Spire STL Pipeline Project

Resource Report 9
Air and Noise Quality

FERC Docket No. CP17-__-__

FERC Application
January 2017

Public

RESOURCE REPORT 9 - GENERAL PROJECT DESCRIPTION	
SUMMARY OF FILING INFORMATION	
Information	**Found in**
1. Describe existing air quality in the vicinity of the project. (§ 380.12(k)(1)) • Identify criteria pollutants that may be emitted above U.S. Environmental Protection Agency (USEPA)-identified significance levels.	Sections 9.1.2 and 9.1.3.
2. Quantify the existing noise levels (day-night sound level (Ldn) and other applicable noise parameters) at noise sensitive areas and at other areas covered by relevant state and local noise ordinances. (§ 380.12(k)(2)) • If new compressor station sites are proposed, measure or estimate the existing ambient sound environment based on current land uses and activities. • For existing compressor stations (operated at full load), include the results of a sound level survey at the site property line and nearby noise-sensitive areas. • Include a plot plan that identifies the locations and duration of noise measurements. • All surveys must identify the time of day, weather conditions, wind speed and direction, engine load, and other noise sources present during each measurement.	Not applicable.
3. Quantify existing and proposed emissions of compressor equipment plus construction emissions, including nitrogen oxides (NOX) and carbon monoxide (CO), and the basis for these calculations. Summarize anticipated air quality impacts for the project. (§ 380.12(k)(3)) • Provide the emission rate of NO, from existing and proposed facilities, expressed in pounds per hour and tons per year for maximum operating conditions, include supporting calculations, emission factors, fuel consumption rate, and annual hours of operation.	Sections 9.1.3.

RESOURCE REPORT 9 - GENERAL PROJECT DESCRIPTION	
SUMMARY OF FILING INFORMATION	
Information	**Found in**
4. Describe the existing compressor units at each station where new, additional, or modified compressor units are proposed, including the manufacturer, model number, and horsepower of the compressor units. For proposed new, additional, or modified compressor units include the horsepower, type, and energy source. (§ 380.12(k)(4))	Not applicable.
5. Identify any nearby noise-sensitive area by distance and direction from the proposed compressor unit building/enclosure. (§ 380.12(k)(4))	Not applicable.
6. Identify any applicable state or local noise regulations. (§ 380.12(k)(4)) • Specify how the facility will meet the regulations.	Sections 9.2.1.2 and 9.2.1.3.
7. Calculate the noise impact at noise-sensitive areas of the proposed compressor unit modifications or additions, specifying how the impact was calculated, including manufacturer's data and proposed noise control equipment. (§ 380.12(k)(4))	Not applicable.
INFORMATION RECOMMENDED OR OFTEN MISSING	
1. Include climate information as part of the air quality information provided for the project area.	Section 9.1.2.1.
2. Identify potentially applicable federal and state air quality regulations.	Section 9.1.4.
3. Provide construction emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for proposed pipelines and aboveground facilities.	Section 9.1.3.
4. Provide copies of state and federal applications for air permits.	Not applicable.
5. Provide operational and fugitive emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for pipelines and aboveground facilities.	Section 9.1.3.6
6. Provide air quality modeling for entire compressor stations.	Not applicable.

RESOURCE REPORT 9 - GENERAL PROJECT DESCRIPTION	
INFORMATION RECOMMENDED OR OFTEN MISSING	
Information	**Found in**
7. Identify temporary and permanent emissions sources that may have cumulative air quality effects in addition to those resulting from the project.	Resource Report 1
8. Describe the existing noise environment and ambient noise surveys for compressor stations, liquefied natural gas facilities, meter and regulation facilities, and drilling locations.	Section 9.2.3.
9. Identify any state or local noise regulations applicable to construction and operation of the project	Section 9.2.1.
10. Indicate whether construction activities would occur over 24-hour periods.	Section 9.2.4.
11. Discuss construction noise impacts and quantify construction noise impacts from drilling, pile driving, dredging, etc.	Section 9.2.3.
12. Quantify operational noise from aboveground facilities, including blowdowns.	Section 9.2.3
13. Describe the potential for the operation of the proposed facilities to result in an increase in perceptible vibration and how this would be prevented.	Section 9.2.3
14. Identify temporary and permanent noise sources that may have cumulative noise effects in addition to those resulting from the project.	Resource Report 1.

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Acronyms and Abbreviations

AQCR	Air Quality Control Region
CAA	Clean Air Act
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
dB	decibel
dBA	"A" weighting frequency scale
Enable MRT	Enable Mississippi River Transmission, LLC
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
GHG	Greenhouse Gas
GWP	global warming potential
HDD	horizontal directional drill
IPCC	Intergovernmental Panel on Climate Change
Leq	Equivalent Sound Level
Ldn	Day-Night Level
Ln	Night Level
LGC	Laclede Gas Company
M&R	metering and regulating
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NSA	noise sensitive area
NSPS	New Source Performance Standards
NSR	New Source Review
$PM_{2.5}$	particulate matter sized 2.5 microns in aerodynamic diameter and smaller
PM_{10}	particulate matter sized 10 microns in aerodynamic diameter and smaller

Project	Spire STL Pipeline Project
scfh	standard cubic feet per hour
SO_2	Sulfur Dioxide
Spire	Spire STL Pipeline LLC
TPY	tons per year
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

Air and Noise Quality

9.1 Air Quality

This Resource Report addresses the effects of the Project on the existing air and noise environment and describes proposed measures to mitigate the effects for the Spire STL Pipeline LLC ("Spire") Spire STL Pipeline Project ("Project") within both Illinois and Missouri.

9.1.1 Design Basis

Construction of the Project is proposed in Scott, Green, and Jersey Counties, Illinois; and St. Charles and St. Louis Counties, Missouri, and includes approximately 66 miles of pipeline and associated ancillary facilities. No major aboveground facilities are proposed for the Project. The Project will consist of approximately 59 miles of new 24-inch pipeline and modifications in certain locations along seven miles of the existing Line 880 pipeline.

The Project will include the construction of three new metering and regulating ("M&R") station interconnects with REX in Illinois and Laclede Gas Company ("LGC") and Enable Mississippi River Transmission, LLC ("Enable MRT") in Missouri and the construction of a new facility at an existing LGC site along Line 880. The exact arrangement and equipment to be located at these sites is provided in Resource Report 1, Appendix 1-F. There are no existing or proposed compressor stations associated with the Project. Fuel burning equipment associated with the construction of the 24-inch pipeline, the modifications along the existing Line 880 pipeline, and associated aboveground facilities (i.e., pipeline heaters) is discussed below.

As more fully explained in Resource Report 1, a primary purpose of the Project is to provide enhanced reliability and diversity of supply and pipeline capacity to support existing natural gas end use needs. As such, the natural gas transported on the Project for its Foundation Shipper, LGC, is anticipated to be used in the same manner as its current gas supply portfolio, to serve LGC's existing retail gas utility customers. Approximately 70 percent of LGC's utility gas supply is currently used for home and space heating needs of residential customers, and the remaining 30 percent is used for commercial and industrial purposes. The majority of the natural gas transported on Spire's pipeline for LGC is anticipated to supply these same downstream uses. With the introduction of additional, competitively priced, natural gas supply access into the greater St. Louis/eastern Missouri region, however, there will also be the opportunity for increased use of natural gas, as opposed to other fossil fuels, by LGC's industrial customers with duel boiler fuel capability, thereby reducing Greenhouse Gas ("GHG") emissions.

An additional planned benefit of the Project is for LGC to be able to replace its historical reliance on liquid propane for winter peaking support with natural gas, which has cost, reliability, and environmental advantages over liquid propane. The actual displacement of liquid propane with natural gas is not anticipated to be significant, however, given that this peakshaving need arises only on the coldest winter days.

As also discussed in Resource Report 1, 12.5 percent of the firm capacity to be created by the Project is as yet unsubscribed. Accordingly, this new capacity will offer the opportunity for other end users in the region, including electric generators, to switch to natural gas from other fossil fuels and thereby lower GHG emissions in the greater St. Louis and southern Illinois areas.

9.1.2 Existing Conditions

9.1.2.1 Local Climate

The 24-inch pipeline is located in western Illinois and generally runs from north to south and crosses the Mississippi River, then parallels the Mississippi River until crossing the Missouri River just north of St. Louis, Missouri which is the nearest large city. The Line 880 modifications will be located just south of the Missouri River. This area is flat with the majority of the Project area being located on land in agricultural use in the upper Mississippi River Valley. The climate of this area is best classified as a Mid-latitude Continental which has warm summers and cold winters. Summer temperatures in this area are typically in the upper 80s [degrees Fahrenheit (°F)] while winter temperatures are typically in the lower 40s. Prevailing winds are usually from the northeast. Average annual precipitation totals are approximately 41 inches. There are several surface weather stations located near the Project area all with statistically equivalent data and located in areas with high agricultural use. The St. Charles County Airport located in St. Charles County, Missouri was used as the representative station for the Project area. A summary of climate data collected at this station is provided in Table 9.1-1.

Table 9.1-1. Climate Data for St. Charles County Airport, Missouri (1981 to 2010) for the Project

Month	Average Maximum Temperature (°F)	Average Minimum Temperature (°F)	Average Temperature (°F)	Precipitation (inches)
January	39	21	30	2.36
February	44	26	35	2.24
March	55	35	45	3.23
April	67	45	56	3.82
May	76	55	65.5	4.76
June	85	64	74.5	4.29
July	89	68	78.5	4.33
August	88	66	77	3.15
September	80	56	68	3.27
October	68	44	56	3.39
November	55	35	45	3.82
December	42	25	33.5	2.80

Note:

Data sourced from United States Climate Data
http://www.usclimatedata.com/climate/portage-des-sioux/missouri/united-states/usmo1709

The USEPA has established NAAQS for seven pollutants:

- sulfur dioxide ("SO_2");
- carbon monoxide ("CO");
- nitrogen dioxide ("NO_2");
- inhalable particulate matter ("PM") [i.e., PM sized 10 microns in aerodynamic diameter and smaller (PM_{10})];
- fine PM [i.e., PM sized 2.5 microns in aerodynamic diameter and smaller ($PM_{2.5}$)] excluding regulated precursors for $PM_{2.5}$, which are addressed by their own standards;
- lead; and
- ozone [for which nitrogen oxides ("NOx") and volatile organic compounds ("VOCs") are regulated as precursors].

9.1.2.2 National Ambient Air Quality Standards

The Clean Air Act of 1970 ("CAA") (Title 42 United States Code § 7401 et seq.) required the United States Environmental Protection Agency ("USEPA") to establish National Ambient Air Quality Standards ("NAAQS") to protect public health and welfare.

Revisions to Section 107 of the CAA in 1977 required the states/commonwealths and USEPA to identify areas of the country which meet and do not meet the NAAQS. Areas meeting the NAAQS are called "attainment areas," and areas not meeting the NAAQS are called "nonattainment areas." The designation of an area is made on a pollutant-by-pollutant basis.

The USEPA maintains a list of attainment/non-attainment designations for all seven criteria pollutants on their "Green Book" website (USEPA, 2014). The Green Book was used to determine the area designations for the proposed Project area. The USEPA also designates areas where communities that are in close proximity to one another and share a common air quality as Air Quality Control Regions ("AQCRs").

In the Project area there is only one AQCR that has a designation of non-attainment; the Metropolitan St. Louis Interstate AQCR. The Metropolitan St. Louis Interstate AQCR (Missouri-Illinois) consists of the territorial area encompassed by the boundaries of the following jurisdictions:

- In the State of Illinois - Bond County, Clinton County, Madison County, Monroe County, Randolph County, St. Clair County, Washington County; and
- In the State of Missouri - Franklin County, Jefferson County, St. Charles County, St. Louis City, St. Louis County.

The Project is located in both St. Charles and St. Louis Counties; otherwise, the rest of the counties in the Project area are designated as being in attainment for all pollutants and are not designated as maintenance areas. The Metropolitan St. Louis Interstate AQCR is designated as non-attainment for both Ozone (Marginal, eight-hour Ozone 2008) and $PM_{2.5}$ (Moderate, $PM_{2.5}$ 1997). Further discussion is provided in Section 9.1.4.2, General Conformity.

Additionally, Jersey County in Illinois was designated as a maintenance area for Ozone in 2012.

15.9 miles of new 24-inch pipeline will be located in Jersey County, IL. Within the Metropolitan St. Louis Interstate AQCR, 12.7 miles of new 24-inch pipeline will be located in St. Charles County, Missouri and 0.7-mile of new 24-inch pipeline will be located in St. Louis County, Missouri. Seven miles of Line 880 is in St. Louis County, Missouri and the Metropolitan St. Louis Interstate AQCR.

Within the Project area, there are several existing, operational monitoring locations collecting data related to criteria air pollutants. This information is presented to provide background levels for these criteria pollutants. This data represents the latest, publicly available data from the USEPA and, therefore, note that it may be raw and invalidated.

Three active monitoring locations have been identified near the Project area (e.g., within counties where the proposed pipeline would be constructed). These are monitors 29-183-1004 (St. Charles County, Missouri), 29-183-1002 (St. Charles County, Missouri), and 17-083-1001 (Jersey County, Illinois), and are described in Tables 9.1-2, 9.1-3, 9.1-4, and 9.1-5.

Table 9.1-2. Yearly Local Ozone Data for West Alton Site

Location:	General Electric Store, Highway 94, St. Charles County, Missouri 63386		
Pollutants Monitored:	Active O3		
Status:	Active		
Monitor ID:	29-183-1002		
Year	**Maximum One-Hour Average**	**Maximum Eight-Hour Average**	**Fourth Maximum Eight-Hour Average**
2016	No Data Available		
2015	0.087	0.072	0.070
2014	0.092	0.078	0.072

Note:

Data sourced from https://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual

Table 9.1-3. Yearly Local Ozone Data for Orchard Farm Site

Location:	2165 Highway V, St. Charles County, Missouri 63301		
Pollutants Monitored:	Active O3		
Status:	Active		
Monitor ID:	29-183-1004		
Year	**Maximum One-Hour Average**	**Maximum Eight-Hour Average**	**Fourth Maximum Eight-Hour Average**
2016	No Data Available		
2015	0.085	0.078	0.066
2014	0.087	0.740	0.720

Note:

Data sourced from https://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual

Table 9.1-4. Yearly Local Ozone Data for Illini Junior High Site

Location:	Liberty Street and County Road, Jersey County, Illinois		
Pollutants Monitored:	Active O3, $PM_{2.5}$		
Status:	Active		
Monitor ID:	17-083-1001		
Year	**Maximum One-Hour Average**	**Maximum Eight-Hour Average**	**Fourth Maximum Eight-Hour Average**
2016 (through 6/7/16)	0.055	0.050	0.042
2015	0.091	0.074	0.067
2014	0.089	0.071	0.065

Note:

Data sourced from https://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual

Table 9.1-5. Yearly Local PM2.5 Data for Illini Junior High Site

Location:	Liberty Street and County Road, Jersey County, Illinois		
Pollutants Monitored:	Active O3, $PM_{2.5}$		
Status:	Active		
Monitor ID:	17-083-1001		
Year	**Daily Arithmetic Mean**	**Maximum Daily Mean**	**Fourth Daily Mean**
2016 (through 6/7/16)	7.448	20.0	18.2
2015	7.714	28.7	16.6
2014	10.002	25.5	17.9

Note:

Data sourced from https://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual

9.1.3 Project Emissions

9.1.3.1 Construction Emissions

Construction activities will result in temporary increases in emissions of some pollutants due to the use of non-stationary equipment powered by diesel fuel or gasoline engines; the temporary generation of fugitive dust due to disturbance of the ground surface, vegetation clearing, and other dust generating actions; and indirect emissions attributable to activities associated with construction activities of the Project (e.g., workers commuting to and from work sites during construction, etc.).

These sources are not considered stationary sources and their impacts will generally be temporary and localized. Moreover, the emissions from construction activities are not expected to cause or significantly contribute to an exceedance of the NAAQS.

The installation and construction of the Project is estimated to begin in January 2018 with completion estimated by November 2018. To date, this Project has not been awarded to a contractor and the exact equipment to be used on-site for construction is not known. The equipment anticipated to be used on this Project and the operating hours for each piece of equipment was estimated based upon similar projects of similar size. As such, the emissions provided in Table 9.1-6 are believed to represent a conservative best available estimate of construction emissions for the Project. Actual emissions from the Project will vary by day and type of construction activity. An estimation of these individual activities (e.g., construction engine emissions and fugitive dust emissions) involving construction of the pipelines has been included in this analysis.

9.1.3.2 Construction Engine Emissions

Construction related emission estimates are based on a typical construction equipment list, hours of operation, and vehicle miles traveled by the construction equipment and supporting vehicles for the Project. This is a conservative estimate based on worst-case assumptions, Exhaust and Crankcase Emission Factors for Nonroad

Engine Modeling - Compression-Ignition, NR-009c (EPA420-P-04-009), April 2004 (Tables 9A-1 and 9A-2 in Appendix 9-A), and the USEPA and Intergovernmental Panel on Climate Change ("IPCC") emission factors (Tables 9A-7 and 9A-8 in Appendix 9-A). Nevertheless, the estimated air emissions from construction of the Project is expected to be transient in nature, with negligible impact on the baseline regional air quality. Construction equipment will be properly maintained and operated only on an as-needed basis to minimize the construction engine emissions. There will also be some emissions attributable to vehicles delivering materials to the construction sites. For the purposes of this estimate, it was assumed that all non-road engines were either Tier 2 (2001 through 2006) or Tier 3 (2006 through 2008) with relation to emissions standards.

Table 9A-1 and Table 9A-2 summarize the estimated emissions of criteria pollutants from construction equipment and PM emissions from material transfers and road traffic, respectively. Emissions from non-road construction equipment engines used during construction were estimated based on the anticipated types of non-road equipment and their associated levels of use. Emission factors in grams per HP-hour were obtained from Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling -- Compression-Ignition. Greenhouse gas emissions where estimated using emission factors from IPCC Guidelines for National Greenhouse Gas Inventories and are summarized in Tables 9A-7 and 9A-8 (IPCC 2006).

Table 9.1-6. Summary of Temporary Construction Emissions

Description	Criteria Pollutants (TPY)						Greenhouse Gases[1] (TPY)			CO2e (Metric Tonnes) [1]
	PM_{10}	$PM_{2.5}$	VOCs	CO	SO2	NOx	CO_2	N_2O	CH_4	
Off-Road Engines - 24-Inch Pipeline	10.37	10.06	11.61	55.62	0.33	175.43	13,479.09	0.75	5.20	12,550.10
Off-Road Engines - Line 880	1.16	1.12	1.29	6.26	0.04	19.17	891.72	0.05	0.34	830.27
Unpaved Roads - 24-Inch Pipeline	8.40	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads - Line 880	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Material Handling & Wind Erosion - 24-Inch Pipeline	1.01	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Material Handling & Wind Erosion - Line 880	0.27	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Project Pipeline Emissions	**21.21**	**12.14**	**12.90**	**61.88**	**0.36**	**194.60**	**14,370.82**	**0.80**	**5.55**	**13,380.36**
Total Emissions Metropolitan St. Louis Interstate Air Quality Control Region[2]	**5.91**	**3.64**	**3.92**	**18.86**	**0.11**	**58.90**	**3,944.48**	**0.22**	**1.52**	**3,672.62**
Total Emissions Jersey County, Illinois maintenance area [2]	**5.44**	**3.02**	**3.20**	**15.31**	**0.09**	**48.29**	**3,710.27**	**0.21**	**1.43**	**3,454.56**
Total Emissions non-attainment and maintenance areas [2]	**11.36**	**6.66**	**7.11**	**34.17**	**0.20**	**107.19**	**7,654.75**	**0.43**	**2.95**	**7,127.18**

Notes:

1 Greenhouse gas emissions were adjusted for global warming potential ("GWP"), using GWP factors of 298 for N_2O and 25 for methane ("CH_4"). Additionally, greenhouse gas emissions were converted from short tons to metric tonnes.

2 All of Line 880 is located in the Metropolitan St. Louis Interstate AQCR. 13.4 miles of the 24-inch pipeline is located in the Metropolitan St. Louis Interstate AQCR; 15.9 miles of the 24-inch pipeline is located with Jersey County, Illinois which is a maintenance area for ozone. Emission estimates for the 24-inch pipeline are calculated based on this mileage.

Table 9.1-6(a). Equipment Type and Fuel Consumptions

Equipment	Type	Fuel Consumption	24-Inch Pipeline Quantity	Line 880 Quantity	M&R Facilities Quantity (each)
Excavator	CAT 336	5 to 8 gallons/hour	30	5	2
Side Boom Tractor	CAT 573	2 to 5 gallons/hour	30	2	0
Bulldozers	CAT D7 or CAT D8	5 to 10 gallons/hour	20	2	1
Low Boy Trucks	200 HP	6 miles/gallon	5	2	2
Contractor Trucks	½ ton pickup truck	14 miles/gallon	30	12	12
Inspector Trucks	½ ton pickup truck	14 miles/gallon	20	5	0
Surveyor Trucks	½ ton pickup truck	14 miles/gallon	5	2	0
Welder Rigs	1 ton	8 miles/gallon (truck) & 1.1 gallons/hour (welder)	10	4	1
Boom Trucks	5 ton	6 miles/gallon	3	1	0
Fuel Trucks	5 ton	6 miles/gallon	2	1	0
Water Trucks	5 ton	6 miles/gallon	2	0	0
Water Pumps	5 HP	.5 gallons/hour	10	2	0
Air Compressors	25 HP	.5 gallons/hour	10	2	1
Portable Light Plant	25 HP	1 gallon/hour	10	0	0
Employee Vehicles	½ ton pickups & cars	14 mpg & 20 mpg	75	15	0
Pipe Stringing Trucks	200 HP	6 miles/gallon	5	0	0
HDD Rig	600 HP	25 gallons/hour	2	0	0
Mud Pumps	25 HP	10 gallons/hour	4	0	0
R/W Mowing Tractors	75 HP	5 gallons/hour	5	0	0
Tree Cutting Hot Saw	200 HP	5 to 8 gallons/hour	2	0	0
Crane	Grove 300T Hydraulic (550HP)	18-20 gallons/hour	0	0	1
Carry Deck Loader	15 ton	3 gallons/hour	0	0	1
Generator	10 HP	1 gallon/hour	0	0	2
Mini Excavator	25 HP	1 gallon/hour	0	0	2
Dump Trucks	16-yard bed, 300 HP	1 gallon/hour	0	0	2

9.1.3.3 Fugitive Dust Emissions

Fugitive dust will result from land clearing, grading, excavation, concrete work, and vehicle traffic on paved and unpaved roads. The majority of particulate air emissions produced during construction activities will be PM_{10} and $PM_{2.5}$ in the form of fugitive dust. The amount of dust generated will be a function of construction activity, soil type, soil moisture content, wind speed, precipitation, vehicle traffic, vehicle types, and roadway characteristics. Emissions will be greater during dry periods and in areas of fine textured soils subject to surface activity. Potential PM emissions from material transfers, wind erosion, and unpaved/paved road were estimated using USEPA's AP-42 emissions factors. An estimation of fugitive emissions for the Project is provided in Tables 9A-3 through 9A-6 provided in Appendix 9-A of this report.

Spire will employ proven construction-related practices to control and limit releases of fugitive dust, including the application of water or other commercially available dust control agents on unpaved areas subject to frequent vehicle traffic in accordance with the Fugitive Dust Control Plan for the Project in Appendix 9-E. In addition, construction equipment will only be operated on an as needed basis.

9.1.3.4 Open Burning Emissions

Spire is not proposing open burning as a means of disposing of land clearing waste during construction.

9.1.3.5 Stationary Source Emissions

Spire is proposing to install two 10 MMBtu/hr line heaters at the Laclede/Lange Delivery Station. Anticipated operational emissions for the line heaters can be estimated as shown in Table 9.1-7.

Table 9.1-7. Summary of Stationary Source Emissions

Source:			**Line Heater**
Number			2
Rated Capacity (MMBtu/hr ea)			10.00
Rated Capacity (MMBtu/hr total)			20.00
Heating Value (MMBtu/scf)			1,016
Capacity (10^6 scf/hr)			0.019685
Potential Operating Hours			8,760
Total Emissions			
	Emission Factor	**Emissions**	
Pollutant	**(lb/10^6 scf)**	**lb/hr**	**tpy**
PM Total[1]	7.6	0.15	0.66
NO_x	100	1.97	8.62
CO	84	1.65	7.24
VOC	5.5	0.11	0.47

Table 9.1-7. Summary of Stationary Source Emissions (Continued)

Total Emissions			
	Emission Factor	Emissions	
Pollutant	(lb/10^6 scf)	lb/hr	tpy
PM Total[1]	7.6	0.15	0.66
NO_x	100	1.97	8.62
CO	84	1.65	7.24
VOC	5.5	0.11	0.47
CO_2	120,000	2,362.20	10,346.46
CH_4	2.3	0.04	0.20
N_2O	0.25	0.005	0.02
CH_4 (as CO_2e) [2]	2.3	1.13	4.96
NO (as CO_2e) [2]	0.25	1.47	6.42

Note:

Data sourced from USEPA (1998) AP-42: Compilation of Air Emission Factors, Chapter 1.4 Natural Gas Combustion

[1] Assume PM_{10} = PM Total

[2] Tons CH_4 converted to Tons CO_2e by multiplying by 25

9.1.3.6 Fugitive Emissions of Methane

Conservatively, anticipated operational fugitive emissions for the proposed pipeline (24-inch pipeline, Line 880 Modifications, and new and modified M&R Stations) of methane can be estimated as shown in Table 9.1-8.

Table 9.1-8. Methane to Carbon Dioxide Equivalent for Pipelines and Stations

Total Miles of Protected Steel Pipeline	65.8
Protected Steel Pipeline CH_4 Emission Factor[3]	358.7 scf CH_4/year/mile
Total Protected Steel Pipeline Fugitive CH_4 Emissions/Year	**0.6 tons**
Total Protected Steel Pipeline Fugitive CO_2e Emissions/Year	**15.6 tons**
Number of Metering/Regulation/Pigging Stations	4
Station CH_4 Emission Factor[1]	21.8 tons/year/station
Total Station Fugitive CH_4 Emissions/Year	**87.0 tons**
Total Station Fugitive CO_2e Emissions/Year[2]	**2175.0 tons**
Total Project Fugitive CH_4 Emissions/Year	**87.6 tons**
Total Project Fugitive CO_2e Emissions/Year[4]	**2190.6 tons**

Notes:

1 American Petroleum Institute (2009) Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry: Table 5-26

2 USEPA (2014) Code of Federal Regulations, Title 40, Part 98, Chapter I, Subchapter C, Subpart A, Table A-1 - Global Warming Potentials

3 American Petroleum Institute (2009) Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry: Table C-24

4 Tons CH4 converted to Tons CO2e by multiplying by 25

These fugitive emissions come from a variety of sources including connections and line segment blowdowns.

For the Project, engineering design and operational measures will be evaluated to minimize fugitive and episodic CH_4 emissions. These measures represent the most efficient design with the least environmental impact while providing reliable pipeline operation. These measures include:

- pumping down the pressure of lines to as low a pressure as possible using inline compression prior to blowdown for maintenance; and
- installing low-leak fugitive components, where practicable

Spire is intending to participate in the USEPA's Methane Challenge Program.

9.1.3.7 Greenhouse Gas Mandatory Reporting Rule

The GHG Mandatory Reporting Rule, at 40 Code of Federal Regulations ("CFR") Part 98 (Subpart W), requires certain facilities that emit 25,000 metric tons or more of CO_2 per year to report annual emissions of specified GHGs from various processes within the facility and conduct associated monitoring. Onshore natural gas transmission pipeline industry segments are included in this requirement only if they emit 25,000 metric tons per year or more of emissions from activities under §98.232(m). This relates to pipeline blowdown CO_2 and CH_4 emissions from blowdown vent stacks.

Based on Table 9.1-8 in Section 9.1.3.6 of this report, this Project will not result in emissions equal to, or in excess of, this threshold. Therefore, the GHG Mandatory Reporting Rule does not apply.

9.1.3.8 Odorization Equipment

Odorization equipment will be located at three M&R stations along the new pipeline and Line 880 (Laclede/Lange Delivery Station, Redman Delivery Station, and MRT Bi-directional Station). The potential for odorant release is very low during normal operations of a natural gas M&R facility. Industry accepted procedures and equipment will be utilized to minimize operational-required releases of odorized gas and fugitive emissions will be mitigated by filtering through activated charcoal filters. Additionally, the odorization equipment located at the M&R stations will be regularly maintained to ensure proper functioning.

9.1.3.9 Leak Detection

Spire to perform leak detection and maintenance as described in Section 1.4 of Resource Report 1.

9.1.4 Regulatory Requirements for Air Quality

The provisions of the CAA that are potentially applicable to construction and operation of the new facilities associated with the Project are:

- New Source Performance Standards ("NSPS");
- State Regulations; and
- Conformity of General Federal Actions.

Provisions under the New Source Review permitting program National Emission Standards for Hazardous Air Pollutants, Greenhouse Gas Mandatory Reporting Rule, and the Title V Operating Permit program are not applicable to the Project. The following is a brief description of the potentially applicable regulations and their requirements.

9.1.4.1 NSPS

NSPS in 40 CFR Part 60 regulate emissions from new emissions sources from specific source categories. The majority of the source categories cover emission sources that are not associated with the equipment being installed as part of the Project; however, recent updates to Subpart OOOO - Crude Oil and Natural Gas Production Transmission and Distribution) know as Subpart OOOOa do potentially apply.

Subpart OOOOa - Standards of Performance for Crude Oil and Natural Gas: Production, Transmission, and Distribution

On August 18, 2015, the USEPA proposed amendments to 40 CFR 60, Subpart OOOO and proposed an entirely new Subpart OOOOa, which was published to the Federal Register on September 18, 2015. On August 2, 2016 this new subpart went into effect; therefore, Subpart OOOOa will apply to oil and natural gas production, transmission, and distribution affected facilities that are constructed, reconstructed, and modified after the Federal Register date of September 18, 2015. The proposed NSPS Subpart OOOOa would establish standards for both VOC and

CH_4. In all cases, natural gas is used as a surrogate for both CH_4 and VOC. Subpart OOOOa will affect additional sources at the proposed facilities beyond Subpart OOOO. Many of the requirements of this subpart are applicable to natural gas processing plants and compressor stations. Continuous bleed natural gas-driven pneumatic controllers that are located on a natural gas transmission systems are limited to natural gas bleed rates of six standard cubic feet per hour ("scfh"). However, the rule does allow for the use of a natural gas bleed rate greater than six scfh if it can be demonstrated that the functional needs of the control are required due to but not limited to response time, safety and positive actuation. For continuous bleed natural gas-driven pneumatic controllers that seek to make this justification there are tagging and recordkeeping requirements.

9.1.4.2 General Conformity

Section 176 of the 1990 CAA Amendments required the USEPA to promulgate rules to make certain federal actions conform to the applicable state implementation plan. These rules, known together as the General Conformity Rule (40 CFR 93, Subpart B), require any federal agency responsible for an action in a non-attainment or maintenance area for any criteria pollutant to determine if the action conforms with the applicable state implementation plan or is exempt from the General Conformity Rule requirements.

The USEPA amended the General Conformity rule in 2010 (Federal Register, Volume 75, Number 64, April 5, 2010). As amended, emissions regulated by a permit issued under minor or major New Source Review ("NSR") are exempted from a General Conformity applicability analysis. Previously, only major NSR permit emissions were excluded.

General Conformity currently applies to areas designated as non-attainment or maintenance for ozone under the 1997 and 2008 eight-hour ozone NAAQS. To remove the complexity of having to address requirements under two ozone NAAQS, the USEPA published the "Implementation of the 2008 NAAWS for Ozone: State Implementation Plan Requirements - Proposed Rule" in the Federal Register on June 6, 2013.

The proposed rule provides that all requirements, including General Conformity, will not apply to areas designated as non-attainment or maintenance for the 1997 ozone NAAQS when that NAAQS is revoked. The 1997 ozone NAAQS will be revoked upon publication of the final rule. The public comment period for the proposed rule ended August 5, 2013 and the final rule has not been promulgated to date. Until the USEPA publishes the final rule, requirements to address General Conformity under the 1997 eight-hour ozone NAAQS continue to apply alongside the 2008 eight-hour ozone NAAQS.

A General Conformity analysis consists of two steps. The first step is an applicability analysis where estimated Project emissions from construction and operation (with emission sources covered by a permit excluded) are compared to de minimis thresholds defined in the General Conformity Rule. Step two, a General Conformity determination, is required for each pollutant where the total of direct and indirect emissions caused by a federal action (such as a FERC action) would equal or exceed de minimis levels as specified in 40 CFR Part 93.153 with the exceptions specified in 40 CFR Part 51.853(c), (d), or (e). General Conformity does not apply to federal actions in attainment areas or unclassifiable/attainment areas.

For ozone non-attainment areas, emissions of VOC and NOx are evaluated because they are precursor pollutants to ozone formation. For $PM_{2.5}$ non-attainment areas, emission of NOx and SO_2 are evaluated (in addition to direct $PM_{2.5}$) because they are precursor pollutants to $PM_{2.5}$ formation. Project activities in Counties belonging to the same non-attainment area or area under maintenance are assumed to contribute cumulatively to the non-attainment or maintenance area. During the applicability analysis, estimated emissions within non-attainment and maintenance areas are compared against preset threshold levels per 40 CFR Section 93.153. The applicability thresholds vary, depending on the severity of the non-attainment area. De minimis emissions are total direct and indirect emissions of a criteria pollutant caused by a federal action in a non-attainment or maintenance area at rates less than the specified applicability thresholds. These thresholds are presented in Table 9.1-9.

Table 9.1-9. General Conformity Thresholds

Pollutant/Non-Attainment Area	TPY
Ozone (VOCs or NOx)	
Serious Non-Attainment Areas	50
Severe Non-Attainment Areas	25
Extreme Non-Attainment Areas	10
Other Ozone Non-Attainment Areas outside an Ozone Transport Region	100
Other Ozone Non-Attainment Areas inside an Ozone Transport Region	
VOC	50
NOx	100
CO_2 (all non-attainment areas)	100
SO_2 or NO_2 (all non-attainment areas)	100
PM_{10}	
Moderate Non-Attainment Areas	100
Serious Non-Attainment Areas	70
$PM_{2.5}$	
Direct Emissions	100
SO_2	100
NOx (unless determined not to be a significant precursor)	100
VOC or Ammonia (if determined to be significant precursors)	100
Lead (all non-attainment areas)	25

Source: 40 CFR §93.153

The emissions for the Project are below these thresholds, as previously shown in Table 9.1-6 For example, the AQCR is designated as “Other ozone non-attainment areas outside an Ozone Transport Region” for Ozone, thus the General Conformity Thresholds for VOC and NOx are 100 TPY. VOC emissions are 3.92 TPY and NOx emissions are 58.90 TPY, putting them below the General Conformity thresholds.

9.1.4.3 Air Quality Modeling Analysis

An air quality modeling analysis is not provided as part of this resource report.

9.1.4.4 State-Specific Air Regulations

Illinois and Missouri both have state-specific air quality regulations. Illinois regulations can be found in Title 35 of the Illinois Administrative Code, Subtitle B. Missouri regulations can be found in Division 10 of the Missouri Code of Regulations, Chapter 6. More detailed descriptions of potentially applicable Illinois and Missouri state-specific air regulations can be found in Appendices B and C respectively.

9.2 Noise Quality

The unit of noise measurement is the decibel (“dB”), which measures the energy of the noise. Because the human ear is not uniformly sensitive to noise frequencies, the "A" weighting frequency scale (“dBA”) was devised to correspond with the ear's sensitivity. The dBA uses specific weighting of a sound pressure level for the purpose of determining the human response to sound and the resulting unit of measure is the dBA.

Because noise levels can vary over a given time period, they are further quantified using the Equivalent Sound Level (“Leq”), Night Level (“Ln”), and Day-Night Level (“Ldn”). The Leq is an average of the time-varying sound energy for a specified time period. The Ln is an average of the time-varying sound energy for the time period between 10 p.m. and 7 a.m. local time. The Ldn is an average of the time-varying sound energy for one 24-hour period, with a 10 dB addition to the sound energy for the time period of 10 p.m. to 7 a.m. local time. If the sound energy does not vary with time, the Ldn level will be equal to the Leq level plus 6.4 dBA due to 10 dBA penalty for nighttime noise sensitivity during the period of 10 p.m. to 7 a.m.

The Project includes the construction of three new M&R stations at interconnects with REX in Illinois and LGC and Enable MRT in Missouri and the modification of an existing LGC facility along Line 880. Spire conducted baseline noise surveys at each facility in December 2016.

The Project also includes two horizontal directional drills (“HDDs”) at the Mississippi and Missouri Rivers. Each river crossing will include one entry/exit sites on either side of the river. Spire conducted baseline noise surveys at each of these sites in December 2016.

9.2.1 Regulatory Requirements for Noise

9.2.1.1 Federal Noise Regulations

The USEPA has identified a noise level of 55 dBA as being the maximum sound level that will not adversely affect public health and welfare by interfering with speech or other activities in outdoor areas, with an adequate margin of safety (USEPA 1971). The FERC guidelines [18 CFR Part 157.206-(b)(5)(i) and (ii)] require that the noise

attributable to new compressor engines or modification not exceed an Ldn of 55 dBA at the nearest noise sensitive area ("NSA") (schools, hospitals, or residences) unless such NSAs are established after facility construction. In addition, the FERC typically requires that the noise attributable to the full-load operation of a compressor station, including the compressor unit addition, should not exceed the previously existing noise levels produced by the compressor station at nearby NSAs that are above an Ldn of 55 dBA.

For HDD operations, the FERC guidelines [18 CFR Part 157.206-(b)(5)(iii)] require that the noise attributable to HDD not exceed an Ln of 55 dBA at the nearest NSAs unless such NSAs are established after facility construction.

9.2.1.2 State Noise Regulations

A preliminary review of local noise ordinances for the areas where the HDD operations and M&R facilities will be located has resulted in the following assessment of noise level regulations for the area. This review should not be considered exhaustive, constituting publicly available information on the websites of the counties in question.

9.2.1.3 Illinois/Missouri State Ordinances

No state-specific noise ordinances pertaining to HDD operations were found for either state.

9.2.1.4 Local/County Noise Regulations

Scott County, Illinois

The REX Receipt Station is proposed to be located in this county. Spire is coordinating with the county. No applicable noise regulations have been identified.

Jersey County, Illinois

There is a proposed HDD entry/exit location located in this county. This location is to the north of the Mississippi River.

Spire is coordinating with the county. No applicable noise regulations have been identified.

St. Charles County, Missouri

There is a proposed HDD entry/exit location located in this county to the south of the Mississippi River and a second HDD entry/exit location located in this county to the north of the Missouri River.

This county restricts noise levels from portable or motor vehicle audio equipment and public address systems. Spire is coordinating with the county. No applicable noise regulations have been identified.

St. Louis County, Missouri

There is a proposed HDD entry/exit location to the south of the Missouri River and three M&R facilities located in this county (Laclede/Lange Delivery Station, Redman Delivery Station and the MRT Bi-directional Station).

There is a general noise ordinance for St. Louis County, Missouri. This ordinance generally states that, "It is also unlawful to speak, shout, sing, or create any noise at a volume that disturbs the peace of another person." Spire is coordinating with the county. No applicable noise regulations have been identified.

9.2.2 Noise Level Impacts

Although pipeline construction activities may cause some noise impact during construction, this impact will be limited to the relatively short period of active construction. The Project is not expected to result in a significant or long-term disturbance during construction of the pipeline in the Project area.

The Project will include four HDD entry/exit locations and four M&R facilities. HDDs are proposed under the Mississippi River and under the Missouri River. A total of eight locations are considered impacted due to construction and/or operational noise. There are no new or modified compression facilities associated with this Project.

HDD operations generally consists of an HDD drilling rig and auxiliary support equipment, including mud pumps, portable generators, cranes, mud mixing and cleaning equipment, forklifts, loaders, trucks, and portable light sets. The sound level impacts at NSAs associated with the HDD entry/exit sites will depend on the drilling contractor and type of equipment used, the mode of operation of the equipment, the length of time the equipment is in use, the amount of equipment used simultaneously, and the distances between sound sources and sensitive sites. Noise analysis at the HDD sites was completed assuming that drilling may occur on either or both sides of the river.

Three of the M&R facilities will be new construction. One of the M&R facilities currently exists along the Line 880 and is being modified as part of this Project. The impacts of the construction and/or modification of the M&R stations will be evaluated. M&R stations typically include a fenced control building and a permanent access road. They also include a supply line and a discharge line from the associated pipeline, an emergency bypass line, and communication equipment for supervisory control.

The locations of the NSAs preliminarily identified to the proposed HDD entry/exit locations and proposed M&R facilities are described below and are shown on the figures associated with each site in Appendix 9-D. The anticipated noise impacts from the HDD operations and M&R facilities were analyzed and where necessary, means to control construction noise from HDD operations and M&R facilities are presented. Spire performed a field reconnaissance the HDD entry/exit locations, the proposed M&R facility locations, and the NSAs within a 0.5-mile radius of these locations, and conducted ambient sound level monitoring in the vicinity of the NSAs for each of the selected locations. Spire monitored sound level and established two sets of 15-minute averages at each location using a 3M SOUNDPRO Sound Level Meter (or equivalent).

An acoustical analysis was performed to determine the estimated noise contribution at each NSA using SoundPLAN® acoustical modeling software. Baseline noise survey results and noise impact calculation results are presented in Appendix 9-D.

9.2.3 Noise Impacts

9.2.3.1 Ambient/Existing Noise Surveys

Ambient noise surveys consisting of two 15-minute readings were conducted at each location determined to be potentially impacted by construction or operational noise during and after the Project.

These sites consisted of four M&R station locations and four HDD entry/exit locations. The results of these ambient noise level surveys are included in Appendix 9-D of this report and are summarized in Table 9.2-1 below.

Table 9.2-1. Measured Ambient Noise Levels

Location	Start	Stop	LAeq
Aboveground Facilities			
REX Receipt Station	12:45 PM	1:00 PM	53.7
	1:01 PM	1:16 PM	49.7
Laclede/Lange Delivery Station	8:07 AM	8:22 AM	54.5
	4:57 PM	5:13 PM	52.7
Redman Delivery Station	7:23 AM	7:38 AM	68.6
	5:28 PM	5:43 PM	51.4
MRT Bi-directional Station	6:30 AM	6:46 AM	61.0
	5:52 PM	6:07 PM	54.7
HDD Entry/Exit Locations			
Mississippi River North HDD Location[1]	11:19 AM	11:34 AM	58.3
	2:28 PM	2:43 PM	61.5
Mississippi River South HDD Location	10:09 AM	10:24 AM	40.0
	3:25 PM	3:40 PM	46.5
Missouri River North HDD Location	9:27 AM	9:42 AM	43.7
	5:03 PM	5:18 PM	58.9
Missouri River South HDD Location	8:56 AM	9:11 AM	50.2
	4:29 PM	4:44 PM	47.3

Note:

[1] Due to restricted site access, ambient noise surveys for the Mississippi River North HDD Location were performed in the public right-of-way, north of River Road.

9.2.3.2 Operational And Construction Noise Level Models

For each site denoted in Section 9.2.3.1 of this report, a sound model was constructed for noise producing activities associated with its construction and/or operation. Construction noise models were performed for each of the four HDD entry/exit locations. Operational noise models were conducted for each of the proposed new or modified M&R facilities.

The models were constructed and run using SoundPLAN® acoustical modeling software.

The resultant noise model maps are provided in Appendix 9-D of this report.

REX Receipt Station (Operational Noise Model)

The REX Receipt Station was modeled to include the following equipment and structures with associated conservatively assumed sound pressure levels:

- Proposed Odorizer Room at 50.0 dBA;
- Proposed O.P.P. Skid at 86.2 dBA;
- Proposed Flow Control Skid at 86.2 dBA;
- Proposed Separation Filter at 60.0 dBA;
- Proposed Condensate Tank at 50 dBA; and
- Proposed Pig Launcher/Receiver at 86.2 dBA.

There is one NSA near this location:

- NSA RE001 consists of single-family dwellings to the northeast, along Clay Hollow Road, located approximately 500 feet from the proposed REX Receipt Station.

The results of this model show the sound level impacts on the above-listed NSAs will be negligible or non-existent with a 55 dBA sound level or less at or near the facility's fence line. See Figure 9.2-1 in Appendix 9-D.

Laclede/Lange Delivery Station (Operational Noise Model)

The Laclede/Lange Delivery Station was modeled to include the following equipment and structures with associated conservatively assumed sound pressure levels:

- Two Proposed Indirect Gas Fired Heaters at 86.2 dBA;
- Proposed Pig Receiver at 86.2 dBA;
- Proposed Pig Launcher/Receiver at 86.2 dBA;
- Proposed Separation Filter at 60.0 dBA;
- Proposed O.P.P. Skid at 86.2 dBA;
- Proposed Flow Control Skid at 86.2 dBA; and
- Proposed Odorant Tank at 50 Dba.

There are several NSAs near this location:

- NSA LL001 consists of single-family dwellings to the east located on the opposite side of Blue Spruce Lane and along Fort Bellefontaine Road, located approximately 300 feet from the proposed Laclede/Lange Delivery Station;

- NSA LL002 consists of single-family dwellings to the southeast of the proposed facility and on the opposite side of Blue Spruce Lane, located approximately 365 feet from the proposed Laclede/Lange Delivery Station; and
- NSA LL003 consists of single-family dwellings to the northwest of the proposed Laclede/Lange Delivery Station and along Old Jamestown Road, located approximately 715 feet from the proposed Laclede/Lange Delivery Station.

The results of this model show the sound level impacts on the above-listed NSAs will be negligible or non-existent with a 55 dBA sound level or less at or near the facility's fence line. See Figure 9.2-2 in Appendix 9-D.

Redman Delivery Station (Operational Noise Model)

The existing Redman Station which will be modified as part of this Project (referred to as the Redman Delivery Station) on the existing Line 880 was modeled after the modifications to include the following equipment and structures with associated conservatively assumed sound pressure levels:

- Proposed Condensate Tank at 50.0 dBA;
- Proposed Meter Building at 50.0 dBA;
- Proposed Separation Filter at 60.0 dBA;
- Proposed Control Valve Building at 50 dBA;
- Existing Installed Pneumatics Building at 50 dBA;
- Proposed Odorant Injection Building at 50 dBA;
- Proposed Odorant Tank at 50 dBA; and
- Existing Pneumatics Building at 50 dBA.

An existing rail line runs north/south along the western edge of the existing facility.

There are numerous NSAs near this location:

- NSA RD001 consists of single-family dwellings due north of the existing facility and along Bridgevale Avenue, located approximately 180 feet from the Redman Delivery Station. Some of these structures may be abandoned or condemned based on observations;
- NSA RD002 consists of single-family dwellings due south of the existing facility and along Bridgevale Avenue, located approximately 130 feet from the Redman Delivery Station. Some of these structures may be abandoned or condemned based on observations;
- NSA RD003 consists of single-family dwellings to the west of the existing facility and along Criterion Avenue, located approximately 220 feet from the Redman Delivery Station;

- NSA RD004 consists of several single-family dwellings, directly east and on the other side of Bridgevale Avenue from the existing facility between Redman Boulevard and Cove Lane, located approximately 80 feet from the Redman Delivery Station;
- NSA RD005 consists of several single-family dwellings, to the south east and on the other side of Bridgevale Avenue from the existing facility between Cove Lane and Reale Avenue, located approximately 75 feet from the Redman Delivery Station;
- NSA RD006 consists of several single-family dwellings, to the north east and on the other side of Bridgevale Avenue from the existing facility between Redman Avenue and Maple Avenue, located approximately 175 feet from the Redman Delivery Station;
- NSA RD007 consists of several single-family dwellings, to the north east and on the other side of Bridgevale Avenue from the existing facility, north of Maple Avenue, located approximately 480 feet from the Redman Delivery Station; and
- NSA RD008 consists of several single-family dwellings, to the west and on the other side of Criterion Avenue from the existing facility, north of Reale Avenue and south of Widefields Lane, located approximately 350 feet from the Redman Delivery Station.

The results of this model show the sound level impacts on the above-listed NSAs will be negligible or non-existent with a 55 dBA sound level or less at or near the facility's fence line. See Figure 9.2-3 in Appendix 9-D. These results are based on times when no train is present on the tracks to the west of the facility location.

The contribution to closest NSAs from the proposed equipment is <1 dBA. Changes to the sound environment < 3 dBA are considered negligible and generally undetectable to the human ear.

A single 15-minute reading taken between 7:23 AM and 7:38 AM on December 6, 2016 when the track was being utilized by a freight train showed sound levels of LAFmax of 83.7 dBA and an LAFeq of 68.6 dBA. The contribution of sound to the existing environment when compared to this source is also negligible.

MRT Bi-directional Station (Operational Noise Model)

The MRT Bi-directional M&R Facility on the existing Line 880 was modeled after the expansion to include the following equipment and structures with associated conservatively assumed sound pressure levels:

- Proposed Regulator Skid at 86.2 dBA;
- Proposed Meter Skid at 86.2 dBA; and
- Proposed Launcher/Receiver at 86.2 dBA.

There are three NSAs near this location:

- NSA BD001 consists of several single-family dwellings, a church, and other public use areas to the southwest, located approximately 580 feet from the proposed MRT Bi-directional Station. This NSA contains three public roads: Hobarth Drive, Prigge Road, and Riverview Road;

- NSA BD002 consists of a structure of undetermined use, but appears to be of public/private use to the northwest, located approximately 1,310 feet from the proposed MRT Bi-directional Station. This NSA is located opposite the proposed facility on the other side of Riverview Road; and
- NSA BD003 consists of several single-family dwellings abutting what appears to be industrial/commercial use area to the north, located approximately 970 feet from the proposed MRT Bi-directional Station. This NSA is located along Riverview Road.

The area directly abutting the location to the west of the site is currently in use as an industrial/light commercial zone.

The results of this model show the sound level impacts on the above-listed NSAs will be negligible or non-existent with a 55 dBA sound level at or near the expanded facility's fence line. See Figure 9.2-4 in Appendix 9-D.

Mississippi River North HDD Site (Construction Noise Model)

Spire will operate HDD operations at a location located north of the Mississippi River.

The HDD entry/exit location, when in operation, will preliminarily consist of the following equipment:

- Large Drill Rig at 110 dBA;
- Two Mud Pumps at 110 dBA;
- Three Generators at 90 dBA and
- Separation Plant at 100 dBA.

There is one impacted NSA near this location:

- NSA MS002 consists of single-family dwellings to the southeast, located approximately 1,450 feet from the proposed Mississippi River North HDD entry/exit location.

Vehicles will be used to access the site as well as perform work around the site. These vehicles are assumed to be limited in speed to less than 30 MPH.

Spire is planning on conducting HDD activities during daytime working hours, except for pull-back activities which will require 24-hour operations for a short timeframe. The drill times vary depending on the length of the drill, existing geology, and other factors.

River Road is a major artery for traffic through the area and influences the sound environment. It has been included in the sound model.

Figure 9.2-5 in Appendix 9-D shows the sound level contributions to the surrounding sound environment during operation on the site. The sound level impact at or near the property line is shown to be 55 dBA or less.

Mississippi River South HDD Site (Construction Noise Model)

Spire will operate HDD operations at a location located south of the Mississippi River. The HDD entry/exit location, when in operation, will preliminarily consist of the following equipment:

- Large Drill Rig at 110 dBA;
- Two Mud Pumps at 110 dBA;
- Three Generators at 90 dBA; and
- Separation Plant at 100 dBA.

There is one impacted NSA near this location:

- NSA MS002 consists of single-family dwellings to the southeast, located approximately 1,450 feet from the proposed Mississippi River South HDD entry/exit.

Vehicles will be used to access the site as well as perform work around the site. These vehicles are assumed to be limited in speed to less than 30 MPH.

Spire is planning on conducting HDD activities during daytime working hours, except for pull-back activities which will require 24-hour operations for a short timeframe. The drill times vary depending on the length of the drill, existing geology, and other factors.

Figure 9.2-6 in Appendix 9-D shows the sound level contributions to the surrounding sound environment during operation on the site. The sound level impact at or near the property line is shown to be 55 dBA or less.

Missouri River North HDD Site (Construction Noise Model)

Spire will operate HDD operations at a location located north of the Missouri River.

The HDD entry/exit location, when in operation, will preliminarily consist of the following equipment:

- Large Drill Rig at 110 dBA;
- Two Mud Pumps at 110 dBA;
- Three Generators at 90 dBA; and
- Separation Plant at 100 dBA.

There is one NSA near this location:

- NSA MO002 consists of single-family dwellings to the north, along Minert Road, located approximately 2,120 feet from the proposed Missouri River North HDD entry/exit location.
- Two additional NSAs (NSAs MO003 and MO004) are located to the east and in excess of 0.5-mile from the proposed Missouri River North HDD entry/exit location.

Vehicles will be used to access the site as well as perform work around the site. These vehicles are assumed to be limited in speed to less than 30 MPH.

Spire is planning on conducting HDD activities during daytime working hours, except for pull-back activities which will require 24-hour operations for a short timeframe. The drill times vary depending on the length of the drill, existing geology, and other factors.

Figure 9.2-7 in Appendix 9-D shows the sound level contributions to the surrounding sound environment during operation on the site. The sound level impact at or near the property line is shown to be 55 dBA or less.

Missouri River South HDD Site (Construction Noise Model)

Spire will operate HDD operations at a location within Central Stone's facility located south of the Missouri River. The proposed HDD entry/exit location is on the western edge of the property.

The HDD entry/exit location, when in operation, will preliminarily consist of the following equipment:

- Large Drill Rig at 110 dBA;
- Two Mud Pumps at 110 dBA;
- Three Generators at 90 dBA; and
- Separation Plant at 100 dBA.

There is one NSA near this location:

- NSA MO001 consists of single-family dwellings to the northwest, located approximately 250 feet from the proposed Missouri River South HDD entry/exit location. An earthen barrier currently exists between the proposed HDD entry/exit location and the NSAs.

Vehicles will be used to access the site as well as perform work around the site. These vehicles are assumed to be limited in speed to less than 30 MPH.

Spire is planning on conducting HDD activities during daytime working hours, except for pull-back activities which will require 24-hour operations for a short timeframe. The drill times vary depending on the length of the drill, existing geology, and other factors.

Figure 9.2-8 in Appendix 9-D shows the sound level contributions to the surrounding sound environment during operation on the site. The sound level impact at or near the property line is shown to be 55 dBA or less.

9.2.3.3 Blasting

Blasting activities are proposed to occur at two locations during pipeline construction, between mileposts 44.94 and 44.95 and 58.24 through 58.62. Blasting activities would only occur during daytime hours, specifically between the hours of 9:00 a.m to 3:00 p.m. in accordance with Spire's Blasting Plan (Resource Report 6, Appendix 6-C). All blasting activities will be performed in accordance with local and state regulations by a qualified blasting contractor.

9.2.4 Noise Mitigation

For diesel equipment used during construction of the Project, if it is found to be necessary to mitigate noise, it is anticipated that common construction mitigation measures such as vibration control, mufflers, etc. would be utilized for the Project.

HDD noise impacts determined in Section 9.2.3, Noise Impacts, may be mitigated as determined necessary through measures such as installing noise barriers, enclosing the drill rig fully or partially, and/or offering to temporarily relocate affected NSAs during short periods of elevated noise.

Construction activity and associated noise levels for the pipeline and aboveground facility installation will vary depending on the phase of construction in progress at any one time. These construction phases include site grading, clearing/grubbing, and pipeline and aboveground facility installation. The highest level of construction noise is assumed to occur during earthwork.

For M&R stations and mainline valves associated with the Project, the site construction noise associated with the installation of the new equipment should have a negligible impact on nearby NSAs, noting that construction will be limited to weekday daytime hours. The most prevalent sound source during construction will be the internal combustion engines used to power the construction equipment.

Pipeline construction noise-related impacts from the Project are expected to be short in duration at any given location and, therefore, have minimal impact. People at nearby residences and buildings will hear the construction noise but the overall impact will have a short duration and be insignificant. Construction will not result in the generation of, or exposure of persons to, excessive noise or vibration levels for lengthy periods.

Noise mitigation measures to be employed during construction include ensuring that sound muffling devices that are provided as standard equipment by the construction equipment manufacturer are kept in good working order.

The nature of construction of a pipeline dictates that construction activities and associated noise levels will move along the corridor and that no single NSA will be exposed to significant noise levels for an extended period. Some discrete activities like hydrostatic testing, tie-ins, and purging and packing the pipeline, may require 24-hour activity for limited periods (from one to three days). These 24-hour activities require only a few overnight construction personnel and do not result in significant noise generation.

There will be locations where pipeline construction will occur within 50 feet of residences on Line 880. Noise and vibration generated during construction at this distance will not be unusual in nature and will be similar to that which would occur during public works type projects (e.g., paving, trenching). This work will only occur for a few days or less at any location and impacts will be temporary. This work will only occur during weekday daytime hours in order to minimize impacts.

Work along the pipeline and at aboveground facilities will be performed in accordance with local noise ordinances.

Appendix 9-D provides detailed analysis of methodology, source sound level data, and proposed noise control treatments for each noise study.

9.3 References

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APPENDIX 9-A

Emission Estimates

Table 9A-1

Equipment Type	HP	Estimated Operating Hours				Emission Factors (g/hp-hr)[1]					Estimated Emissions (tons/yr)					
		New Build Pipeline														
		Number	Months at Project	% Utilization	Total Hours[2]	HC [3]	CO	SO_2 [4]	NO_x	Particulates [5]	VOC	CO	SO_2	NO_x	$PM1_0$	$PM_{2.5}$
Cranes																
Crane: 150 ton (Tier 3)	425	1	0.11	50%	22	0.1669	0.8425	4.86E-03	2.5	0.15	0.00	0.01	5.01E-05	0.03	0.00	0.00
Earthwork/Concrete Equipment																
Excavator (CAT 336) (Tier 3)	300	30	4.16	50%	24,960	0.1836	0.7475	4.86E-03	2.5	0.15	1.52	6.17	4.01E-02	20.64	1.24	1.20
Side Boom (CAT 573) (Tier 3)	225	30	4.16	50%	24,960	0.1836	0.7475	4.86E-03	2.5	0.15	1.14	4.63	3.01E-02	15.48	0.93	0.90
Dozer (CAT D8) (Tier 3)	325	20	4.16	50%	16,640	0.1669	0.8425	4.86E-03	2.5	0.15	1.00	5.02	2.90E-02	14.91	0.89	0.87
Vehicles																
Low Boy Truck (Tier 3)	200	5	4.48	50%	4,480	0.1836	0.7475	4.86E-03	2.5	0.15	0.18	0.74	4.80E-03	2.47	0.15	0.14
Contractor Truck (1/2 ton pickup) (Tier 3)	350	30	4.16	50%	24,960	0.1669	0.8425	4.86E-03	2.5	0.15	1.61	8.11	4.68E-02	24.08	1.44	1.40
Inspector Trucks (1/2 ton Pickup) (Tier 3)	350	20	4.16	50%	16,640	0.1669	0.8425	4.86E-03	2.5	0.15	1.07	5.41	3.12E-02	16.05	0.96	0.93
Surveyor Trucks (1/2 ton Pickup) (Tier 3)	350	5	4.16	50%	4,160	0.1669	0.8425	4.86E-03	2.5	0.15	0.27	1.35	7.80E-03	4.01	0.24	0.23
Welder Rig (Tier 2)	350	10	4.16	50%	8,320	0.1669	0.8425	4.86E-03	4.3351	0.1316	0.54	2.70	1.56E-02	13.92	0.42	0.41
Boom Truck (5 Tons) (Tier 2)	400	3	3.20	50%	1,920	0.1669	0.8425	4.86E-03	4.3351	0.1316	0.14	0.71	4.12E-03	3.67	0.11	0.11
Fuel Truck (5 ton) (Tier 3)	400	2	3.20	50%	1,280	0.1669	0.8425	4.86E-03	2.5	0.15	0.09	0.48	2.74E-03	1.41	0.08	0.08
Water Truck (5 ton) (Tier 3)	400	2	3.20	50%	1,280	0.1669	0.8425	4.86E-03	2.5	0.15	0.09	0.48	2.74E-03	1.41	0.08	0.08
Employee Vehicles (1/2 pickups) (Tier 3)	350	40	4.80	50%	38,400	0.1669	0.8425	4.86E-03	2.5	0.15	2.47	12.48	7.20E-02	37.04	2.22	2.16
Employee Vehicles (cars) (Tier 3)	150	35	4.80	50%	33,600	0.1836	0.8667	4.86E-03	2.5	0.22	1.02	4.82	2.70E-02	13.89	1.22	1.19
Pipe Stinging Truck (Tier 3)	200	5	3.20	50%	3,200	0.1836	0.7475	4.86E-03	2.5	0.15	0.13	0.53	3.43E-03	1.76	0.11	0.10
R/W Mowing Tractors (Tier 2)	75	5	1.60	50%	1,600	0.3672	2.3655	4.86E-03	4.7	0.24	0.05	0.31	6.43E-04	0.62	0.03	0.03
Air Compressors																
Air Compressor (Tier 2)	50	10	3.84	50%	7680	0.3672	2.3655	9.36E-03	4.7	0.24	0.16	1.00	3.96E-03	1.99	0.10	0.10
Miscellaneous Equipment																
Water Pumps (Tier 2)	5	10	3.20	50%	6400	0.5508	4.1127	9.36E-03	4.3	0.5	0.02	0.15	3.30E-04	0.15	0.02	0.02
Portable Light Plant (Tier 2)	25	10	3.20	50%	6400	0.2789	1.5323	9.36E-03	4.7279	0.3389	0.05	0.27	1.65E-03	0.83	0.06	0.06
Mud Pumps (Tier 2)	25	4	3.20	50%	2560	0.2789	1.5323	9.36E-03	4.7279	0.3389	0.02	0.11	6.61E-04	0.33	0.02	0.02
Tree Cutting Hot Saw (Tier 2)	200	2	2.05	50%	820	0.3085	0.7475	4.86E-03	4	0.1316	0.06	0.14	8.79E-04	0.72	0.02	0.02
Boring Machine (Tier 2)	600	2	3.20	80%	0.1669	0.8425	4.86E-03	4.3351	0.1316	0.1316	0.00	0.00	4.79E-04	0.00	0.00	0.00
											VOC	CO	SO_2	NOx	PM_{10}	$PM_{2.5}$
Total Estimated Project Emissions (Tons/Project/Year)											**11.61**	**55.62**	**0.33**	**175.43**	**10.37**	**10.06**

Notes:

VMT per Day for 24-inch Pipeline: [5]

[2] Assume 100 hour work weeks and four weeks per month.

[3] Assume Hydrocarbon(HC) approximately equal to VOCs.

[4] Assumes Ultra Low Sulfur Diesel Fuel of 15ppm sulfur.

[5] Per the *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition,* all PM emissions are assumed to be smaller than 10 microns (PM_{10}) and 97% of the PM is assumed to be smaller than 2.5 microns ($PM_{2.5}$) and all emissions are based on the assumption that all non-road engines will be either Tier 2 or Tier 3 Compliant (as noted). For the purpose of this estimate, all emissions sources are conservatively assumed to be desiel powered.

Table 9A-2

Equipment Type	HP	Estimated Operating Hours				Emission Factors (g/hp-hr)[1]					Estimated Emissions (tons/yr)					
		Line 880														
		Number	Months at Project	% Utilization	Total Hours[2]	HC [3]	CO	SO_2[4]	NO_x	Particulates [5]	VOC	CO	SO_2	NO_x	$PM1_0$	$PM_{2.5}$
Cranes																
Crane: 150 ton (Tier 3)	425	1	0.07	50%	14	0.1669	0.8425	4.86E-03	2.5	0.15	0.00	0.01	3.19E-05	0.02	0.00	0.00
Earthwork/Concrete Equipment																
Excavator (CAT 336) (Tier 3)	300	5	3.2	50%	3,150	0.1836	0.7475	4.86E-03	2.5	0.15	0.19	0.78	5.07E-03	2.60	0.16	0.15
Side Boom (CAT 573) (Tier 3)	225	0	3.2	50%	0	0.1836	0.7475	4.86E-03	2.5	0.15	0.00	0.00	0.00E+00	0.00	0.00	0.00
Dozer (CAT D8) (Tier 3)	325	1	3.2	50%	630	0.1669	0.8425	4.86E-03	2.5	0.15	0.04	0.19	1.10E-03	0.56	0.03	0.03
Vehicles																
Low Boy Truck (Tier 3)	200	2	2.9	50%	1,176	0.1836	0.7475	4.86E-03	2.5	0.15	0.05	0.19	1.26E-03	0.65	0.04	0.04
Contractor Truck (1/2 ton pickup) (Tier 3)	350	12	2.7	50%	6,552	0.1669	0.8425	4.86E-03	2.5	0.15	0.42	2.13	1.23E-02	6.32	0.38	0.37
Inspector Trucks (1/2 ton Pickup) (Tier 3)	350	0	2.7	50%	0	0.1669	0.8425	4.86E-03	2.5	0.15	0.00	0.00	0.00E+00	0.00	0.00	0.00
Surveyor Trucks (1/2 ton Pickup) (Tier 3)	350	0	2.7	50%	0	0.1669	0.8425	4.86E-03	2.5	0.15	0.00	0.00	0.00E+00	0.00	0.00	0.00
Welder Rig (Tier 2)	350	1	2.7	50%	546	0.1669	0.8425	4.86E-03	4.3351	0.1316	0.04	0.18	1.02E-03	0.91	0.03	0.03
Boom Truck (5 Tons) (Tier 2)	400	0	2.1	50%	0	0.1669	0.8425	4.86E-03	4.3351	0.1316	0.00	0.00	0.00E+00	0.00	0.00	0.00
Fuel Truck (5 ton) (Tier 3)	400	1	2.1	50%	420	0.1669	0.8425	4.86E-03	2.5	0.15	0.03	0.16	9.00E-04	0.46	0.03	0.03
Water Truck (5 ton) (Tier 3)	400	0	2.1	50%	0	0.1669	0.8425	4.86E-03	2.5	0.15	0.00	0.00	0.00E+00	0.00	0.00	0.00
Employee Vehicles (1/2 pickups) (Tier 3)	350	10	3.2	50%	6,300	0.1669	0.8425	4.86E-03	2.5	0.15	0.41	2.05	1.18E-02	6.08	0.36	0.35
Employee Vehicles (cars) (Tier 3)	150	5	3.2	50%	3,150	0.1836	0.8667	4.86E-03	2.5	0.22	0.10	0.45	2.53E-03	1.30	0.11	0.11
Pipe Stinging Truck (Tier 3)	200	0	2.1	50%	0	0.1836	0.7475	4.86E-03	2.5	0.15	0.00	0.00	0.00E+00	0.00	0.00	0.00
R/W Mowing Tractors (Tier 2)	75	0	1.1	50%	0	0.3672	2.3655	4.86E-03	4.7	0.24	0.00	0.00	0.00E+00	0.00	0.00	0.00
Air Compressors																
Air Compressor (Tier 2)	50	2	2.5	50%	1008	0.3672	2.3655	9.36E-03	4.7	0.24	0.02	0.13	5.20E-04	0.26	0.01	0.01
Miscellaneous Equipment																
Water Pumps (Tier 2)	5	2	0.0	50%	0	0.5508	4.1127	9.36E-03	4.3	0.5	0.00	0.00	0.00E+00	0.00	0.00	0.00
Portable Light Plant (Tier 2)	25	0	0.0	50%	0	0.2789	1.5323	9.36E-03	4.7279	0.3389	0.00	0.00	0.00E+00	0.00	0.00	0.00
Mud Pumps (Tier 2)	25	0	0.0	50%	0	0.2789	1.5323	9.36E-03	4.7279	0.3389	0.00	0.00	0.00E+00	0.00	0.00	0.00
Tree Cutting Hot Saw (Tier 2)	200	0	2.7	50%	0	0.3085	0.7475	4.86E-03	4	0.1316	0.00	0.00	0.00E+00	0.00	0.00	0.00
Boring Machine (Tier 2)	600	0	0.0	80%	0	0.8425	0.004862	4.34E+00	0.1316	0.1316	0.00	0.00	0.00E+00	0.00	0.00	0.00
											VOC	CO	SO_2	NOx	PM_{10}	$PM_{2.5}$
Total Estimated Project Emissions (Tons/Project/Year)											**1.29**	**6.26**	**0.04**	**19.17**	**1.16**	**1.12**

Notes:

VMT per Day for 24-inch Pipeline: [5]

[2] Assume 100 hour work weeks and four weeks per month.

[3] Assume Hydrocarbon(HC) approximately equal to VOCs.

[4] Assumes Ultra Low Sulfur Diesel Fuel of 15ppm sulfur.

[5] Per the *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition,* all PM emissions are assumed to be smaller than 10 microns (PM_{10}) and 97% of the PM is assumed to be smaller than 2.5 microns ($PM_{2.5}$) and all emissions are based on the assumption that all non-road engines will be either Tier 2 or Tier 3 Compliant (as noted). For the purpose of this estimate, all emissions sources are conservatively assumed to be desiel powered.

Table 9A-3

Equipment Type	HP	Estimated Operating Hours				Information		Emission Factors[1]		Estimated Emissions		
		New Build Pipeline										
		Number	Months at Project	% Utilization	Total Hours	W: mean vehicle Wt (tons)[2]	material Silt Content (%)[3]	E: based on PM_{10} (lb/VMT)	E: based on $PM_{2.5}$ (lb/VMT)	Vehicle Miles Traveled (mi per	Particulate PM_{10} (tons per project)	Particulate $PM_{2.5}$ (tons per project)
Cranes												
Crane: 150 ton (Tier 3)	425	1	0.1	50%	22	150	8.5%	6.40	0.64	24	0.08	0.01
Earthwork/Concrete Equipment												
Excavator (CAT 336) (Tier 3)	300	30	4.2	50%	24,960	24	8.5%	2.80	0.28	895	1.26	0.13
Side Boom (CAT 573) (Tier 3)	225	30	4.2	50%	24,960	35	8.5%	3.32	0.33	895	1.49	0.15
Dozer (CAT D8) (Tier 3)	325	20	4.2	50%	16,640	40	8.5%	3.53	0.35	895	1.58	0.16
Vehicles												
Low Boy Truck (Tier 3)	200	5	4.5	50%	4,480	7	8.5%	1.61	0.16	964	0.78	0.08
Contractor Truck (1/2 ton pickup) (Tier 3)	350	30	4.2	50%	24,960	7	8.5%	1.61	0.16	895	0.72	0.07
Inspector Trucks (1/2 ton Pickup) (Tier 3)	350	20	4.2	50%	16,640	7	8.5%	1.61	0.16	895	0.72	0.07
Surveyor Trucks (1/2 ton Pickup) (Tier 3)	350	5	4.2	50%	4,160	7	8.5%	1.61	0.16	895	0.72	0.07
Welder Rig (Tier 2)	350	10	4.2	50%	8,320	7	8.5%	1.61	0.16	895	0.72	0.07
Boom Truck (5 Tons) (Tier 2)	400	3	3.2	50%	1,920	7	8.5%	1.61	0.16	689	0.55	0.06
Fuel Truck (5 ton) (Tier 3)	400	2	3.2	50%	1,280	7	8.5%	1.61	0.16	689	0.55	0.06
Water Truck (5 ton) (Tier 3)	400	2	3.2	50%	1,280	7	8.5%	1.61	0.16	689	0.55	0.06
Employee Vehicles (1/2 pickups) (Tier 3)	350	40	4.8	50%	38,400	18.0	8.5%	2.46	0.25	1033	1.27	0.13
Employee Vehicles (cars) (Tier 3)	150	35	4.8	50%	33,600	18.0	8.5%	2.46	0.25	1033	1.27	0.13
Pipe Stinging Truck (Tier 3)	200	5	3.2	50%	3,200	7	8.5%	1.61	0.16	689	0.55	0.06
R/W Mowing Tractors (Tier 2)	75	5	1.6	50%	1,600	0.83	8.5%	0.62	0.06	344	0.11	0.01
Air Compressors												
Air Compressor (Tier 2)	50	10	3.8	50%	7,680	1.1	8.5%	0.69	0.07	827	0.29	0.03
Miscellaneous Equipment												
Water Pumps (Tier 2)	5	10	3.2	50%	6,400	15	8.5%	2.27	0.23	689	0.78	0.08
Portable Light Plant (Tier 2)	25	10	3.2	50%	6,400	7	8.5%	1.61	0.16	689	0.55	0.06
Mud Pumps (Tier 2)	25	4	3.2	50%	2,560	7	8.5%	1.61	0.16	689	0.55	0.06
Tree Cutting Hot Saw (Tier 2)	200	2	2.1	50%	820	7	8.5%	1.61	0.16	441	0.36	0.04
Boring Machine (Tier 2)	600	2	3.2	80%	2,048	7	8.5%	1.61	0.16	689	0.55	0.06
Total Estimated Project Emissions (Tons/Project/Year) Uncontrolled											**13.99**	**1.40**
Total Estimated Project Emissions (Tons/Project/Year) Controlled											**8.40**	**0.84**

Estimated Travel Distances:		
VMT per Day for 24-inch Pipeline: [5]	7.175	mi.
Water Spray Control Efficiency [6]	0.4	%

Notes:

[1] Calculations based EPA's AP 42 Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources Chapter 13.0 – Introduction to Miscellaneous Sources, Section 13.2 – Introduction to Fugitive Dust Sources Final Section of 13.2.2 Unpaved Roads (November 2006) 13.2.2. Unpaved Roads

[2] Mean Vehicle Weight for equipment engines obtained from Dataquest, 2006 and public sources (Caterpillar home page and Internet).

[3] Surface Material Silt Content estimated based on similar projects and data from AP-42, Chapter 13.2.2 Table 13.2-1 Construction Sites.

[4] Boring Machine is moved into place and does not move on a daily basis; therefore, emissions are not calculated for this piece of equipment.

[5] Assumed that each piece of equipment travels a length of 25% of the ROW spread on a daily basis.

[6] Based on low end of test data range of 40% to 70% for PM-10 from, obtained from background Document Emission Factor Documentation for AP-42, Section 13.2.2 Unpaved Roads Final Report (September 1998).

Table 9A-4

Equipment Type	HP	Estimated Operating Hours				Information		Emission Factors[1]		Estimated Emissions		
		Line 880										
		Number	Months at Project	% Utilization	Total Hours	W: mean vehicle Wt (tons)[2]	material Silt Content (%)[3]	E: based on PM_{10} (lb/VMT)	E: based on $PM_{2.5}$ (lb/VMT)	Vehicle Miles Traveled (mi per	Particulate PM_{10} (tons per project)	Particulate $PM_{2.5}$ (tons per project)
Cranes												
Crane: 150 ton (Tier 3)	425	1	0.1	50%	14	150	8.5%	6.40	0.64	4	0.01	0.00
Earthwork/Concrete Equipment												
Excavator (CAT 336) (Tier 3)	300	5	3.2	50%	3,150	24	8.5%	2.80	0.28	0	0.00	0.00
Side Boom (CAT 573) (Tier 3)	225	0	3.2	50%	0	35	8.5%	3.32	0.33	0	0.00	0.00
Dozer (CAT D8) (Tier 3)	325	1	3.2	50%	630	40	8.5%	3.53	0.35	0	0.00	0.00
Vehicles												
Low Boy Truck (Tier 3)	200	2	2.9	50%	1,176	7	8.5%	1.61	0.16	0	0.00	0.00
Contractor Truck (1/2 ton pickup) (Tier 3)	350	12	2.7	50%	6,552	7	8.5%	1.61	0.16	0	0.00	0.00
Inspector Trucks (1/2 ton Pickup) (Tier 3)	350	0	2.7	50%	0	7	8.5%	1.61	0.16	0	0.00	0.00
Surveyor Trucks (1/2 ton Pickup) (Tier 3)	350	0	2.7	50%	0	7	8.5%	1.61	0.16	0	0.00	0.00
Welder Rig (Tier 2)	350	1	2.7	50%	546	7	8.5%	1.61	0.16	0	0.00	0.00
Boom Truck (5 Tons) (Tier 2)	400	0	2.1	50%	0	7	8.5%	1.61	0.16	0	0.00	0.00
Fuel Truck (5 ton) (Tier 3)	400	1	2.1	50%	420	7	8.5%	1.61	0.16	0	0.00	0.00
Water Truck (5 ton) (Tier 3)	400	0	2.1	50%	0	7	8.5%	1.61	0.16	0	0.00	0.00
Employee Vehicles (1/2 pickups) (Tier 3)	350	10	3.2	50%	6,300	18.0	8.5%	2.46	0.25	0	0.00	0.00
Employee Vehicles (cars) (Tier 3)	150	5	3.2	50%	3,150	18.0	8.5%	2.46	0.25	0	0.00	0.00
Pipe Stinging Truck (Tier 3)	200	0	2.1	50%	0	7	8.5%	1.61	0.16	0	0.00	0.00
R/W Mowing Tractors (Tier 2)	75	0	1.1	50%	0	0.83	8.5%	0.62	0.06	0	0.00	0.00
Air Compressors												
Air Compressor (Tier 2)	50	2	2.5	50%	1,008	1.1	8.5%	0.69	0.07	0	0.00	0.00
Miscellaneous Equipment												
Water Pumps (Tier 2)	5	2	0.0	50%	0	15	8.5%	2.27	0.23	0	0.00	0.00
Portable Light Plant (Tier 2)	25	0	0.0	50%	0	7	8.5%	1.61	0.16	0	0.00	0.00
Mud Pumps (Tier 2)	25	0	0.0	50%	0	7	8.5%	1.61	0.16	0	0.00	0.00
Tree Cutting Hot Saw (Tier 2)	200	0	2.7	50%	0	7	8.5%	1.61	0.16	0	0.00	0.00
Boring Machine (Tier 2)	600	0	0.0	80%	0	7	8.5%	1.61	0.16	0	0.00	0.00
Total Estimated Project Emissions (Tons/Project/Year) - Uncontrolled											**0.01**	**0.00**
Total Estimated Project Emissions (Tons/Project/Year) - Controlled											**0.01**	**0.00**

Estimated Travel Distances:		
VMT per Day for 24-inch Pipeline: [5]	1.9	mi.
Water Spray Control Efficiency [6]	0.4	%

Notes:

[1] Calculations based on equation (1a) [Emission Factor (lb/VMT): E = k*[(s/12)^a]*(W/3)^b] from EPA's AP 42 Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources Chapter 13.0 – Introduction to Miscellaneous Sources, Section 13.2 – Introduction to Fugitive Dust Sources Final Section of 13.2.2 Unpaved Roads (November 2006) 13.2.2. Unpaved Roads. Empirical constants used in this equation k, a, b where obtained from Table 13.2.2-2.

[2] Mean Vehicle Weight for equipment engines obtained from Dataquest, 2006 and public sources (Caterpillar home page and Internet).

[3] Surface Material Silt Content estimated based on similar projects and data from AP-42, Chapter 13.2.2 Table 13.2-1 Construction Sites.

[4] Boring Machine is moved into place and does not move on a daily basis; therefore, emissions are not calculated for this piece of equipment.

[5] Assumed that each piece of equipment travels a length of 25% of the ROW spread on a daily basis.

[6] Based on low end of test data range of 40% to 70% for PM-10 obtained from background Document Emission Factor Documentation for AP-42, Section 13.2.2 Unpaved Roads Final Report (September 1998).

Table 9A-5 **Material**

Handling Emission Calculation Basis Data (24-inch Pipeline)

Project Aspect	Parameter	units	New Build	Line 880
All Aspects	Pipe Length	miles	57.4	7.6
	Dig Sites [1]	#	-	53
	Pipe Length	yards	101,024	13,376
	Pipe Length	feet	303,072	40,128
	Length in Agricultural Use[2]	miles	52	3
	Length in Agricultural Use	Yards	90,922	5,350
	Length in Agricultural Use	Feet	272,765	16,051
Trench Spoil Pile	Pipe Diameter	inches	24.0	20.0
	Max Trench Bottom Width[3]	feet	4.0	3.7
	Max Trench Top Width	feet	15	-
	Max Dig Site Width [4]	feet	-	25
	Max Dig Site Width [4]	yards	-	8.33
	Max Trench Width @ Top Soil Spoil Interface	feet	12.938	21.001
	Total - Max Trench Depth Removed	feet	8	8
	Total - Trench Cross Sectional Area[5]	ft^2	76.00	114.68
	Total - Trench Cross Sectional Area[5]	yd^2	8.44	12.74
	Total - Volume of Soil Material Moved	yd^3	852,643	5,625
	Spoil - Max Depth of Removed	feet	6.5	6.5
	Spoil - Cross Sectional Area	ft^2	55.05	80.18
	Spoil - Cross Sectional Area	yd^2	6.12	8.91
	Spoil - Volume of Material Moved	yd^3	618,267	3,934
	Spoil - Pile height	feet	5.2	6.3
	Spoil - Pile base (width)	feet	10.5	12.7
	Spoil - Pile Face	feet	7.4	9.0
	Spoil - Pile Surface Area[6]	ft^2	2,248,664	3,953
	Spoil - Pile Surface Area [6]	yd^2	249,852	439
Trench Top Soil Pile	Top Soil - Max Depth of Topsoil Removed[7]	feet	1.5	1.5
	Top Soil - Cross Sectional Area from Trench [5]	ft^2	20.95	34.5
	Top Soil - Cross Sectional Area from Trench [5]	yd^2	2.33	3.83
	Top Soil - Width of Top Soil Removed In Workspace[8]	feet	31.49	40.0
	Top Soil - Cross Sectional Area	ft^2	45.69	34.50
	Top Soil - Cross Sectional Area	yd^2	5.08	3.83
	Top Soil - Volume of Material Moved	yd^3	512,896	3,662
	Top Soil - Pile height	feet	4.6	5.9
	Top Soil - Pile base (width)	feet	9.2	11.7
	Top Soil - Pile Face	feet	6.5	8.3
	Top Soil - Pile Surface Area [6]	ft^2	653,930	111,109
	Top Soil - Pile Surface Area[6]	yd^2	72,659	12,345
Agricultural Top Soil Removed	Top Soil - Max Depth of Topsoil Removed[7]	feet	1.5	1.5
	Top Soil - Width of Extra Topsoil removed in Ag areas[8]	feet	50	15
	Top Soil - Additional Cross Sectional Area for Ag lands	ft^2	75	22.5
	Top Soil - Additional Cross Sectional Area for Ag lands	yd^2	8.33	2.50
	Top Soil - Additional Volume of Material Moved in Ag Lands	yd^3	757,680	441
	Top Soil - Pile height for Additional Ag Soil Pile	feet	8.7	4.7
	Top Soil - Pile base (width) for Additional Ag Soil Pile	feet	17.3	9.5
	Top Soil - Pile Face for Additional Ag Soil Pile	feet	12.2	6.7
	Top Soil - Pile Surface Area for Additional Ag Soil Pile[8]	ft^2	3,340,673	107,675
	Top Soil - Pile Surface Area for Additional Ag Soil Pile[8]	yd^2	371,186	11,964

Notes:

[1] For Line 880, it was assumed of the 7.6 miles there where 7 dig sites per mile

[2] Assumed 90% of land in IL and 40% in MO was in agricultural use.

[3] Assumed one foot of space between walls and each side of pipe.

[4] Assumed a 25ft by 25ft dimension at each dig site.

[5] Trench is a shape of a trapezoid.

[6] Assume pile is a triangular mound, with 45 degree slopes, that runs the length of open trench, that base of pile equals Max Trench Top Width, and that shape of the end of pile is ignored.

[7] Used 1.5 feet as topsoil depth due to deeper topsoil layers anticipated in IL.

[8] Equal to width of trench plus width of base of spoil pile and 6 foot buffer.

[9] Assumed top soil removed in the agricultural areas is equal to two 25 foot travel lanes for new build and one 15 foot travel lane for Line 880.

Table 9A-6
Material Handling & Wind Erosion Emission Calculation Basis Data (24-inch Pipeline)

Site and Material Specific Information			
		Value	
Parameters	**Units**	**New Build**	**Line 880**
Mean Wind Speed (U)[1]	mph	9.1	
Volume of Spoil Material Moved[2]	yd^3	1,236,534	7,867
Volume of Top Soil Material Moved[2]	yd^3	2,541,153	8,207
Density of Soil[3]	lb/yd^3	2,241.79	
Mass of Spoil Material Moved	tons	1,386,025	8,818
Mass of Top Soil Material Moved	tons	2,848,365	9,199
Working Surface Area of Spoil Piles[4]	yd^2	13,058	110
Working Surface Area of Top Soil Piles[4]	yd^2	23,197	6,077
Length of open trench/dig site[5]	miles	3	0.06
Material Moisture Content - Spoil (M)[6]	%	7.4	
Material Moisture Content - Top Soil (M)[7]	%	12.0	

Site and Material Specific Information							
		New Build			Line 880		
Parameters	**Units**	**TSP**	**PM_{10}**	**$PM_{2.5}$**	**TSP**	**PM_{10}**	**$PM_{2.5}$**
Handling Particulate Size Multiplier (k)[8]	--	0.74	0.35	0.053	0.74	0.35	0.053
Handling Emission Factor Spoil Material[9]	lb/ton	8.26E-04	3.91E-04	5.92E-05	8.26E-04	3.91E-04	5.92E-05
Handling Emission Factor Top Soil Material[9]	lb/ton	4.20E-04	1.99E-04	3.01E-05	4.20E-04	1.99E-04	3.01E-05
Wind Erosion Emission Factor[10]	lb/yd^2	5.04E-02	2.52E-02	1.01E-02	5.04E-02	2.52E-02	1.01E-02
Handling Spoil Emissions	tons	0.57	0.27	0.04	0.004	0.002	0.0003
Handling Top Soil Emissions	tons	0.60	0.28	0.04	0.002	0.001	0.0001
Wind Erosion Spoil Pile Emissions	tons	0.33	0.16	0.07	0.003	0.001	0.001
Wind Erosion Top Soil Pile Emissions	tons	0.58	0.29	0.12	0.15	0.08	0.03
Total Emissions	**tons**	**2.08**	**1.01**	**0.27**	**0.16**	**0.08**	**0.03**

Notes:

[1] St. Louis, Missouri (KSTL) Local Climatological Data, Normals, Means, and Extremes.

[2] Volume doubled because material is removed and replaced.

[3] Density from USDA, NRCS, *Soil Quality Indicators*, Medium textured soil 50% pore space.

[4] Working Surface Area is the surface area of pile(s) adjacent to the open trench.

[5] Assumed 3 miles of open trench on the new build pipeline and 25% of the dig sites on Line 880.

[6] Based on mean value listed in AP-42 Table 13.2.4-1, Municipal solid waste landfills, Sand.

[7] Based on mean value listed in AP-42 Table 13.2.4-1, Municipal solid waste landfills, Cover.

[8] Particle size multiplier obtained from values listed in AP-42 page 13.2.4-4.

[9] Emission factor calculated using equation (1) in AP-42 Chapter 13.2.4, Emission Factor (lb/ton): E = k*0.0032*[(U/5)^1.3]/[(M/2)^1.4]

[10] Emission factor calculated using questions in AP-42 Chapter 13.2.5 as detailed in Table 9A-6a.

Table 9A-6a **Wind**

Erosion Emission Factor Calculation Basis Data (24-inch Pipeline)

Basis for Calculations:

AP-42 Chapter 13.2.5 Industrial Wind Erosion

EF = emission factor, g/m^2 (EF_c is for chronic conditions, EF_a is for acute conditions)

k = particle size multiplier, dimesionless

N = number of days of disturbances per year

P_i = erosion potential for disturbed area, g/m^2 (Per AP-42, erosion potential is assumed to be 0 between disturbances and for undisturbed areas.)

u* = fiction velocity, m/s

u_t^* = threshold friction velocity m/s (From Table 13.2.5-2, ut* ranges from 0.54 m/s for fine coal dust to 1.33 m/s for roadbed material; From Table 13.2.5-2, ut* = 1.02 m/s for overburden at a coal mine)

u_{10}^+ = fastest mile of wind, m/s, at reference anemometer height of 10 m.

A = disturbed area, m^2

E = emissions, grams/year

Equation (1): $u^* = 0.053 * u_{10}^+$

Equation (2): $P_i = 58*(u^* - u_t^*)^2 + 25*(u^* - u_t^*)$

Equation (3): $EF = k * \sum_{N} P_i$

Equation (4): $E = EF * A$

Meteorological Information:

VMT per Day for 24-inch Pipeline: [5]

Station: [1] **St. Louis, MO (KSTL) WBAN13994**

Parameter	Value	Units
Anemometer Height (z) [2]	10	meters
MAX 2-minute Wind Speed:	53	mph
MAX 2-minute Wind Speed:	23.69	m/s
Roughness Height: [3]	0.005	meters

Emission Factor Calculation:

Variable	Both New Build & Line 880	
u_{10}^+	23.69	For St. Louis, MO (KSTL) WBAN13994 u+ = 53 mph (23.69 m/s) at 10 m)
u*	1.256	Calculated using equation (1).
u_t^*	1.02	Overbuden from Table 13.2.5-2 was used
P_i	9.11	Calculated using Equation (2). Note: If u* < u_t^*, then P_i = 0.
N	3	Assume stockpile are disturbed 3 times during construction

PM =>	< 30 µm	< 15 µm	< 10 µm	< 2.5 µm
k [4]	1.0	0.6	0.5	0.2
EF (g/m^2) [5]	27.32	16.39	13.66	5.46
EF (lb/yd^2)	5.04E-02	3.02E-02	2.52E-02	1.01E-02

Notes:

[1] National Oceanic and Atmospheric Administration, National Centers for Environmental Information. 2015. Local Climatological Data Annual Summary with Comparative Data – ST Louis Missouri (KSTL).

[2] KSTL's Anemometer has been 10 meters since 1996, per the "anenometer_height__info" excel file found at the link below.

[3] A typical roughness height of 0.5 cm (0.005 m) has been assumed. If a site a specific roughness height is available, it should be used.

[4] Particle size multiplier obtained from values listed in AP-42 page 13.2.5-3.

[5] Calculated using Equation (3) and daily condition variables.

http://www.wcc.nrcs.usda.gov/ftpref/downloads/climate/windrose/

Table 9A-7
Potential Greenhouse Gas Emissions (24-inch Pipeline - New Build)

Equipment Type	HP	Estimated Operating Hours				Emission Factors (g/hp-hr) [1]			Estimated Emissions (tons/yr)		
		New Build									
		Number	Months at Project	% Utilization	Total Hours [2]	CO_2	N_2O	CH_4	CO_2	N_2O	CH_4
Cranes											
Crane: 150 ton (Tier 3)	425	1	0.1	50%	22	199.1	0.0111	0.0768	2.05	0.00011	0.00079
Earthwork/Concrete Equipment											
Excavator (CAT 336) (Tier 3)	300	30	4.2	50%	24,960	199.1	0.0111	0.0768	1643.56	0.09205	0.63436
Side Boom (CAT 573) (Tier 3)	225	30	4.2	50%	24,960	199.1	0.0111	0.0768	1232.67	0.06904	0.47577
Dozer (CAT D8) (Tier 3)	325	20	4.2	50%	16,640	199.1	0.0111	0.0768	1187.02	0.06648	0.45815
Vehicles											
Low Boy Truck (Tier 3)	200	5	4.5	50%	4,480	199.1	0.0111	0.0768	196.67	0.01101	0.07591
Contractor Truck (1/2 ton pickup) (Tier 3)	350	30	4.2	50%	24,960	199.1	0.0111	0.0768	1917.49	0.10739	0.74008
Inspector Trucks (1/2 ton Pickup) (Tier 3)	350	20	4.2	50%	16,640	199.1	0.0111	0.0768	1278.33	0.07159	0.49339
Surveyor Trucks (1/2 ton Pickup) (Tier 3)	350	5	4.2	50%	4,160	199.1	0.0111	0.0768	319.58	0.01790	0.12335
Welder Rig (Tier 2)	350	10	4.2	50%	8,320	199.1	0.0111	0.0768	639.16	0.03580	0.24669
Boom Truck (5 Tons) (Tier 2)	400	3	3.2	50%	1,920	199.1	0.0111	0.0768	168.57	0.00944	0.06506
Fuel Truck (5 ton) (Tier 3)	400	2	3.2	50%	1,280	199.1	0.0111	0.0768	112.38	0.00629	0.04337
Water Truck (5 ton) (Tier 3)	400	2	3.2	50%	1,280	199.1	0.0111	0.0768	112.38	0.00629	0.04337
Employee Vehicles (1/2 pickups) (Tier 3)	350	40	4.8	50%	38,400	199.1	0.0111	0.0768	2949.98	0.16522	1.13859
Employee Vehicles (cars) (Tier 3)	150	35	4.8	50%	33,600	199.1	0.0111	0.0768	1106.24	0.06196	0.42697
Pipe Stinging Truck (Tier 3)	200	5	3.2	50%	3,200	199.1	0.0111	0.0768	140.48	0.00787	0.05422
R/W Mowing Tractors (Tier 2)	75	5	1.6	50%	1,600	199.1	0.0111	0.0768	26.34	0.00148	0.01017
Air Compressors											
Air Compressor (Tier 2)	50	10	3.8	50%	7,680	199.1	0.0111	0.0768	84.29	0.00472	0.03253
Miscellaneous Equipment											
Water Pumps (Tier 2)	5	10	3.2	50%	6,400	199.1	0.0111	0.0768	7.02	0.00039	0.00271
Portable Light Plant (Tier 2)	25	10	3.2	50%	6,400	199.1	0.0111	0.0768	35.12	0.00197	0.01355
Mud Pumps (Tier 2)	25	4	3.2	50%	2,560	199.1	0.0111	0.0768	14.05	0.00079	0.00542
Tree Cutting Hot Saw (Tier 2)	200	2	2.1	50%	820	199.1	0.0111	0.0768	36.00	0.00202	0.01389
Boring Machine (Tier 2)	600	2	3.2	80%	2,048	199.1	0.0111	0.0768	269.71	0.01511	0.10410
									CO2	N2O	CH4
Total Estimated Project Emissions (Tons/Project/Year)									**13,479.1**	**0.75**	**5.20**

Notes:

VMT per Day for 24-inch Pipeline: [5]

Original Default Factors given in Kg/TJ for Diesel Off-Road Mobile Sources: 74,100 4.15 28.6 (in Kg/TJ)

[2] Assume 100 hour work weeks and four weeks per month.

Table 9A-8
Potential Greenhouse Gas Emissions (24-inch Pipeline - Line 880)

Equipment Type	HP	Estimated Operating Hours				Emission Factors (g/hp-hr) [1]			Estimated Emissions (tons/yr)		
		Line 880									
		Number	Months at Project	% Utilization	Total Hours [2]	CO_2	N_2O	CH_4	CO_2	N_2O	CH_4
Cranes											
Crane: 150 ton (Tier 3)	425	1	0.1	50%	14	199.1	0.0111	0.0768	1.31	0.00007	0.00050
Earthwork/Concrete Equipment											
Excavator (CAT 336) (Tier 3)	300	5	3.2	50%	3,150	199.1	0.0111	0.0768	207.42	0.01162	0.08006
Side Boom (CAT 573) (Tier 3)	225	0	3.2	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Dozer (CAT D8) (Tier 3)	325	1	3.2	50%	630	199.1	0.0111	0.0768	44.94	0.00252	0.01735
Vehicles											
Low Boy Truck (Tier 3)	200	2	2.9	50%	1,176	199.1	0.0111	0.0768	51.62	0.00289	0.01993
Contractor Truck (1/2 ton pickup) (Tier 3)	350	12	2.7	50%	6,552	199.1	0.0111	0.0768	503.34	0.02819	0.19427
Inspector Trucks (1/2 ton Pickup) (Tier 3)	350	0	2.7	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Surveyor Trucks (1/2 ton Pickup) (Tier 3)	350	0	2.7	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Welder Rig (Tier 2)	350	1	2.7	50%	546	199.1	0.0111	0.0768	41.95	0.00235	0.01619
Boom Truck (5 Tons) (Tier 2)	400	0	2.1	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Fuel Truck (5 ton) (Tier 3)	400	1	2.1	50%	420	199.1	0.0111	0.0768	36.87	0.00207	0.01423
Water Truck (5 ton) (Tier 3)	400	0	2.1	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Employee Vehicles (1/2 pickups) (Tier 3)	350	10	3.2	50%	6,300	199.1	0.0111	0.0768	483.98	0.02711	0.18680
Employee Vehicles (cars) (Tier 3)	150	5	3.2	50%	3,150	199.1	0.0111	0.0768	103.71	0.00581	0.04003
Pipe Stinging Truck (Tier 3)	200	0	2.1	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
R/W Mowing Tractors (Tier 2)	75	0	1.1	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Air Compressors											
Air Compressor (Tier 2)	50	2	2.5	50%	1,008	199.1	0.0111	0.0768	11.06	0.00062	0.00427
Miscellaneous Equipment											
Water Pumps (Tier 2)	5	2	0.0	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Portable Light Plant (Tier 2)	25	0	0.0	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Mud Pumps (Tier 2)	25	0	0.0	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Tree Cutting Hot Saw (Tier 2)	200	0	2.7	50%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
Boring Machine (Tier 2)	600	0	0.0	80%	0	199.1	0.0111	0.0768	0.00	0.00000	0.00000
									CO2	N2O	CH4
Total Estimated Project Emissions (Tons/Project/Year)									**1,486.2**	**0.08**	**0.57**

Notes:

VMT per Day for 24-inch Pipeline: [5]

Original Default Factors given in Kg/TJ for Diesel Off-Road Mobile Sources: 74,100 4.15 28.6 (in Kg/TJ)

[2] Assume 100 hour work weeks and four weeks per month.

APPENDIX 9-B

Illinois Air Regulations

Title 35 Illinois Administrative Code (IAC), Subtitle B provides air quality regulations and standards for the state of Illinois. Spire will comply with requirements of each provision as applicable to the project, including:

- **Part 201: Permits & General Provisions -** Establishes general provisions and applicability to air permits in the state of Illinois including addressing: prohibitions, permit application process, special provisions for smaller sources, CAAPP permits, compliance programs, malfunctions, breakdowns, and startups, monitoring and testing, and recordkeeping and reporting.
- **Parts 211-217: Emission Standards & Limitations for Stationary Sources -** Establishes general provisions and applicability to stationary source emission standards and limitations. Establishes emissions standards and limitations for various air pollutants.
- **Part 237: Open Burning -** Establishes general provisions and applicability to open burning regulations
- **Part 240: Mobile Sources -** Establishes general provisions and applicability to mobile source emission standards and limitations.
- **Part 243 Air Quality Standards -** Establishes general provisions and air quality standards for various air pollutants.
- **Part 244 Episodes -** Defines air pollutions episode stages and establishes episode procedures and responsibilities.
- **Part 245: Odors -** Provides determination of an objectionable nuisance odor and establishes exemption to Part 245.
- **Part 251: Procedures for Collection of Air Pollution Site Fees -** Establishes a system for determination and collection of air pollution site fees.
- **Part 252: Public Participation in the Air Pollution Control Permit Program -**Establishes public participation procedures for certain air permit applications and provides the public with an opportunity to comment on certain proposed permits.
- **Part 254: Annual Emissions Report -** Establishes uniform procedures for the reporting of air pollution emissions data and for the reporting of seasonal emissions from sources participating in the Emissions Reduction Market System.
- **Part 255: General Conformity: Criteria & Procedures -** Establishes criteria and procedures substantively similar to 40 CFR part 51, Subpart W whereby Federal agencies required to make conformity determinations of Federal actions to Illinois= air quality implementations plans may consult and coordinate with the Illinois Environmental Protection Agency (IEPA)
- **Part 261: Procedures for Providing Grants from the Illinois Clean Diesel Program (ICDGP) –** Establishes the procedures to be used by the IEPA to operate the ICDGP.
- **Part 273: NO_x Trading Program Procedures -** Provides procedures for the sale of NOx allowances by the IEPA and disbursement of certain proceeds from these sales.
- **Part 283: General Procedures for Emissions Test Averaging -** Establishes the general procedures and conditions for emissions tests averaging.

APPENDIX 9-C

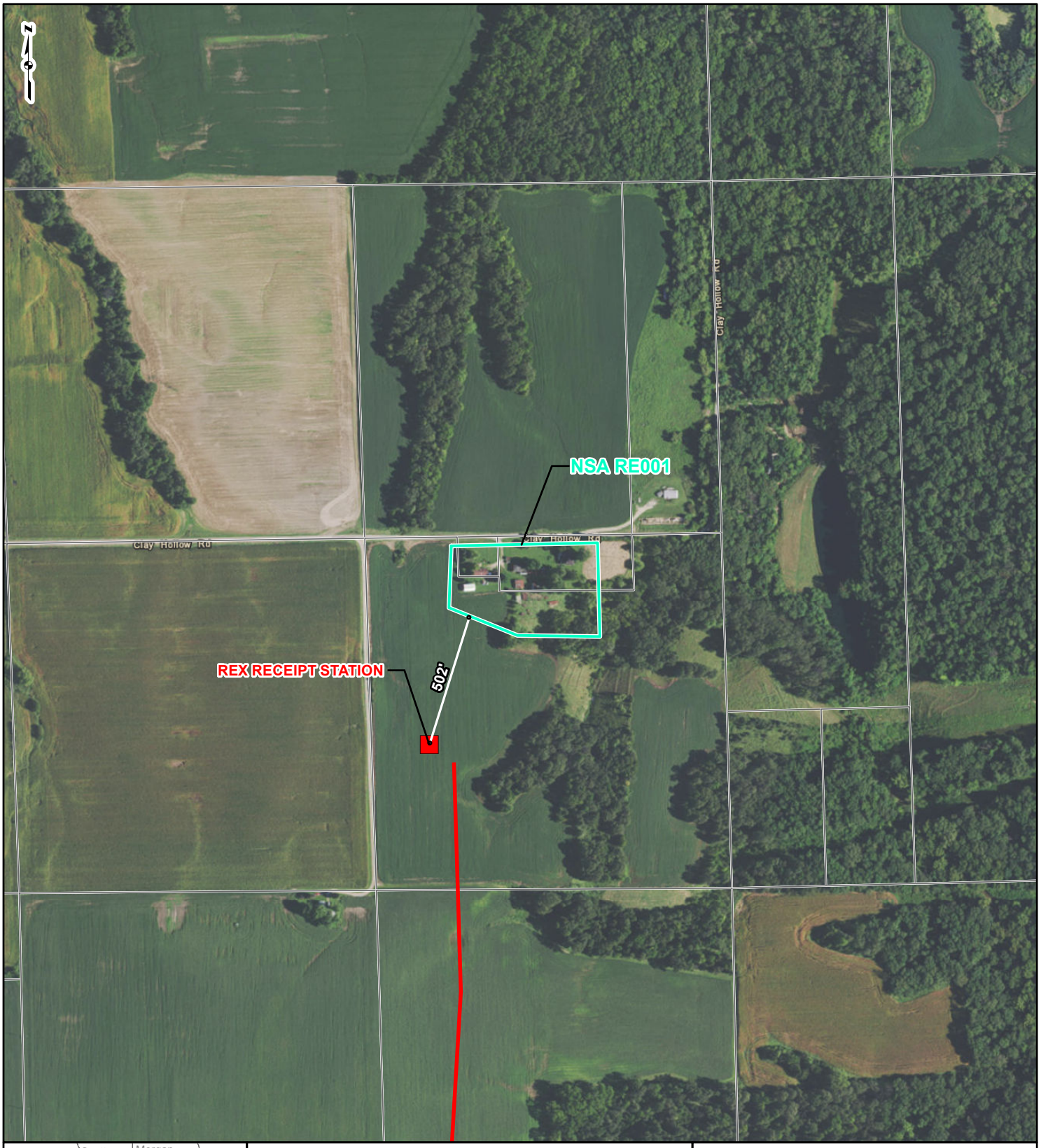
Missouri Air Regulations

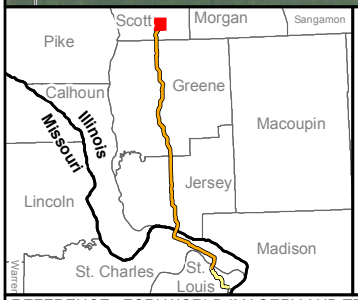
Division 10 of the Missouri Code of State Regulations (CSR), Chapter 6 provides air quality regulations and standards for the state of Missouri. Spire will comply with requirements of each provision as applicable to the project, including:

- **10 CSR 10-6.010: Ambient Air Quality Standards –** Establishes air quality standards for the state of Missouri.
- **10 CSR 10-6.045: Open Burning Requirements** - Establishes general provisions and applicability to open burning regulations.
- **10 CSR 10-6.050: Start-up, Shutdown and Malfunction Conditions –** Establishes procedures and regulations for start-up, shutdown, and malfunction conditions
- **10 CSR 10-6.060: Construction Permits Required –** Establishes applicability to and subsequent procedures for obtaining a construction permit.
- **10 CSR 10-6.065: Operating Permits -** Establishes applicability to and subsequent procedures for obtaining an operating permit.
- **10 CSR 10-6.080: Emission Standards for Hazardous Air Pollutants -** Establishes emission standards for new or modified sources emitting hazardous air pollutants.
- **10 CSR 10-6.100: Alternate Emission Limits –** Establishes procedures for sources in ozone nonattainment areas to propose alternate means of achieving reductions of volatile organic compounds emissions.
- **10 CSR 10-6.110: Reporting of Emission Data, Emission Fees and Process Information –** Establishes procedures for reporting emission related information and establishing emissions fees.
- **10 CSR 10-6.130: Controlling Emissions During Episodes of High Air Pollution Potential –** Establishes air pollution alert and emergency alert levels and subsequent procedures to be followed.
- **10 CSR 10-6.150: Circumvention –** Prohibits the installation or use of any device or means which conceals or dilutes an emission violating a rule.
- **10 CSR 10-6.165: Restriction of Emission of Odors –** Establishes applicability and restrictions to the emission of excessive odorous matter.
- **10 CSR 10-6.170: Restriction of Particulate Matter to the Ambient Air Beyond the Premises of Origin –** Restricts the emission particulate matter to the ambient air beyond the premises of origin.
- **10 CSR 10-6.180: Measurement of Emissions of Air Contaminants –** Establishes emissions testing applicability and procedures.
- **10 CSR 10-6.280: Compliance Monitoring Usage –** Establishes a methodology for identifying acceptable testing, monitoring, or information

APPENDIX 9-D

Pre-Construction Noise Survey Data





LEGEND

- FACILITY
- 24-INCH PIPELINE
- NOISE SENSITIVE AREA
- PARCEL BOUNDARY

0 250 500 1,000 Feet

NOISE SENSITIVE AREAS

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SPIRE STL PIPELINE PROJECT

spire

DRAWN BY: PMH DATE: 1/23/2017
CHECKED: EFJ APPROVED: LMF

REFERENCE: ESRI WORLD IMAGERY AND TRANSPORTATION, NAIP, USDA FSA, 2014, ACCESSED 01/2017.

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Legend

- Building
- Roadway
- M&R Facility

Noise level
Ldn

in dB(A)

- <= 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- > 90

Figure: 9.2-1
REX Receipt Station Location
39°34'0.35"N 90°24'56.38"W

Prepared By: _____
Reviewed By: _____
Approved By: _____

Scale 1:100

0 25 50 100 150 200 feet

Project Location: REX M&R	**Project Number:** C160438.00
Client: SPIRE	Model Run: C132336.04 -001
Field Staff: JJJ TL	Document Originator: JJJ Checked: Approved:

Type of Work/Study Performed: ☑ Sound Level Monitoring ☑ Sound Level Modeling

Type of Study: ☑ Ambient ☑ Construction ☐ Post Construction ☑ Operation

Duration: ☐ Spot ☑ 15-minute ☐ 1 hour ☐ 24 hour ☐ 48 hour ☐ 72 hour ☐ Other _____

Data Collected: ☑ LAeq ☑ LAFmax ☑ LAFmin ☑ LAF90 ☐ LAF10 ☐ Low Frequency ☐ Other _____

Approximate Study Area (sq mi): 0.27

Number of Monitoring Locations: 1

Monitoring Location:

ID:	Location Description:	Type:
ML1	In right of way abutting proposed project site.	Handheld and Fixed

Description of Surrounding Area (sketch, prominent sources of sound, etc.)

See associated Figure 9.2-1 for sound model and area descri

Identified Sound Level Sources:

ID:	Description:	Type:	Sound Levels
1	Clay Hollow Rd.	Line	Measured
2	1215E	Line	Measured
3	See Project Notes below for M&R Station Sources		Estimated

Project Notes:

1. M&R Facility expansion conservatively modeled to include the following significant sources:
- Proposed Odorizer Room @ 50.0 dBA
- Proposed O.P.P. Skid @ 86.2 dBA
- Proposed Flow Control Skid @ 86.2 dBA
- Proposed Separation Filter @ 60.0 dBA
- Proposed Condensate Tank @ 50 dBA
- Proposed Pig Launcher/Reciever @ 86.2 dBA

2. Sound level contributions from Clay Hollow R and 1215E. derived from traffic counts taken during 15-minute sound level surveys.

Results Summary:

See attached Figure 9.2-1 for sound level map with delineated NSAs.
See attached sound monitoring report sheets for results of 15-minute sound level surveys.

Attachment __
EQT Corporation, Haywood Pad
Washington County, Pennsylvania

Site Number: • Description: REX STATION

Done By:
Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/15		
Start Time:	12:45		
End Time:	1:45		
Duration:	15 MIN	MIN	MIN
LAeq:	53.7		

Traffic Data

Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			

Weather Conditions

Atmospheric data

Wind Speed (mph): 12 mph SSE

Temp. (°F): 38

Humidity (%): 77

Cloud Cover: 99%

Notes:

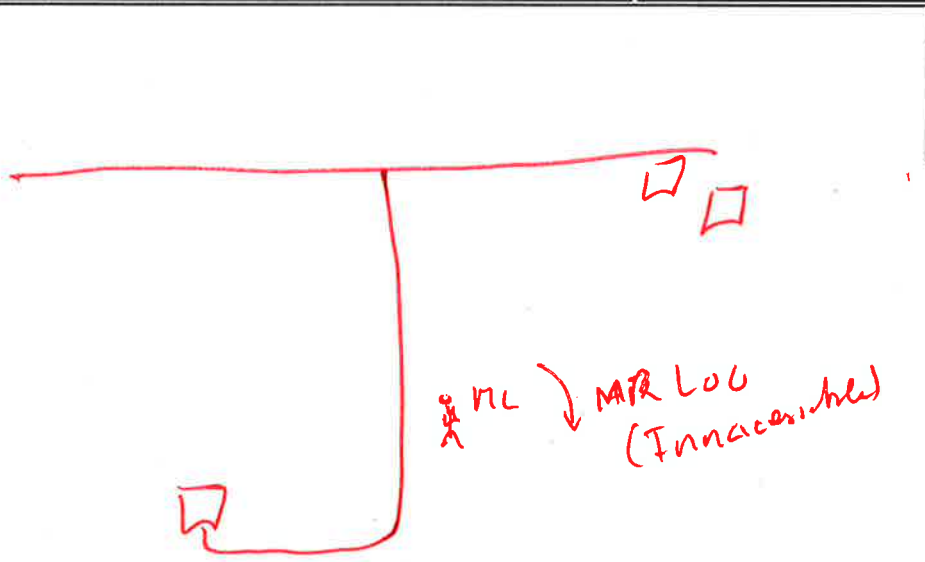
Mail Truck drove by late in study

LAFMin: 35.9 dB
LAFMax: 80.3 dB
LAFEQ: 53.7 dB
LAF90: 38.7 dB

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Plan View:



Profile View:

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Attachment __
EQT Corporation, Haywood Pad
Washington County, Pennsylvania

Site Number: ____ Description: REX Station

Done By: ____

Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	13:01		
End Time:	13:16		
Duration:	15. MIN	MIN	MIN
LAeq:	49.7		

Traffic Data

Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			

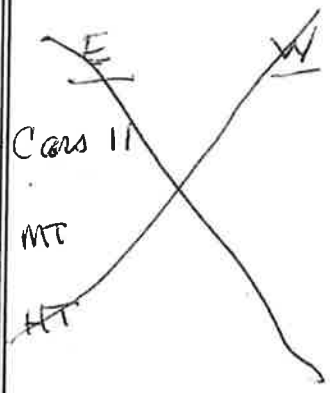
Weather Conditions

Atmospheric data	
Wind Speed (mph)	12 mph SE
Temp. (°F)	38
Humidity (%)	77
Cloud Cover	99

Site Data: Site Surphase (Alpha): ____ Shielding Factor: ____ Pavment Type: ____

Calibration Details: ____

Notes:



LAFMin: 35.1 dB
LAFMax: 64.0 dB
LAFEQ: 49.7 dB
LAF90: 39.2 dB

Plan View:

NORTH

See previous

Profile View:

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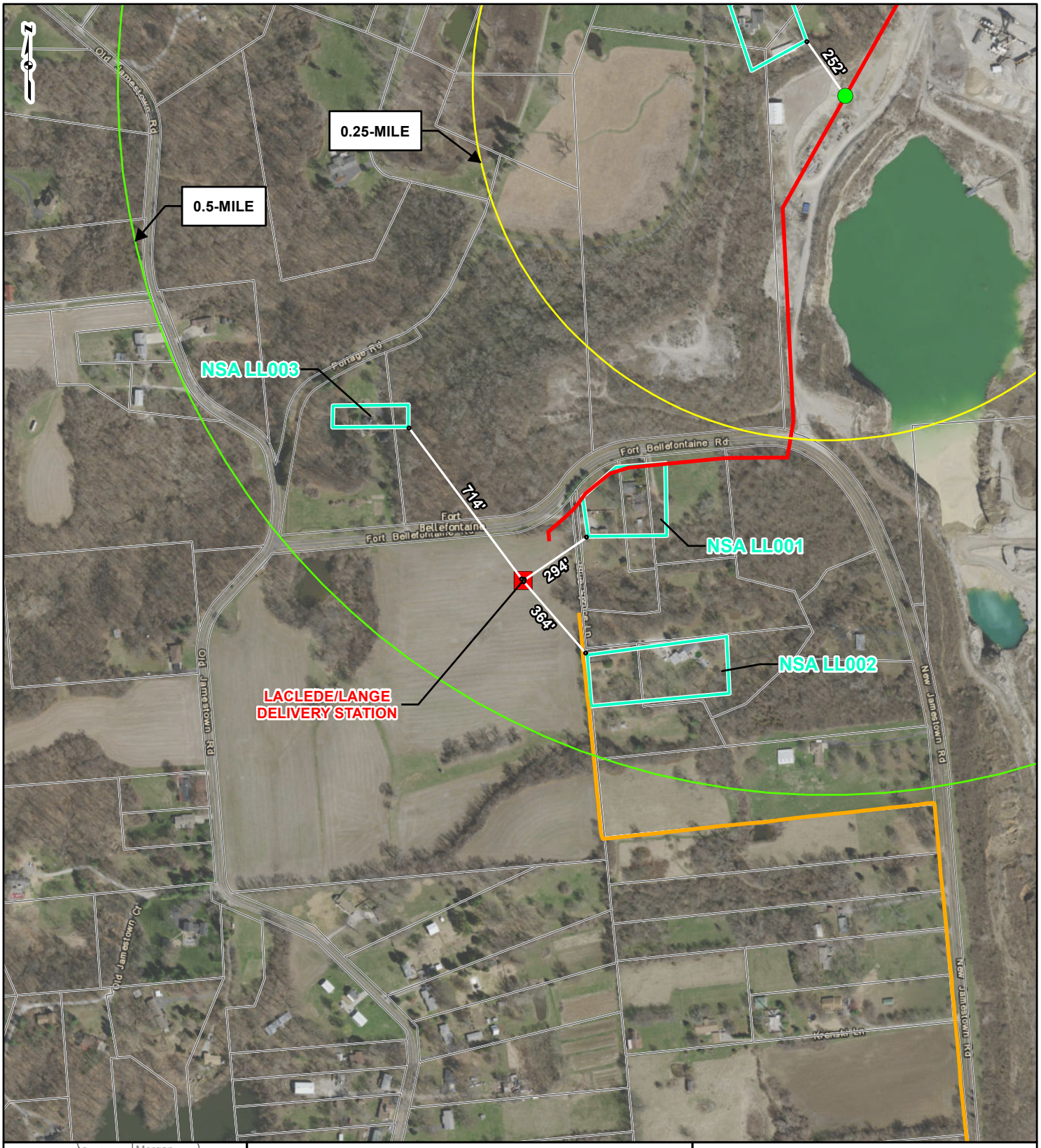

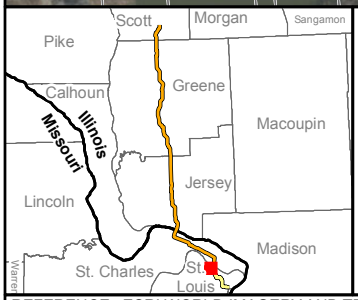

LEGEND

- FACILITY
- HDD LOCATION
- 24-INCH PIPELINE
- LINE 880 MODIFICATIONS
- NOISE SENSITIVE AREA
- 0.25- MILE HDD RADIUS
- 0.50- MILE HDD RADIUS
- PARCEL BOUNDARY

0 250 500 1,000 Feet

NOISE SENSITIVE AREAS

SPIRE STL PIPELINE PROJECT

gai consultants

spire

DRAWN BY: PMH DATE: 1/23/2017
CHECKED: EFJ APPROVED: LMF

REFERENCE: ESRI WORLD IMAGERY AND TRANSPORTATION, NAIP, USDA FSA, 2014, ACCESSED 01/2017.

Z:\Energy\2016\E160438.00 - Spire - STL Pipeline Proj\GIS\MXD\Resource_Reports\RR_9_Delineated_Noise_Sensitive_Areas_Laclede_Lange_2017_01_23.mxd

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Legend

- Road
- Building
- M&R Station

Noise level
Ldn

in dB(A)

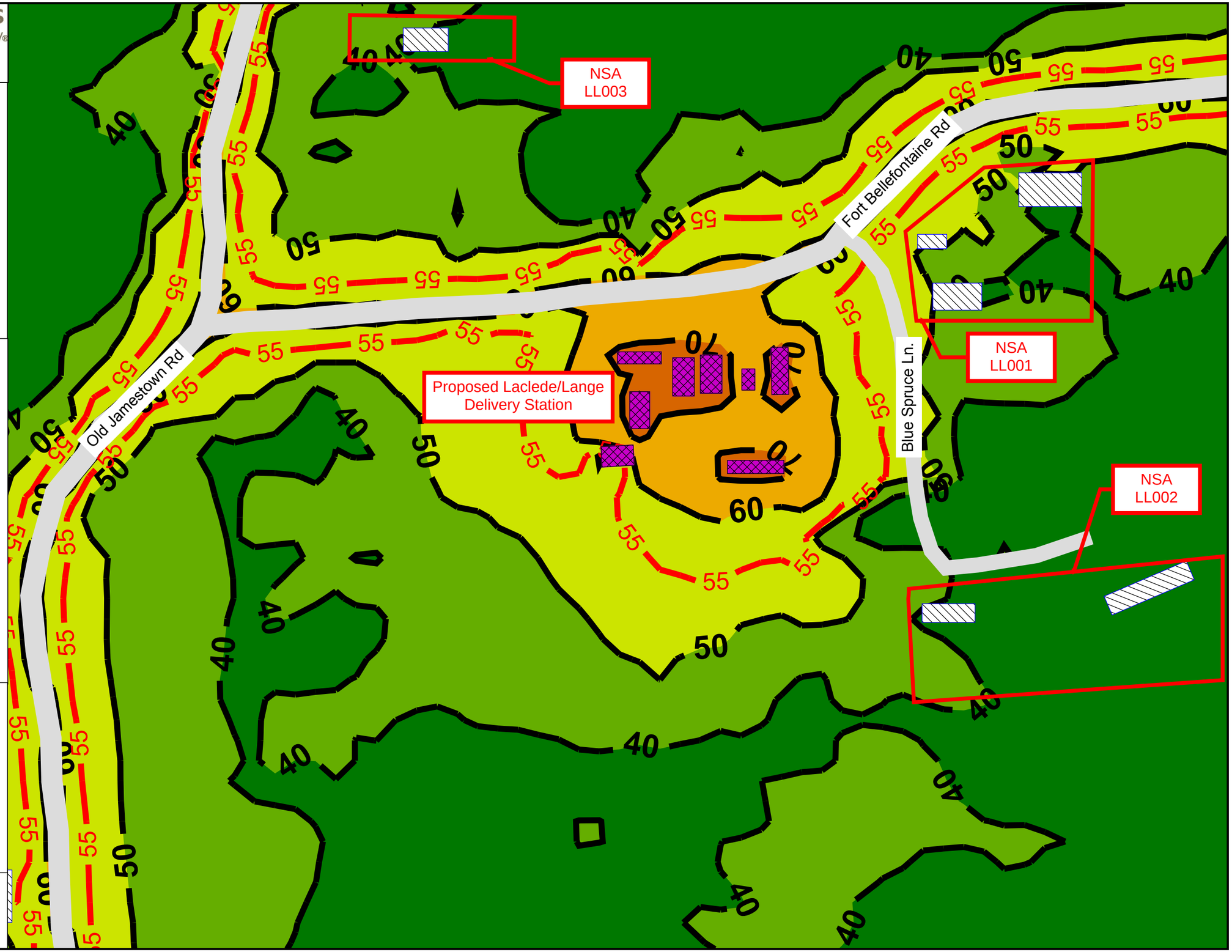
- <= 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- > 90

Figure: 9.2-2
SPIRE Laclede/Lange Delivery Station
Location
38°50'13.75"N 90°14'54.22"W

Prepared By: _____
Checked By: _____
Approved By: _____

Scale 1:150

0 37.5 75 150 225 300 feet



Project Location: Laclede/Lange M&R	**Project Number:** C160438.00
Client: SPIRE	Model Run: C132336.04 -001
Field Staff: JJJ TL	Document Originator: JJJ Checked: Approved:

Type of Work/Study Performed: ☑ Sound Level Monitoring ☑ Sound Level Modeling

Type of Study: ☑ Ambient ☑ Construction ☐ Post Construction ☑ Operation

Duration: ☐ Spot ☑ 15-minute ☐ 1 hour ☐ 24 hour ☐ 48 hour ☐ 72 hour ☐ Other _____

Data Collected: ☑ LAeq ☑ LAFmax ☑ LAFmin ☑ LAF90 ☐ LAF10 ☐ Low Frequency ☐ Other _____

Approximate Study Area (sq mi): 0.27

Number of Monitoring Locations: 1

Monitoring Location:

ID:	Location Description:	Type:
ML1	In right of way abutting proposed project site.	Handheld and Fixed

Description of Surrounding Area (sketch, prominent sources of sound, etc.)

See attached Figure 9.2-2 for sound model and area description

Identified Sound Level Sources:

ID:	Description:	Type:	Sound Levels
1	Fort Bellfontaine Rd.	Line	Measured
2	Old Jamestown Rd.	Line	Estimated
3	See Project Notes below for M&R Station Sources		Estimated

Project Notes:

1. M&R Facility expansion conservatively modeled to include the following significant sources:
- Two Proposed Indirect Gas Fired Heaters @ 86.2 dBA
- Proposed Pig Reciever @ 86.2 dBA
- Proposed Pig Launcher/Reciever @ 86.2 dBA
- Proposed Separation Filter @ 60.0 dBA
- Proposed O.P.P. Skid @ 86.2 dBA
- Proposed Flow Control Skid @ 86.2 dBA
- Proposed Odorant Tank @ 50 dBA

2. Sound level contributions from Fort Bellefontaine Rd. derived from traffic counts taken during 15-minute sound level surveys.
3. Sound contributions from Old Jamestown Rd. conservatively estimated based on typical sound levels for similar roads.

Results Summary:

See attached Figure 9.2-2 for sound level map with deliniated NSAs.
See attached sound monitoring report sheets for results of 15-minute sound level surveys.

Site Number: • Description: LAC lede/Lange M & R

Done By:

Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	9:07		
End Time:	2:22		
Duration:	15 MIN	MIN	MIN
LAeq:	54.5		

Traffic Data

Roadway			
Direction			
Traffic Total	2		
Cars	1		
MT	1		
HT			

Weather Conditions

Atmospheric data

Wind Speed (mph): 12 mph to East

Temp. (°F): 39

Humidity (%): 74

Cloud Cover: 87%

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

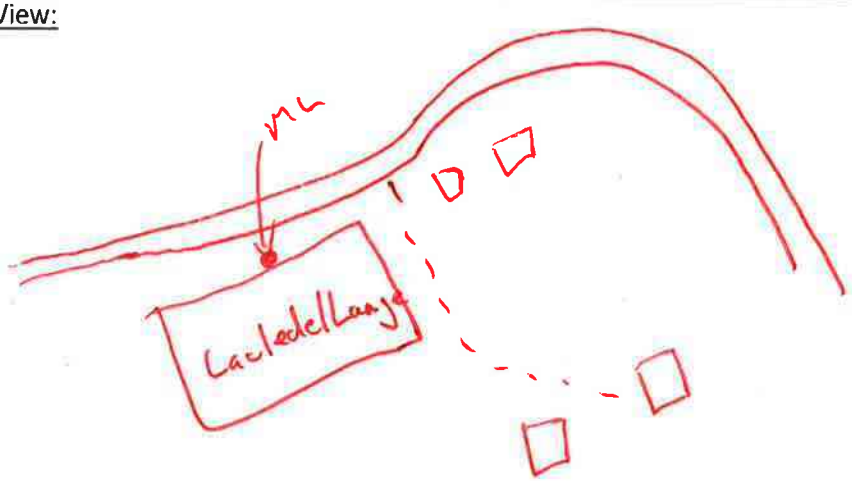
Calibration Details: _____

Notes:

Traffic
Cars 1
MT 1

LAFMin: 46.7 dB
LAFMax: 72.4 dB
LAFEQ: 54.5 dB
LAF90: 49.2 dB

Plan View:



Profile View:

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Site Number: _____ Description: LACLEDE/ LANGE M&R

Done By: _____

Meter: ⟶

	AM Peak	Off-Peak	PM Peak
Monitoring Data:			
Date	12/6/16		
Start Time:	16:58		
End Time:	17:13		
Duration:	15 MIN	MIN	MIN
LAeq:	52.7		
Traffic Data			
Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			
Weather Conditions			

Atmospheric data

Wind Speed (mph): 12 WNW

Temp. (°F): 42

Humidity (%): 62

Cloud Cover: 60%

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Notes:

LAFMin: 34.3 dB
LAFMax: 75.3 dB
LAFEQ: 52.7 dB
LAF90: 36.1 dB

Birds chirping

Plan View:

NORTH

see previous

Profile View:

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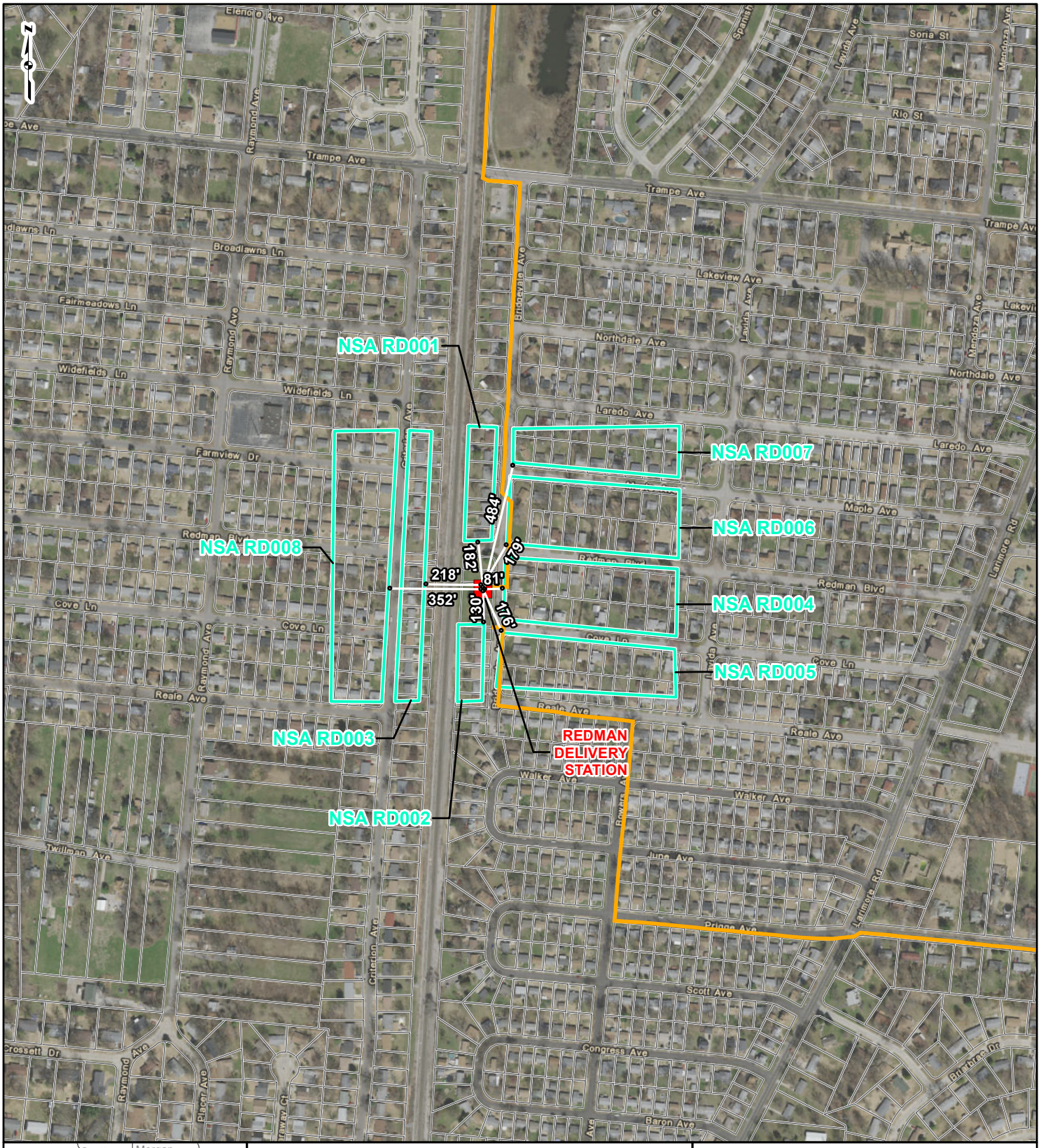

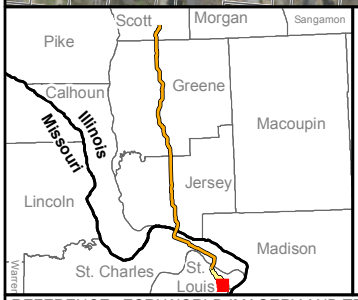

LEGEND

- FACILITY
- LINE 880 MODIFICATIONS
- NOISE SENSITIVE AREA
- PARCEL BOUNDARY

0 250 500 1,000 Feet

NOISE SENSITIVE AREAS

SPIRE STL PIPELINE PROJECT

gai consultants

spire

DRAWN BY: PMH DATE: 1/23/2017
CHECKED: EFJ APPROVED: LMF

REFERENCE: ESRI WORLD IMAGERY AND TRANSPORTATION, NAIP, USDA FSA, 2014, ACCESSED 01/2017.

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Legend

- Building
- Surface
- Rail Road Line
- M&R Facility

Noise level
Ldn

in dB(A)

	<= 40
	40 - 50
	50 - 60
	60 - 70
	70 - 80
	80 - 90
	> 90

Figure: 9.2-3
SPIRE Redman Delivery Station
M&R Facility
Location
38°47'4.61"N 90°12'21.52"W
Prepared By: _____
Checked By: _____
Approved By: _____

Scale 1:100

0 25 50 100 150 200 feet

Project Location: Redman M&R	**Project Number:** C160438.00
Client: SPIRE	Model Run: C132336.04 -001
Field Staff: JJJ TL	Document Originator: JJJ Checked: Approved:

Type of Work/Study Performed: ☑ Sound Level Monitoring ☑ Sound Level Modeling

Type of Study: ☑ Ambient ☑ Construction ☐ Post Construction ☑ Operation

Duration: ☐ Spot ☑ 15-minute ☐ 1 hour ☐ 24 hour ☐ 48 hour ☐ 72 hour ☐ Other _____

Data Collected: ☑ LAeq ☑ LAFmax ☑ LAFmin ☑ LAF90 ☐ LAF10 ☐ Low Frequency ☐ Other _____

Approximate Study Area (sq mi): 0.27

Number of Monitoring Locations: 1

Monitoring Location:

ID:	Location Description:	Type:
ML1	Fenceline of existing installation	Handheld and Fixed

Description of Surrounding Area (sketch, prominent sources of sound, etc.)

See attached Figure 9.2-3 for sound model and area description

Identified Sound Level Sources:

ID:	Description:	Type:	Sound Levels
1	Bridgevale Ave.	Line	Measured
2	Redman Rd.	Line	Estimated
3	Cove Ln.	Line	Estimated
4	Maple Ave.	Line	Estimated
5	Criterion Ave.	Line	Estimated
6	See Project Notes below for M&R Station Sources		

Project Notes:

1. M&R Facility expansion conservatively modeled to include the following significant sources:
- Proposed Condensate Tank @ 50.0 dBA
- Proposed Meter Building @ 50.0 dBA
- Proposed Separation Filter @ 60.0 dBA
- Proposed Control Valve Building @ 50 dBA
- Existing Installed Pneumatics Building @ 50 dBA
- Proposed Odorant Injection Building @ 50 dBA
- Proposed Odorant Tank @ 50 dBA
- Existing Pneumatics Building @ 50 dBA

2. Existing Railway line along western edge of property is active, but intermittent use.
3. Sound level contributions from Bridgevale Ave. derived from traffic counts taken during 15-minute sound level surveys.
4. Sound contributions from Redman Rd., Cove Ln., Maple Avenue, and Criterion Ave. were conservatively estimated based on typical sound levels for similar roads.

Results Summary:

See attached Figure 9.2-3 for sound level map with delineated NSAs.
See attached sound monitoring report sheets for results of 15-minute sound level surveys.

Site Number: _____ Description: REDMAN Facility - Bridgedale Ave.

Done By:

Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	7:23		
End Time:	7:38		
Duration:	15 MIN	MIN	MIN
LAeq:	68.6		

Traffic Data

Roadway			
Direction			
Traffic Total	7		
Cars	6		
MT	1		
HT	—		

Weather Conditions

Atmospheric data	
Wind Speed (mph)	10MPH From NNW
Temp. (°F)	38
Humidity (%)	76
Cloud Cover	85%

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

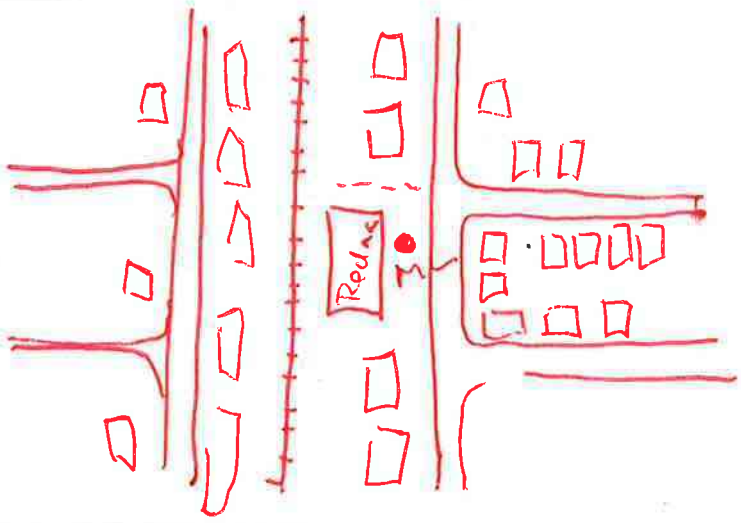
Calibration Details: _____

Notes:
Traffic
Cars LHT 1
MT 1

Train Passed At
7:31 to 7:36

LAFMin: 43.1 dB
LAFMax: 83.7 dB
LAFEQ: 68.6 dB
LAF90: 46.8 dB

Plan View:



NORTH ↑

Profile View:

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Site Number: ____ Description: Redman Facility

Done By: ____

Meter: ⟶ ____ ____ ____

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	6/12/16		
Start Time:	17:28		
End Time:	17:43		
Duration:	15 MIN	MIN	MIN
LAeq:	57.4		

Traffic Data

Roadway			
Direction			
Traffic Total	11		
Cars	11		
MT			
HT			

Weather Conditions

Atmospheric data
Wind Speed (mph)
5mph WNW
Temp. (°F)
40
Humidity (%)
64
Cloud Cover
60%

Site Data: Site Surphase (Alpha): ____ Shielding Factor: ____ Pavment Type: ____

Calibration Details: ____

Notes:

Cars ||||| |||| |

LAFMin: 43.4 dB
LAFMax: 67.7 dB
LAFEQ: 51.4 dB
LAF90: 46.0 dB

Plan View:

NORTH

See previous

Profile View:

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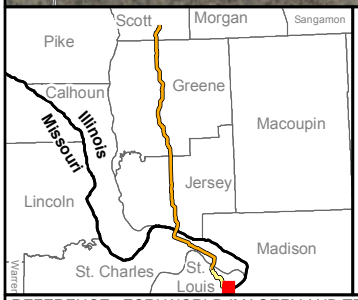

LEGEND

- FACILITY
- LINE 880 MODIFICATIONS
- NOISE SENSITIVE AREA
- PARCEL BOUNDARY

0 250 500 1,000 Feet

NOISE SENSITIVE AREAS

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SPIRE STL PIPELINE PROJECT

spire

DRAWN BY: PMH DATE: 1/23/2017
CHECKED: EFJ APPROVED: LMF

REFERENCE: ESRI WORLD IMAGERY AND TRANSPORTATION, NAIP, USDA FSA, 2014, ACCESSED 01/2017.

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Legend
- Building
- Surface
- M&R Facility

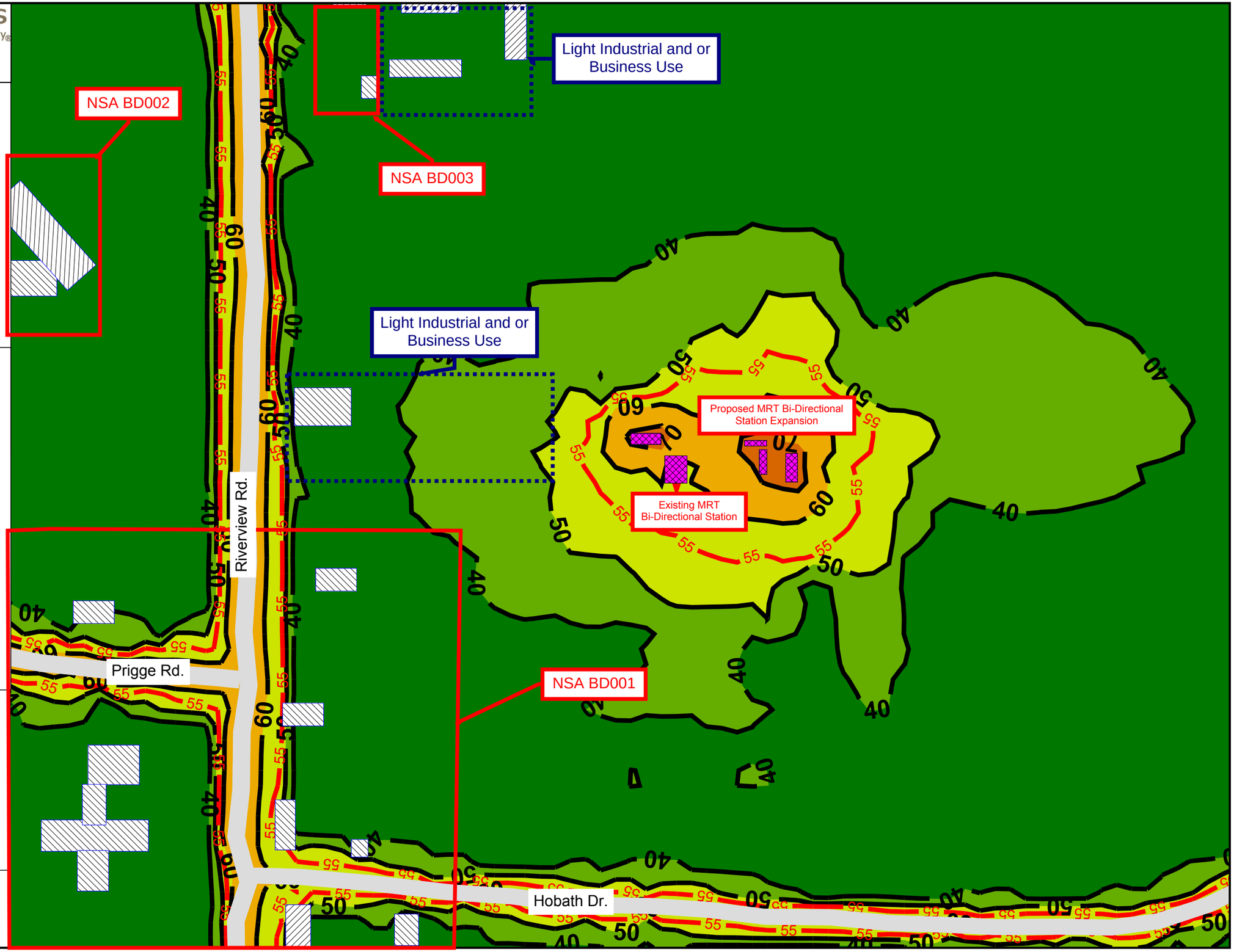
Noise level
Ldn
in dB(A)

- <= 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- > 90

Figure: 9.2-4
SPIRE MRT Bi-directional Station Location
38°46'44.40"N 90°10'42.93"W

Prepared By: _____
Checked By: _____
Approved By: _____

Scale 1:200
0 50 100 200 300 400 feet



Project Location: MRT Bi-Directional M&R	**Project Number:** C160438.00
Client: SPIRE	Model Run: C132336.04 -001
Field Staff: JJJ TL	Document Originator: JJJ Checked: Approved:

Type of Work/Study Performed: ☑ Sound Level Monitoring ☑ Sound Level Modeling

Type of Study: ☑ Ambient ☑ Construction ☐ Post Construction ☑ Operation

Duration: ☐ Spot ☑ 15-minute ☐ 1 hour ☐ 24 hour ☐ 48 hour ☐ 72 hour ☐ Other _____

Data Collected: ☑ LAeq ☑ LAFmax ☑ LAFmin ☑ LAF90 ☐ LAF10 ☐ Low Frequency ☐ Other _____

Approximate Study Area (sq mi): 0.27

Number of Monitoring Locations: 1

Monitoring Location:

ID:	Location Description:	Type:
ML1	Fenceline of existing installation	Handheld and Fixed

Description of Surrounding Area (sketch, prominent sources of sound, etc.)

See attached Figure 9.2-4 for sound model and area descrip

Identified Sound Level Sources:

ID:	Description:	Type:	Sound Levels
1	Riverview Rd	Line	Estimated
2	Prigge Rd	Line	Measured
3	Hobarth Dr.	Line	Estimated

Project Notes:

1. Sound levels emanating from light industrial/business use area adjacent to the existing MRT station were intermittent and not consistent.
2. Sound levels emanating from light industrial/business use area adjacent to NSA BD003 were not measured or quantified.
3. M&R Facility expansion conservatively modeled to include the following significant sources:
• Proposed Regulator Skid @ 86.2 dBA
• Proposed Meter Skid @ 86.2 dBA
• Proposed Launcher/Receiver @ 86.2 dBA
4. Sound contributions from Riverview Rd. and Hobath Rd. were conservatively estimated based on typical sound levels for similar roads.
5. Sound level contributions for Prigge Road determined based on traffic count during 15-minute readings.

Results Summary:

See attached Figure 9.2-4 for sound level map with delineated NSAs.
See attached sound monitoring report sheets for results of 15-minute sound level surveys.

Site Number: _____ Description: MRT Bidirectional Station

Done By: _____

Meter: ⟶ _____

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	6:30		
End Time:	6:46		
Duration:	MIN	MIN	MIN
LAeq:	66.0		
Traffic Data			
Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			
Weather Conditions			

Atmospheric data
Wind Speed (mph)
Temp. (°F)
39
Humidity (%)
76
Cloud Cover
90%

Notes:

LAFMin: 41.2 dB
LAFMax: 79.0 dB
LAFEQ: 61.0 dB
LAF90: 44.7 dB

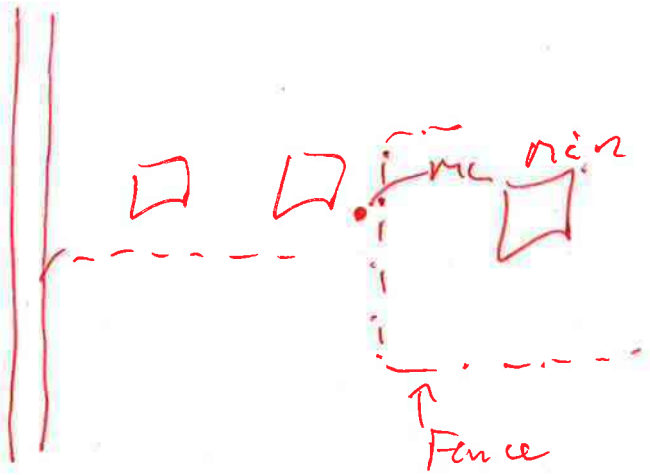
Intermittent Banging

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Plan View:

NORTH ↑



Profile View:

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Site Number: ____ Description: NRT Bidirectional station

Done By:

Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	18:12		
End Time:	18:27		
Duration:	15 MIN	MIN	MIN
LAeq:	48.3		
Traffic Data			
Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			
Weather Conditions			

Atmospheric data
Wind Speed (mph): 9 mph W
Temp. (°F): 42
Humidity (%): 67
Cloud Cover: 40

Notes:

LAFMin: 44.5 dB
LAFMax: 62.9 dB
LAFEQ: 48.3 dB
LAF90: 46.2 dB

Site Data: Site Surphase (Alpha): ____ Shielding Factor: ____ Pavment Type: ____

Calibration Details: ____

Plan View:

NORTH

See previous

Profile View:

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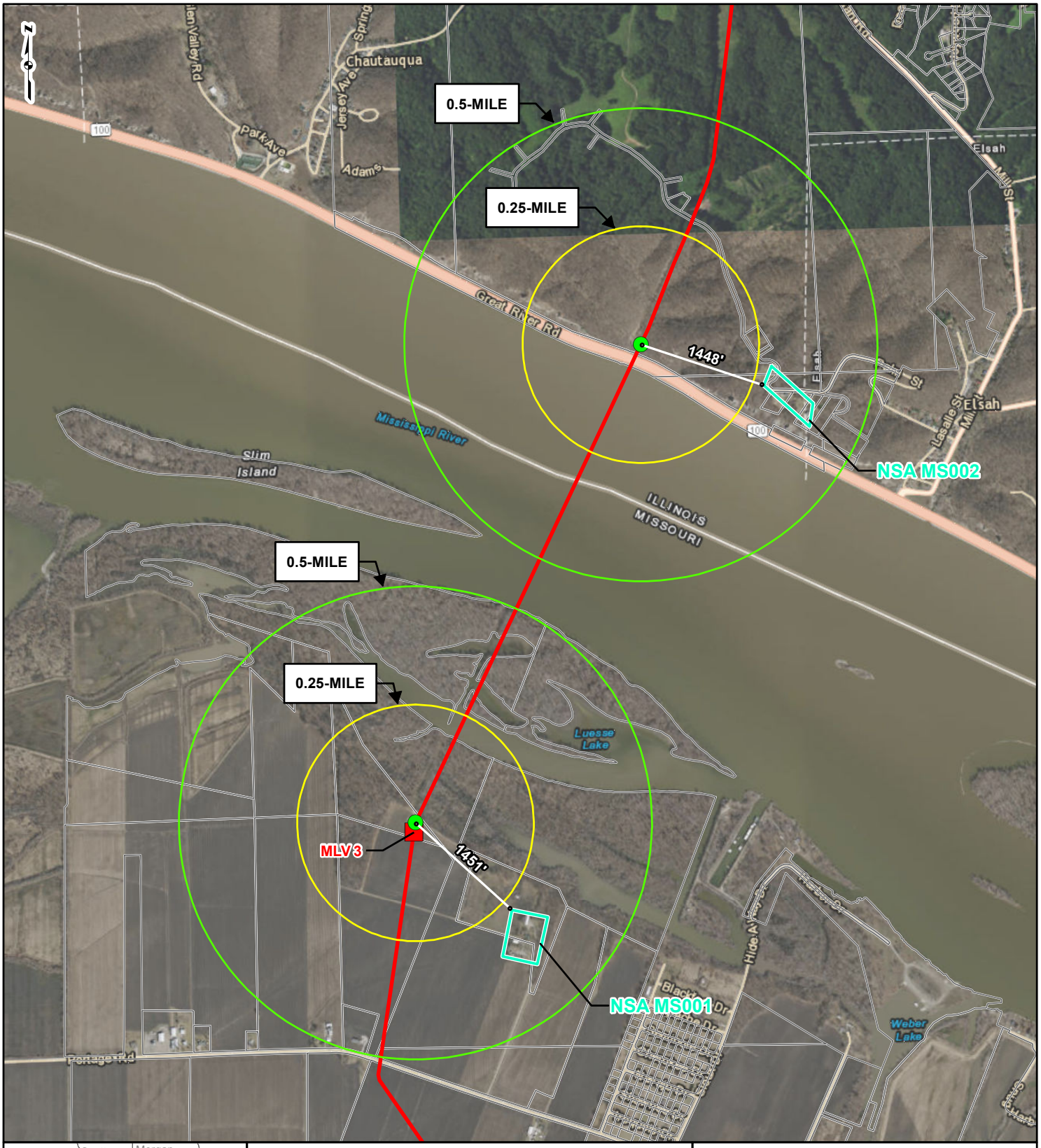

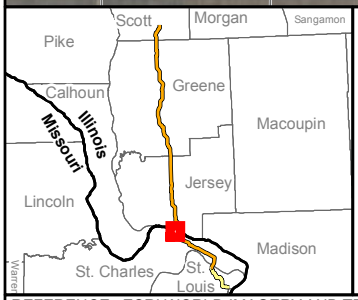

LEGEND

- FACILITY
- HDD LOCATION
- 24-INCH PIPELINE
- NOISE SENSITIVE AREA
- 0.25- MILE HDD RADIUS
- 0.50- MILE HDD RADIUS
- PARCEL BOUNDARY

0 750 1,500 3,000 Feet

NOISE SENSITIVE AREAS

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SPIRE STL PIPELINE PROJECT

spire

DRAWN BY: PMH DATE: 1/23/2017
CHECKED: EFJ APPROVED: LMF

REFERENCE: ESRI WORLD IMAGERY AND TRANSPORTATION, NAIP, USDA FSA, 2014, ACCESSED 01/2017.

Z:\Energy\2016\E160438.00 - Spire - STL Pipeline Proj\GIS\MXD\Resource_Reports\RR_9_Delineated_Noise_Sensitive_Areas_2017_01_23.mxd

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Legend

Building

Road

Noise level
Ldn

in dB(A)

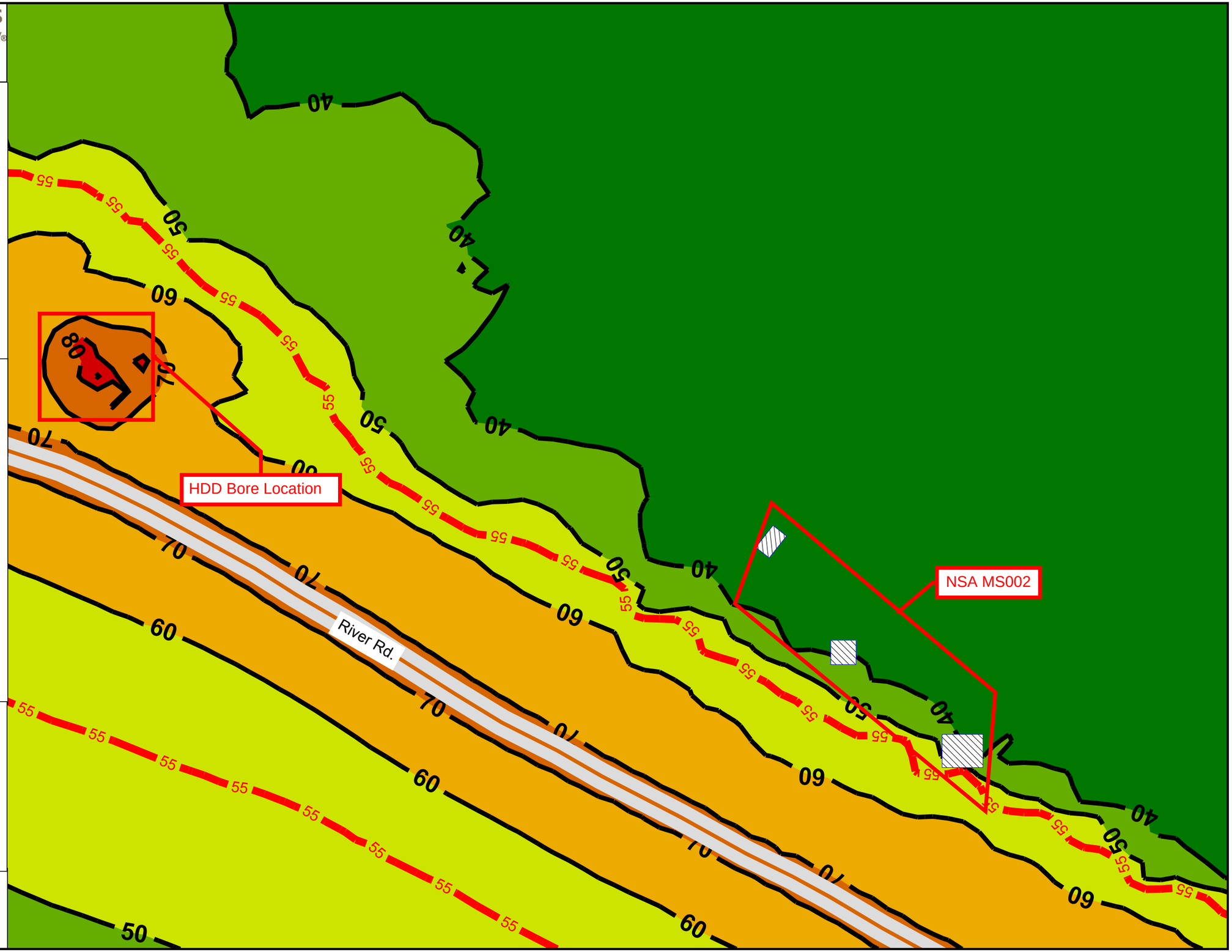
	<= 40
	40 - 50
	50 - 60
	60 - 70
	70 - 80
	80 - 90
	> 90

Figure: 9.2-5
SPIRE Mississippi River North HDD Location
38°57'24.67"N 90°22'25.14"W

Prepared By: _____
Checked By: _____
Approved By: _____

Scale 1:200

0 50 100 200 300 400 feet



Project Location: Mississippi River North HDD	**Project Number:** C160438.00
Client: SPIRE	Model Run: C132336.04 -001
Field Staff: JJJ TL	Document Orignator: JJJ Checked: Approved:

Type of Work/Study Performed: ☑ Sound Level Monitoring ☑ Sound Level Modeling

Type of Study: ☑ Ambient ☑ Construction ☐ Post Construction ☑ Operation

Duration: ☐ Spot ☑ 15-minute ☐ 1 hour ☐ 24 hour ☐ 48 hour ☐ 72 hour ☐ Other _____

Data Collected: ☑ LAeq ☑ LAFmax ☑ LAFmin ☑ LAF90 ☐ LAF10 ☐ Low Frequency ☐ Other _____

Approximate Study Area (sq mi): 0.27

Number of Monitoring Locations: 1

Monitoring Location:

ID:	Location Description:	Type:
ML1	In right of way near River Road (site access denied)	Handheld and Fixed

Description of Surrounding Area (sketch, prominent sources of sound, etc.)

See attached Figure 9.2-5 for sound model and area description

Identified Sound Level Sources:

ID:	Description:	Type:	Sound Levels
1	River Road	Line	Estimated
2	See Project Notes below for HDD Station Sources		Estimated

Project Notes:

1. M&R Facility expansion conservatively modeled to include the following significant sources:
- Large Drill Rig @ 110 dBA
- Two Mud Pumps @ 110 dBA
- Three Generators @ 90 dBA
- Separation Plant @ 100 dBA

2. Sound level contributions from nearby River Road estimated based on traffic counts during 15-minute sound level surveys.

Results Summary:

See attached Figure 9.2-5 for sound level map with delineated NSAs.
See attached sound monitoring report sheets for results of 15-minute sound level surveys.

Site Number: _____ Description: Mississippi River North HDD

Done By: _____

Meter: ⟶ _____ _____ _____

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	11:19		
End Time:	11:34		
Duration:	15 MIN	MIN	MIN
LAeq:	58.3		

Traffic Data

Roadway						
Direction	E	W	~~E~~	~~W~~		
Traffic Total	14	13				
Cars	11	9				
MT	3	2				
HT	-	2				

Weather Conditions _____ _____ _____

Atmospheric data

Wind Speed (mph): L4 From W NW

Temp. (°F): 41

Humidity (%): 75

Cloud Cover: 100%

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Notes:

TRAFFIC

E CARS IIII MT III HT

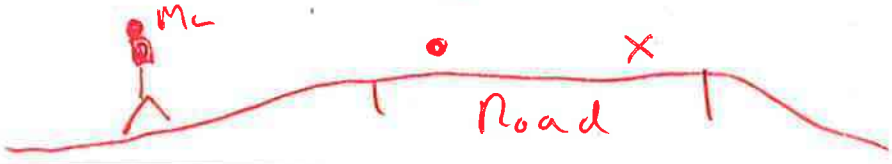
W CARS IIII MT II HT II

LAFMin: 32.3 dB
LAFMax: 78.8 dB
LAFEQ: 58.3 dB
LAF90: 36.1 dB

Plan View:

NORTH

Profile View:



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Site Number: _____ Description: Mississippi North HDD

Done By: _____

Meter: ⟶ _____ _____ _____

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	14:28		
End Time:	14:43		
Duration:	15 MIN	MIN	MIN
LAeq:	61.5		

Traffic Data

Roadway						
Direction	E	W				
Traffic Total	24	23				
Cars	10	10				
MT	12	12				
HT	2	1				

Weather Conditions _____ _____ _____

Atmospheric data
Wind Speed (mph): 13 WNW
Temp. (°F): 41
Humidity (%): 68
Cloud Cover: 96%

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Notes:

	E	W
Cars	𝍸 𝍸 II	𝍸 𝍸
MT	𝍸 𝍸 II 𝍸 I	𝍸 𝍸 II
HT	II	I

LAFMin: 31.8 dB
LAFMax: 81.6 dB
LAFEQ: 61.5 dB
LAF90: 36.4 dB

Plan View:

NORTH

See previous

Profile View:

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Legend

Building

Surface

Noise level
Ldn
in dB(A)

<= 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
> 90

HDD Bore Location

NSA MS001

Figure: 9.2-6
SPIRE Mississippi River South HDD Location
38°56'31.96"N 90°22'59.46"W

Prepared By: _____
Checked By: _____
Approved By: _____

Scale 1:200
0 50 100 200 300 400
feet

Project Location:	Mississippi River South HDD	**Project Number:**	C160438.00
Client:	SPIRE	Model Run:	C132336.04 -001
Field Staff:		Document Originator:	JJJ
JJJ		Checked:	
TL		Approved:	

Type of Work/Study Performed: ☑ Sound Level Monitoring ☑ Sound Level Modeling

Type of Study: ☑ Ambient ☑ Construction ☐ Post Construction ☑ Operation

Duration: ☐ Spot ☑ 15-minute ☐ 1 hour ☐ 24 hour ☐ 48 hour ☐ 72 hour ☐ Other _____

Data Collected: ☑ LAeq ☑ LAFmax ☑ LAFmin ☑ LAF90 ☐ LAF10 ☐ Low Frequency ☐ Other _____

Approximate Study Area (sq mi): 0.27

Number of Monitoring Locations: 1

Monitoring Location:

ID:	Location Description:	Type:
ML1	At roadway property gate of proposed HDD site	Handheld and Fixed

Description of Surrounding Area (sketch, prominent sources of sound, etc.)

See attached Figure 9.2-6 for sound model and area description

Identified Sound Level Sources:

ID:	Description:	Type:	Sound Levels
1	Portage Rd	Line	Estimated
2	See Project Notes below for HDD Station Sources		Estimated

Project Notes:

1. M&R Facility expansion conservatively modeled to include the following significant sources:
- Large Drill Rig @ 110 dBA
- Two Mud Pumps @ 110 dBA
- Three Generators @ 90 dBA
- Separation Plant @ 100 dBA

2. Sound level contributions from nearby Portage Rd Estimated

Results Summary:

See attached Figure 9.2-6 for sound level map with delineated NSAs.
See attached sound monitoring report sheets for results of 15-minute sound level surveys.

Site Number: _____ Description: Mississippi River South HDD

Done By: _____

Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	10:09		
End Time:	10:24		
Duration:	15 MIN	MIN	MIN
LAeq:	40.0		

Traffic Data

Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			

Weather Conditions

Atmospheric data

Wind Speed (mph): 10 mph From NW

Temp. (°F): 41

Humidity (%): 75%

Cloud Cover: 100%

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Notes:

LAFMin: 33.9 dB
LAFMax: 59.2 dB
LAFEQ: 40.0 dB
LAF90: 46.9 dB

Plan View:

Profile View:

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Site Number: • Description: Mississippi River South

Done By:

Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	~~16:25~~ 15:25		
End Time:	15:40		
Duration:	15 MIN	MIN	MIN
LAeq:	46.5		

Traffic Data

Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			

Weather Conditions

Atmospheric data

Wind Speed (mph): 9 mph ESE

Temp. (°F): 42

Humidity (%): 87

Cloud Cover: 100%

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Notes:

LAFMin: 32.6 dB
LAFMax: 67.7 dB
LAFEQ: 46.5 dB
LAF90: 37.2 dB

Plan View:

NORTH

See previous

Profile View:

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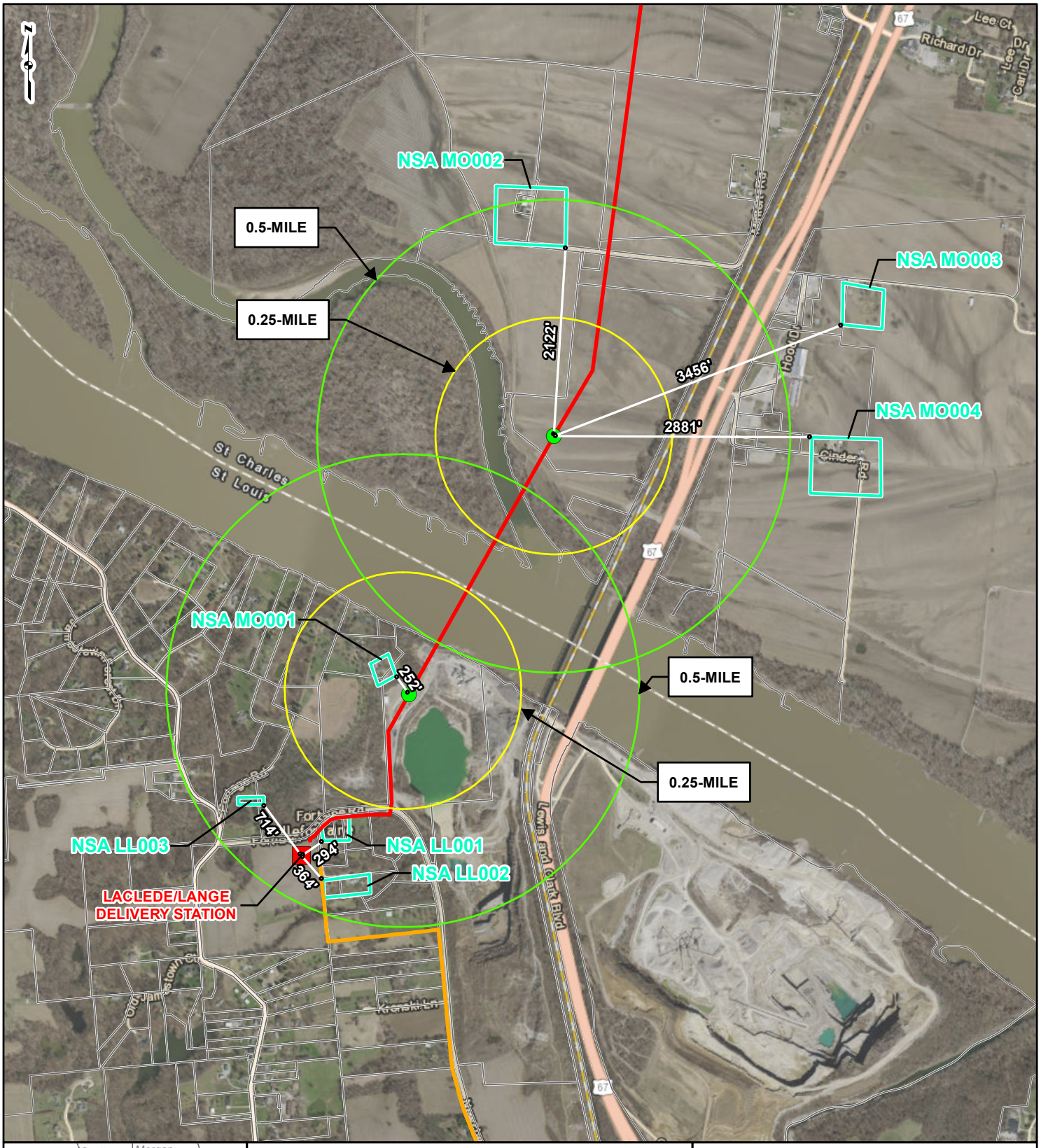

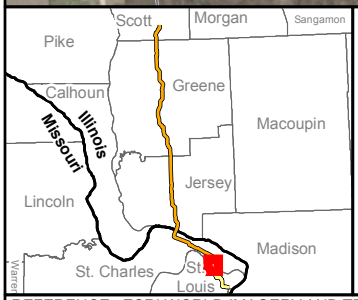

LEGEND

- FACILITY
- HDD LOCATION
- 24-INCH PIPELINE
- LINE 880 MODIFICATIONS
- NOISE SENSITIVE AREA
- 0.25- MILE HDD RADIUS
- 0.50- MILE HDD RADIUS
- PARCEL BOUNDARY

0 750 1,500 3,000 Feet

NOISE SENSITIVE AREAS

SPIRE STL PIPELINE PROJECT

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spire

DRAWN BY: PMH DATE: 1/23/2017
CHECKED: EFJ APPROVED: LMF

REFERENCE: ESRI WORLD IMAGERY AND TRANSPORTATION, NAIP, USDA FSA, 2014, ACCESSED 01/2017.

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Legend

Building

Surface

Noise level
Ldn

in dB(A)

<= 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
> 90

NSA MO002

NSA MO003

NSA MO004

Minert Rd.

Red School Rd.

HDD Bore Location

US 67

Light Industrial and or Business Use

Cinder Rd.

Figure:9.2-7
SPIRE Missouri River North HDD Location
38°50'59.16"N 90°14'13.14"W

Prepared By: _____
Checked By: _____
Approved By: _____

Scale 1:398

0 100 200 400 600 800 feet

Project Location:	Missouri River North HDD	**Project Number:**	C160438.00
Client:	SPIRE	Model Run:	C132336.04 -001
Field Staff:		Document Originator:	JJJ
JJJ		Checked:	
TL		Approved:	

Type of Work/Study Performed: ☑ Sound Level Monitoring ☑ Sound Level Modeling

Type of Study: ☑ Ambient ☑ Construction ☐ Post Construction ☑ Operation

Duration: ☐ Spot ☑ 15-minute ☐ 1 hour ☐ 24 hour ☐ 48 hour ☐ 72 hour ☐ Other _____

Data Collected: ☑ LAeq ☑ LAFmax ☑ LAFmin ☑ LAF90 ☐ LAF10 ☐ Low Frequency ☐ Other _____

Approximate Study Area (sq mi): 0.27

Number of Monitoring Locations: 1

Monitoring Location:

ID:	Location Description:	Type:
ML1	At roadway north of proposed HDD bore location and near closest NSA	Handheld and Fixed

Description of Surrounding Area (sketch, prominent sources of sound, etc.)

See attached Figure 9.2-7 for sound model and area description

Identified Sound Level Sources:

ID:	Description:	Type:	Sound Levels
1	Minert Rd.	Line	Estimated
2	US Rt 67	Line	Estimated
3	See Project Notes below for HDD Station Sources		Estimated

Project Notes:

1. M&R Facility expansion conservatively modeled to include the following significant sources:
• Large Drill Rig @ 110 dBA
• Two Mud Pumps @ 110 dBA
• Three Generators @ 90 dBA
• Separation Plant @ 100 dBA
2. Sound level contributions from nearby US Rt 67 Estimated
3. Sound level contribution from Minert Rd estimated based on traffic count performed during 15-minute sound level readings.

Results Summary:

See attached Figure 9.2-7 for sound level map with delineated NSAs.
See attached sound monitoring report sheets for results of 15-minute sound level surveys.

Site Number: 2 Description: Missouri North HDD

Done By:

Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	9:27		
End Time:	9:42		
Duration:	15 MIN	MIN	MIN
LAeq:	43.7		

Traffic Data

Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			

Weather Conditions

Atmospheric data	
Wind Speed (mph)	14 From NNW
Temp. (°F)	40
Humidity (%)	72
Cloud Cover	90%

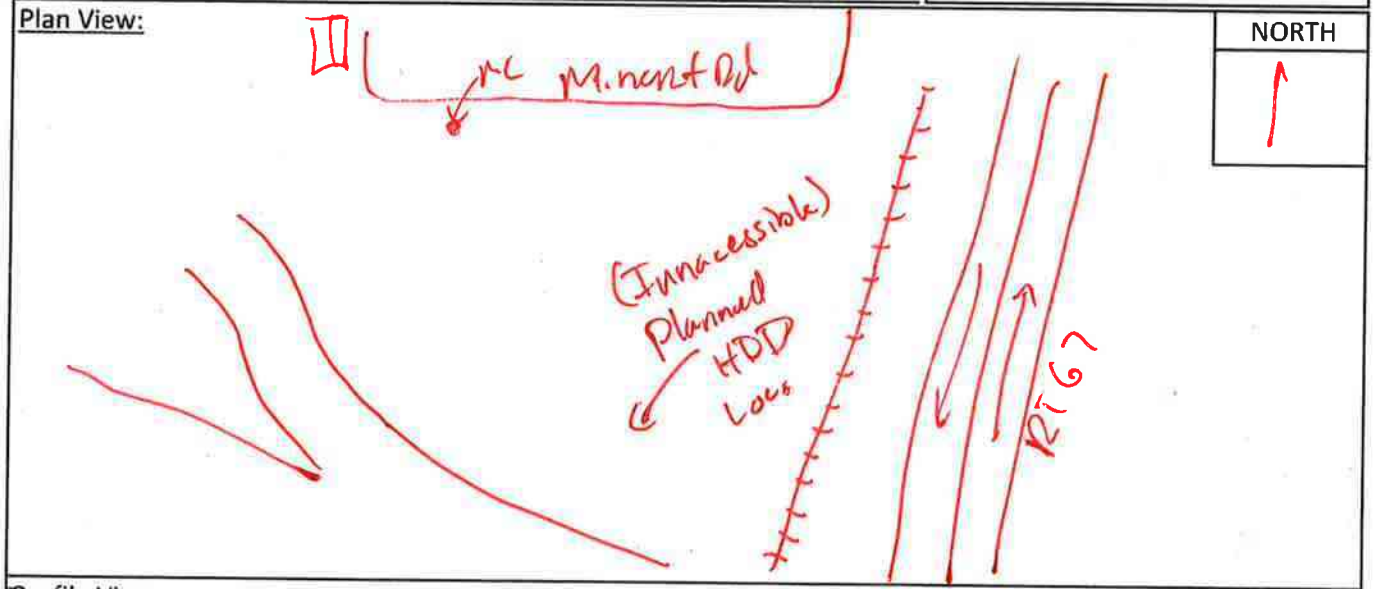
Notes:

LAFMin: 37.5 dB
LAFMax: 56.9 dB
LAFEQ: 43.7 dB
LAF90: 40.0 dB

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Plan View:



Profile View:

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Site Number: • Description: Missouri River North HDD

Done By:

Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	16:03		
End Time:	16:18		
Duration:	15 MIN	MIN	MIN
LAeq:	58.9		

Traffic Data

Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			

Weather Conditions

Atmospheric data	
Wind Speed (mph)	14 mph WNW
Temp. (°F)	41
Humidity (%)	79
Cloud Cover	35%

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Notes:

LAFMin: 34.4 dB
LAFMax: 80.0 dB
LAFEQ: 58.9 dB
LAF90: 38.5 dB

Plan View:

NORTH

See previous

Profile View:

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Legend

Building

Noise level
Ldn

in dB(A)

<= 40	
40 - 50	
50 - 60	
60 - 70	
70 - 80	
80 - 90	
> 90	

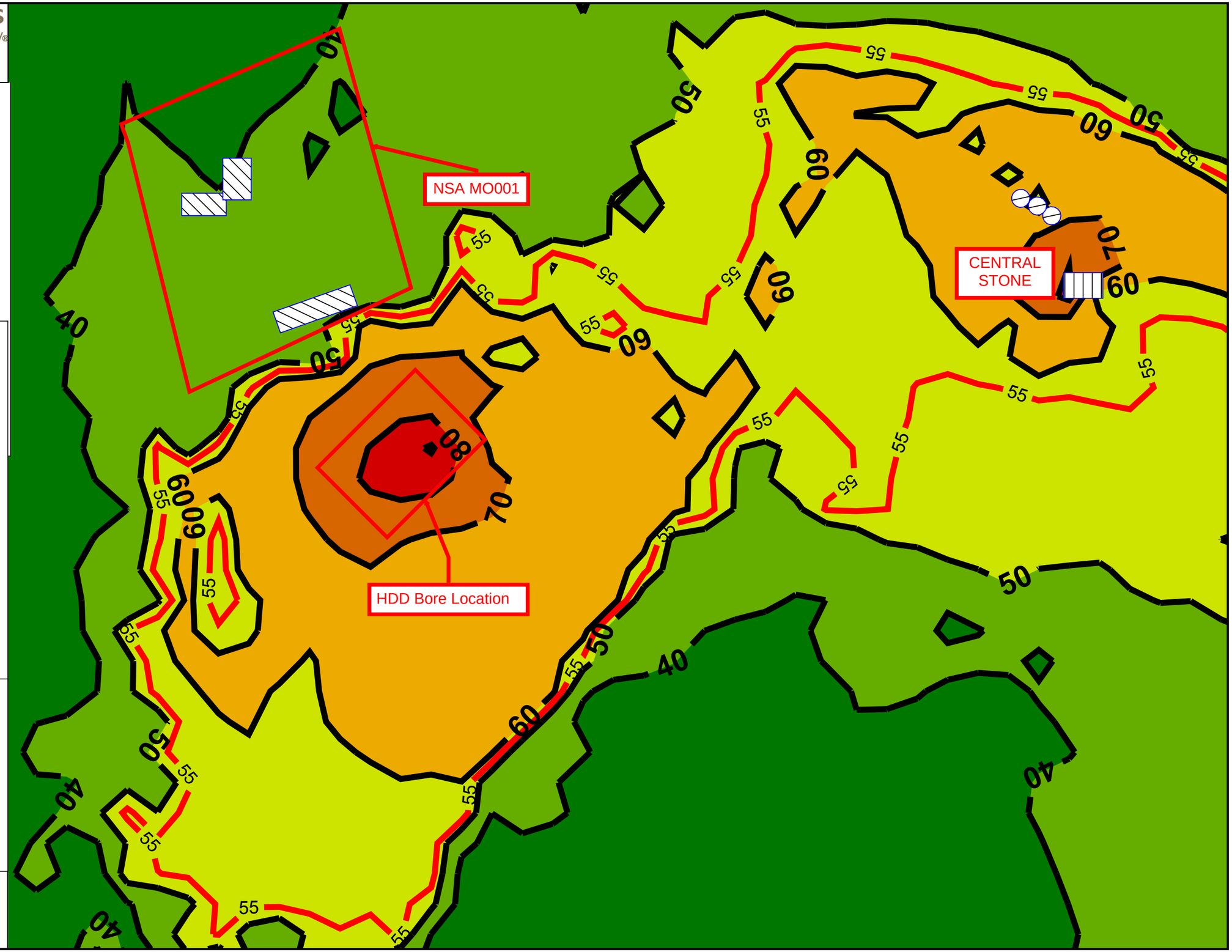


Figure: 9.2-8
SPIRE Missouri River South HDD Location
38°50'30.81"N 90°14'36.15"W

Prepared By: _____
Checked By: _____
Approved By: _____

Scale 1:100

0 25 50 100 150 200 feet

Project Location:	Missouri River South HDD	**Project Number:**	C160438.00
Client:	SPIRE	Model Run:	C132336.04 -001
Field Staff:		Document Originator:	JJJ
JJJ		Checked:	
TL		Approved:	

Type of Work/Study Performed: ☑ Sound Level Monitoring ☑ Sound Level Modeling

Type of Study: ☑ Ambient ☑ Construction ☐ Post Construction ☑ Operation

Duration: ☐ Spot ☑ 15-minute ☐ 1 hour ☐ 24 hour ☐ 48 hour ☐ 72 hour ☐ Other _____

Data Collected: ☑ LAeq ☑ LAFmax ☑ LAFmin ☑ LAF90 ☐ LAF10 ☐ Low Frequency ☐ Other _____

Approximate Study Area (sq mi): 0.27

Number of Monitoring Locations: 1

Monitoring Location:

ID:	Location Description:	Type:
ML1	At proposed HDD location	Handheld and Fixed

Description of Surrounding Area (sketch, prominent sources of sound, etc.)

See attached Figure 9.2-8 for sound model and area description

Identified Sound Level Sources:

ID:	Description:	Type:	Sound Levels
1	Existing Stone Handling Operations	Line	Estimated
2	See Project Notes below for HDD Station Sources		Estimated

Project Notes:

1. M&R Facility expansion conservatively modeled to include the following significant sources:
- Large Drill Rig @ 110 dBA
- Two Mud Pumps @ 110 dBA
- Three Generators @ 90 dBA
- Separation Plant @ 100 dBA

2. Sound level contributions from nearby existing material/rock handling operation were estimated

Results Summary:

See attached Figure 9.2-8 for sound level map with delineated NSAs.
See attached sound monitoring report sheets for results of 15-minute sound level surveys.

Site Number: • Description: Central Stone - Missouri South

Done By:

Meter: →

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	8:56		
End Time:	9:11		
Duration:	15 MIN	MIN	MIN
LAeq:	50.2		

Traffic Data

Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			

Weather Conditions

Atmospheric data
Wind Speed (mph): 10 mph ESE
Temp. (°F): 39°
Humidity (%): 73
Cloud Cover: 78%

Notes:

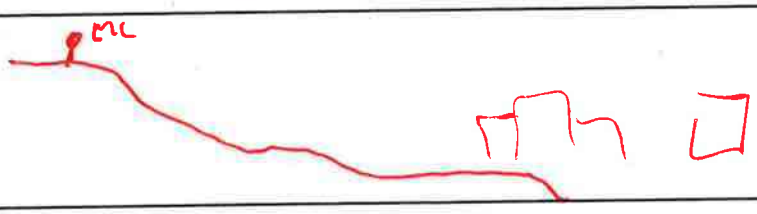
LAFMin: 46.4 dB
LAFMax: 62.8 dB
LAFEQ: 50.2 dB
LAF90: 48.7 dB

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Plan View:

Profile View:



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Site Number: • Description: Central Stone. Missouri River South

Done By:

Meter: ⟶

Monitoring Data:	AM Peak	Off-Peak	PM Peak
Date	12/6/16		
Start Time:	16:30		
End Time:	16:45		
Duration:	15 MIN	MIN	MIN
LAeq:	47.3		

Traffic Data

Roadway			
Direction			
Traffic Total			
Cars			
MT			
HT			

Weather Conditions

Atmospheric data

Wind Speed (mph): 1 Z WNW

Temp. (°F): 42

Humidity (%): 62

Cloud Cover: 60%

Notes:

LAFMin: 34.9 dB
LAFMax: 70.3 dB
LAFEQ: 47.3 dB
LAF90: 37.1 dB

Site Data: Site Surphase (Alpha): _____ Shielding Factor: _____ Pavment Type: _____

Calibration Details: _____

Plan View:

NORTH

see previous

Profile View:

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APPENDIX 9-E

Fugitive Dust Control Plan

Spire STL Pipeline Project

Fugitive Dust Control Plan

FERC Docket No. CP17-__-__

January 2017

Public

Table of Contents

Acronyms and Abbreviations

Project	Spire STL Pipeline Project
Spire	Spire STL Pipeline LLC

Fugitive Dust Control Plan

1.1 Introduction

Land disturbance from construction activities has the potential to generate fugitive dust emissions. Dust control measures may reduce surface and air movement of dust from disturbed soil surfaces. This Fugitive Dust Control Plan describes the general control measures to be implemented by Spire STL Pipeline LLC ("Spire") and its contractors to ensure that dust suppression techniques are taken during construction of the Spire STL Pipeline Project ("Project"). Measures identified within this Fugitive Dust Control Plan outline dust control methods that will be used on all work areas including temporary workspaces and access roads and outlines the recommended records to be maintained onsite during construction.

1.2 Fugitive Dust Emission Sources

The following Project activities have the potential to generate fugitive dust:

- vegetation removal;
- clearing and grading;
- topsoil removal;
- cutting and filling;
- trenching;
- backfilling;
- track-out onto roads;
- bulk material loading, hauling, and unloading;
- vehicle and motorized equipment movement on unpaved roads;
- use of material storage piles; and
- use of parking, staging, and storage areas.

It is the responsibility of the Project contractor(s) and the designated Environmental Inspector(s) to ensure that:

- sources of potential dust generation are identified;
- specific areas of Project construction will be monitored for fugitive dust generation; and
- appropriate dust suppression techniques are implemented when dust plumes are visible.

1.3 Fugitive Dust Control Methods

1.3.1 Pipeline Construction Activities and Other Earth Disturbances

Fugitive dust emissions from vegetation removal, clearing and grading, cutting and filling, topsoil removal, trenching, backfilling, and stockpile storage will be controlled to the extent possible by applying water if sustained visible dust plumes occur. Water would be acquired from municipal sources should this be necessary. Additionally, spoil piles left undisturbed can be temporarily stabilized to prevent wind and water erosion if fugitive dust becomes an issue along the construction right-of-way.

1.3.2 Unpaved Roads

Fugitive dust emissions generated by motorized equipment and miscellaneous vehicle traffic will be controlled by wet suppression as necessary. Fugitive dust emissions from active access roads will be controlled by periodic wetting of surfaces using a water truck. During periods of high truck traffic, road surfaces will be wetted more frequently to minimize fugitive emissions. Watering will occur less frequently if meteorological conditions (e.g., rain, frozen surfaces, etc.) are adequate to suppress dust. Additionally, construction traffic will be limited to speeds of 5 miles per hour along unpaved access roads and 20 miles per hour along unpaved public roads.

1.3.3 Paved Roads

Fugitive dust emissions from paved roads will be controlled with a combination of wet suppression, sweeping and/or vacuuming, as appropriate, to minimize the amount of fugitive dust that is generated.

1.3.4 Track-out onto Roads

Track-out of loose materials will be controlled by maintaining construction entrances on access roads that begin at junctions with paved roads. This is done to prevent tracking of mud on to public roadways. Soil tracked onto a paved road will be cleaned up by the Contractor by the end of each working day.

1.3.5 Deposition on Other Premises

Spire will take all appropriate actions to prevent the deposition of solid or liquid materials onto any other premises from the Project site and access roads which may cause or contribute to visible dust emissions. Preventive actions may include, but are not limited to dust control, such as wet suppression, the operation of a sweeper truck on paved roadways equipped with water suppression, and the operation of a vacuum truck.

1.4 Tackifiers

The construction contractor may propose the use of tackifiers to reduce fugitive dust provided that the product to be utilized has been approved by the appropriate State and Municipal entities where its application will occur. The construction contractor will detail the proposed use of any such substances and provide copies of the Material Safety Data Sheet and application procedures.

1.5 Sensitive Receptors

Construction activities occurring near sensitive receptors receive a higher level of planning for controlling fugitive dust. Sensitive receptors include school-aged children (schools, daycare, playgrounds) the elderly (retirement communities, nursing homes), the infirm (medical facilities, hospitals) and receptors in residential areas near planned construction areas.

Dust control measures near sensitive receptors will generally be the same as those used in other areas along the Project. In addition, should weather conditions make dust control near these sensitive receptors impossible then construction operations may be limited or shut down until such time as dust control becomes effective.

1.6 Inspection, Monitoring, and Record Keeping

The construction contractor will implement the dust control measures specified in this Fugitive Dust Control Plan, and construction personnel will be informed of the measures in this Plan. Environmental Inspectors will have primary responsibility for monitoring and enforcing the implementation of dust control measures by the construction contractor. Environmental Inspectors will also be responsible for ensuring that these measures are effective and proper documentation is maintained. When environmental conditions are dry, inspection of dust control measures will be conducted daily, and the Environmental Inspectors will be responsible for recording the following information on a daily basis:

- weather conditions, including temperature, wind speed, and wind direction;
- number of water trucks in use;
- incidents where dust concentration is such that special abatement measures must be implemented;
- condition of soils (damp, crusted, unstable, other) on the right-of-way and other construction sites;
- condition of soils (damp, crusted, unstable, other) on access roads;
- condition of track-out pads; and
- overall status of dust control compliance.

This information will be incorporated into the Environmental Inspector's daily report, and significant instances of non-compliance with the Fugitive Dust Control Plan will be reported to the Construction Manager as soon as they are discovered.

1.7 Plan Maintenance

A copy of this Fugitive Dust Control Plan will be retained on-site, and it will be made available to the federal, state, and local agencies upon request.

1.8 Staff Training

All staff that are responsible for implementing this Fugitive Dust Control Plan. Project contractors will be trained on this Fugitive Dust Control Plan prior to the commencing of construction as part of Spire's Environmental Training Program.