woodmen Road. Direct access to the transmission line will be via Golden Sage Road to Woodman Frontage Road and then left onto Falcon Meadows Boulevard. The Project traffic distribution between North Powers Boulevard and U.S. Highway 24 was assumed to be about equal. A map illustrating the location of the Project and construction vehicle haul routes is attached as Figure 2.

Haul Route Road Classification

East Woodmen Road is classified as an expressway with four east-west through lanes. According to Map 6: Existing Capacity Analysis of the *El Paso County 2016 Major Transportation Corridors Plan Update,*[1] East Woodmen Road is considered "congesting" with about 22,000 vehicles per day (vpd), Map 5: Existing Traffic Volumes. At the intersection of East Woodmen

[1] https://publicworks.elpasoco.com/wp-content/uploads/Documents/MTCP-Adopted-Report-12-6-2016.pdf

Road with Mohawk Road, there are single dedicated turn lanes in each direction. Mohawk Road has a left turn lane and a combined right turn and through lane dedicated to traffic accessing East Woodman Road. On the south leg of the intersection, all three movements share one lane. The intersection is signalized with a simple two-phase traffic signal. A two-phase traffic signal has one green phase for the major street and one green phase for the minor street, and left turn movements are not given a protected phase. The Golden Sage Road and East Woodmen Road intersection that will provide access for transmission line construction traffic is a signalized intersection with dedicated left and right turn lanes. The Woodmen Frontage Road can serve as a secondary access between Mohawk Road and Falcon Meadows Boulevard for local traffic. Mohawk Road and Falcon Meadows Boulevard terminate about 0.9 mile north of their intersection with the Woodman Frontage Road; however, there is no connection between these roads at their terminus. Presently, Mohawk Road and Falcon Meadows Boulevard serve as primary access for small large-lot residential communities north of East Woodmen Road.

Construction Traffic Estimates

The Institute of Transportation Engineers (ITE) *Trip Generation Manual, 10th Edition* does not address values for the construction of a substation or high voltage electric transmission line. The estimates for Project duration, number of workers and vehicles, quantity of materials and equipment, and number of deliveries required to construct the proposed Project was provided by Tri-State and is based on their prior experience constructing substations and transmission lines (see Figure 3 - Project Construction Vehicle Table). Utilizing the estimates, it is anticipated that peak construction traffic (one-month duration) will be less than 80 vehicle round trips per day. Only 26 to 32 vehicles are expected during peak hours.

A commonly used measure of the performance of a roadway or intersection is level of service (LOS). Roadway LOS is measured on a scale from A to F, where “A” represents the best operations with no congestion. LOS “F” represents poor LOS with severe congestion. LOS is reported for the peak hour of a roadway, the “peak hour” representing a morning or afternoon commuting rush hour. According to the *2016 Major Transportation Corridors Plan Update*, El Paso County’s goal is to maintain LOS D or better on each roadway segment. Since East Woodmen Road experiences about 22,000 vpd, the *Highway Capacity Manual, 6th Edition* guidelines estimate that 2,200 of those vehicles will be peak-hour vehicles, or around 550 vehicles per lane per hour. Project construction traffic will be considerably less than the confidence interval of the estimated traffic values. There is an uncertainty of at least +/- 50 peak-hour vehicles on East Woodmen Road.

Mohawk Road provides access to about 23 single-family homes situated on large lots along Mohawk Road. To address the number of daily trips associated with single-family homes, the analysis made use of data from the ITE *Trip Generation Manual.* 9.44 trips per day is a generally accepted estimate per single-family home. This amounts to an estimated 217 one-way trips per day on Mohawk Road. The intersection with East Woodmen Road will see around double that number because of additional traffic from the Woodmen Frontage Road, an estimated 435 one-way trips per day, or approximately 44 trips during peak hour. The number of vehicles that

could utilize the minor leg of the intersection in an hour on a green light from Mohawk Road was estimated to be about 450. A similar number could make the turn onto Mohawk Road. Thus, Mohawk Road and the intersection turning movements entering and exiting East Woodmen Road are underutilized. The intersection is at roughly 10% capacity and is capable of accommodating Project vehicles. Based on the analysis conducted, Project construction traffic will be an insignificant and negligible addition to existing traffic and will have no substantive influence on the East Woodmen Road LOS. The LOS at the intersection with Mohawk Road was estimated to be "C", which will be better than the acceptable LOS D for urban signalized intersections. Project vehicle traffic will not change the LOS for this intersection.

Transmission line construction traffic will utilize both Mohawk Road and Falcon Meadows Boulevard (see Figure 2). Construction traffic will access Falcon Meadows Boulevard by exiting East Woodmen Road onto Golden Sage Road, turn right (east) onto the Woodmen Frontage Road, and then travel less than 1,000 feet to Falcon Meadows Boulevard. Traffic volume on Falcon Meadows Boulevard provides access to about 68 single-family homes situated on large lots along and west of Falcon Meadows Boulevard. Using the estimate of 9.44 trips per day per single-family home equals about 642 one-way trips per day. There are also about 50 homes a little over 0.5 mile east of Falcon Meadows that will also use the Golden Sage Road and East Woodmen Road intersection by way of the Woodmen Frontage Road. The addition of trips associated with these homes will increase the number of trips to 1,114 one-way trips per day, which will be about 110 trips during peak hour. The intersections minor leg can service roughly the same number of vehicles as Mohawk Road (450 per hour). The Golden Sage Road and East Woodmen Road intersection will have less construction traffic than the East Woodman Road and Mohawk Road intersection since it will only be utilized for transmission line construction vehicles. Delays for vehicles turning left from East Woodman Road onto Golden Sage Road may occur due to the amount of through traffic on East Woodmen Road, but no more than three construction vehicles are anticipated to use this movement during peak hours.

Operational Traffic Trip Generation

After the Project has been constructed and placed in service, traffic impacts from operations are not expected because the substation and electric transmission line are passive uses and will not generate trips in excess of those occasionally needed for maintenance or emergencies. The substation will not be staffed, and the only vehicles entering and exiting the site on a monthly basis will be related to maintenance.

Based on the analysis conducted, Tetra Tech believes the Project construction traffic will be incorporated into the existing roadway network without noticeable impact. The results of our analysis are as follows:

- The added Project construction traffic will be less than typical daily fluctuations in traffic volume and represents no measurable impact to streets and intersections.
- It is anticipated that construction activities will neither block roadways nor impede daily traffic volume due to the location of the Project and the proposed type of construction.

- Vehicles associated with maintaining the substation and the transmission line are generally pickup trucks or an occasional bucket truck and will have a negligible impact to transportation infrastructure. Such vehicles will likely only access the Project site on a monthly basis.

In conclusion, Tetra Tech does not recommend any changes to the roadway configurations. Tetra Tech further concludes that short-term construction impacts to local infrastructure will be minimal, and long-term operations impacts will be negligible. If you have any questions or require any additional information, please do not hesitate to contact me at (303) 980-3549.

Sincerely,
TETRA TECH, INCORPORATED

Perry Patton, P.E.
Project Civil Engineer

Eric Mathers, E.I.
Civil Engineer I

Attachments

Figure 1—Vicinity Map
Figure 2—Haul Route
Figure 3—Project Construction Vehicle Table
Site Plan

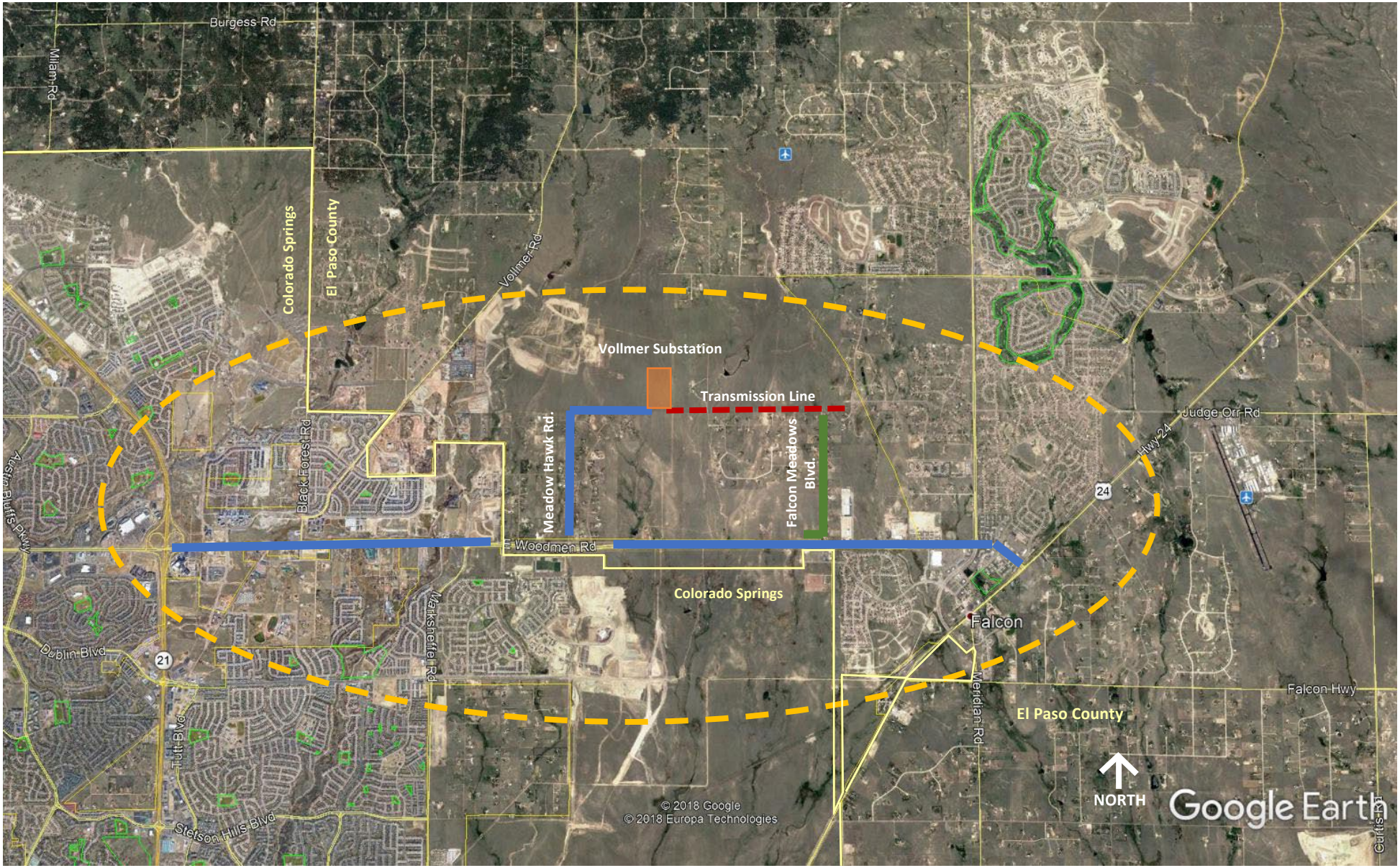

Figure 1 – Vicinity Map

Tri-State Generation and Transmission

Haul Route Map

Vollmer Substation and Tansmission Line

Haul Routes

- Substation & Transmission Line
- Transmission Line

- Proposed Transmission Line
- Vollmer Substation Property
- Township/Range

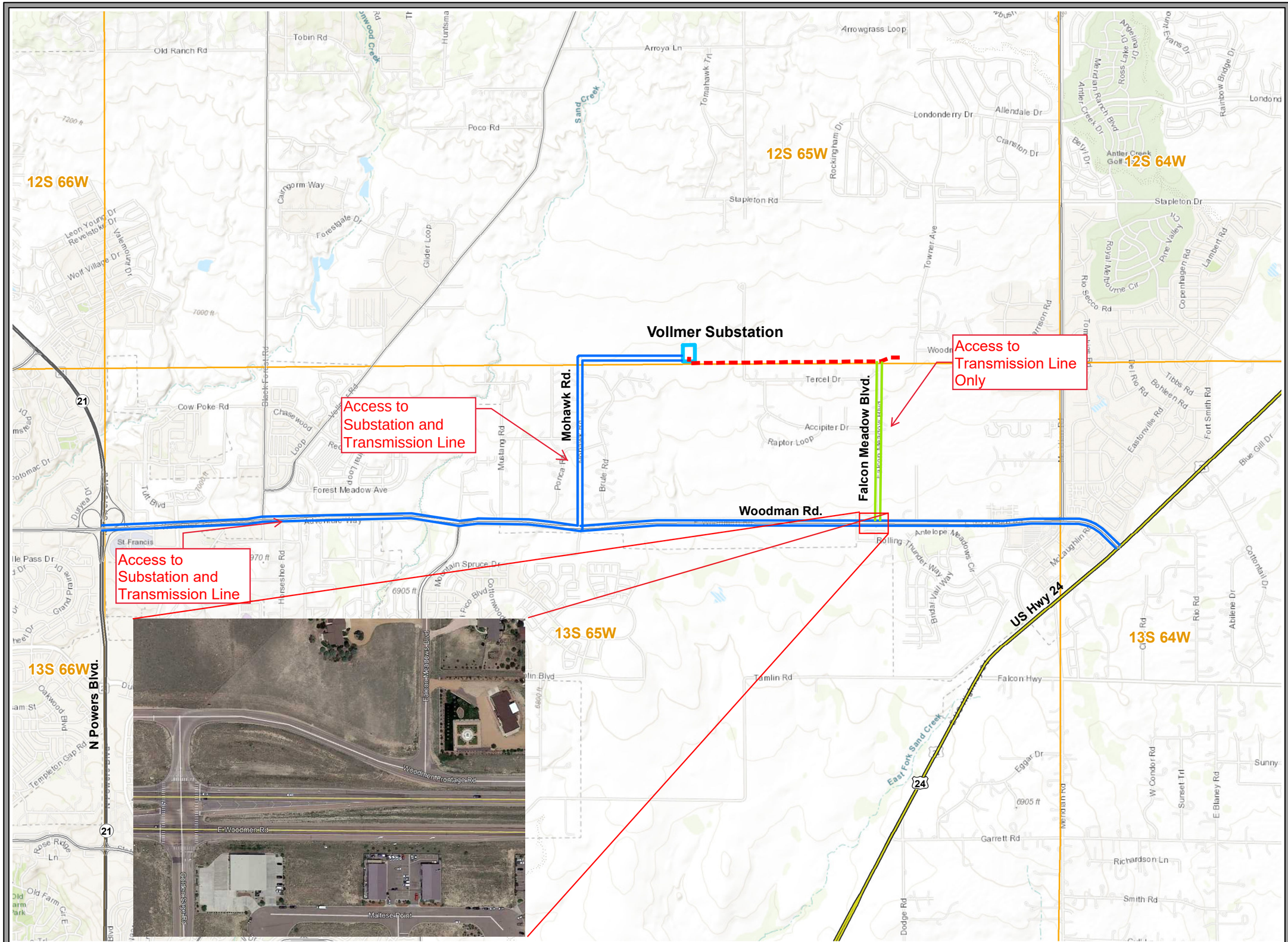

Figure 2

TRI-STATE G&T A Touchstone Energy Cooperative

Geographic Information Systems

0 0.25 0.5 1 Miles

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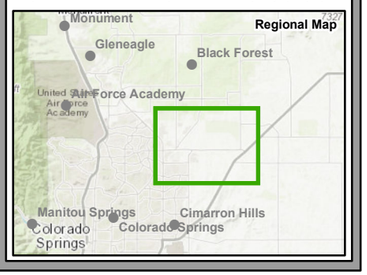
Updated By: curtmi

Updated: 4/11/2019



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Substation Construction

Using: Woodman Road and Mohawk Road

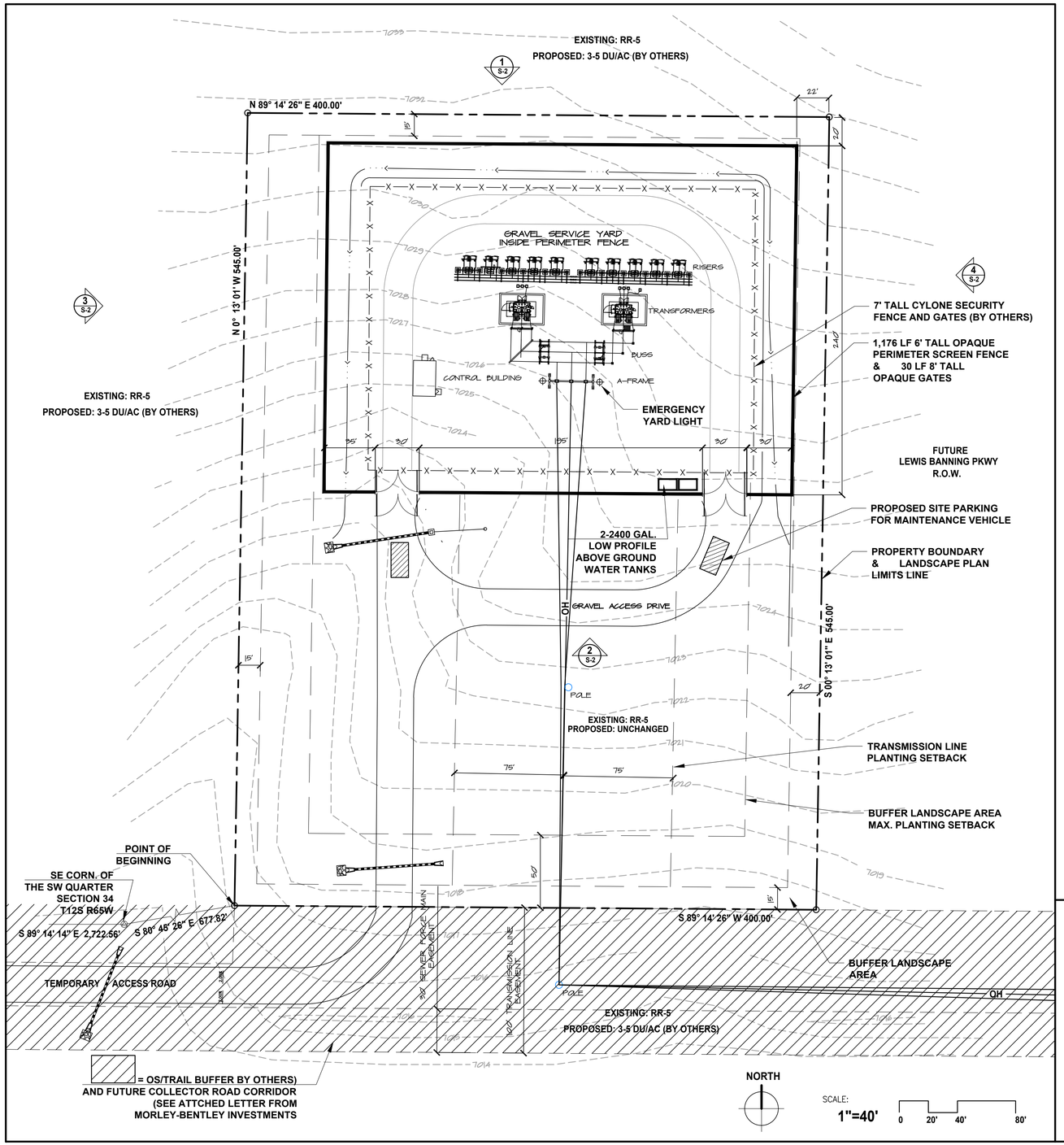
Activity	Equipment	Weight Estimates (lbs)	Round Trip Counts	Duration on Site	VPD	Peak Hr. Trips
Site Preparations	Bulldozers /Excavators	30,000	1	8 weeks	3.5	2
	Grader	60,000-70,000	1			
	Water truck	54,000	1/day for 8 weeks			
	Backhoe	14,000	1			
	Pick-up trucks	10,000	2/day for 8 weeks (80)			
	Bobcat	8,000	1			
Foundations/ Materials delivery	Tractor trailers	40,000-80,000	4/day for 3 weeks then 2/day for 5 weeks (110 trips)	12 weeks	8	3
	Pressure digger	40,000	1			
	Pick-up trucks	10,000	2/day for 12 weeks (120)			
	Concrete truck	40,000-80,000	4/day for 3 weeks (60)			
Structure Assembly and Wiring	Bucket trucks	40,000-50,000	1	12 weeks	4	3
	Boom truck	20-30 tons	1			
	Man lift	10,000	1			
	Crane	80,000	1			
	Pick-up trucks	10,000	3/day for 12 weeks (180)			
	Transformers Via tractor trailer	110,000	1			

Transmission Line Construction

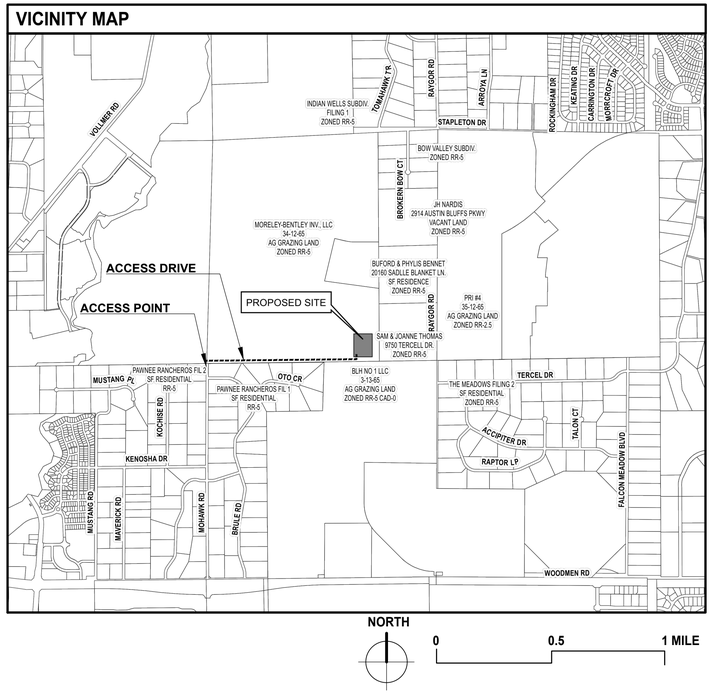
Using: Woodman Road, Mohawk Road, and Falcon Meadows Blvd.

Activity	Equipment	Weight Estimates (lbs)	Round Trip Counts	Duration on Site	ADT	Peak Hr. Trips
Material delivery	foreman pickup	10,000	1-3 per day	1 week	7	4
	line crew trucks	38,000	2-6 per day			
	dump truck	20,000-70,000	1			
	tractor/trailer	40,000-60,000	1- per day			
	skidsteer	8000	1			
Structure Assembly and Erection	bucket trucks	40,000-50,000	1	1 week	6	4
	digger trucks	80,000-110,000	1			
	skidsteers	5,000-10,000	1			
	foreman pickups	10,000	1-3 per day			
	backhoe	14,000	1			
	line crew trucks	38,000	2-6 per day			
	tractor/trailers	40,000-60,000	1			
Wire Installation	puller	40,000	1	1 week	4	3
	line crew trucks	38,000	2-6 per day			
	tensioner	5,000-10,000	1			
Cleanup	skidsteer	8000	1	1 week	5	3
	tractor trailer	40,000-60,000	1			
	foreman pickup	10000	1-3 per day			
	line crew trucks	38000	2-6 per day			

***NOTE** : Transmission line construction is assumed to occur at the same time as the substation contruction.*



VICINITY MAP



PROJECT DATA TABULATION

	ITEM	%	QTY	UNIT
1	PROPERTY SQUARE FOOTAGE	100	217,800	SF
2	CONTROL BUILDING SQUARE FOOTAGE 25'X15'	>1	375	SF
3	PARKING/VEHICULAR USE AREAS - MAINTENANCE VEHICLES	42	91,225	SF
4	LANDSCAPED AREA	67	126,200	SF

LEGAL DESCRIPTION

A PARCEL OF LAND IN THE SOUTTHEAST QUARTER OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER (SE 1/4, SW 1/4, SE 1/4) OF SECTION 34, TOWNSHIP 12 SOUTH, RANGE 65 WEST, OF THE SIXTH PRINCIPAL MERIDIAN, EI PASO COUNTY, COLORADO, MORE PARTICUIARLY DESCRIBED AS FOLLOWS:
BASIS OF BEARINGS: THE SOUTH LINE OF THE SOUTHWEST QUARTER (SWI/4) OF SECTION 34, TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M. EL PASO COUNTY, COLORADO. TI-IE SOUTHWEST CORNER OF SAID SOUTHWEST QUARTER (SWI/4) BEING MONUMENTED WITH A 2-1/211 ALUMINUM CAP STAMPED 11LS 11624", FROM WHICH THE SOUTHEAST CORNER OF SAID SOUTHWEST QUARTER {SWI/4) BEING MONUMENTED WITH A 2-1/2" ALUMINUM CAP STAMPED 11LS 1162411, BEARS N89°14114nE, A DISTANCE OF 2,722.56 FEET.
COMMENCING AT THE SOUTHEAST CORNER OF SAID SOUTHWEST QUARTER {SWI/4} OF SECTION 34;
THENCE N80"45'26"E, A DISTANCE OF 677.82 FEET TO THE POINT OF BEGINNING;
THENCE N00°13'01"W, A DISTANCE OF 545,00 FEET;
THENCE N89.1412611E, A DISTANCE OF 400.00 FEET;
THENCE S00°1310111E, A DISTANCE OF 545.00 FEET;
THENCE S89°14'26"W, A DISTANCE OF 400.00 FEET TO THE POINT OF BEGINNING;
SAID PARCEL CONTAINS A CALCULATED AREA OF 5.00 ACRES MORE OR LESS.

LEGEND

- EXISTING OVERHEAD LINE — OH —
- EASEMENT LINE
- PROPERTY LINE
- EXISTING CONTOUR LINE 7052
- PROPOSED FENCE LINE —x—x—x—x—
- SCREEN FENCE
- PROPOSED EMERGENCY YARD LIGHT

MARK BUTTON 659
11/26/2019
Original Date of Licensure
STATE OF COLORADO
LICENSED LANDSCAPE ARCHITECT

Visual Environments
Landscape Architecture/ Planning/GIS
(303) 646-2985
P.O. 1263, Elizabeth, CO 80107

OWNER/DEVELOPER:
MOUNTAIN VIEW ELECTRIC ASSOCIATION, INC.
Your Touchstone Energy® Cooperative
A Member Owned Utility

11140 E WOODMEN RD.
FALCON, CO 80831-8199
(719) 495 - 2283 VOICE
(719) 495 - 3814 FAX

REV	DESCRIPTION	DSN	DWN	CHK	DATE
1	POST EL PASO COUNTY 5/23/19 REVIEW	MB	MB	MB	7/1/19
2	EASEMENT & OS BUFFER NOTATIONS	MB	MB	MB	1/23/20
3					
4					
5					
6					
7					
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11					
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18					

CASE ID #S
EA-17195

811 Know what's below Call before you dig.

ENG: MB
DWN: MB
CHK: MB
DATE: 1/23/20

CLIENT/PROJECT: MOUNTAIN VIEW ELECTRIC ASSOCIATION VOLLMER SUBSTATION

TITLE: SITE PLAN

SHEET: S-1

PAGE: 1 OF 2

REVISION:

Road Condition Assessment

November 21, 2019

Mr. Curtis B. Miller
Transmission Siting and Environmental Planner
Tri-State Generation and Transmission Association, Inc.
1100 W. 116th Ave.
Westminster, CO 80234

Sent via email

Re: **Pavement Condition Assessment of Haul Routes**
Vollmer Transmission Line and Substation Project, El Paso County, Colorado

Dear Mr. Miller,

The purpose of this letter is to document the results of the pre-construction pavement condition assessment (assessment) completed by Tetra Tech Inc. (Tetra Tech) for the Vollmer Transmission Line and Substation Project (Project) in El Paso County, Colorado. As requested by El Paso County and Tri-State,[1] Tetra Tech collected existing roadway conditions along approximately 2 miles of Project haul routes: Falcon Meadows Boulevard, between Woodmen Road, just north of Tercel Drive; and along Mohawk Road, between Woodmen Road and just north of Brule Road. The methodology for collection and processing is described below. A haul route map depicting the Project location and proposed haul routes is shown in Figure 1.

Pavement Assessment Methodology

Tetra Tech conducted the assessment on October 15, 2019, using a Mobile Mapping System (MMS). The MMS includes a 3D LiDAR sensor and seven cameras mounted to a truck. The system was driven at posted speeds to collect digital data within the data collection limits (i.e., along the haul routes). The data collected include survey-grade LiDAR data as well as high-resolution 360-degree imagery. Using this data collection methodology, American Society of Testing Materials (ASTM) road condition information could then be extracted to provide a measurable baseline of the existing conditions prior to the start of Project construction.

The collection process began by setting a survey control monument in the middle of the data collection limits to establish a permanent control point. A GPS was set up on the control monument and collected data over a 4-hour period provide a stable and accurate position for data collection.

Once the survey control monument had been established, the MMS collection of existing condition data began. To effectively ensure total site coverage within the data collection limits, the MMS was driven on each lane (i.e., northbound and southbound) of Mohawk Road and Falcon

[1] Tetra Tech collected additional roadway conditions data along Woodmen Road between Marksheffel and Meridian roads while traveling between the two haul routes but has not processed the data as it was not originally requested; this data will remain on file at Tetra Tech in the event Tri-State requests further work be completed.

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Meadows Boulevard. LiDAR data, as well as 360-degree imagery, was collected every 3 meters to ensure sufficient coverage of the data collection limits to assess existing conditions.

The collected data were then processed and aligned with individual drive lines into a complete registered Project dataset. Processing was accomplished by using common overlapping data in each drive pass and aligning that with the GPS data. With the data from each drive pass properly aligned to each other and the GPS data, the information was exported into LASer (LAS) point cloud file format. LAS is a universal point cloud format that can be imported into most AutoCAD and design software.

TopoDOT software was used to extract the ASTM data collected and processed using MicroStation. The LAS data were imported into MicroStation so that the road condition algorithm could be run on the data. The algorithm creates both a visual representation of the quality of the road as well as a quantifiable representation in an Excel file format that breaks the roadways down into sample sites and quantifies the level of pavement condition types (i.e., rutting, corrugation, pothole, bump, and depression). Table 1 provides the threshold for each of the pavement condition types. The threshold values are based off ASTM 6433 national roadway standards. The thresholds noted in the table correspond to Figure 2 which shows the collected data overlaid on the corresponding photograph that was collected concurrently with the Lidar data, and indicates pavement conditions and the thresholds (i.e., low, medium, high) for each occurrence.

Table 1: Thresholds for Roadway Pavement Conditions

Rutting Thresholds	**Feet (US)**
Low	0.019
Medium	0.035
High	0.072
Pothole/Bump Thresholds	
Depth/Height low	0.017
Depth/Height Medium	0.058
Depth/Height High	0.12
Pothole Diam Low	0.328
Pothole Diam Medium	0.656
Pothole Diam High	1.476
Corrugation Thresholds	
Low	0.014
Medium	0.026
High	0.064

Within each roadway segment the total volumetric of all the pavement condition types recorded are added together and averaged and provide a Pavement Condition Index rating (i.e. very poor, poor, fair, satisfactory, good).

The data collected during the October 2019 site visit, including panoramic images, will become the baseline to compare the post construction conditions of the haul routes. Electronic results of the data collection are included on an external hard drive and are being submitted under separate cover. Electronic file formats include KML, KMZ, Excel, and AutoCAD (.dwg). In the Excel files, a volumetric condition assessment is also included. A hard drive containing panoramic images will be sent to you under separate cover.

If you have any questions or require any additional information, please do not hesitate to contact me at (303) 980-3549.

Sincerely,
TETRA TECH, INCORPORATED

Bret Bienkowski
Mobile Mapping Survey Manager

cc: Jennifer Chester, Tetra Tech
Lori Davidson, Tetra Tech

Attachment:
Figure 1—Vicinity Map
Figure 2—Roadway Pavement Condition Example

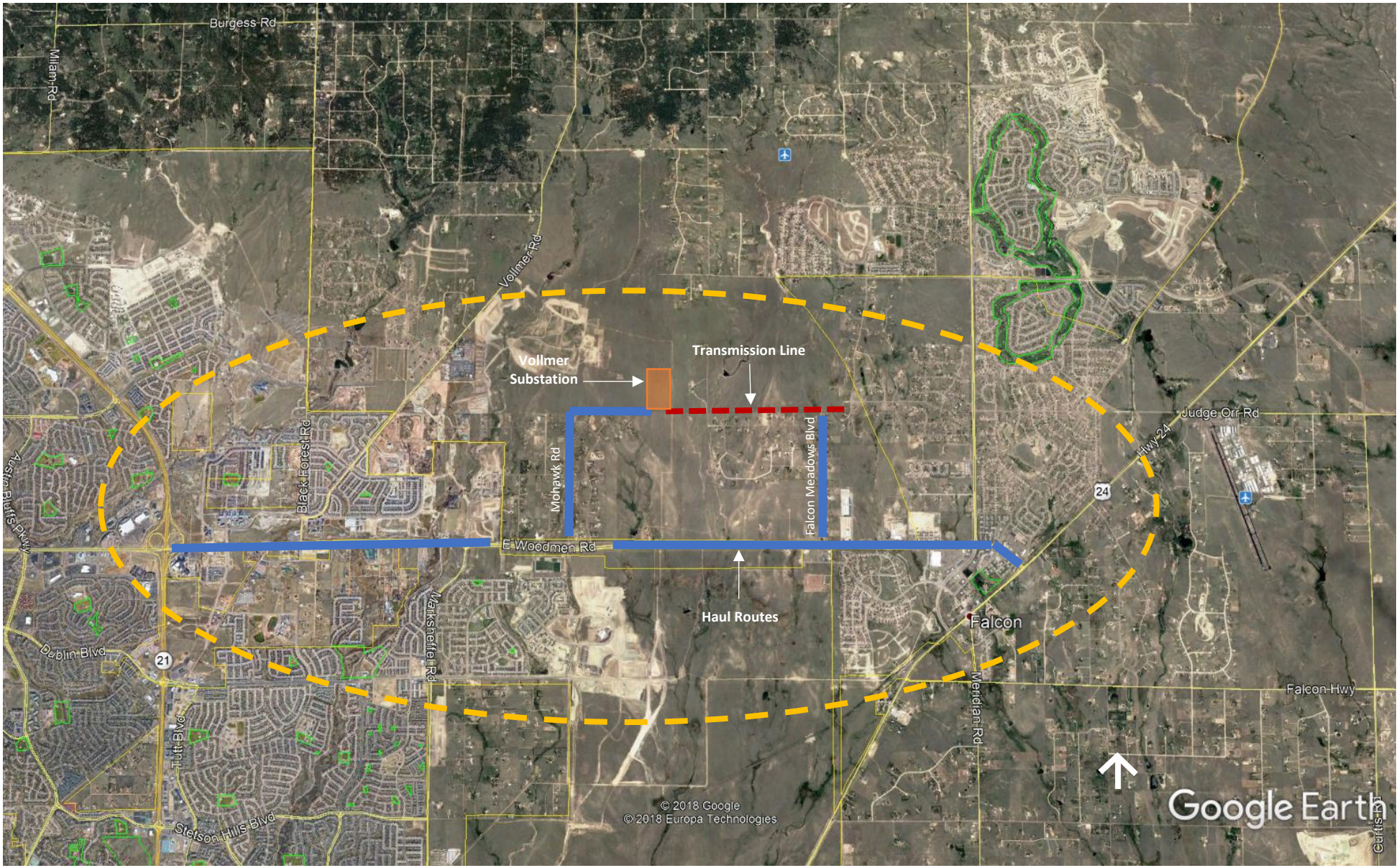

Figure 1 – Vicinity Map

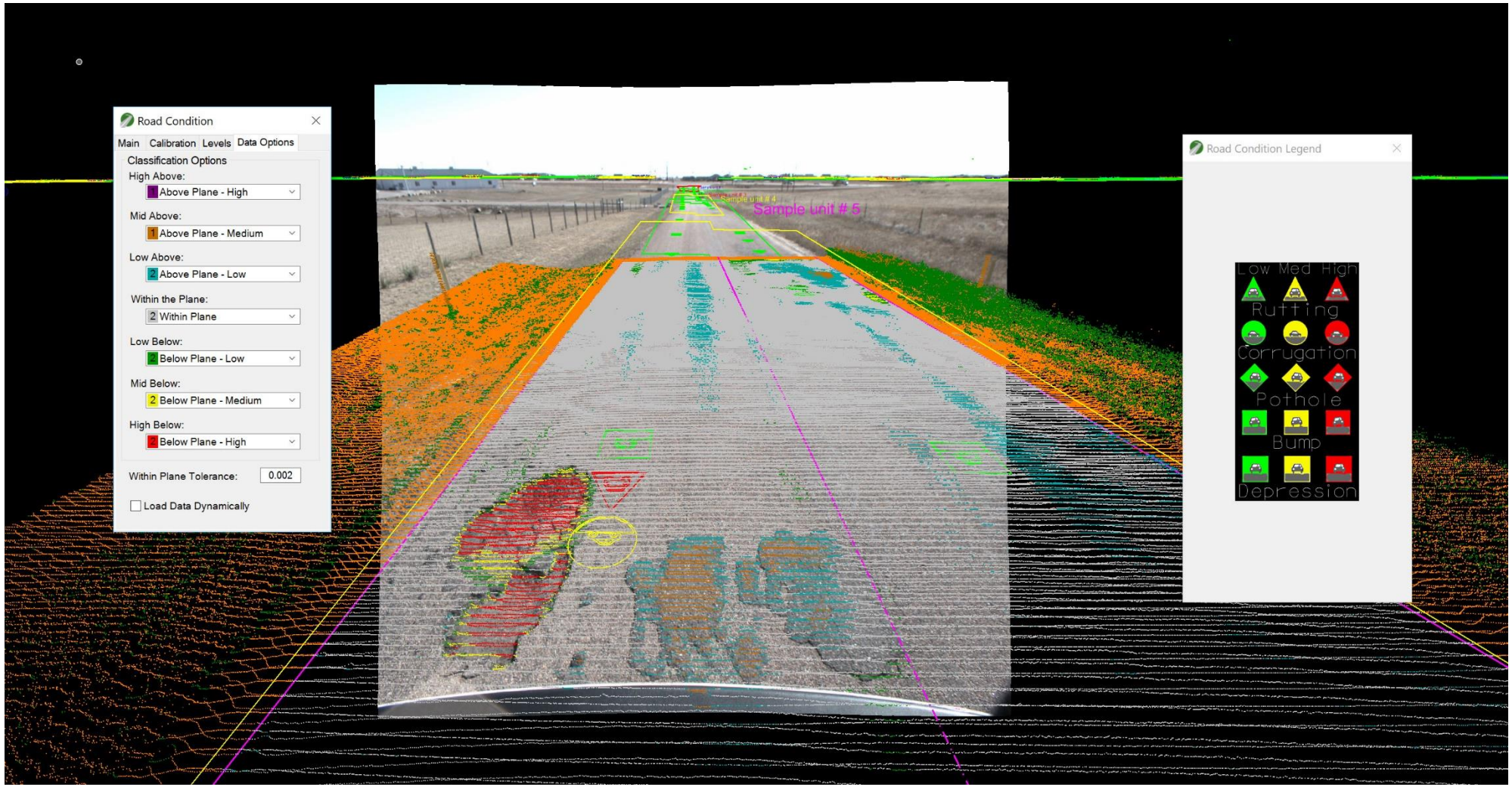

Figure 2 – Roadway Pavement Condition Example