

**I-70 Floyd Hill to Veterans Memorial Tunnels Project**  
**TRAFFIC NOISE TECHNICAL REPORT**

Environmental Assessment

Project Number NHPP 0703-446 and Subaccount Number 21912

May 2021

***Prepared for:***

Colorado Department of Transportation  
Region 1  
2829 W. Howard Place  
Denver, CO 80204

***Prepared by:***

Atkins North America, Inc.  
7604 Technology Way, Suite 400  
Denver, CO 80237  
(303) 221-7275

# TABLE OF CONTENTS

	<u>Page</u>
<b>1 EXECUTIVE SUMMARY-----</b>	<b>1</b>
<b>2 PROJECT INTRODUCTION-----</b>	<b>2</b>
<b>3 BACKGROUND -----</b>	<b>5</b>
3.1 Characteristics of Noise -----	5
3.2 Applicable Regulations, Guidelines, and Tools -----	5
3.3 CDOT Noise Abatement Criteria and Land Use Activity Categories-----	6
<b>4 NOISE ANALYSIS METHODS-----</b>	<b>7</b>
4.1 Noise Study Zone Identification -----	7
4.2 Land Use Identification -----	8
4.3 Noise Measurements-----	9
4.4 Model Validation -----	10
4.5 TNM Model Inputs-----	11
<b>5 TNM RESULTS-----</b>	<b>13</b>
5.1 Existing Conditions Summary-----	23
5.2 No Action Alternative Summary -----	23
5.3 Tunnel Alternative Summary -----	23
5.4 Canyon Viaduct Alternative Summary-----	23
<b>6 NOISE ABATEMENT EVALUATION -----</b>	<b>23</b>
6.1 Noise Abatement Options Considered -----	24
6.2 Noise Abatement: Noise Insulation-----	24
6.3 Noise Barrier Evaluation-----	24
<b>7 STATEMENT OF LIKELIHOOD -----</b>	<b>34</b>
<b>8 CONSTRUCTION NOISE-----</b>	<b>34</b>
8.1 Construction Noise Implications-----	34
8.2 Construction Noise Mitigation Strategies -----	35
8.3 Local Noise Ordinances -----	35
<b>9 INFORMATION FOR LOCAL OFFICIALS -----</b>	<b>36</b>
<b>10 SOURCES AND REFERENCES -----</b>	<b>37</b>

## LIST OF APPENDICES

Appendix A	Noise Measurement Data
Appendix B	TNM Noise Modeling Input Data
Appendix C	TNM Noise Modeling Results
Appendix D	Noise Abatement Determination Worksheets (CDOT Form 1209)

## LIST OF FIGURES

Figure 1	I-70 Floyd Hill to Veterans Memorial Tunnels Project Vicinity -----	39
Figure 2	I-70 Floyd Hill to Veterans Memorial Tunnels Noise Study Zone, Activity Categories, and Noise Measurement Locations-----	40
Figure 3	I-70 Floyd Hill to Veterans Memorial Tunnels TNM Model Objects for 2045 Proposed Action -----	48
Figure 4	I-70 Floyd Hill to Veterans Memorial Tunnels Roadways and Receiver Locations for Existing (2018) and 2045 No Action Alternative Conditions-----	49
Figure 5	I-70 Floyd Hill to Veterans Memorial Tunnels Roadways and Receiver Noise Levels for 2045 Tunnel Alternative (Impacts Identified)-----	57
Figure 6	I-70 Floyd Hill to Veterans Memorial Tunnels Roadways and Receiver Noise Levels for 2045 Canyon Viaduct Alternative (Impacts Identified) -----	65
Figure 7	I-70 Floyd Hill to Veterans Memorial Tunnels Noise Barrier Locations for 2045 Tunnel Alternative -----	73
Figure 8	I-70 Floyd Hill to Veterans Memorial Tunnels Noise Barrier Locations for 2045 Canyon Viaduct Alternative -----	81
Figure 9	I-70 Floyd Hill to Veterans Memorial Tunnels 2045 Tunnel Alternative NAC Activity Category G Noise Level Contours -----	89
Figure 10	I-70 Floyd Hill to Veterans Memorial Tunnels 2045 Canyon Viaduct Alternative NAC Activity Category G Noise Level Contours-----	90

## LIST OF TABLES

Table 1	Project Overview -----	1
Table 2	Project Background-----	3
Table 3	CDOT Noise Abatement Criteria -----	7
Table 4	Land Use Considerations -----	8
Table 5	Noise Measurement Summary -----	9
Table 6	Noise Measurement Details -----	9
Table 7	Noise Measurement Results and Model Validation Summary-----	10
Table 8	TNM Model Inputs-----	11
Table 9	Modeled Noise Levels Without Abatement-----	14
Table 10	Tunnel Alternative Noise Barrier Evaluation -----	25
Table 11	Tunnel Alternative Modeled Noise Levels with and without Barrier 1 -----	26
Table 12	Tunnel Alternative Modeled Noise Levels with and without Barrier 2-----	26
Table 13	Tunnel Alternative Modeled Noise Levels with and without Barrier 3-----	27
Table 14	Tunnel Alternative Modeled Noise Levels with and without Barrier 4-----	27

Table 15	Tunnel Alternative Modeled Noise Levels with and without Barrier 5-----	28
Table 16	Tunnel Alternative Modeled Noise Levels with and without Barrier 8-----	28
Table 17	Tunnel Alternative Modeled Noise Levels with and without Barrier 10-----	28
Table 18	Canyon Alternative Noise Barrier Evaluation-----	29
Table 19	Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 1-----	30
Table 20	Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 2-----	30
Table 21	Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 3-----	32
Table 22	Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 4-----	32
Table 23	Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 5-----	32
Table 24	Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 7-----	33
Table 25	Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 8-----	33
Table 26	Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 9-----	33
Table 27	Typical Construction Equipment Noise-----	35
Table 28	Tunnel Alternative Contour Modeled Results (in dBA)-----	36
Table 29	Canyon Viaduct Alternative Contour Modeled Results (in dBA)-----	37

## LIST OF ABBREVIATIONS AND ACRONYMS

Atkins	Atkins North America, Inc.
CDOT	Colorado Department of Transportation
CFR	Code of Federal Regulations
CR	County Road
dBA	A-weighted decibels
EA	Environmental Assessment
EB	eastbound
FHWA	Federal Highway Administration
ft <sup>2</sup>	square feet
GIS	Geographic information systems
Guidance	FHWA's Highway Traffic Noise: Analysis and Abatement Guidance
I-70	Interstate 70
ID	identification
Leq	one-hour equivalent sound level
LOS	Level of Service
MP	Milepost
mph	miles per hour
NAC	Noise Abatement Criterion
NAAG	CDOT's Noise Analysis and Abatement Guidelines
NEPA	National Environmental Policy Act
PEIS	Programmatic Environmental Impact Statement
ROD	Record of Decision
TNM	FHWA's Traffic Noise Model
US 6	U.S. Highway 6
US 40	U.S. Highway 40
WB	westbound

1 **1 EXECUTIVE SUMMARY**

2 This Traffic Noise Technical Report has been prepared in support of the Interstate 70 (I-70)  
 3 Floyd Hill to Veterans Memorial Tunnels Project. An executive summary of this Project's traffic  
 4 noise analysis and abatement evaluation is included in Table 1.

5 **Table 1 Project Overview**

<p><b>Project Location and Type I Status Explanation</b></p>	<p>The Project is located in Clear Creek and Jefferson counties, Colorado, on I-70 between milepost (MP) 248 (east of the Beaver Brook/Floyd Hill interchange) and MP 241 (Idaho Springs/Colorado Boulevard exit), west of the Veterans Memorial Tunnels. The original Project limits have been extended one mile to the east (to MP 249, Soda Creek Road) to include limits of wildlife fencing. No other improvements except wildlife fencing and advance signage for the Express Lane are planned in the expanded Project limits. The Project is located mostly in Clear Creek County, with the eastern end in Jefferson County (see Figure 1). Based on conversations with the Colorado Department of Transportation (CDOT) noise specialist, it was agreed that the modeling would not include the fencing-only section of the Project limits, which is consistent with CDOT's proposed revised <i>Noise Analysis and Abatement Guidelines</i> (NAAG), although it is subject to review. It is expected that the revised NAAG will be released in 2020.</p> <p>According to the FHWA's noise guidance, the addition of a full lane to the mainline of a highway categorizes the project as a Type I project. If a project is determined to be a Type I project, then the entire project area as defined in the environmental document is a Type I project. This project is a Type I project because it would add a third westbound travel lane to I-70 from the current three-lane to two-lane drop through the Veterans Memorial Tunnels and include a new approximately 1.5-mile-long frontage road connection between the Hidden Valley/Central City interchange and the US 6 interchange.</p>
<p><b>Noise Level and Impact Overview</b></p>	<ul style="list-style-type: none"> <li>• Existing (2018) modeled noise levels range from 55.9 A-weighted decibels (dBA) to 76.9 dBA at 122 receivers<sup>1</sup>, which represent 140 receptors.</li> <li>• Future (2045) modeled noise levels for the No Action Alternative range from 57.1 dBA to 77.0 dBA at 122 receivers, which represent 140 receptors.</li> <li>• Future (2045) modeled noise levels for the Tunnel Alternative range from 56.8 dBA to 77.9 dBA at 122 receivers, which represent 140 receptors. The Tunnel Alternative is expected to impact the following receivers and receptors:             <ul style="list-style-type: none"> <li>○ 72 Activity Category B receivers/90 receptors</li> <li>○ 12 Activity Category C receivers/12 receptors</li> <li>○ 3 Activity Category E receivers/3 receptors</li> </ul> </li> </ul>

---

<sup>1</sup> A receiver is a modeled point that represents one or more receptors. Receptor types are listed in Table 3, in the column titled "Description of Land Use Category." A receiver that represents more than one receptor must represent receptors of the same Activity Category.

	<ul style="list-style-type: none"> <li>• Future (2045) modeled noise levels for the Canyon Viaduct Alternative range from 56.9 dBA to 77.8 dBA at 122 receivers, which represent 140 receptors. The Canyon Viaduct Alternative is expected to impact the following receivers and receptors:                     <ul style="list-style-type: none"> <li>○ 72 Activity Category B receivers/90 receptors</li> <li>○ 12 Activity Category C receivers/12 receptors</li> <li>○ 3 Activity Category E receivers/3 receptors</li> </ul> </li> </ul>
<p><b>Noise Abatement Considerations and Commitments Overview</b></p>	<p>As shown in Figure 7 and Figure 8, 11 noise barriers were evaluated for the Tunnel Alternative and 10 noise barriers were evaluated for the Canyon Viaduct Alternative.</p> <p>For the Tunnel Alternative, Wall 2 was determined to be feasible and reasonable. Walls 1, 3, 4, 5, 8, and 10 were determined to be feasible but not reasonable because they do not meet the minimum noise reduction design goal of at least 7 dBA for at least one receptor or because the Cost Benefit exceeded the Cost Benefit Index. Walls 6, 7, 9, and 11 were determined to be not feasible because they do not provide at least 5 dBA of noise reduction for at least one receptor or because a wall needs to be higher than 20 feet to reduce noise by at least 7 dBA.</p> <p>For the Canyon Viaduct Alternative, Wall 2 was determined to be feasible and reasonable. Walls 1, 3, 4, 5, 7, 8, and 9 were determined to be feasible but not reasonable because they do not meet the minimum noise reduction design goal of at least 7 dBA for at least one receptor or because the Cost Benefit exceeded the Cost Benefit Index. Walls 6 and 10 were determined to be not feasible because they do not provide at least 5 dBA of noise reduction for at least one receptor or because a wall needs to be higher than 20 feet to reduce noise by at least 7 dBA.</p>
<p><b>Information for Local Officials</b></p>	<p>This Project's Noise Study Zone includes land that is unpermitted and undeveloped (i.e., Activity Category G). Therefore, Part 772.17 of Title 23 of the Code of Federal Regulations (23 CFR 772.17) is applicable and information does need to be provided to local officials, as described in Chapter 9.</p>

1

2 **2 PROJECT INTRODUCTION**

3 CDOT, in cooperation with the Federal Highway Administration (FHWA), is preparing an  
 4 Environmental Assessment (EA) for this Project. The improvements, which are described in  
 5 Table 2 and hereafter called the Proposed Action, constitute a Type I project because it would  
 6 add a third westbound travel lane to I-70 from the current three-lane to two-lane drop through  
 7 the Veterans Memorial Tunnels and include a new approximately 1.5-mile-long frontage road  
 8 connection between the Hidden Valley/Central City interchange and the US 6 interchange.  
 9 According to the FHWA's noise guidance, the addition of a full lane to the mainline of a highway  
 10 categorizes the project as a Type I project. If a project is determined to be a Type I project, then  
 11 the entire project area as defined in the environmental document is a Type I project.

12 Because the Project is Type I and because there is at least one Activity Category A, B, C, D,  
 13 and/or E receptor within the Noise Study Zone, a noise analysis is needed to determine if noise  
 14 levels will be impacted as a result of building the Project. Atkins North America, Inc. (Atkins),

- 1 acting on behalf of CDOT, conducted a noise analysis for the Project and prepared this report.
- 2 Table 2 includes information about this Project and provides context for this traffic noise
- 3 analysis.

4 **Table 2 Project Background**

<b>Project Location</b>	The Noise Study Zone is located in Clear Creek and Jefferson counties on I-70 between MP 248 (east of the Beaver Brook/Floyd Hill interchange) and MP 241 (Idaho Springs/Colorado Boulevard exit), west of the Veterans Memorial Tunnels. The original Project limits have been extended one mile to the east (to MP 249, Soda Creek Road) to include limits of wildlife fencing. No other improvements except wildlife fencing and advance signage for the Express Lane are planned in the expanded Project limits. The Project is located mostly in Clear Creek County, with the eastern end in Jefferson County (see Figure 1). Based on conversations with the CDOT noise specialist, it was agreed that the modeling would not include the fencing-only section of the Project limits, which is consistent with CDOT’s proposed revised NAAG, although it is subject to review. It is expected that the revised NAAG will be released in 2020.
<b>Affected Roadways</b>	<ul style="list-style-type: none"> <li>• I-70</li> <li>• US 40</li> <li>• US 6</li> <li>• CR 314</li> <li>• Homestead Road</li> <li>• Central City Parkway</li> </ul>
<b>Project Purpose</b>	The purpose of the Project is to improve travel time reliability, safety, and mobility, and to address the deficient infrastructure on westbound I-70 through this area. An additional purpose of the Project is to address tight horizontal curves on eastbound I-70 causing safety concerns. This Project also addresses two improvements from US 6 to Hidden Valley and Hidden Valley to Idaho Springs to improve multimodal connectivity and provide an alternate route parallel to the interstate mainline.
<b>Project Need</b>	<p>The need for the Project results from the following issues:</p> <ul style="list-style-type: none"> <li>• High peak period traffic volumes and limited capacity on I-70 in the westbound direction, which affects regional and local mobility and accessibility</li> <li>• Unreliable travel times and frequent delays due to traffic congestion on I-70 in the westbound direction</li> <li>• Occasional severe weather conditions causing closure on the interstate, which results in congestion, mobility, and local accessibility challenges</li> <li>• Safety concerns due to congestion, substandard geometry with tight curves, and steep grades</li> <li>• Aging and failing infrastructure</li> <li>• Insufficient infrastructure for pedestrian and bicycle users between US 6 and Idaho Springs</li> <li>• Lack of road redundancy and parallel routes between US 6 and Idaho Springs, which hinders emergency response times in emergencies</li> </ul>



<p><b>Proposed Action Description</b></p>	<p>The Project improvements would include:</p> <ul style="list-style-type: none"> <li>• Add a third westbound travel lane to the two-lane section of I-70 from the current three-lane to two-lane drop (approximately MP 246) through the Veterans Memorial Tunnels (the new lane would be an Express Lane).</li> <li>• Construct a new frontage road between the US 6 interchange and the Hidden Valley/Central City interchange.</li> <li>• Improve interchanges and intersections throughout the Project area.</li> <li>• Improve design speeds and stopping sight distance on horizontal curves.</li> <li>• Adding an eastbound auxiliary lane to I-70 on Floyd Hill between the US 6 interchange and the Hyland Hills/Floyd Hill interchange</li> <li>• Improve the multimodal trail (Clear Creek Greenway) between US 6 and the Veterans Memorial Tunnels.</li> <li>• Reduce animal-vehicle conflicts and improve wildlife connectivity with new and/or improved wildlife overpasses or underpasses.</li> <li>• Providing two permanent air quality monitors at Floyd Hill and Idaho Springs to collect data on local air quality conditions and trends</li> <li>• Coordinating rural broadband access with local communities, including providing access to existing conduits and fiber in the interstate right-of-way</li> </ul>
<p><b>Considered Alternative(s) Description</b></p>	<p>Potential alternatives considered for this Project include:</p> <ul style="list-style-type: none"> <li>• No Action Alternative</li> <li>• Action Alternatives             <ul style="list-style-type: none"> <li>○ Tunnel Alternative</li> <li>○ Canyon Viaduct Alternative</li> </ul> </li> </ul> <p>The Project improvements are grouped into three geographic sections: (1) East Section (top of Floyd Hill to US 6 interchange), (2) Central Section (US 6 interchange to Hidden Valley/Central City interchange), and (3) West Section (Hidden Valley/Central City interchange through Veterans Memorial Tunnels).</p> <p>The Action Alternatives—the Tunnel Alternative and the Canyon Viaduct Alternative—include the same improvements in the East Section and West Section to flatten curves, add a third westbound travel lane, provide wildlife and water quality features, and improve interchange/intersection operations.</p> <p>Through the Central Section between the US 6 interchange and the Hidden Valley/Central City interchange, the Action Alternatives vary in how they provide for the third westbound I-70 travel lane and frontage road connections as follows:</p> <ul style="list-style-type: none"> <li>• The Tunnel Alternative would realign westbound I-70 to the north through a new tunnel west of US 6. This alternative would include two design options for the alignment of the new frontage road north or south of Clear Creek. For the purpose of the noise analysis, only the North Frontage Road Option was modeled because there are no geometric differences between the North Frontage Road Option and the South Frontage Road Option in locations where receivers are identified.</li> <li>• The Canyon Viaduct Alternative would realign approximately one-half mile of both the westbound and eastbound I-70 lanes on viaduct structures south of the existing I-70 alignment on the south side of Clear Creek Canyon.</li> </ul>

<p><b>No Action Alternative Description</b></p>	<p>The No Action Alternative includes ongoing highway maintenance. Due to its poor condition, the westbound I-70 bridge at the bottom of Floyd Hill is programmed to be replaced regardless of whether CDOT moves forward with one of the Action Alternatives from this Project. Under the No Action Alternative, the bridge would be replaced in its current location but would need to be designed to current standards, with a 55-mph design speed and improved sight distance with wider shoulders. The ongoing I-70 Westbound Peak Period Shoulder Lane Project from the Veterans Memorial Tunnels to the west end of the Project area was modeled in the 2045 No Action Alternative, as those modifications will be in place in the future.</p>
<p><b>Prior National Environmental Policy Act (NEPA) Approvals</b></p>	<p>The EA for this Project is a Tier 2 NEPA process that advances a portion of the program of improvements for the I-70 Mountain Corridor identified in the 2011 Tier 1 <i>Final I-70 Mountain Corridor Programmatic Environmental Impact Statement (PEIS)</i> and approved in the 2011 <i>I-70 Mountain Corridor Record of Decision (ROD)</i>.</p>

1

2 **3 BACKGROUND**

3 This noise analysis was performed as required by 23 CFR 772, in accordance with CDOT's  
 4 *Noise Analysis and Abatement Guidelines* (NAAG) (CDOT, 2015) and FHWA's *Highway Traffic*  
 5 *Noise: Analysis and Abatement Guidance* (Guidance) (FHWA, 2011). The analysis determines  
 6 whether 2045 traffic noise levels from the Proposed Action will exceed applicable impact  
 7 thresholds at properties (i.e., receptors) within the Proposed Action Noise Study Zone, which is  
 8 described in Section 4.1. Traffic noise abatement is evaluated for any impacted receptors.

9 This noise analysis included the following tasks:

- 10 • Conducting field measurements of existing sound levels (see Section 4.1)
- 11 • Validating a noise model using field measurement results (see Section 4.2)
- 12 • Modeling existing noise conditions for existing roadways (see Section 4.3 and Chapter  
13 5)
- 14 • Modeling future build alternatives and a future No Action Alternative for design roadways  
15 (see Section 4.3 and Chapter 5)
- 16 • Completing a noise abatement evaluation (see Chapter 6)
- 17 • Determining noise contour lines for unpermitted, undeveloped land (see Chapter 9)

18 **3.1 Characteristics of Noise**

19 Fundamental information about noise, such as terminology, how sound travels, and sound  
 20 intensity, is included in CDOT's NAAG. It is incorporated by reference to supplement this report.

21 **3.2 Applicable Regulations, Guidelines, and Tools**

22 The following regulation, guidelines, and tools were used to complete this noise analysis:

- 23 • **23 CFR Part 772 (Procedures for Abatement of Highway Traffic Noise and**  
 24 **Construction Noise)** (23 CFR §772, 2010): Federal highway noise standard that must  
 25 be followed in analyzing and abating highway traffic noise. This regulation required  
 26 states to adopt state-specific guidelines, which included adopting specific parameters  
 27 such as the noise reduction design goal.

- 1 • **CDOT NAAG** (CDOT, 2015): Fulfilled federal requirement to adopt state-specific  
2 guidelines. Provides Colorado's procedural and technical requirements for analyzing  
3 highway project traffic noise and evaluating noise abatement.
- 4 • **FHWA Guidance** (FHWA, 2011): Provides FHWA guidance for applying 23 CFR Part  
5 772 in the analysis and abatement of highway traffic noise.
- 6 • **Noise Measurement Handbook** (FHWA, 2018): Includes procedures for measuring  
7 highway noise.
- 8 • **FHWA Traffic Noise Model (TNM) Version 2.5** (FHWA, February 2004): Model used to  
9 determine existing and design year noise levels.
- 10 • **Techniques for Reviewing Noise Analyses and Associated Noise Reports** (FHWA,  
11 2018): includes information on how to review a noise study report and provides guidance  
12 on reviewing the noise section of the environmental document.

### 13 **3.3 CDOT Noise Abatement Criteria and Land Use Activity Categories**

14 A traffic noise impact occurs if either of the following conditions is met:

- 15 • Predicted design year traffic noise level approaches (i.e., equals) or exceeds CDOT's  
16 Noise Abatement Criteria (NAC) at a minimum of one receptor
- 17 • Predicted design year traffic noise level substantially exceeds the existing highway  
18 traffic noise level at a minimum of one receptor. "Substantial" is defined as a noise  
19 increase of 10 dBA or more between the existing and design years.

20 CDOT's NAC are shown in Table 3. CDOT's NAAG require that the one-hour equivalent sound  
21 level (Leq) be used in the analysis.

22 The NAC for Activity Category D applies to interior areas of frequent human use. All other NACs  
23 apply to exterior areas of frequent human use. Exterior area examples include yards for Activity  
24 Category B, park activity areas for Activity Category C, and exterior restaurant dining areas for  
25 Activity Category E.

26 Undeveloped lands for which development has been permitted before the Date of Public  
27 Knowledge must be treated as though the development has already been constructed. CDOT  
28 considers a proposed development to be permitted when a formal building permit has been  
29 issued to the developer.

1 **Table 3 CDOT Noise Abatement Criteria**

Activity Category	Activity L <sub>eq</sub> (dBA) <sup>1</sup>	Evaluation Location	Description of Land Use Category
A	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B <sup>2</sup>	66	Exterior	Residential
C <sup>2</sup>	66	Exterior	Active sport areas, amphitheatres, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	51	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E <sup>2</sup>	71	Exterior	Hotels, motels, time-share resorts, vacation rental properties, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	Not Applicable	Not Applicable	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, railyards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	Not Applicable	Not Applicable	Undeveloped lands that are not permitted for development.
<sup>1</sup> Hourly A-weighted sound level in dBA, reflecting a 1-dBA approach value below 23 CFR 772 values <sup>2</sup> Includes undeveloped lands permitted for this activity category.			

2

3 **4 NOISE ANALYSIS METHODS**

4 Prior to running a noise model, the analysis includes identifying the Noise Study Zone,  
 5 identifying the land uses within the Noise Study Zone, taking noise measurements within the  
 6 Noise Study Zone, validating the noise model, and inputting several parameters into the noise  
 7 model. These steps are described in this chapter.

8 **4.1 Noise Study Zone Identification**

9 The Noise Study Zone for this Project extends 500 feet in all directions from the proposed edge  
 10 of travel lanes throughout the Project extent and includes a 1,000-foot radius around  
 11 interchanges to account for new movements at the interchanges and flattening of horizontal  
 12 curves, as shown in Figure 2.

1 **4.2 Land Use Identification**

2 Table 4 identifies the land use categories and noise receivers and receptors included in the  
 3 noise analysis. Figure 2 identifies land uses in the Noise Study Zone.

4 **Table 4 Land Use Considerations**

<p>Receiver Activity Category Summary (see Table 9)</p>	<p>Receivers with the following Activity Categories were modeled in the existing condition and design year scenarios:</p> <ul style="list-style-type: none"> <li>• Activity Category B: 99 receivers representing 117 receptors</li> <li>• Activity Category C: 13 receivers representing 13 receptors</li> <li>• Activity Category E: 10 receivers representing 10 receptors</li> </ul>
<p>Other Considerations</p>	<ul style="list-style-type: none"> <li>• The Noise Study Zone does not contain any receptors that have been permitted but are not yet built.             <ul style="list-style-type: none"> <li>○ The Noise Study Zone contains Activity Category F land and Activity Category G land. Activity Category F land and Activity Category G land are not considered noise sensitive, so receivers are not required for these locations. However, they are shown in Figure 2. For Activity Category G land, a total of nine undeveloped parcels and three trail locations were modeled at 25 feet, 50 feet, 75 feet, and 100 feet from the nearest edge of pavement, and then at 50-foot intervals to 300 feet. The three trail locations were modeled to provide the County with better knowledge regarding any noise impacts along the trail. The 12 locations are shown in Figure 9 and Figure 10. Noise contour lines are not recommended to represent sound levels because distances may vary somewhat over the corridor due to topography and changing road alignments; therefore, contour lines are not provided.</li> </ul> </li> <li>• The Noise Study Zone has four Section 4(f) site(s) with frequent human use, which were modeled as:             <ul style="list-style-type: none"> <li>○ Shelly Quinn Fields Park (R44, R45, R48)</li> <li>○ Game Check Area Park and Trailhead (R7)</li> <li>○ Scott Lancaster Memorial Trail (R4, R9, R117, R118)</li> <li>○ Floyd Hill Trail and Trailhead (R115)</li> </ul> </li> <li>• The Project Area has three Section 106 properties that may require noise information for Section 106 purposes, which may differ from highway traffic noise requirements. These sites are discussed in the <i>I-70 Floyd Hill to Veterans Memorial Tunnels Section 106 Technical Report</i>.             <ul style="list-style-type: none"> <li>○ The Mesa LLC Property (5JF.7445) is outside of the Noise Study Zone. Therefore, it was not modeled in the noise analysis.</li> <li>○ The Hyland Hills Subdivision (5CC.2546), including multiple addresses (5CC.2546), is located approximately six miles east of Idaho Springs on the south side of Clear Creek and I-70. The residences that are within the Noise Study Zone were modeled as R10, R11, R12, R14, R15, R16, R18, R19, R20, R23, and R111.</li> <li>○ The Saddleback Ridge Estates (5CC.2547), including multiple addresses, is located on the western side of Floyd Hill. The residences and businesses that are within the Noise Study Zone were modeled as R21, R25, R26, R27, R28, R37, R38, R39, R40, R41, R42, R114, and R122.</li> </ul> </li> </ul>

5

1 **4.3 Noise Measurements**

2 Table 5 and Table 6 summarize noise measurement information for this analysis. Traffic noise  
 3 measurements were performed at different locations to acquire data for TNM model validation.  
 4 Traffic counts and speeds, listed in Table A-1 of Appendix A, were collected during the noise  
 5 measurement periods. Noise measurement field data sheets are in Appendix A.

6 **Table 5 Noise Measurement Summary**

Measurement Location ID	Location	Date	Time (a.m. or p.m.)		Length (minutes)
			Start	Stop	
V1	Business near US 40; 37899 US 40, Evergreen, CO	03/22/18	10:00 a.m.	10:15 a.m.	15
V2	Between business and a daycare; 195 Hyland Dr, Evergreen, CO	03/22/18	10:33 a.m.	10:48 a.m.	15
V3	Idaho Springs Skatepark near townhomes	03/22/18	11:16 a.m.	11:31 a.m.	15
V4	Shelly Quinn Fields; 101 East Idaho Springs Road, Idaho Springs, CO	03/22/18	11:50 a.m.	12:05 p.m.	15
V5	Pull-off area near EB I-70 between the US 6 interchange and the Hyland Hills/Floyd Hill interchange	03/22/18	1:28 p.m.	1:43 p.m.	15

7

8 **Table 6 Noise Measurement Details**

Number of Noise Measurement Locations	5
Noise Measurement Locations	Traffic noise measurement locations are shown on Figure 2. These measurement locations were selected because they were located near noise-sensitive sites along I-70 where safe access to monitoring sites existed, representative sampling of free-flow traffic (traffic counts) could be obtained, and roadway geometry remained relatively constant.
Basis for Measurement Length	Existing highway traffic noise measurements are made to represent an hourly equivalent sound level—Leq(h). The measurement time period is 15 minutes, which is considered statistically accurate enough to obtain a good measurement for high-volume roads by the FHWA standard. During the measurement, no unusual events occurred.
Method to Estimate Traffic Volume During Noise Measurement	Traffic counts were performed at the time of monitoring using a clicker. Vehicle counts were separated into three categories: cars, medium trucks, and heavy trucks.
Method to Estimate Traffic Speed	Vehicle speeds were modeled at 10 miles per hour above the posted speed limit, as speeding vehicles were observed by driving the corridor before and after the traffic noise data collection activities for the Project.
Weather Conditions Summary (See Appendix A)	Noise measurements were made during weather conditions acceptable according to FHWA guidance (FHWA, 2018). Weather conditions, including wind speed, were monitored during the measurements.

Sound Level Meter Used	Traffic noise measurements were collected via a Larson Davis 812 Type I Sound Level Meter and a Larson Davis 712 Type I Sound Level Meter.
Sound Level Meter Laboratory Calibration Date	December 13, 2017
Field Calibrator Used	Larson Davis CAL-200; Larson Davis CAL-150  Calibrations traceable to the United States National Institute of Standards and Technology were performed in the field before each set of measurements and checked in the field after each set of measurements.
Height of Noise Measurement Above Grade	5 feet
Reason for Delay Between Noise Measurements and Modeling	The field measurements were collected in 2018 at the beginning of the project. The proposed Build options were modeled to assess noise impacts and the noise level in 2020 to allow for refinement of design details for the proposed alternatives. The 2018 field measurements are acceptable because the traffic conditions in the Noise Study Zone generally remained the same.

1

2 **4.4 Model Validation**

3 Existing noise levels were measured in the field, as described in Section 4.1, and compared to  
 4 computer predictions using the traffic data taken during noise measurements to verify the  
 5 accuracy of the computer model. This process is called model validation. If the predicted and  
 6 measured levels are within  $\pm 3$  dBA of each other, the model is within the accepted level of  
 7 accuracy and is considered to have been validated. Measured noise levels, corresponding  
 8 modeled noise levels, and the differences between the two are presented in Table 7.

9 **Table 7 Noise Measurement Results and Model Validation Summary**

Noise Measurement Location ID	Location (see Figure 2)	Measured Leq (dBA)	Original Modeled Leq (dBA)	Adjusted Modeled* Leq (dBA)	Difference (dBA)	Difference after rounding (dBA)**
V1	Business near US 40	77.4	72.2	74.2	-3.2	-3
V2	Between business and a daycare	76.9	73.5	75.5	-1.4	-1
V3	Open space near townhomes	74.8	71.5	73.5	-1.3	-1
V4	Baseball fields	75.9	72.4	74.4	-1.5	-2
V5	Pull-off area near I-70	82.4	77.0	79.0	-3.4	-3

10 \*Due to the unusual factors on the corridor—including the varying and steep terrain, how noise reacts to the mountainous areas  
 11 and rocky cliff surfaces, truck exhaust, engine and brake noise on steep grades, and the varying traffic speeds of vehicles—the  
 12 Project Team agreed that it would be appropriate to add a 2-dBA calibration factor to all noise level outputs from the models after  
 13 consultation with CDOT and FHWA noise specialists. This will account for the additional noise levels the TNM model is unable to  
 14 accurately reflect on such a complex corridor and will apply to the existing, no action, and action alternative noise models for the  
 15 noise levels the models produce.

16 \*\*The 2015 NAAG threshold to compare measured to modeled noise levels in the validation process is 3 dB; 3.0 dB is not  
 17 specified.

1 Differences between measured and predicted levels are all within the allowable  $\pm 3$  dBA  
 2 tolerance after rounding and applying the 2-dBA calibration factor. Therefore, the noise model is  
 3 considered to be validated for this Project.

4 **4.5 TNM Model Inputs**

5 The noise model software used on this project was TNM Version 2.5, as required by FHWA. It  
 6 was used to analyze noise levels for existing (2018) and future (2045) conditions. As part of the  
 7 analysis, noise levels were calculated by the model at receivers in the Noise Study Zone. Each  
 8 receiver represented one or more receptors. Modeling results represent predicted traffic  
 9 conditions during worst-hour noise periods. Table 8 describes model inputs and methods.

10 **Table 8 TNM Model Inputs**

Noise Sensitive Receptors	Noise sensitive receptors are defined according to Table 3. Receivers (modeled points) have been selected to represent these receptors within the Noise Study Zone.
Receivers	Receivers are listed in Table 9 and shown in Figure 4.
Modeled Roadways	<p>The following roadways were modeled:</p> <ul style="list-style-type: none"> <li>• I-70, Central City Parkway, US 6, U.S. Highway 40 (US 40), Homestead Road, Colorado Boulevard, E. Idaho Springs Road, County Road (CR) 65, Hyland Drive, and Beaver Brook Canyon Road</li> <li>• A third westbound travel lane on I-70 from the current three-lane to two-lane drop through the Veterans Memorial Tunnels (Proposed Action scenario; not in existing condition)</li> <li>• A new I-70 frontage road between the US 6 interchange and the Hidden Valley/Central City interchange (Proposed Action scenario; not in existing condition)</li> </ul> <p>For the Proposed Action, the analysis included roads that would be changed or newly built by the Project, would have substantially different traffic volumes, or would be important local traffic noise sources.</p>
Differences in How Roadways Were Modeled Between Alternatives	<p>Under the Tunnel Alternative, approximately one mile of westbound I-70 would be realigned to the north just west of the US 6 interchange through a tunnel that would tie in to the existing westbound I-70 alignment and elevation just east of the Hidden Valley/Central City interchange.</p> <p>Under the Canyon Viaduct Alternative, both lanes of I-70 would shift to the south on a new viaduct beginning east of the exit ramp to US 6 and they would rejoin the existing alignment about one-half mile east of the Hidden Valley/Central City interchange.</p> <p>Both Action Alternatives include a new approximately 1.5-mile-long frontage road connection between the Hidden Valley/Central City interchange and the US 6 interchange. The Tunnel Alternative includes two design options for this frontage road:</p> <ul style="list-style-type: none"> <li>• The North Frontage Road Option would provide the new frontage road connection between the two interchanges mostly on the north side of Clear Creek.</li> </ul>



	<ul style="list-style-type: none"> <li>• The South Frontage Road Option would provide the new frontage road connection between the two interchanges mostly on the south side of Clear Creek.</li> <li>• For the purpose of the noise analysis, only the North Frontage Road Option was modeled because there are no geometric differences between the North Frontage Road Option and the South Frontage Road Option in locations where receivers are identified.</li> </ul>
<b>TNM Objects and Elevations</b>	The following objects were modeled: terrain lines, tunnels modeled as barriers, buildings modeled as barriers, bridge barriers and retaining walls modeled as barriers, and noise walls modeled as barriers. These are shown in Figure 3.
<b>Existing Noise Barriers</b>	The Noise Study Zone does not contain any existing noise barriers.
<b>Modeled Pavement Type</b>	Average (FHWA requirement)
<b>Default Ground Type</b>	Lawn
<b>Traffic Data (See Appendix B)</b>	<ul style="list-style-type: none"> <li>• Roadway coordinates generated from geographic information systems (GIS) (Existing and No Action) and CAD (Proposed Action)</li> <li>• Traffic volumes are from:             <ul style="list-style-type: none"> <li>○ Worst noise-hour traffic volumes, in accordance with FHWA regulations (23 CFR 772.9(d)) for mainline I-70 and the estimated traffic volumes from the Project traffic analysis performed for the Project for 2018 (2018). The TransModeler results were calibrated to the data collected in the Project Area in 2018.</li> <li>○ Worst noise-hour traffic volumes, in accordance with FHWA regulations (23 CFR 772.9(d)) for mainline I-70 and the estimated traffic volumes from the Project traffic analysis performed for the Project for 2045 (2045).</li> <li>○ A Level of Service (LOS) C/D threshold was used to calculate the maximum lane capacity at free-flow speeds for mainline I-70. This threshold was selected to ensure that the facility's reduced capacity due to horizontal and vertical curves was reflected in the model. A passenger car equivalent of 3.0 (and 3.5 on the uphill eastbound segment of Floyd Hill) was applied to the truck percentages to account for the impact that trucks have on free-flow speeds.</li> </ul> </li> <li>• Vehicle mixes are from:             <ul style="list-style-type: none"> <li>○ The vehicle mix was based on data collected in 2018 for the Existing Conditions Model (2018). Based on the vehicle classification data collected for the traffic analysis, a value of 7 percent truck volume (1.5 percent medium and 5.5 percent heavy) was calculated and used throughout the Existing Conditions model.</li> <li>○ The same percentages of medium and heavy trucks were used for the No Build and Proposed Action analysis (2045).</li> <li>○ Project traffic volumes were provided based on the modeling performed for the study. Data collection, traffic modeling, and analysis for the Project is discussed in more detail in the following documents:                 <ul style="list-style-type: none"> <li>▪ <i>I-70 Floyd Hill to Veterans Memorial Tunnels Transportation and Traffic Technical Report</i> (not yet finalized as of completion of this Noise Technical Report)</li> <li>▪ <i>I-70 Floyd Hill to Veterans Memorial Tunnels: Model Calibration Results</i> memorandum, September 2018</li> </ul> </li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• Worst noise-hour traffic volume is the highest volume of traffic that can travel at the highest relevant speed for a given roadway. The estimated peak hour traffic volumes on the I-70 corridor have a LOS of D, E, or F; as a result, the threshold of LOS C/D traffic volumes was used to represent the loudest hour according to FHWA regulations. The steep terrain and curvature on this corridor reduce the capacity and worsen the impact that slower-moving vehicles have on free-flow speeds.</li></ul>
--	---

1 **5 TNM RESULTS**

2 In the analysis, 122 receivers representing 140 receptors were modeled (see Table 9). The  
3 modeled noise levels were used to identify which, if any, receptors would be impacted as a  
4 result of the Proposed Action Alternatives.

**Table 9 Modeled Noise Levels Without Abatement**

Receiver ID	Receiver Description	Activity Category/ CDOT NAC (dBA)	Number of Receptors Represented by Receiver	Existing (2018) L <sub>eq</sub> (dBA) *	No Action (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative Change from Existing (dBA)	Tunnel Alternative Causes Impact? (Yes or No)	Canyon Alternative (2045) L <sub>eq</sub> (dBA) *	Canyon Alternative Change from Existing (dBA)	Canyon Alternative Causes Impact? (Yes or No)	Carried Forward in Noise Abatement Evaluation? (Yes or No)**
R1	General Store Outdoor Seating	E / 71	1	67.5	67.8	68.1	0.6	No	68.0	0.5	No	No—Not impacted
R2	Fishing/ Boating Access	C / 66	1	69.8	68.4	70.1	0.3	Yes	71.4	1.6	Yes	Yes
R3	Restaurant Outdoor Seating	E / 71	1	73.9	72.6	71.9	-2.0	Yes	71.1	-2.8	Yes	Yes
R4	Trailhead	C / 66	1	73.9	73.9	73.9	0.0	Yes	73.4	-0.5	Yes	Yes
R5	Residential—SF	B / 66	1	71.3	71.4	72.5	1.2	Yes	72.2	0.9	Yes	Yes
R6	Residential—SF	B / 66	1	72.8	73.3	72.3	-0.5	Yes	72.0	-0.8	Yes	Yes
R7	Trailhead	C / 66	1	66.3	67.7	64.3	-2.0	No	63.4	-2.9	No	No—Not impacted
R8	Residential—SF	B / 66	1	64.4	65.5	62.4	-2.0	No	61.9	-2.5	No	No—Not impacted
R9	Trailhead	C / 66	1	70.6	70.1	66.1	-4.5	Yes	71.2	0.6	Yes	Yes
R10	Residential—SF	B / 66	1	66.3	66.5	66.6	0.3	Yes	66.5	0.2	Yes	No—elevation of the receptor is approximately 190' above the I-70 mainline
R11	Residential—SF	B / 66	1	69.4	69.6	69.1	-0.3	Yes	69.4	0.0	Yes	No—elevation of the receptor is approximately 130' above the I-70 mainline
R12	Residential—SF	B / 66	1	69.0	69.1	68.2	-0.8	Yes	68.2	-0.8	Yes	No—elevation of the receptor is approximately 30' above the I-70 mainline
R13	Residential—SF	B / 66	1	64.9	65.2	64.7	-0.2	No	64.1	-0.8	No	No—Not impacted

Receiver ID	Receiver Description	Activity Category/ CDOT NAC (dBA)	Number of Receptors Represented by Receiver	Existing (2018) L <sub>eq</sub> (dBA) *	No Action (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative Change from Existing (dBA)	Tunnel Alternative Causes Impact? (Yes or No)	Canyon Alternative (2045) L <sub>eq</sub> (dBA) *	Canyon Alternative Change from Existing (dBA)	Canyon Alternative Causes Impact? (Yes or No)	Carried Forward in Noise Abatement Evaluation? (Yes or No)**
R14	Residential—SF	B / 66	1	68.5	68.6	69.4	0.9	Yes	69.1	0.6	Yes	No—elevation of the receptor is approximately 170' above the I-70 mainline
R15	Residential—SF	B / 66	1	66.8	66.9	66.6	-0.2	Yes	66.4	-0.4	Yes	No—elevation of the receptor is approximately 190' above the I-70 mainline
R16	Residential—SF	B / 66	1	70.2	70.4	71.4	1.2	Yes	71.2	1.0	Yes	No—elevation of the receptor is approximately 130' above the I-70 mainline
R17	Residential—SF	B / 66	1	57.0	58.4	59.1	2.1	No	57.2	0.2	No	No—Not impacted
R18	Residential—SF	B / 66	1	64.2	64.3	67.1	2.9	Yes	67.1	2.9	Yes	No—elevation of the receptor is approximately 80' above the roadway
R19	Residential—SF	B / 66	1	64.9	65.0	66.8	1.9	Yes	66.8	1.9	Yes	No—elevation of the receptor is approximately 190' above the I-70 mainline
R20	Residential—SF	B / 66	1	66.3	66.4	71.1	4.8	Yes	71.1	4.8	Yes	No—elevation of the receptor is approximately 110' above the I-70 mainline
R21	Residential—SF	B / 66	1	68.9	69.2	69.4	0.5	Yes	69.0	0.1	Yes	No—elevation of the receptor is approximately 120' above the I-70 mainline
R22	Residential—SF	B / 66	1	62.9	63.5	63.0	0.1	No	61.8	-1.1	No	No—Not impacted
R23	Residential—SF	B / 66	1	68.9	68.9	69.1	0.2	Yes	69.0	0.1	Yes	No—elevation of the receptor is approximately 70' above the I-70 mainline

Receiver ID	Receiver Description	Activity Category/ CDOT NAC (dBA)	Number of Receptors Represented by Receiver	Existing (2018) L <sub>eq</sub> (dBA) *	No Action (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative Change from Existing (dBA)	Tunnel Alternative Causes Impact? (Yes or No)	Canyon Alternative (2045) L <sub>eq</sub> (dBA) *	Canyon Alternative Change from Existing (dBA)	Canyon Alternative Causes Impact? (Yes or No)	Carried Forward in Noise Abatement Evaluation? (Yes or No **)
R24	Daycare Playground	C / 66	1	75.3	75.3	76.5	1.2	Yes	76.3	1.0	Yes	Yes
R25	Office Patio	E / 71	1	76.9	77.0	77.9	1.0	Yes	77.8	0.9	Yes	Yes
R26	Residential—SF	B / 66	1	62.0	62.6	63.4	1.4	No	62.9	0.9	No	No—Not impacted
R27	Residential—SF	B / 66	1	61.0	61.5	62.6	1.6	No	61.7	0.7	No	No—Not impacted
R28	Residential—SF	B / 66	1	68.9	69.1	69.2	0.3	Yes	68.9	0.0	Yes	Yes
R29	Residential—SF	B / 66	1	67.6	67.9	69.5	1.9	Yes	68.0	0.4	Yes	No—elevation of the receptor is approximately 50' above the I-70 mainline
R30	Residential—SF	B / 66	1	65.5	65.9	67.3	1.8	Yes	65.9	0.4	Yes	No—elevation of the receptor is approximately 50' above the I-70 mainline
R31	Office Outdoor Seating	E / 71	1	69.2	69.4	70.3	1.1	No	69.6	0.4	No	No—Not impacted
R32	Residential—SF	B / 66	1	69.6	70.0	71.8	2.2	Yes	70.3	0.7	Yes	Yes
R33	Residential—SF	B / 66	1	68.6	68.7	69.1	0.5	Yes	68.5	-0.1	Yes	No—elevation of the receptor is approximately 70' above the I-70 mainline
R34	Residential—SF	B / 66	1	64.4	66.9	73.5	9.1	Yes	67.9	3.5	Yes	Yes
R35	Residential—SF	B / 66	1	72.3	72.3	72.2	-0.1	Yes	72.1	-0.2	Yes	No—elevation of the receptor is approximately 60' above the I-70 mainline
R36	Residential—SF	B / 66	1	67.8	68.0	68.8	1.0	Yes	67.9	0.1	Yes	Yes

Receiver ID	Receiver Description	Activity Category/ CDOT NAC (dBA)	Number of Receptors Represented by Receiver	Existing (2018) L <sub>eq</sub> (dBA) *	No Action (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative Change from Existing (dBA)	Tunnel Alternative Causes Impact? (Yes or No)	Canyon Alternative (2045) L <sub>eq</sub> (dBA) *	Canyon Alternative Change from Existing (dBA)	Canyon Alternative Causes Impact? (Yes or No)	Carried Forward in Noise Abatement Evaluation? (Yes or No)**
R37	Residential—SF	B / 66	1	65.0	65.3	66.4	1.4	Yes	65.9	0.9	Yes	No—elevation of the receptor is approximately 45' above the I-70 mainline
R38	Residential—SF	B / 66	1	65.3	65.8	66.6	1.3	Yes	66.2	0.9	Yes	No—elevation of the receptor is approximately 40' above the I-70 mainline
R39	Residential—SF	B / 66	1	65.7	65.8	66.8	1.1	Yes	66.4	0.7	Yes	No—elevation of the receptor is approximately 70' above the I-70 mainline
R40	Residential—SF	B / 66	1	65.5	65.7	66.4	0.9	Yes	65.9	0.4	Yes	No—elevation of the receptor is approximately 80' above the I-70 mainline
R41	Residential—SF	B / 66	1	64.4	64.6	65.4	1.0	No	64.9	0.5	No	No—Not impacted
R42	Residential—SF	B / 66	1	65.4	65.6	66.3	0.9	Yes	66.0	0.6	Yes	Yes
R43	Office Picnic Area	E / 71	1	70.9	72.0	70.0	-0.9	No	69.7	-1.2	No	No—Not impacted
R44	Baseball Field	C / 66	1	71.0	71.4	71.0	0.0	Yes	71.1	0.1	Yes	Yes
R45	Baseball Field	C / 66	1	74.2	74.5	74.4	0.2	Yes	74.5	0.3	Yes	Yes
R46	Motel Outdoor Bench	E / 71	1	68.6	70.1	68.5	-0.1	No	68.6	0.0	No	No—Not impacted
R47	Restaurant Outdoor Seating	E / 71	1	69.6	71.6	68.9	-0.7	No	69.1	-0.5	No	No—Not impacted
R48	Picnic Area	C / 66	1	74.4	74.8	74.7	0.3	Yes	74.7	0.3	Yes	Yes
R49	Residential—SF	B / 66	1	64.3	65.3	64.7	0.4	No	64.8	0.5	No	No—Not impacted
R50	Residential—Duplex	B / 66	2	65.4	66.3	65.9	0.5	Yes	66.0	0.6	Yes	Yes

Receiver ID	Receiver Description	Activity Category/ CDOT NAC (dBA)	Number of Receptors Represented by Receiver	Existing (2018) L <sub>eq</sub> (dBA) *	No Action (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative Change from Existing (dBA)	Tunnel Alternative Causes Impact? (Yes or No)	Canyon Alternative (2045) L <sub>eq</sub> (dBA) *	Canyon Alternative Change from Existing (dBA)	Canyon Alternative Causes Impact? (Yes or No)	Carried Forward in Noise Abatement Evaluation? (Yes or No**)
R51	Residential—Duplex	B / 66	2	65.6	66.6	66.1	0.5	Yes	66.2	0.6	Yes	Yes
R52	Residential—Duplex	B / 66	2	65.9	66.6	66.1	0.2	Yes	66.2	0.3	Yes	Yes
R53	Residential—Apartment	B / 66	1	66.5	67.3	66.8	0.3	Yes	66.9	0.4	Yes	Yes
R54	Residential—Apartment	B / 66	1	69.3	69.9	69.4	0.1	Yes	69.5	0.2	Yes	Yes
R55	Residential—Apartment	B / 66	1	70.2	70.8	70.3	0.1	Yes	70.4	0.2	Yes	Yes
R56	Residential—Apartment	B / 66	1	67.3	68.1	67.4	0.1	Yes	67.5	0.2	Yes	Yes
R57	Residential—Apartment	B / 66	1	70.0	70.6	70.0	0.0	Yes	70.1	0.1	Yes	Yes
R58	Residential—Apartment	B / 66	1	70.9	71.6	71.1	0.2	Yes	71.2	0.3	Yes	Yes
R59	Residential—Apartment	B / 66	1	67.7	68.4	67.7	0.0	Yes	67.8	0.1	Yes	Yes
R60	Residential—Apartment	B / 66	1	70.2	70.9	70.4	0.2	Yes	70.5	0.3	Yes	Yes
R61	Residential—Apartment	B / 66	1	71.1	71.9	71.4	0.3	Yes	71.5	0.4	Yes	Yes
R62	Residential—Apartment	B / 66	1	67.8	68.6	68.0	0.2	Yes	68.1	0.3	Yes	Yes
R63	Residential—Apartment	B / 66	1	70.4	71.1	70.5	0.1	Yes	70.6	0.2	Yes	Yes
R64	Residential—Apartment	B / 66	1	71.4	72.1	71.6	0.2	Yes	71.7	0.3	Yes	Yes
R65	Residential—Apartment	B / 66	1	68.1	68.8	68.2	0.1	Yes	68.3	0.2	Yes	Yes
R66	Residential—Apartment	B / 66	1	70.9	71.4	70.8	-0.1	Yes	71.0	0.1	Yes	Yes
R67	Residential—Apartment	B / 66	1	71.8	72.4	71.9	0.1	Yes	72.0	0.2	Yes	Yes

Receiver ID	Receiver Description	Activity Category/ CDOT NAC (dBA)	Number of Receptors Represented by Receiver	Existing (2018) L <sub>eq</sub> (dBA) *	No Action (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative Change from Existing (dBA)	Tunnel Alternative Causes Impact? (Yes or No)	Canyon Alternative (2045) L <sub>eq</sub> (dBA) *	Canyon Alternative Change from Existing (dBA)	Canyon Alternative Causes Impact? (Yes or No)	Carried Forward in Noise Abatement Evaluation? (Yes or No**)
R68	Residential—Apartment	B / 66	1	66.6	67.4	66.8	0.2	Yes	66.9	0.3	Yes	Yes
R69	Residential—Apartment	B / 66	1	69.7	70.2	69.6	-0.1	Yes	69.7	0.0	Yes	Yes
R70	Residential—Apartment	B / 66	1	70.7	71.2	70.7	0.0	Yes	70.8	0.1	Yes	Yes
R71	Residential—Apartment	B / 66	1	68.3	69.0	68.4	0.1	Yes	68.5	0.2	Yes	Yes
R72	Residential—Apartment	B / 66	1	70.9	71.6	71.0	0.1	Yes	71.1	0.2	Yes	Yes
R73	Residential—Apartment	B / 66	1	72.0	72.6	72.1	0.1	Yes	72.2	0.2	Yes	Yes
R74	Residential—Apartment	B / 66	1	68.1	69.1	68.4	0.3	Yes	68.5	0.4	Yes	Yes
R75	Residential—Apartment	B / 66	1	70.8	71.6	71.0	0.2	Yes	71.1	0.3	Yes	Yes
R76	Residential—Apartment	B / 66	1	71.9	72.6	72.1	0.2	Yes	72.2	0.3	Yes	Yes
R77	Residential—Apartment	B / 66	1	55.9	57.1	56.9	1.0	No	57.0	1.1	No	No—Not impacted
R78	Residential—Apartment	B / 66	1	58.4	59.2	59.0	0.6	No	59.1	0.7	No	No—Not impacted
R79	Residential—Apartment	B / 66	1	61.4	62.1	61.8	0.4	No	61.9	0.5	No	No—Not impacted
R80	Residential—Apartment	B / 66	1	56.8	57.9	57.6	0.8	No	57.7	0.9	No	No—Not impacted
R81	Residential—Apartment	B / 66	1	58.8	59.6	59.4	0.6	No	59.5	0.7	No	No—Not impacted
R82	Residential—Apartment	B / 66	1	62.1	62.8	62.5	0.4	No	62.6	0.5	No	No—Not impacted
R83	Residential—Apartment	B / 66	1	56.2	57.3	57.0	0.8	No	57.1	0.9	No	No—Not impacted
R84	Residential—Apartment	B / 66	1	58.2	59.0	58.7	0.5	No	58.8	0.6	No	No—Not impacted



Receiver ID	Receiver Description	Activity Category/ CDOT NAC (dBA)	Number of Receptors Represented by Receiver	Existing (2018) L <sub>eq</sub> (dBA) *	No Action (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative Change from Existing (dBA)	Tunnel Alternative Causes Impact? (Yes or No)	Canyon Alternative (2045) L <sub>eq</sub> (dBA) *	Canyon Alternative Change from Existing (dBA)	Canyon Alternative Causes Impact? (Yes or No)	Carried Forward in Noise Abatement Evaluation? (Yes or No)**
R85	Residential—Apartment	B / 66	1	61.8	62.4	62.1	0.3	No	62.2	0.4	No	No—Not impacted
R86	Residential—Apartment	B / 66	1	56.5	57.7	57.4	0.9	No	57.5	1.0	No	No—Not impacted
R87	Residential—Apartment	B / 66	1	58.6	59.4	59.2	0.6	No	59.3	0.7	No	No—Not impacted
R88	Residential—Apartment	B / 66	1	62.1	62.8	62.5	0.4	No	62.6	0.5	No	No—Not impacted
R89	Residential—Apartment	B / 66	1	56.1	57.2	56.9	0.8	No	57.0	0.9	No	No—Not impacted
R90	Residential—Apartment	B / 66	1	58.2	58.9	58.7	0.5	No	58.8	0.6	No	No—Not impacted
R91	Residential—Apartment	B / 66	1	61.8	62.5	62.2	0.4	No	62.3	0.5	No	No—Not impacted
R92	Residential—Apartment	B / 66	1	56.0	57.1	56.8	0.8	No	56.9	0.9	No	No—Not impacted
R93	Residential—Apartment	B / 66	1	58.4	59.2	58.9	0.5	No	59.0	0.6	No	No—Not impacted
R94	Residential—Apartment	B / 66	1	62.2	62.8	62.5	0.3	No	62.6	0.4	No	No—Not impacted
R95	Residential—Duplex	B / 66	2	70.7	71.5	71.1	0.4	Yes	71.2	0.5	Yes	Yes
R96	Residential—Duplex	B / 66	2	70.9	71.4	71.1	0.2	Yes	71.2	0.3	Yes	Yes
R97	Residential—Duplex	B / 66	2	70.0	70.6	70.3	0.3	Yes	70.4	0.4	Yes	Yes
R98	Residential—Duplex	B / 66	2	71.9	72.5	72.3	0.4	Yes	72.4	0.5	Yes	Yes
R99	Residential—Duplex	B / 66	2	72.3	72.7	72.5	0.2	Yes	72.7	0.4	Yes	Yes
R100	Residential—Duplex	B / 66	2	72.6	73.1	73.0	0.4	Yes	73.1	0.5	Yes	Yes
R101	Residential—Duplex	B / 66	2	73.2	73.9	73.8	0.6	Yes	73.9	0.7	Yes	Yes

Receiver ID	Receiver Description	Activity Category/ CDOT NAC (dBA)	Number of Receptors Represented by Receiver	Existing (2018) L <sub>eq</sub> (dBA) *	No Action (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative Change from Existing (dBA)	Tunnel Alternative Causes Impact? (Yes or No)	Canyon Alternative (2045) L <sub>eq</sub> (dBA) *	Canyon Alternative Change from Existing (dBA)	Canyon Alternative Causes Impact? (Yes or No)	Carried Forward in Noise Abatement Evaluation? (Yes or No)**
R102	Residential—Duplex	B / 66	2	73.9	74.6	74.5	0.6	Yes	74.6	0.7	Yes	Yes
R103	Residential—Duplex	B / 66	2	74.4	74.9	74.8	0.4	Yes	74.9	0.5	Yes	Yes
R104	Residential—Duplex	B / 66	2	71.4	72.0	71.8	0.4	Yes	71.9	0.5	Yes	Yes
R105	Residential—Duplex	B / 66	2	71.6	72.3	72.1	0.5	Yes	72.2	0.6	Yes	Yes
R106	Residential—Duplex	B / 66	2	71.7	72.3	72.1	0.4	Yes	72.2	0.5	Yes	Yes
R107	Residential—Duplex	B / 66	2	71.5	72.0	71.8	0.3	Yes	71.9	0.4	Yes	Yes
R108	Residential—Duplex	B / 66	2	71.1	71.7	71.5	0.4	Yes	71.5	0.4	Yes	Yes
R109	Residential—Duplex	B / 66	2	70.3	70.8	70.5	0.2	Yes	70.6	0.3	Yes	Yes
R110	Residential—SF	B / 66	1	71.0	71.3	72.9	1.9	Yes	72.7	1.7	Yes	Yes
R111	Residential—SF	B / 66	1	68.7	68.8	73.8	5.1	Yes	73.8	5.1	Yes	No—elevation of the receptor is approximately 110' above the I-70 mainline
R112	Skate Park	C / 66	1	75.0	75.7	75.6	0.6	Yes	75.7	0.7	Yes	Yes
R113	Community Pool	C / 66	1	68.1	68.7	68.1	0.0	Yes	68.2	0.1	Yes	Yes
R114	Office Patio	E / 71	1	63.7	64.1	65.3	1.6	No	64.8	1.1	No	No—Not impacted
R115	Trailhead	C / 66	1	69.0	69.5	70.2	1.2	Yes	69.6	0.6	Yes	No—elevation of the receptor is approximately 30' above the I-70 mainline
R116	Commercial Outdoor Seating	E / 71	1	72.1	72.0	71.0	-1.1	Yes	71.0	-1.1	Yes	Yes
R117	Trail crossing	C / 66	1	66.7	67.3	66.7	0.0	Yes	66.6	-0.1	Yes	Yes
R118	Trail crossing	C / 66	1	70.8	72.1	69.1	-1.7	Yes	68.5	-2.3	Yes	Yes

Receiver ID	Receiver Description	Activity Category/ CDOT NAC (dBA)	Number of Receptors Represented by Receiver	Existing (2018) L <sub>eq</sub> (dBA) *	No Action (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative (2045) L <sub>eq</sub> (dBA) *	Tunnel Alternative Change from Existing (dBA)	Tunnel Alternative Causes Impact? (Yes or No)	Canyon Alternative (2045) L <sub>eq</sub> (dBA) *	Canyon Alternative Change from Existing (dBA)	Canyon Alternative Causes Impact? (Yes or No)	Carried Forward in Noise Abatement Evaluation? (Yes or No **)
R119	Cafe Outdoor Seating	E / 71	1	65.8	67.3	66.0	0.2	No	66.1	0.3	No	No—Not impacted
R120	Residential—SF	B / 66	1	68.4	69.2	69.0	0.6	Yes	69.0	0.6	Yes	No—elevation of the receptor is approximately 80' above the I-70 mainline
R121	Residential—SF	B / 66	1	60.1	60.8	60.5	0.4	No	59.5	-0.6	No	No—Not impacted
R122	Residential—SF	B / 66	1	70.5	70.7	71.0	0.5	Yes	70.7	0.2	Yes	Yes

\*A 2-dBA calibration factor has been applied to the existing, no action, and action alternative noise models.

\*\* All impacted receptors were evaluated for noise abatement except for those that are more than 25 feet above the I-70 mainline; CDOT does not build noise walls with heights of more than 20 feet. The elevation difference was measured from the receptor to the closest travel lane of the I-70 mainline.

### **5.1 Existing Conditions Summary**

Under existing conditions (2018), modeled noise levels at 122 receivers range from 55.9 dBA to 76.9 dBA. Figure 4 shows the locations of all modeled receivers. Table 9 shows the modeled noise level at each receiver. Existing conditions are not described as having noise impacts. If the Project were not built, the Project would not be responsible to mitigate noise via an abatement measure regardless of if existing noise levels exceeded NACs.

### **5.2 No Action Alternative Summary**

Under the No Action Alternative (2045), modeled noise levels at 122 receivers range from 57.1 dBA to 77.0 dBA. Figure 4 shows the locations of all modeled receivers. Table 9 shows the modeled noise level at each receiver. No Action Alternatives are not described as having noise impacts. If the Project were not built, the Project would not be responsible to mitigate noise via an abatement measure regardless of if No Action Alternative noise levels exceeded NACs.

### **5.3 Tunnel Alternative Summary**

Under the Tunnel Alternative (2045), modeled noise levels at 122 receivers range from 56.8 dBA to 77.9 dBA. Of the 122 receivers, 87 receivers—representing 105 receptors—would exceed the NAC and no receivers would experience a substantial noise increase of at least 10 dbA. Therefore, a total of 87 receivers, representing 105 receptors, would be impacted during the 2045 worst noise-hour period (see Figure 5). Table 9 shows the modeled noise level at each receiver.

### **5.4 Canyon Viaduct Alternative Summary**

Under the Canyon Viaduct Alternative (2045), modeled noise levels at 122 receivers range from 56.9 dBA to 77.8 dBA. Of the 122 receivers, 87 receivers—representing 105 receptors—would exceed the NAC and no receivers would experience a substantial noise increase of at least 10 dBA. Therefore, a total of 87 receivers, representing 105 receptors, would be impacted during the 2045 worst noise-hour period (see Figure 6). Table 9 shows the modeled noise level at each receiver.

## **6 NOISE ABATEMENT EVALUATION**

As described in Chapter 5, 105 receptors in the Noise Study Zone would be impacted by noise in 2045 under both the Tunnel Alternative and the Canyon Viaduct Alternative. Therefore, abatement for the impacted receptors was evaluated in accordance with guidelines from CDOT's NAAG and FHWA's Guidelines. Although abatement was required to be evaluated, it is only recommended for inclusion in the Project when determined to be both feasible and reasonable.

Abatement is feasible if it:

- Provides at least 5 dBA of noise reduction for at least one receptor
- Does not have any "fatal flaw" issues (e.g., safety, maintenance, access, drainage)
- Does not exceed 20 feet in height to reduce noise by at least 7 dBA

If abatement is not feasible, further evaluation is not needed. However, if it is feasible, reasonableness is evaluated. Abatement is reasonable if it:

- Meets the minimum noise reduction design goal of at least 7 dBA for at least one receptor
- The Cost Benefit (\$/dBA/receptor) equals or is less than the Cost Benefit Index (\$6,800/dBA/receptor)
- Has support from more than 50 percent of the potentially benefited receptors (Support is determined through a Benefited Receptor Preference Survey, which may be conducted after the NEPA process and is documented in a separate report.)

### **6.1 Noise Abatement Options Considered**

Noise barriers (walls and, to a lesser extent, berms) are commonly used as noise abatement and must be evaluated for all impacted receptors, per 23 CFR 772.13(c)(1). Other mitigation measures also may be considered, including traffic management measures (e.g., traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations); alteration of horizontal and vertical alignments; and acquisition of real property or interests therein to serve as a buffer zone to preempt development that would be adversely impacted by traffic noise. However, these mitigation measures generally are not feasible and/or reasonable. For this Project, noise walls were the only abatement option evaluated.

### **6.2 Noise Abatement: Noise Insulation**

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this Project.

### **6.3 Noise Barrier Evaluation**

All impacted receptors were evaluated for noise abatement except for those that are more than 25 feet above the I-70 mainline because CDOT does not build noise walls with heights of more than 20 feet. According to the CDOT NAAG, if abatement is not feasible, further evaluation is not needed.

In the Tunnel Alternative and the Canyon Viaduct Alternative, 10 areas were identified for the noise barrier evaluation, including (1) south of I-70 in East Idaho Springs; (2) north of I-70 in East Idaho Springs; (3) south of I-70 just west of the Veterans Memorial Tunnels; (4) south of I-70 near the Hidden Valley/Central City interchange; (5) south of the new frontage road just east of the Hidden Valley/Central City interchange; (6) north of I-70 near the US 6 interchange; (7) southwest of the Hyland Hills/Floyd Hill interchange; (8) north of I-70 just east of the Hyland Hills/Floyd Hill interchange; (9) south of I-70 just west of the Beaver Brook/Floyd Hill interchange; and (10) north of I-70 just east of the Beaver Brook/Floyd Hill interchange. For the Tunnel Alternative, a total of 11 walls were analyzed, including two walls at Location 6 near the US 6 interchange. For the Canyon Viaduct Alternative, a total of 10 walls were analyzed. Barrier placement for each impacted area was considered in multiple locations. The location determined to be the best performer for each set of impacted receivers was optimized, and those results are described in Table 10 and Table 18. Figure 7 and Figure 8 show the best-performing evaluated barrier location. Appendix D has 21 CDOT Noise Abatement Determination Worksheets (CDOT Form 1209); one was completed for each optimized barrier. Of these evaluated noise barriers, one location was found to be feasible and reasonable, as described in Table 10 through Table 26.

**Table 10 Tunnel Alternative Noise Barrier Evaluation**

Barrier ID	1	2	3	4	5	6	7	8	9	10	11
Barrier Location (general)	South of I-70 in East Idaho Springs	North of I-70 in East Idaho Springs	South of I-70 just west of VMT	South of I-70 near the Hidden Valley Interchange	South of the new frontage road just east of Hidden Valley Interchange	North of I-70 near US 6 Interchange	North of I-70 near US 6 Interchange	Southwest of the Hyland Hills/Floyd Hill Interchange	North of I-70 just east of the Hyland Hills/Floyd Hill Interchange	South of I-70 just west of the Beaver Brook/Floyd Hill Interchange	North of I-70 just east of the Beaver Brook/Floyd Hill Interchange
Barrier Location: Distance from Proposed Edge of Roadway (feet)	4	4	4	4	4	4	4	4	4	4	4
Benefited Receiver IDs	refer to Figure 7	refer to Figure 7	refer to Figure 7	refer to Figure 7	refer to Figure 7	refer to Figure 7	refer to Figure 7	refer to Figure 7	refer to Figure 7	refer to Figure 7	refer to Figure 7
Figure #	Figure 7 Page 1	Figure 7 Page 1	Figure 7 Page 2	Figure 7 Page 3	Figure 7 Page 3	Figure 7 Pages 4 & 5	Figure 7 Pages 4 & 5	Figure 7 Page 7	Figure 7 Page 7	Figure 7 Page 8	Figure 7 Page 8
Recommended Barrier Height & Length (feet)	10 high x 672 long	14 high x 1,395 long	20 high x 2,860 long	20 high x 1,360 long	16 high x 910 long	Must be >20 feet high	Must be >20 feet high	20 high x 1,940 long	Must be >20 feet high	20 high x 2,020 long	Must be >20 feet high
Barrier Area (square feet)	6,720	19,530	57,200	27,200	14,560	N/A	N/A	38,800	N/A	40,400	N/A
Unit Cost	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>
Total Cost	\$302,400	\$878,850	\$2,574,000	\$1,224,000	\$655,200	N/A	N/A	\$1,746,000	N/A	\$1,818,000	N/A
No. Benefited Receptors	3	31	1	1	1	0	0	2	0	1	0
Total Decibels of Benefit Provided	20.5	204.4	8.2	6.2	6.9	N/A	N/A	10.3	N/A	6.4	N/A
Average Benefit (dBA/receptor)	6.8	6.6	8.2	<7 dBA at any receptor	6.9	<5 dBA at any receptor	<5 dBA at any receptor	<7 dBA at any receptor	<5 dBA at any receptor	<7 dBA at any receptor	<5 dBA at any receptor
Cost Benefit(\$/dBA/receptor)	\$14,751	\$4,300	\$313,902	\$197,419	\$94,957	N/A	N/A	\$169,515	N/A	\$284,063	N/A
2045 Leq Range without Abatement (dBA)*	70.5 to 74.3	70.8 to 75.9	71.1	72.9	73.9	N/A	N/A	76.2 to 77.7	N/A	68.9	N/A
2045 Leq Range with Abatement (dBA)*	65.3 to 66.5	64.3 to 71.1	62.9	66.7	67.0	N/A	N/A	70.4 to 73.2	N/A	62.5	N/A
Feasible?	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Reasonable?	No	Yes	No	No	No	No	No	No	No	No	No
Recommended?	No	Yes	No	No	No	No	No	No	No	No	No

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 11 Tunnel Alternative Modeled Noise Levels with and without Barrier 1**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			L <sub>eq</sub> Without Abatement	L <sub>eq</sub> With Abatement	Insertion Loss
R44	Baseball Field	1	70.5	65.3	5.2
R45	Baseball Field	1	74.0	66.5	7.5
R48	Picnic Area	1	74.3	66.5	7.8

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 12 Tunnel Alternative Modeled Noise Levels with and without Barrier 2**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Addresses	Proposed Action (2045)* (dBA)		
				L <sub>eq</sub> Without Abatement	L <sub>eq</sub> With Abatement	Insertion Loss
R95	Residential—Duplex	2	3301 Riverside Dr, Idaho Springs; 3303 Riverside Dr, Idaho Springs	71.5	64.9	6.6
R96	Residential—Duplex	2	3305 Riverside Dr, Idaho Springs; 3307 Riverside Dr, Idaho Springs	72.1	64.3	7.8
R97	Residential—Duplex	2	3309 Riverside Dr, Idaho Springs; 3311 Riverside Dr, Idaho Springs	72.1	64.4	7.7
R98	Residential—Duplex	2	3313 Riverside Dr, Idaho Springs; 3315 Riverside Dr, Idaho Springs	73.8	65.6	8.2
R99	Residential—Duplex	2	3317 Riverside Dr, Idaho Springs; 3319 Riverside Dr, Idaho Springs	73.8	66.1	7.7
R100	Residential—Duplex	2	3321 Riverside Dr, Idaho Springs; 3323 Riverside Dr, Idaho Springs	74.2	66.5	7.7
R101	Residential—Duplex	2	3325 Riverside Dr, Idaho Springs; 3327 Riverside Dr, Idaho Springs	74.5	67.2	7.3
R102	Residential—Duplex	2	3329 Riverside Dr, Idaho Springs; 3331 Riverside Dr, Idaho Springs	74.7	67.8	6.9
R103	Residential—Duplex	2	3333 Riverside Dr, Idaho Springs; 3335 Riverside Dr, Idaho Springs	75.0	68.3	6.7
R104	Residential—Duplex	2	3326 Riverside Dr, Idaho Springs; 3328 Riverside Dr, Idaho Springs	71.9	66.5	5.4
R105	Residential—Duplex	2	3322 Riverside Dr, Idaho Springs; 3324 Riverside Dr, Idaho Springs	72.2	66.7	5.5
R106	Residential—Duplex	2	3318 Riverside Dr, Idaho Springs; 3320 Riverside Dr, Idaho Springs	72.2	66.7	5.5
R107	Residential—Duplex	2	3314 Riverside Dr, Idaho Springs; 3316 Riverside Dr, Idaho Springs	71.8	66.4	5.4

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Addresses	Proposed Action (2045)* (dBA)		
				L <sub>eq</sub> Without Abatement	L <sub>eq</sub> With Abatement	Insertion Loss
R108	Residential—Duplex	2	3310 Riverside Dr, Idaho Springs; 3312 Riverside Dr, Idaho Springs	71.6	65.8	5.8
R109	Residential—Duplex	2	3306 Riverside Dr, Idaho Springs; 3308 Riverside Dr, Idaho Springs	70.8	65.2	5.6
R112	Skate Park	1	Idaho Springs Skatepark	75.9	71.1	4.8

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 13 Tunnel Alternative Modeled Noise Levels with and without Barrier 3**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			L <sub>eq</sub> Without Abatement	L <sub>eq</sub> With Abatement	Insertion Loss
R116	Commercial Outdoor Seating	1	71.1	62.9	8.2

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 14 Tunnel Alternative Modeled Noise Levels with and without Barrier 4**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			L <sub>eq</sub> Without Abatement	L <sub>eq</sub> With Abatement	Insertion Loss
R110	Residential—SF	1	72.9	66.7	6.2

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.



**Table 15 Tunnel Alternative Modeled Noise Levels with and without Barrier 5**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			L <sub>eq</sub> Without Abatement	L <sub>eq</sub> With Abatement	Insertion Loss
R4	Trailhead	1	73.9	67.0	6.9

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 16 Tunnel Alternative Modeled Noise Levels with and without Barrier 8**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			L <sub>eq</sub> Without Abatement	L <sub>eq</sub> With Abatement	Insertion Loss
R24	Daycare Playground	1	76.2	70.4	5.8
R25	Office Patio	1	77.7	73.2	4.5

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 17 Tunnel Alternative Modeled Noise Levels with and without Barrier 10**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			L <sub>eq</sub> Without Abatement	L <sub>eq</sub> With Abatement	Insertion Loss
R36	Residential—SF	1	68.9	62.5	6.4

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 18 Canyon Alternative Noise Barrier Evaluation**

Barrier ID	1	2	3	4	5	6	7	8	9	10
Barrier Location (general)	South of I-70 in East Idaho Springs	North of I-70 in East Idaho Springs	South of I-70 just west of VMT	South of I-70 near the Hidden Valley Interchange	South of the new frontage road just east of Hidden Valley Interchange	North of I-70 near US 6 Interchange	Southwest of the Hyland Hills/Floyd Hill Interchange	North of I-70 just east of the Hyland Hills/Floyd Hill Interchange	South of I-70 just west of the Beaver Brook/Floyd Hill Interchange	North of I-70 just east of the Hyland Hills/Floyd Hill Interchange
Barrier Location: Distance from Proposed Edge of Roadway (feet)	4	4	4	4	4	4	4	4	4	4
Benefited Receiver IDs	refer to Figure 8	refer to Figure 8	refer to Figure 8	refer to Figure 8	refer to Figure 8	refer to Figure 8	refer to Figure 8	refer to Figure 8	refer to Figure 8	refer to Figure 8
Figure #	Figure 8 Page 1	Figure 8 Page 1	Figure 8 Page 2	Figure 8 Page 3	Figure 8 Page 3	Figure 8 Pages 4 & 5	Figure 8 Page 7	Figure 8 Page 7	Figure 8 Page 8	Figure 8 Page 8
Recommended Barrier Height & Length (feet)	10 high x 672 long	14 high x 1,395 long	20 high x 2,860 long	20 high x 1,360 long	20 high x 910 long	Must be >20 feet high	20 high x 1,940 long	20 high x 1,815 long	20 high x 2,020 long	Must be >20 feet high
Barrier Area (square feet)	6,720	19,530	57,200	27,200	18,200	N/A	38,800	36,300	40,400	N/A
Unit Cost	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>	\$45/ft <sup>2</sup>
Total Cost	\$302,400	\$878,850	\$2,574,000	\$1,224,000	\$819,000	N/A	\$1,746,000	\$1,633,500	\$1,818,000	N/A
No. Benefited Receptors	3	31	3	1	1	0	2	1	1	0
Total Decibels of Benefit Provided	20.8	204.8	17.5	5.8	4.5	N/A	13.4	6.5	5.7	N/A
Average Benefit (dBA/receptor)	6.9	6.6	5.8	<7 dBA at any receptor	<7 dBA at any receptor	<5 dBA at any receptor	6.7	6.5	<7 dBA at any receptor	<5 dBA at any receptor
Cost Benefit(\$/dBA/receptor)	\$14,538	\$4,300	\$147,086	\$211,034	\$182,000	N/A	\$130,299	\$251,308	\$318,947	N/A
2045 Leq Range without Abatement (dBA)*	70.6 to 74.4	70.9 to 76.0	66.4 to 71.1	72.8	73.4	N/A	75.1 to 77.3	70.3	68.5	N/A
2045 Leq Range with Abatement (dBA)*	65.2 to 66.6	64.4 to 71.2	61.8 to 64.0	67.0	68.9	N/A	68.1 to 70.9	63.8	62.8	N/A
Feasible?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Reasonable?	No	Yes	No	No	No	No	No	No	No	No
Recommended?	No	Yes	No	No	No	No	No	No	No	No

\*A 2-dBA calibration factor has been applied to the noise levels the models produce

**Table 19 Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 1**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			Leq Without Abatement	Leq With Abatement	Insertion Loss
R44	Baseball Field	1	70.6	65.2	5.4
R45	Baseball Field	1	74.1	66.6	7.5
R48	Picnic Area	1	74.4	66.5	7.9

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 20 Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 2**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Addresses	Proposed Action (2045)* (dBA)		
				Leq Without Abatement	Leq With Abatement	Insertion Loss
R95	Residential— Duplex	2	3301 Riverside Dr, Idaho Springs; 3303 Riverside Dr, Idaho Springs	71.6	65.0	6.6
R96	Residential— Duplex	2	3305 Riverside Dr, Idaho Springs; 3307 Riverside Dr, Idaho Springs	72.2	64.4	7.8
R97	Residential— Duplex	2	3309 Riverside Dr, Idaho Springs; 3311 Riverside Dr, Idaho Springs	72.2	64.4	7.8
R98	Residential— Duplex	2	3313 Riverside Dr, Idaho Springs; 3315 Riverside Dr, Idaho Springs	73.9	65.7	8.2
R99	Residential— Duplex	2	3317 Riverside Dr, Idaho Springs; 3319 Riverside Dr, Idaho Springs	73.9	66.2	7.7
R100	Residential— Duplex	2	3321 Riverside Dr, Idaho Springs; 3323 Riverside Dr, Idaho Springs	74.3	66.6	7.7

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Addresses	Proposed Action (2045)* (dBA)		
				Leq Without Abatement	Leq With Abatement	Insertion Loss
R101	Residential— Duplex	2	3325 Riverside Dr, Idaho Springs; 3327 Riverside Dr, Idaho Springs	74.6	67.2	7.4
R102	Residential— Duplex	2	3329 Riverside Dr, Idaho Springs; 3331 Riverside Dr, Idaho Springs	74.8	67.9	6.9
R103	Residential— Duplex	2	3333 Riverside Dr, Idaho Springs; 3335 Riverside Dr, Idaho Springs	75.1	68.4	6.7
R104	Residential— Duplex	2	3326 Riverside Dr, Idaho Springs; 3328 Riverside Dr, Idaho Springs	72.0	66.6	5.4
R105	Residential— Duplex	2	3322 Riverside Dr, Idaho Springs; 3324 Riverside Dr, Idaho Springs	72.3	66.7	5.6
R106	Residential— Duplex	2	3318 Riverside Dr, Idaho Springs; 3320 Riverside Dr, Idaho Springs	72.2	66.7	5.5
R107	Residential— Duplex	2	3314 Riverside Dr, Idaho Springs; 3316 Riverside Dr, Idaho Springs	71.9	66.5	5.4
R108	Residential— Duplex	2	3310 Riverside Dr, Idaho Springs; 3312 Riverside Dr, Idaho Springs	71.6	65.9	5.7
R109	Residential— Duplex	2	3306 Riverside Dr, Idaho Springs; 3308 Riverside Dr, Idaho Springs	70.9	65.3	5.6
R112	Skate Park	1	Idaho Springs Skatepark	76.0	71.2	4.8

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 21 Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 3**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			Leq Without Abatement	Leq With Abatement	Insertion Loss
R116	Commercial Outdoor Seating	1	71.1	62.7	8.4
R117	Trail crossing	1	66.4	61.8	4.6
R118	Trail crossing	1	68.5	64.0	4.5

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 22 Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 4**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			Leq Without Abatement	Leq With Abatement	Insertion Loss
R110	Residential—SF	1	72.8	67.0	5.8

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 23 Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 5**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			Leq Without Abatement	Leq With Abatement	Insertion Loss
R4	Trailhead	1	73.4	68.9	4.5

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 24 Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 7**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			Leq Without Abatement	Leq With Abatement	Insertion Loss
R24	Daycare Playground	1	75.1	68.1	7.0
R25	Office Patio	1	77.3	70.9	6.4

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 25 Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 8**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			Leq Without Abatement	Leq With Abatement	Insertion Loss
R32	Residential—SF	1	70.3	63.8	6.5

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

**Table 26 Canyon Viaduct Alternative Modeled Noise Levels with and without Barrier 9**

Benefited Receiver ID	Benefited Receiver Description	Number of Benefited Receptors Represented per Receiver	Proposed Action (2045)* (dBA)		
			Leq Without Abatement	Leq With Abatement	Insertion Loss
R36	Residential—SF	1	68.5	62.8	5.7

\*A 2-dBA calibration factor has been applied to the noise levels the models produce.

## 7 STATEMENT OF LIKELIHOOD

The noise abatement evaluation for the Action Alternatives is described in Chapter 6. In the Noise Study Zone, 87 receivers, representing 105 receptors, were determined to be impacted by traffic noise in 2045 under the Tunnel Alternative and the Canyon Viaduct Alternative. Impacted receptors are located throughout the Noise Study Zone, primarily concentrated at Floyd Hill and East Idaho Springs, shown in Figure 5 and Figure 6. Refer to Figure 7 and Figure 8 for locations where noise barriers were analyzed and the benefited receivers are shown. Noise abatement was determined to be feasible and reasonable in one location. Therefore, the following noise walls are recommended to be constructed:

- Barrier 2: north of I-70 in East Idaho Springs, 14 feet high by 1,395 feet long

Note that there will not be any road widening or capacity improvements occurring in the vicinity of the area where Barrier 2 is located as part of the Project. CDOT will conduct a Benefited Receptor Preference Survey for benefited owners and residents affected by the recommended noise wall in eastern Idaho Springs. The recommended noise wall will be constructed if benefitted receptors support it in the preference survey.

Under the Tunnel Alternative, noise abatement at four locations is not feasible; noise abatement at six locations is feasible but not reasonable, as described in Section 6.3 and Table 10. Under the Canyon Viaduct Alternative, noise abatement at two locations is not feasible; noise abatement at seven locations is feasible but not reasonable, as described in Section 6.3 and Table 18.

Note that feasibility and reasonableness determinations for this Project may change if there are changes in final design after approval of the NEPA documentation. In addition, abatement will not be built if the Benefited Receptor Preference Survey results in support of 50 percent or less for the abatement.

## 8 CONSTRUCTION NOISE

This chapter describes construction noise implications and construction noise mitigation strategies and discusses whether the Project is in an area with local noise ordinances.

### 8.1 Construction Noise Implications

Properties adjacent to Project construction may be exposed to noise from construction activities from the Proposed Action. Examples of noise from construction equipment are shown in Table 27. Construction noise differs from traffic noise in several ways:

- Construction noise lasts only for the duration of construction, with most construction activities in noise-sensitive areas being conducted during hours that are least disturbing to most nearby residents, when feasible.
- Construction activities generally are short term and, depending on the nature of the construction operations, last from seconds (e.g., a truck passing a receptor) to months (e.g., bridge construction).
- Construction equipment noise is intermittent and depends on the type of operation, location, and function of the equipment, as well as the equipment usage cycle.

- As opposed to operational traffic noise, construction noise is not analyzed; there are no FHWA or CDOT construction NACs. However, construction noise is subject to relevant local regulations and ordinances (see Section 8.3).

**Table 27 Typical Construction Equipment Noise**

Equipment	Maximum Noise Level (dBA at 50 feet) <sup>1</sup>
Scraper	89
Dozer (Bulldozer)	85
Truck (Heavy Truck)	88 <sup>2</sup>
Pickup Truck	55
Concrete Pump Truck	82
Backhoe	80
Pneumatic Tools	85

<sup>1</sup> Noise levels are from Table 9.1 of FHWA's 2006 [Construction Noise Handbook](#) (FHWA, 2006), unless otherwise noted.

<sup>2</sup> This noise level is from Table 9.9 of FHWA's 2006 [Construction Noise Handbook](#) (FHWA, 2006), which is taken from Chapter 12 of the FTA Transit Noise and Vibration Guidance Handbook.

## 8.2 Construction Noise Mitigation Strategies

To minimize construction noise levels, typical best management practices will be incorporated into construction contracts where it is appropriate to do so. These may include:

- The public information plan will define strategies to notify noise-sensitive receptors near construction work that may result in noise.
- Keep exhaust systems on equipment in good working order. Maintain equipment on a regular basis; regular inspections should be conducted to ensure maintenance is being conducted.
- Locate haul roads and other noisy activities that are not location-specific (such as rock crushing, equipment maintenance, etc.) away from noise-sensitive receptors to the extent possible.
- Place stationary equipment as far from sensitive receptors as possible.
- Construction activities in Clear Creek County shall adhere to Colorado Noise Statute 23-5-12-103, and construction activities in Jefferson County shall adhere to the Jefferson County noise abatement policy. Coordinate with local officials if variances are needed for nighttime construction work to maintain traffic.

## 8.3 Local Noise Ordinances

The Project is in Clear Creek and Jefferson counties. Clear Creek County does not have any local noise ordinances. Therefore, Colorado Noise Statute 23-5-12-103 applies. This means that noise at 25 feet from the project boundary may not exceed 80 dBA from 7:00 a.m. until 7:00 p.m. and 75 dBA from 7:00 p.m. until 7:00 a.m. Jefferson County's noise abatement policy stated that "Construction projects in residential zones shall be subject to the following permissible noise levels for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority, or if no time limitation is imposed, then for a reasonable period of time for completion of project.



- 7:00 A.M. until 7:00 P.M.—80 dBA
- 7:00 P.M. until 7:00 A.M. of the same day of the following day—75 dBA”

## 9 INFORMATION FOR LOCAL OFFICIALS

This Project’s Noise Study Zone includes land that is unpermitted and undeveloped (i.e., Activity Category G). Therefore, 23 CFR 772.17 is applicable, and noise-related information needs to be provided to local officials to support local land use planning decisions and future development.

All undeveloped and unpermitted lands that abut I-70 were identified and are referred to as parcels in this section of the report. The reasons that some of the parcels were not analyzed is because Clear Creek County land use and zoning restricts development on lands with slopes greater than 30 percent, and undeveloped lands within 500 feet of the highway are generally undevelopable with slopes greater than 30 percent, which makes development of these lands within the Project limits unlikely. A total of nine parcels (C1 to C9) were modeled at 25 feet, 50 feet, 75 feet, and 100 feet from the nearest edge of pavement, and then at 50-foot intervals to 300 feet. The nine locations are shown in Figure 9 and Figure 10. The contour modeling results are shown in Table 28 and Table 29.

Noise contour lines are not recommended to represent sound levels because distances may vary somewhat over the corridor due to topography and changing road alignments; therefore, contour lines are not provided. In general, land within approximately 300 feet from the proposed new edge of the nearest travel lane is predicted to exceed 66 dBA during worst noise-hour traffic periods. The distance to 71 dBA for sensitive commercial properties is predicted to be approximately 250 feet from the proposed new edge of the nearest travel lane. Properties developed in those areas would not be compatible with Activity Category B or C (66 dBA) or Activity Category E (71 dBA) uses, respectively.

Each state highway agency is required to identify when the public is officially notified of a proposed highway project location. CDOT’s NAAG defines the Date of Public Knowledge as the date on which the final environmental project document is approved (i.e., signed Categorical Exclusion Form 128, Finding of No Significant Impact, or Record of Decision). After this date, CDOT and FHWA will be responsible for analyzing and documenting existing and future noise levels for these lands as part of Type I noise analyses but will not be required to provide noise abatement for development on these lands if it was permitted after the Date of Public Knowledge. In addition, these areas would not be eligible for federal-aid participation for Type II projects, if funding to the Type II program were to be reinstated in Colorado. Decisions concerning such noise abatement are left to local government agencies and private developers.

**Table 28 Tunnel Alternative Contour Modeled Results (in dBA)**

Contours Parcel Receptor #	25 Feet	50 Feet	75 Feet	100 Feet	150 Feet	200 Feet	250 Feet	300 Feet
C1	78.4	76	74.5	73.2	70.6	69	67.9	67
C2	73.1	72.4	71.1	70.5	69.8	69.1	68.8	69.2
C3	75.7	68.6	65.5	66.4	66.9	67	66.7	66.6
C4	81.8	79.6	77.6	76.2	73.9	72	70.4	68.6

Contours Parcel Receptor #	25 Feet	50 Feet	75 Feet	100 Feet	150 Feet	200 Feet	250 Feet	300 Feet
C5	82.1	80.6	79	77.6	75.2	73.9	72.6	71.6
C6	79	76.8	75.6	74.8	73.3	71.9	71	70
C7	81.5	76.1	74.5	73.3	71.5	70.2	69.1	68.2
C8	80.5	77.6	75.9	74.9	73.5	72.3	71.6	71.2
C9	81.6	74	76.6	76.3	74.5	72.9	71.3	69.7
C10	75.5	73	69.9	66.7	65.1	70.8	71.4	70.6
C11	72.1	67.2	68	68.9	72.1	72.3	72.1	71.5
C12	68.8	68.2	69.7	70.1	72.5	74	73.1	72.2

*\*A 2-dBA calibration factor has been applied to the noise levels the models produce.*

**Table 29 Canyon Viaduct Alternative Contour Modeled Results (in dBA)**

Contours Parcel Receptor #	25 feet	50 feet	75 feet	100 feet	150 feet	200 feet	250 feet	300 feet
C1	78.4	76	74.5	73.2	70.6	69	67.9	67.1
C2	72	71.7	70.1	69.5	69.1	69.1	69.6	69.8
C3	67.2	65.2	64.9	64.8	65.3	65.7	65.8	65.7
C4	81.8	79.6	77.6	76.1	73.9	72	70.4	68.9
C5	82.2	80.6	79	77.5	75.3	73.8	72.5	71.2
C6	75.6	73.9	73.1	72.6	71.6	70.7	70	69.3
C7	80.3	76.4	74.2	72.9	71	69.6	68.4	67.2
C8	76.6	74.8	73.8	73.3	72.3	71.5	71	70.5
C9	80.8	78.5	76.7	75.9	74	72.2	70.6	68.7
C10	72.5	71	69.5	68.8	68.2	70.1	70.6	70.8
C11	69.5	66.7	65.5	64.8	64.2	66	68.4	73.9
C12	70.8	70.9	71.6	72.5	75	74.2	73.4	72.6

*\*A 2-dBA calibration factor has been applied to the noise levels the models produce.*

## 10 SOURCES AND REFERENCES

CDOT. 2015. *Noise Analysis and Abatement Guidelines*, January.

FHWA. 1996. *Measurement of Highway-Related Noise*, May.

FHWA. 2006. *Construction Noise Handbook*, August.

FHWA. 2011. *Highway Traffic Noise: Analysis and Abatement Guidance*, December.

I-70 Floyd Hill to Veterans Memorial Tunnels Traffic Noise Technical Report V.4  
Project No. NHPP 0703-446, Sub Account No. 21912  
May 2021

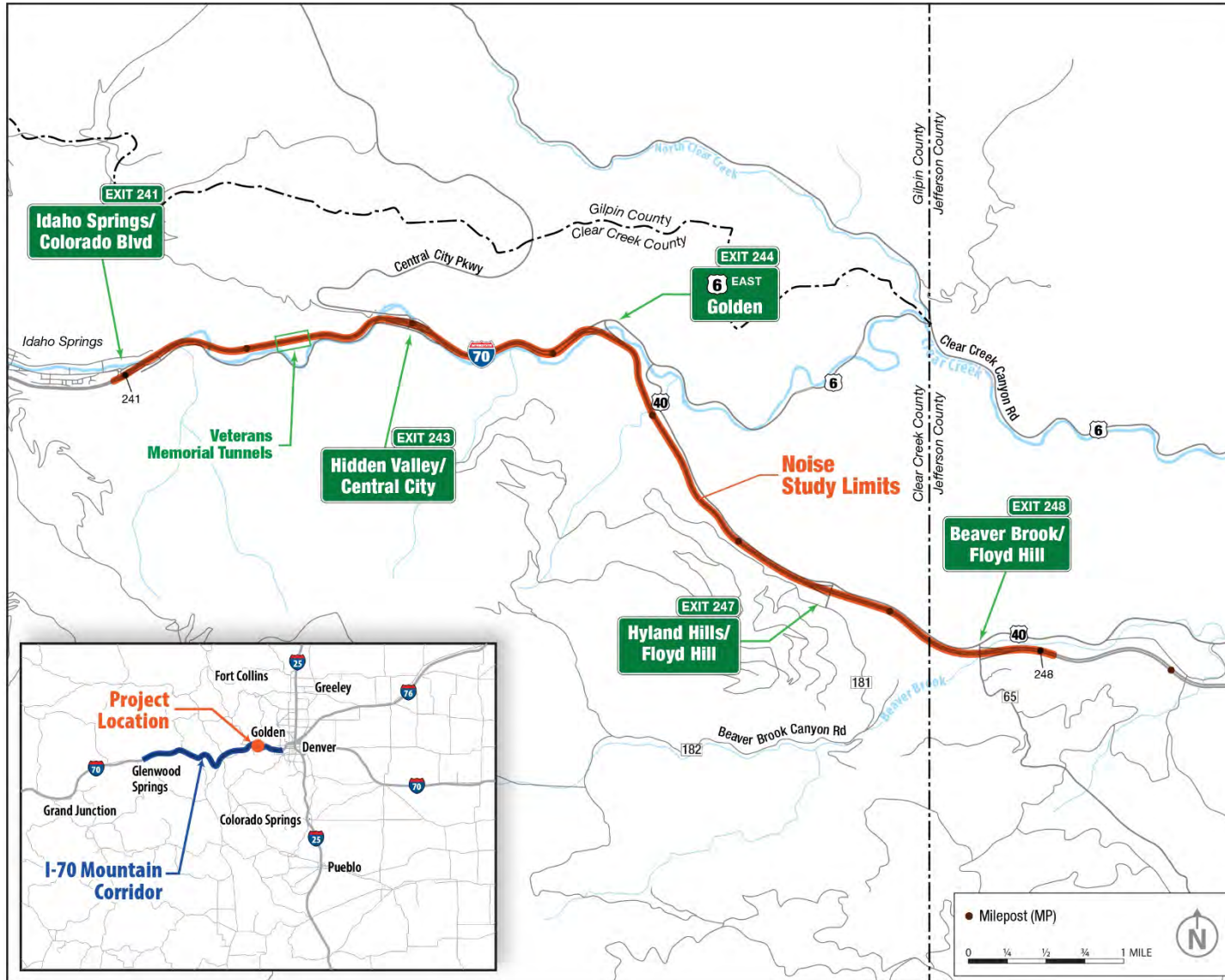
FHWA. 2018. *Techniques for Reviewing Noise Analyses and Associated Noise Reports*, June.

Procedures for Abatement of Highway Traffic Noise and Construction Noise, 23 CFR § 772  
(2010)

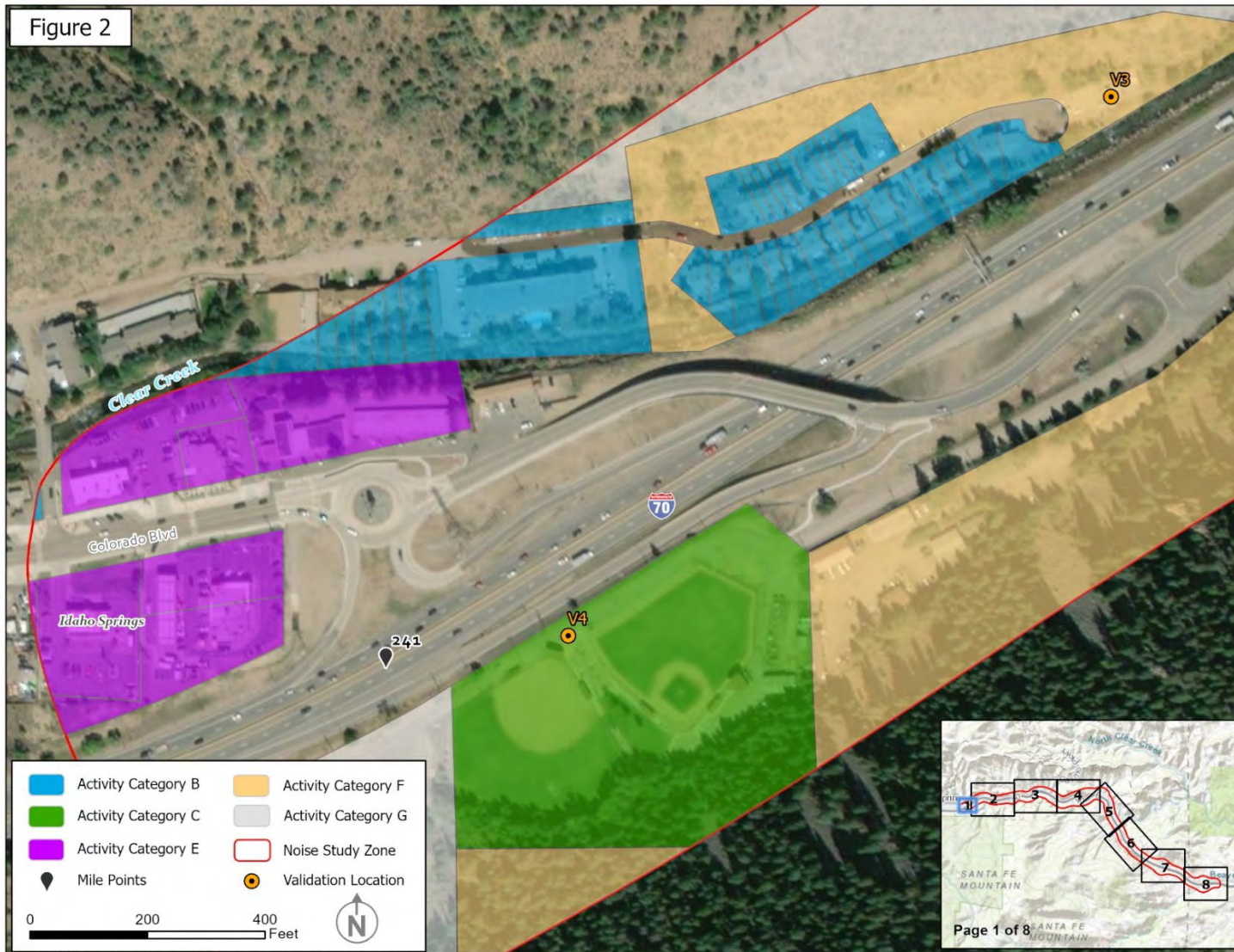
Atkins. *I-70 Floyd Hill to Veterans Memorial Tunnels Transportation and Traffic Technical Report* (not yet finalized as of completion of this Noise Technical Report).

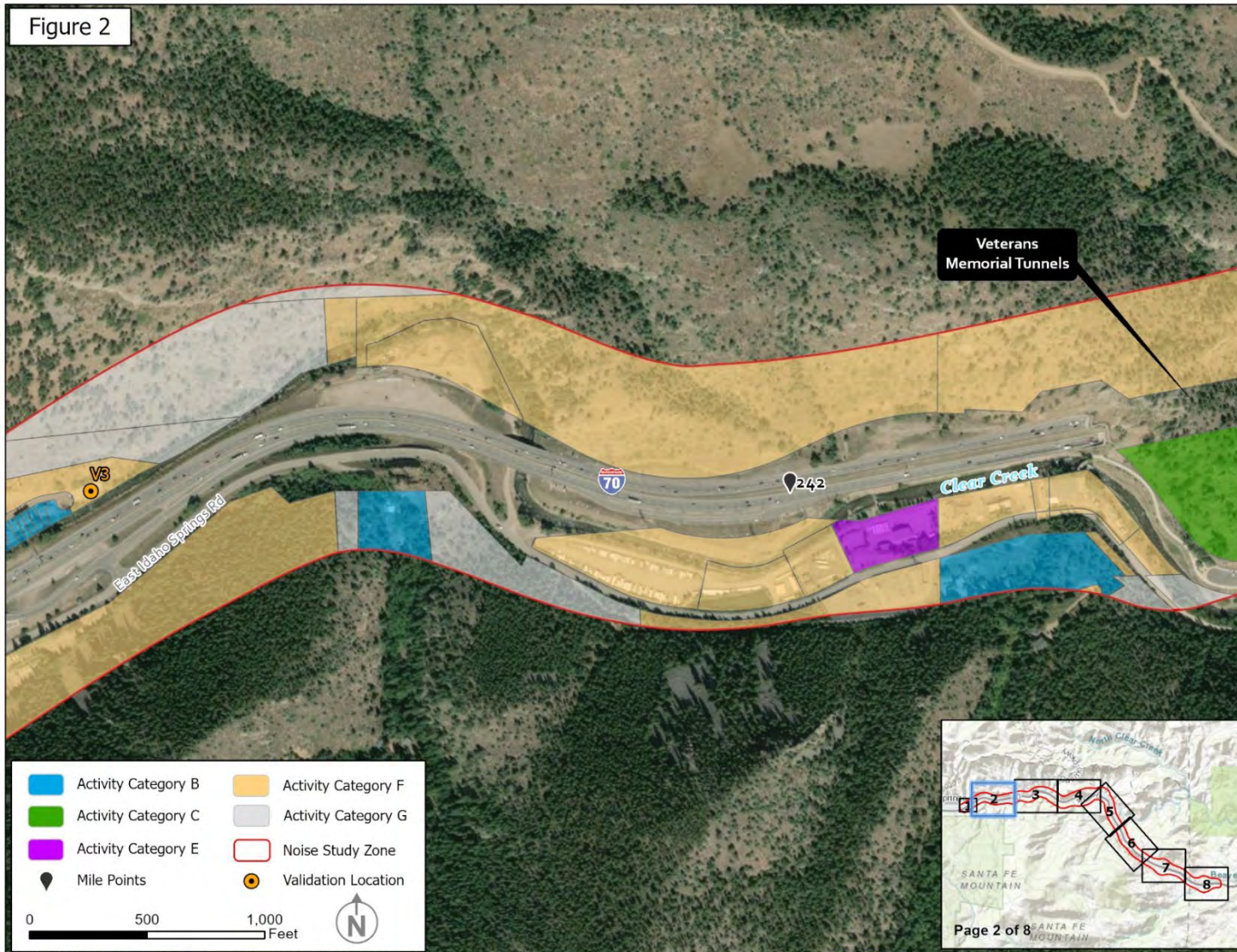
Atkins. 2018. *I-70 Floyd Hill to Veterans Memorial Tunnels: Model Calibration Results Memorandum*, September.

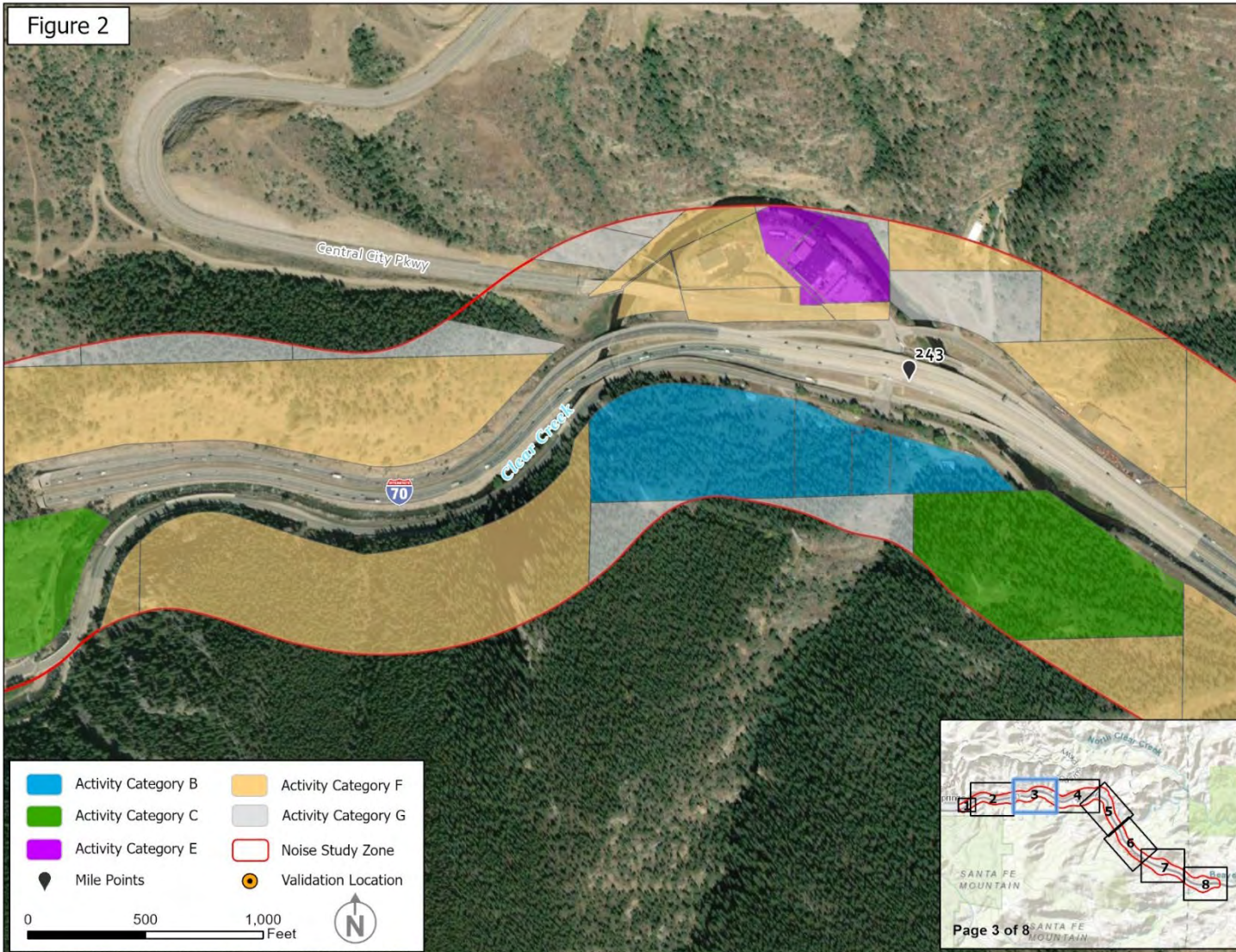
Figure 1 I-70 Floyd Hill to Veterans Memorial Tunnels Project Vicinity

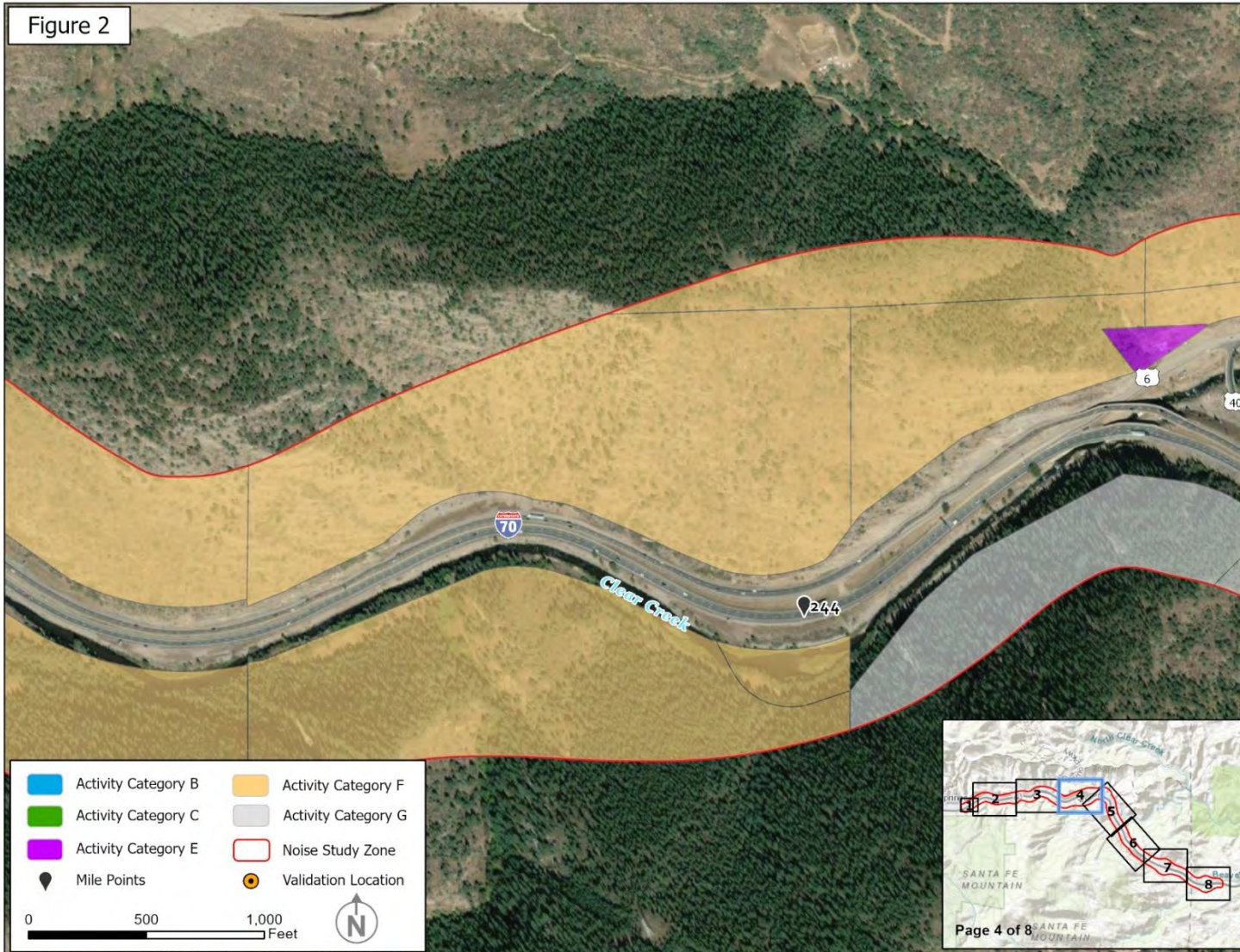


**Figure 2 I-70 Floyd Hill to Veterans Memorial Tunnels Noise Study Zone, Activity Categories, and Noise Measurement Locations**



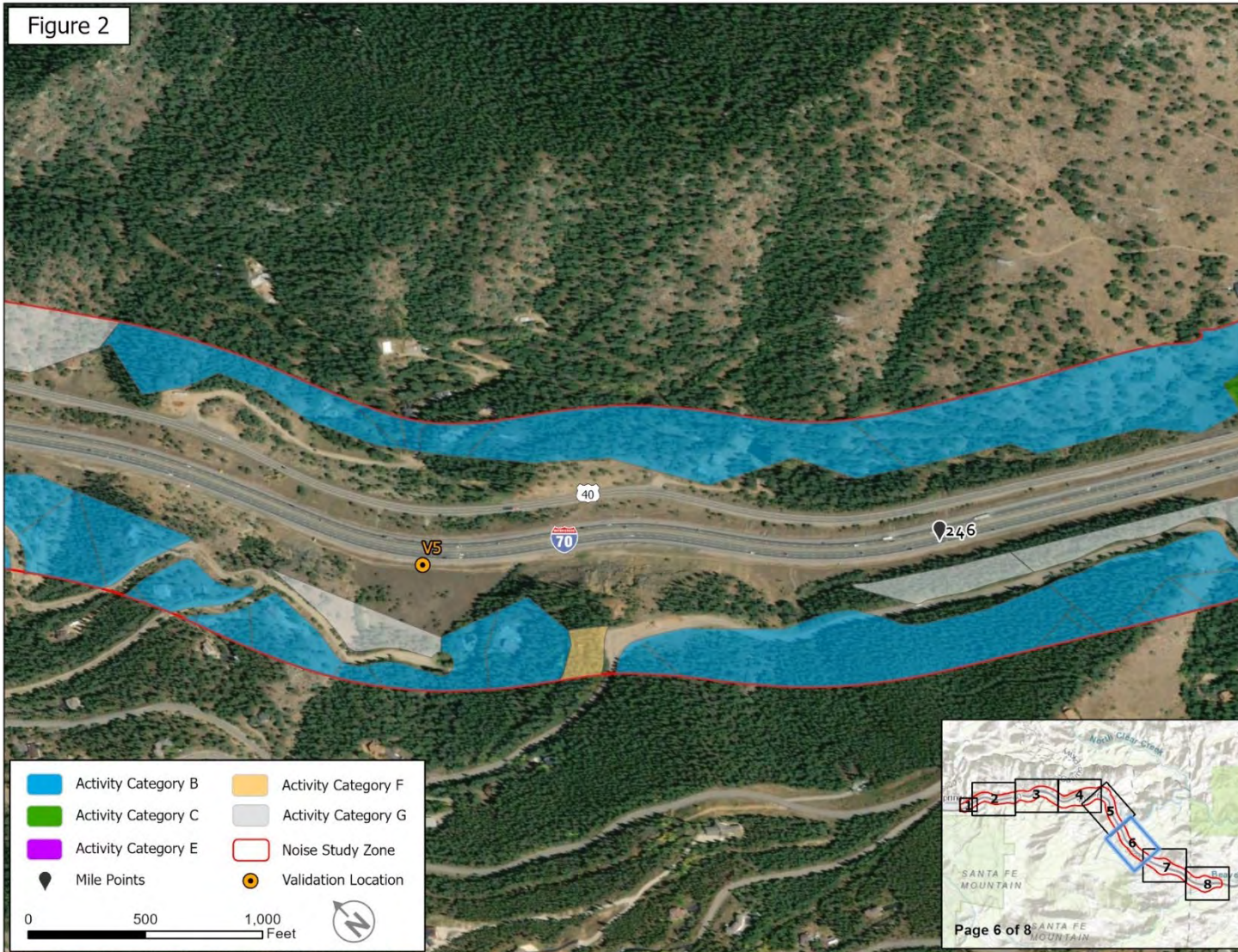


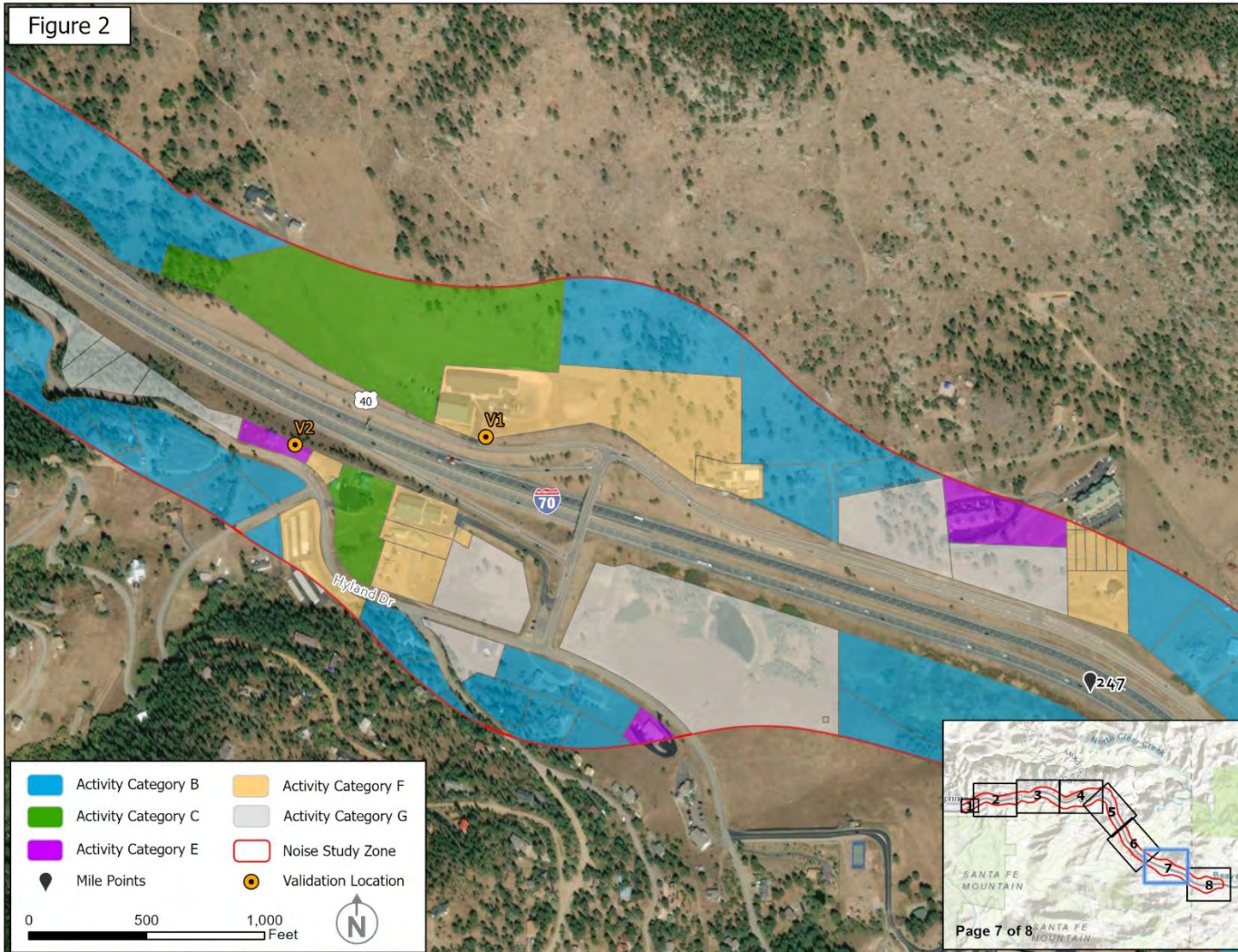


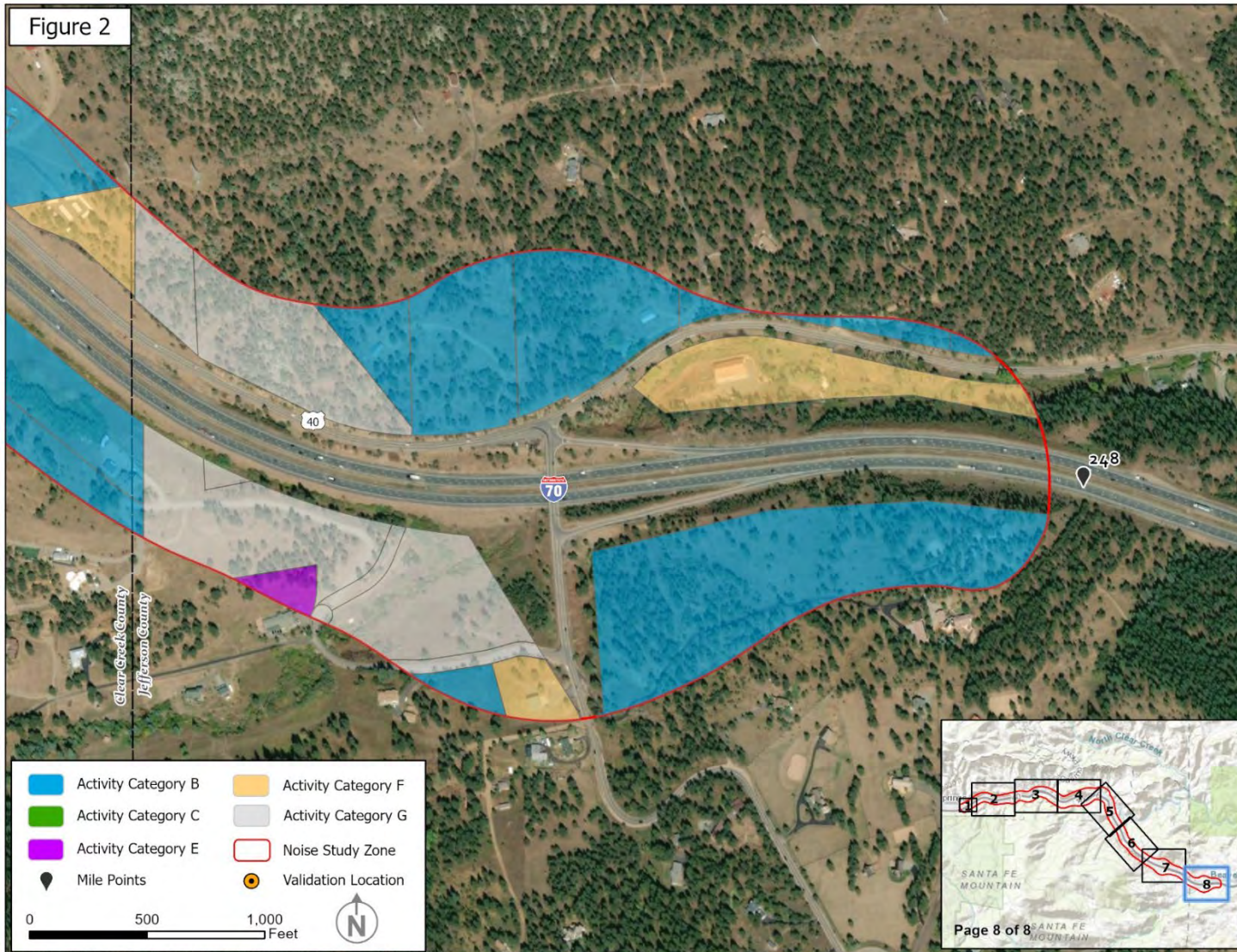






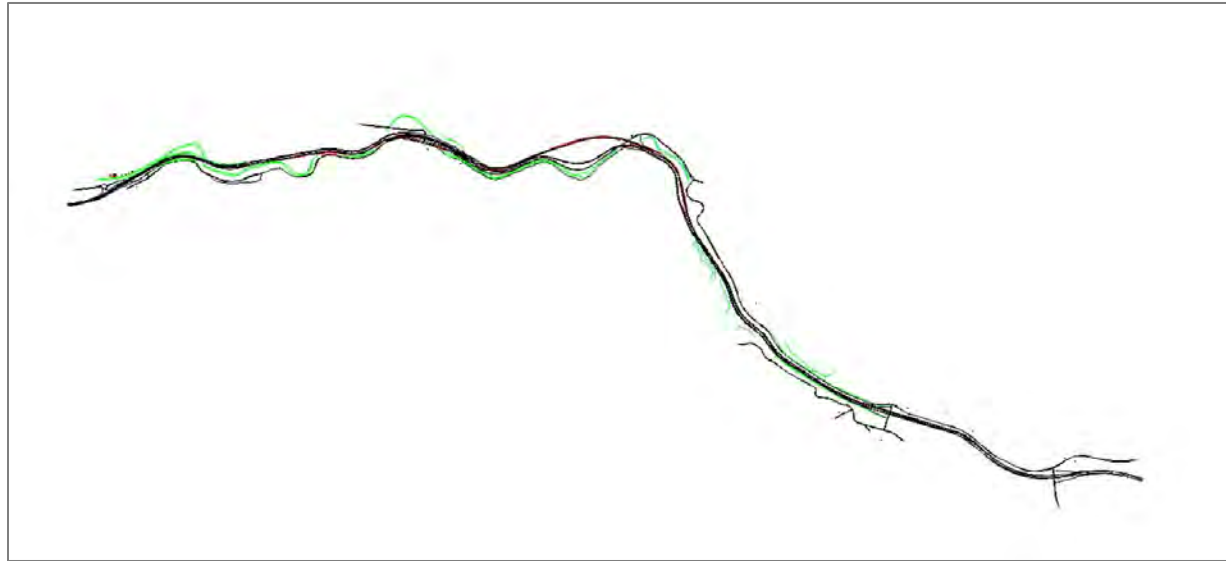






**Figure 3 I-70 Floyd Hill to Veterans Memorial Tunnels TNM Model Objects for 2045 Proposed Action**

**Tunnel Alternative**



**Canyon Viaduct Alternative**

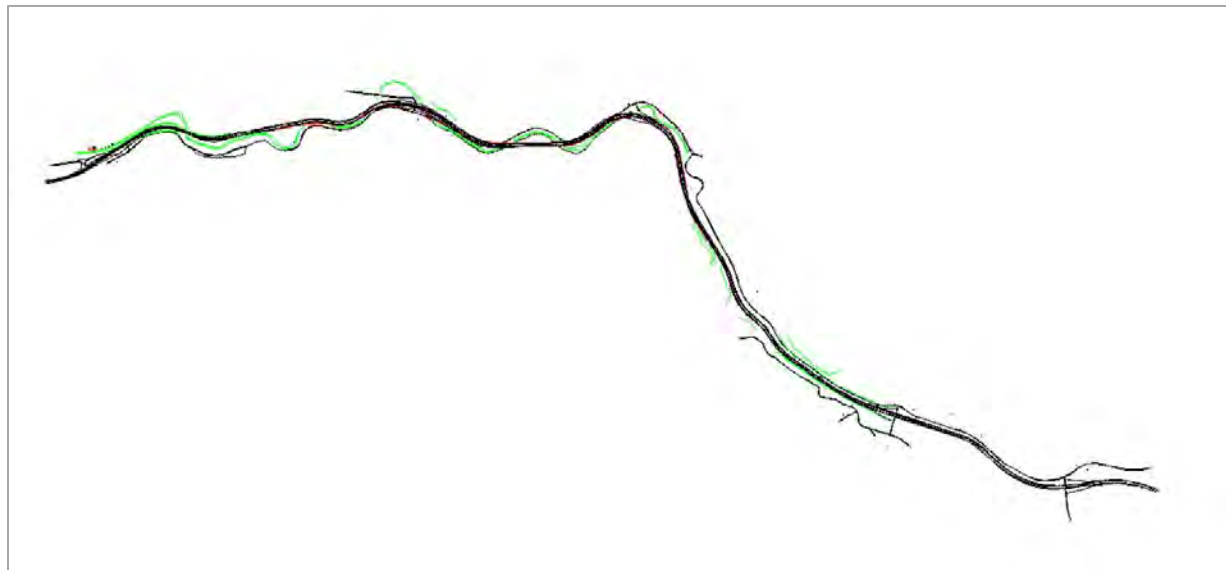
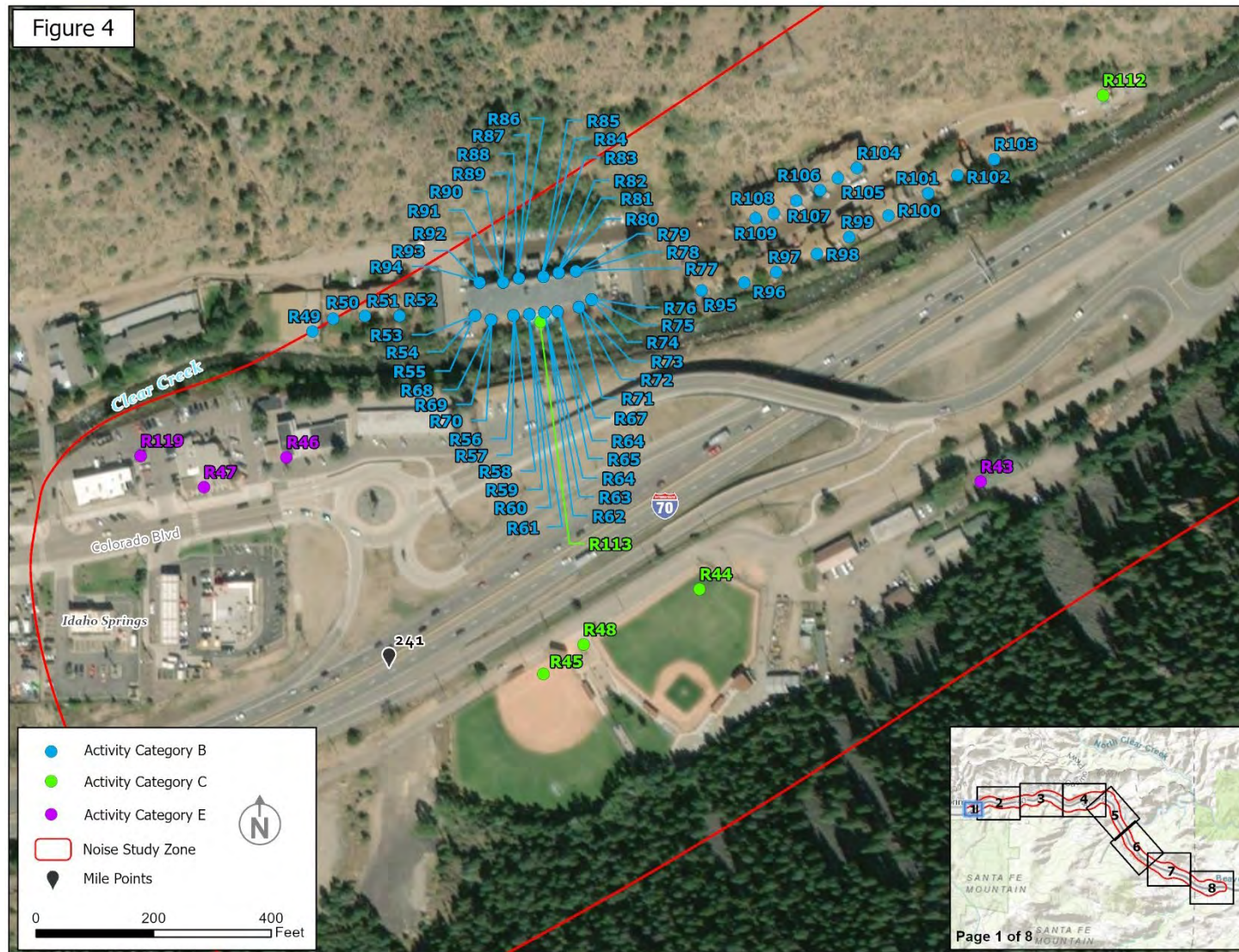
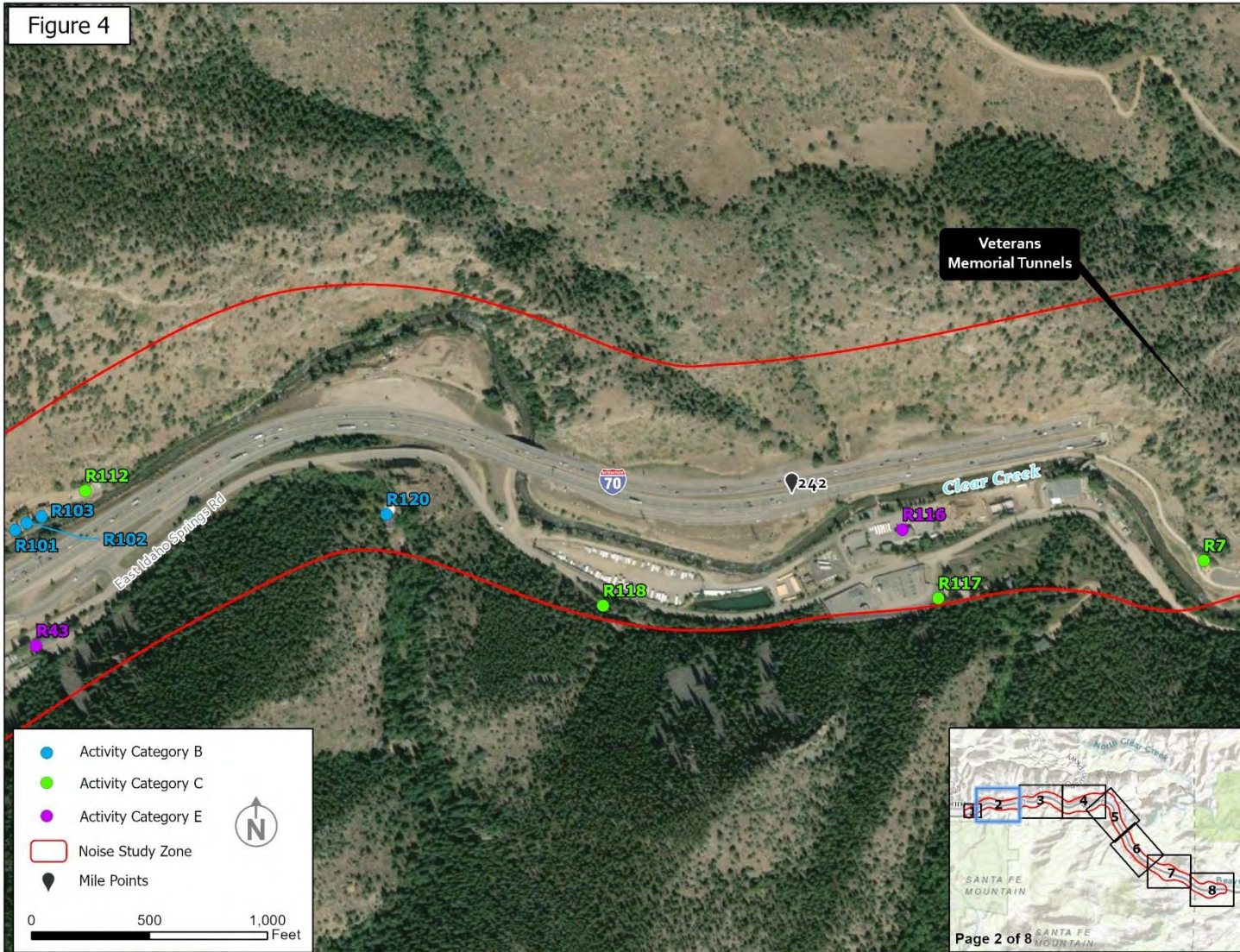
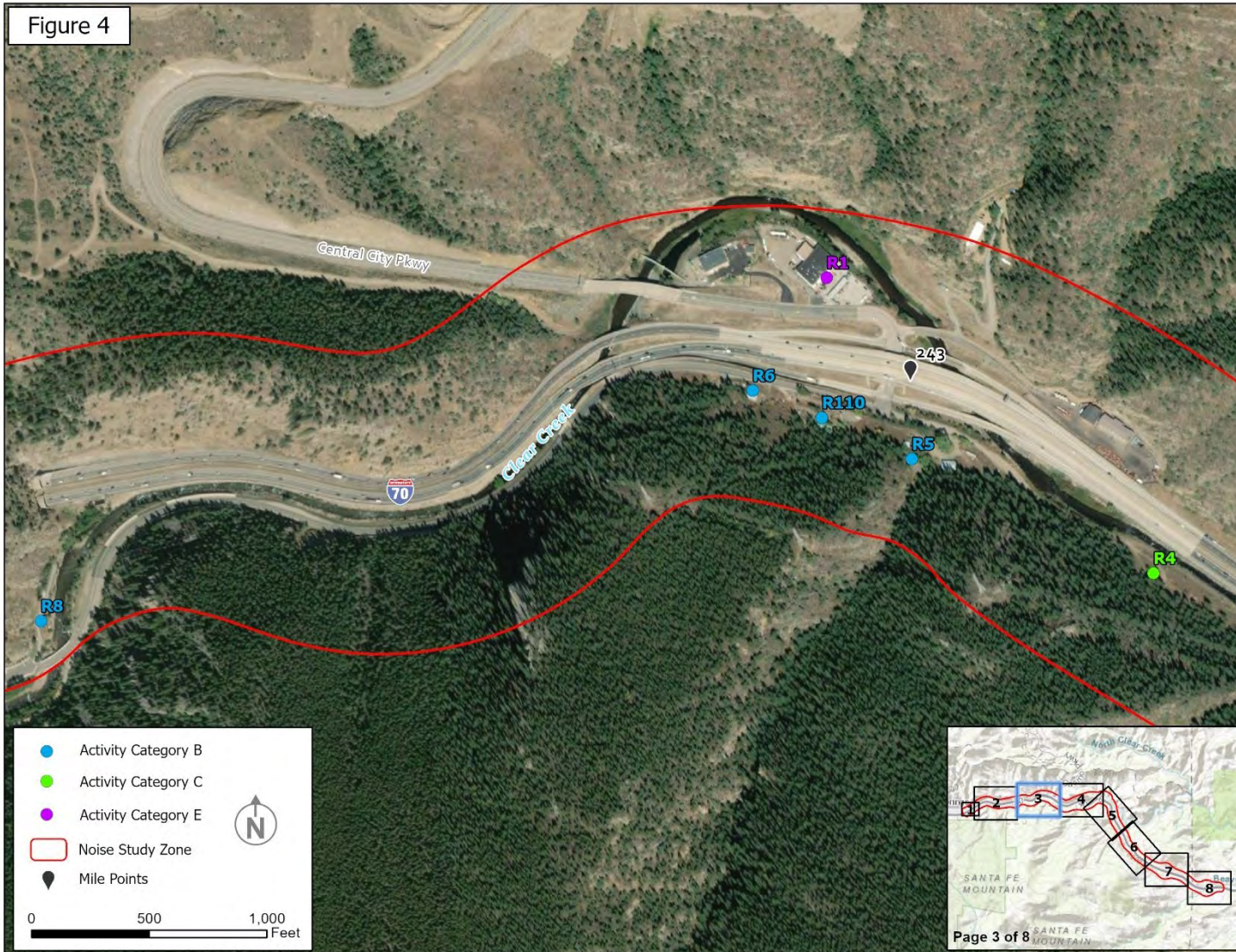


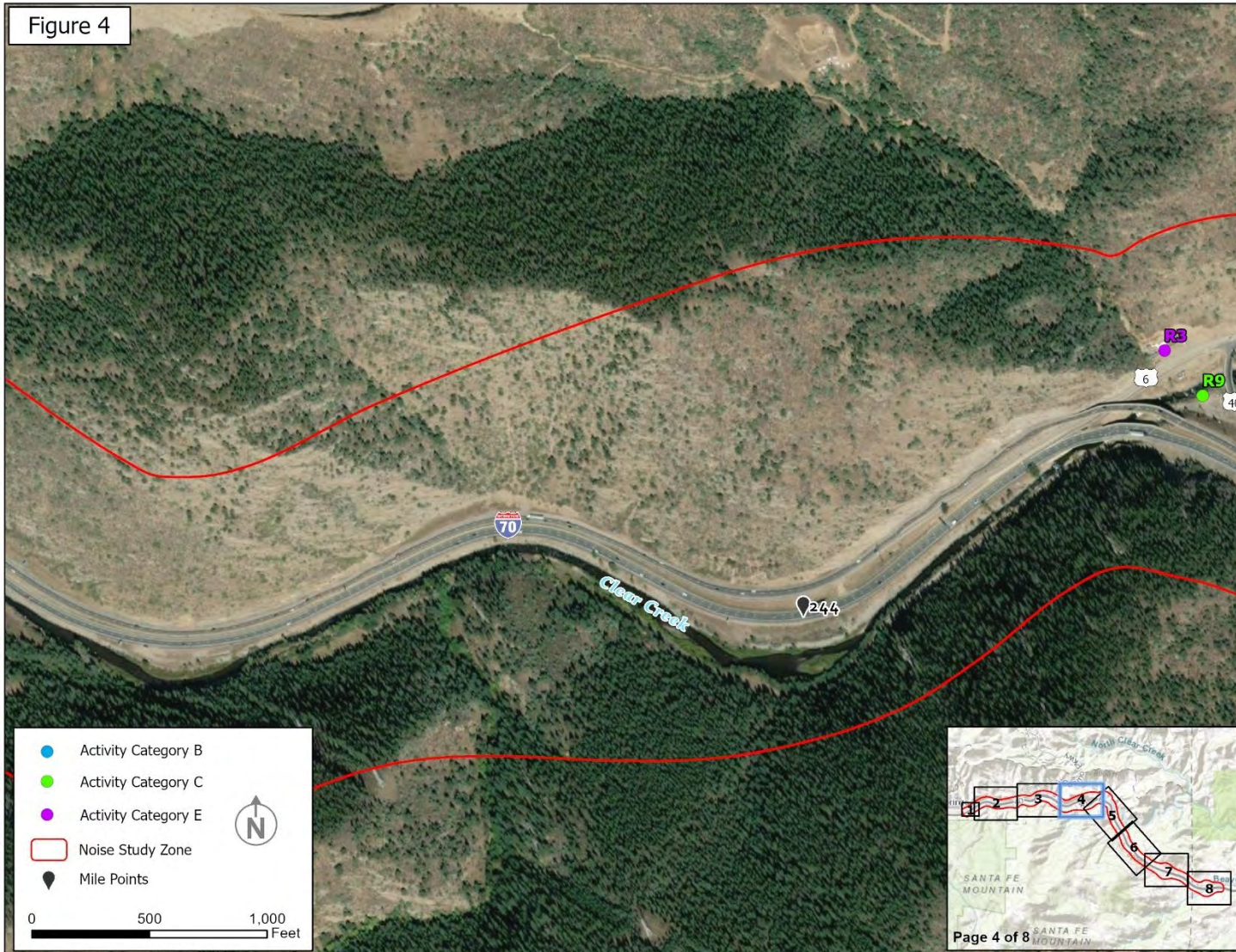
Figure 4 I-70 Floyd Hill to Veterans Memorial Tunnels Roadways and Receiver Locations for Existing (2018) and 2045 No Action Alternative Conditions



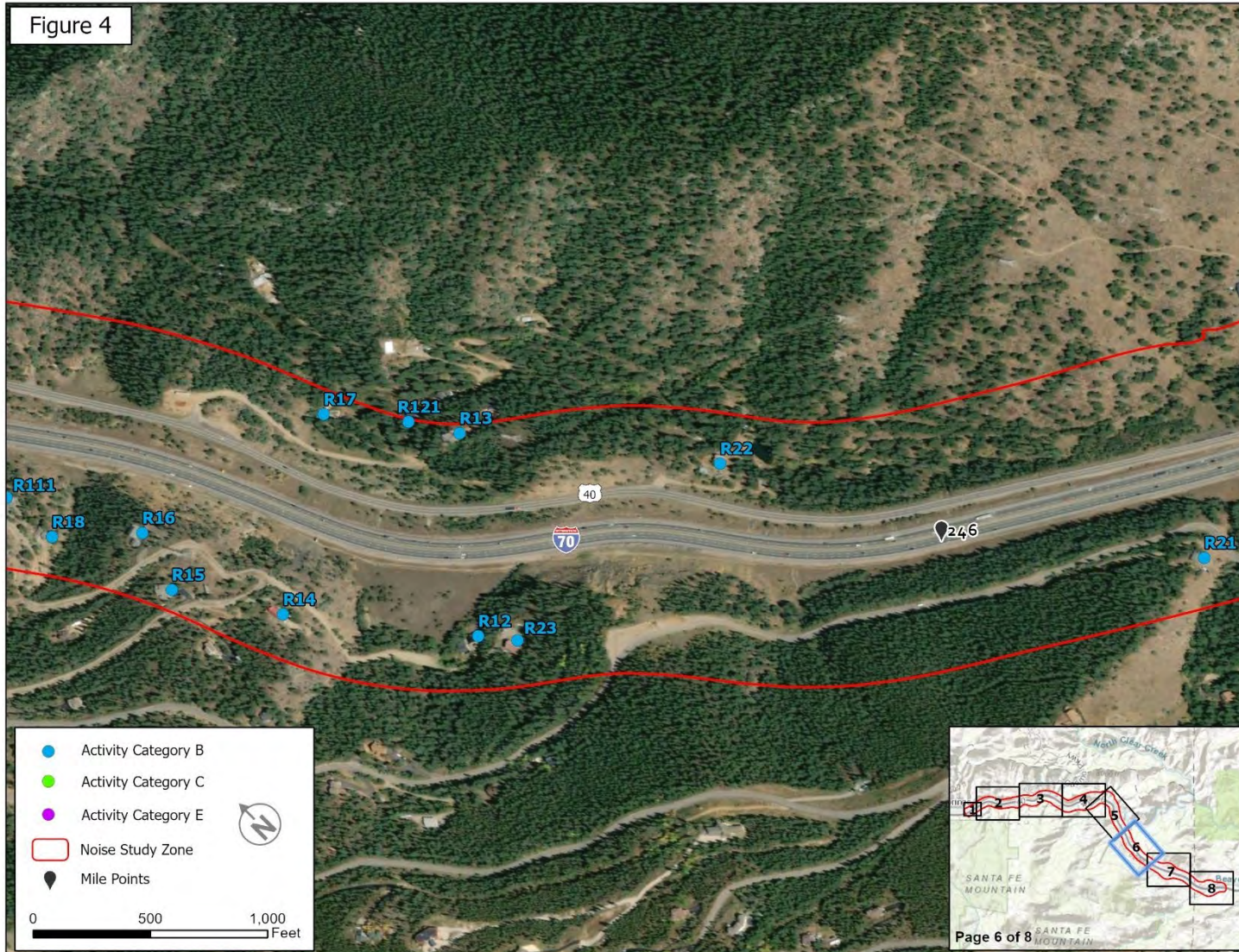


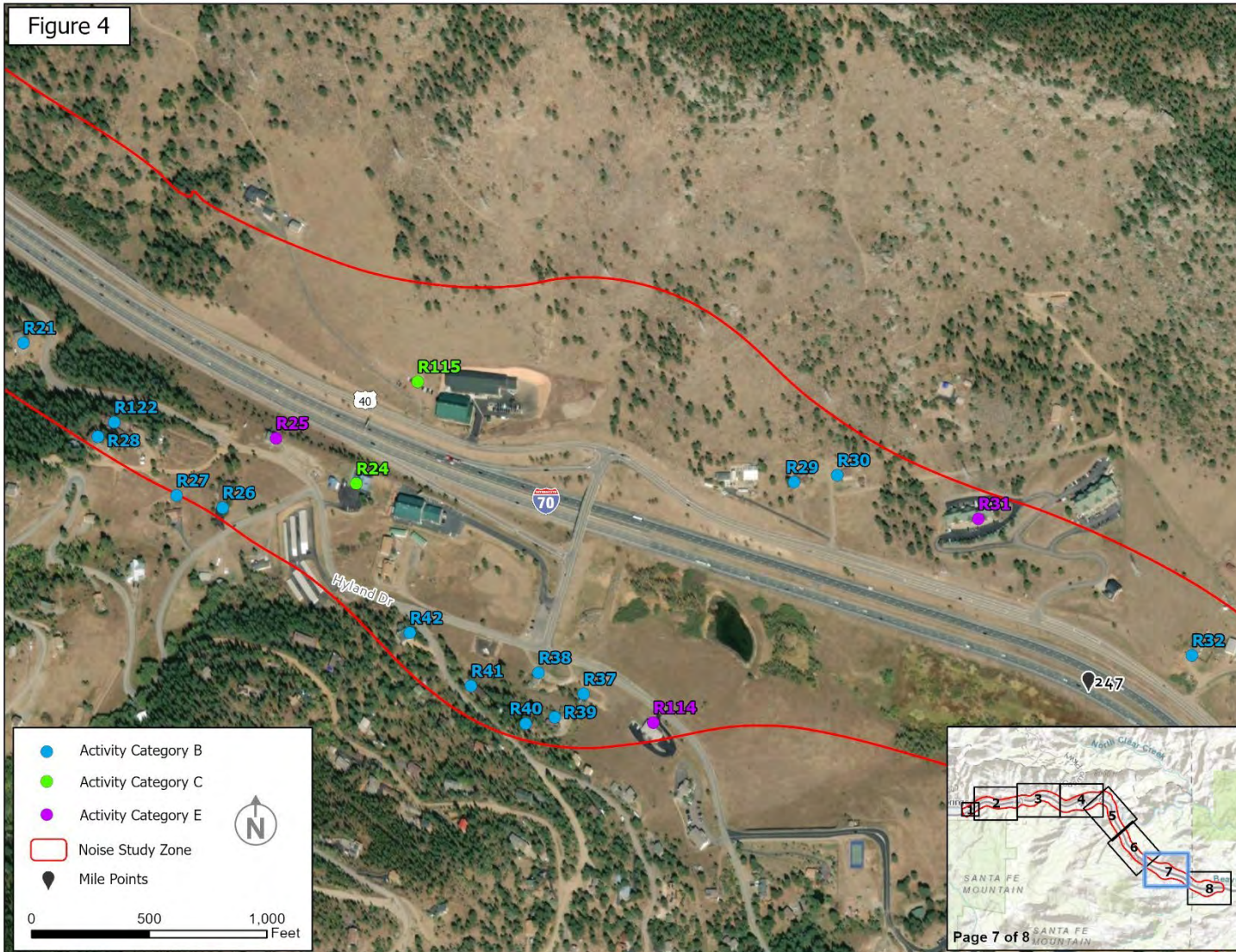


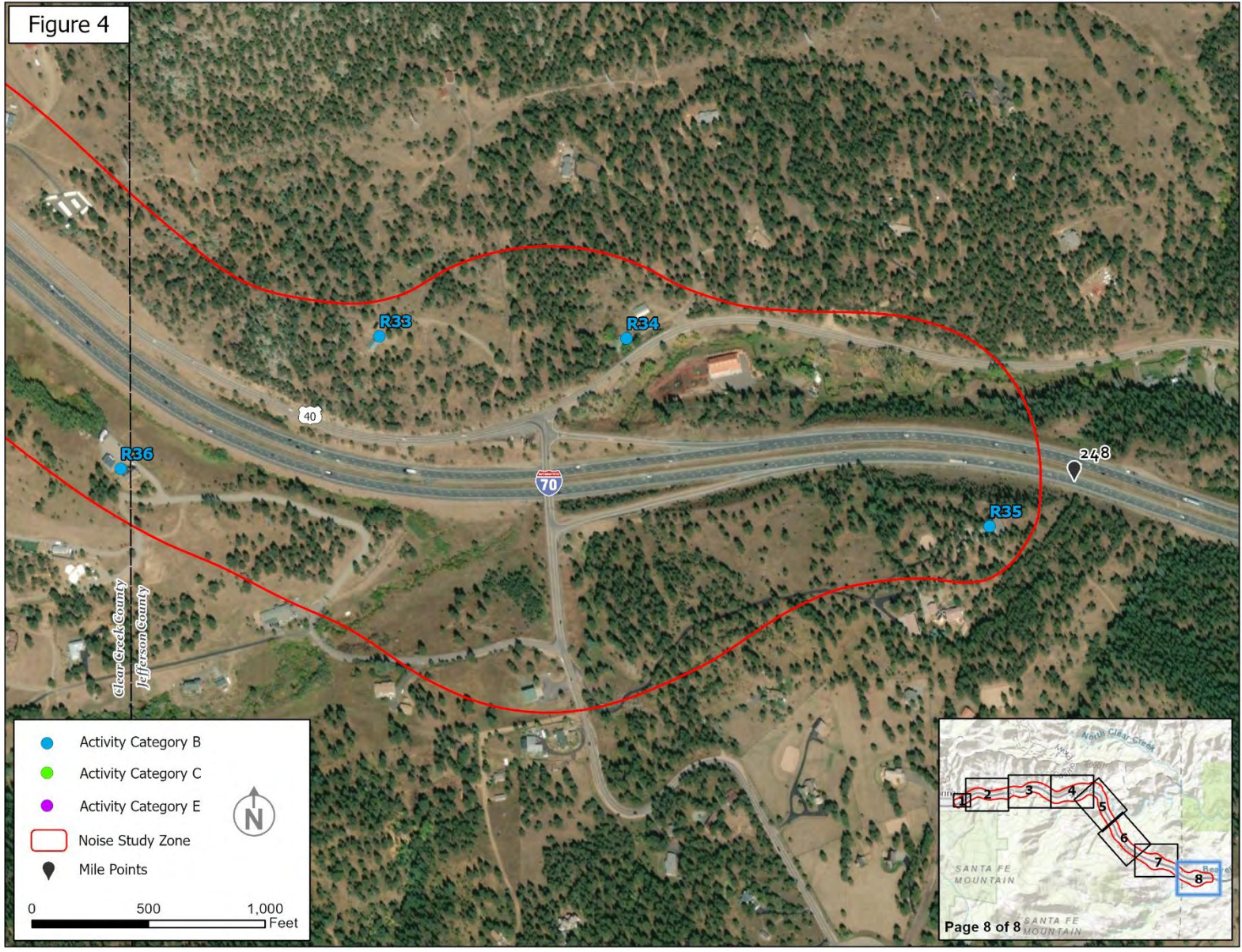




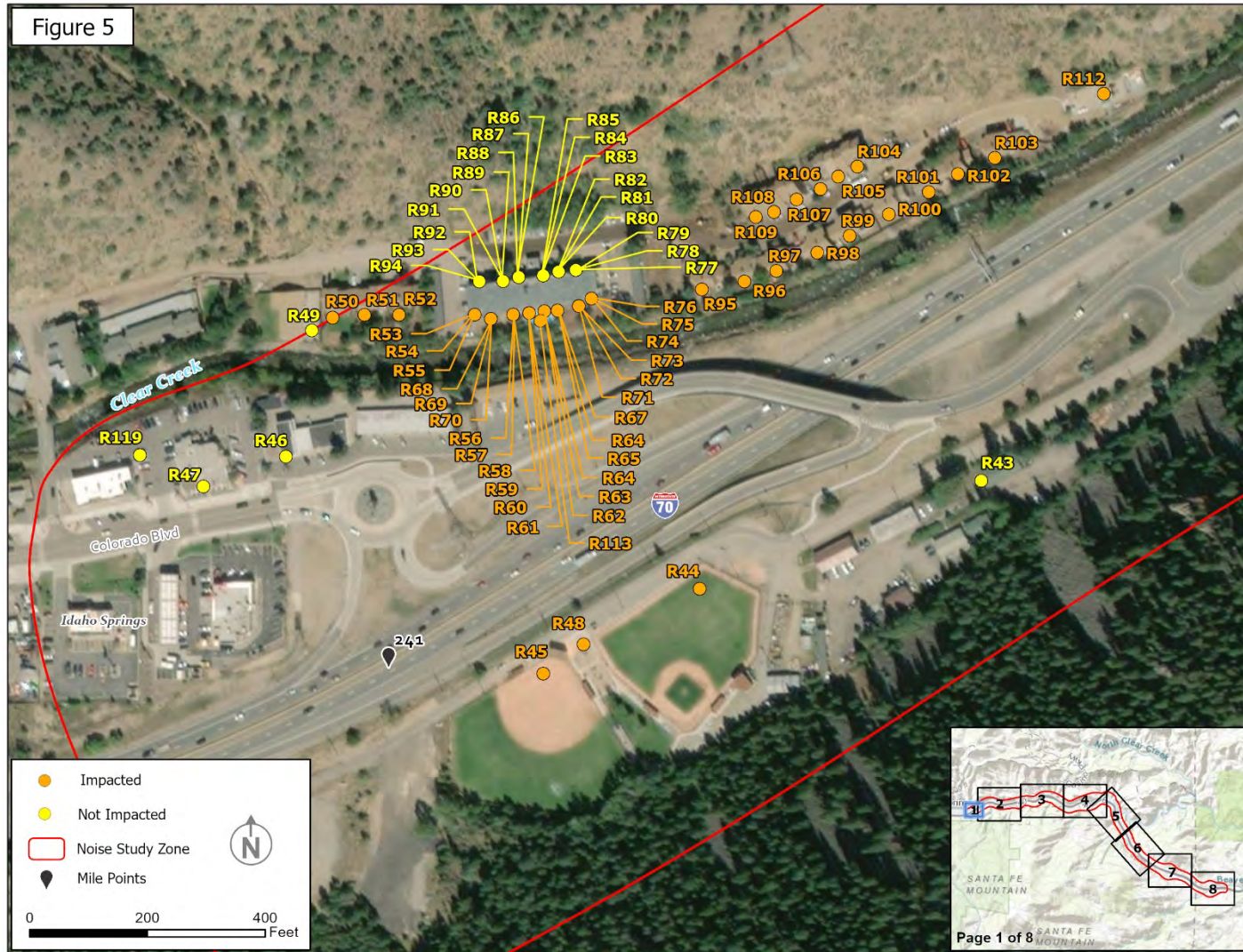


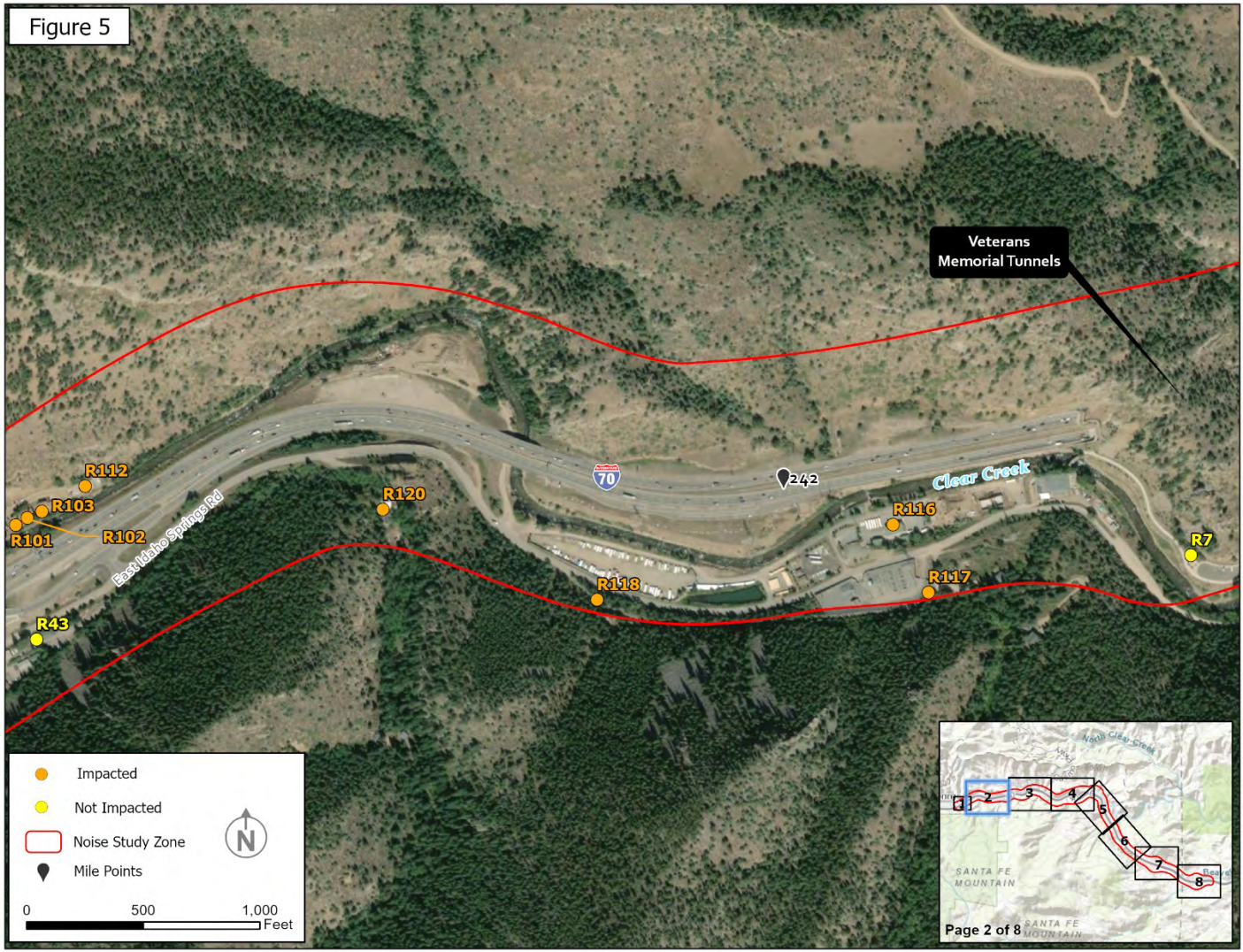


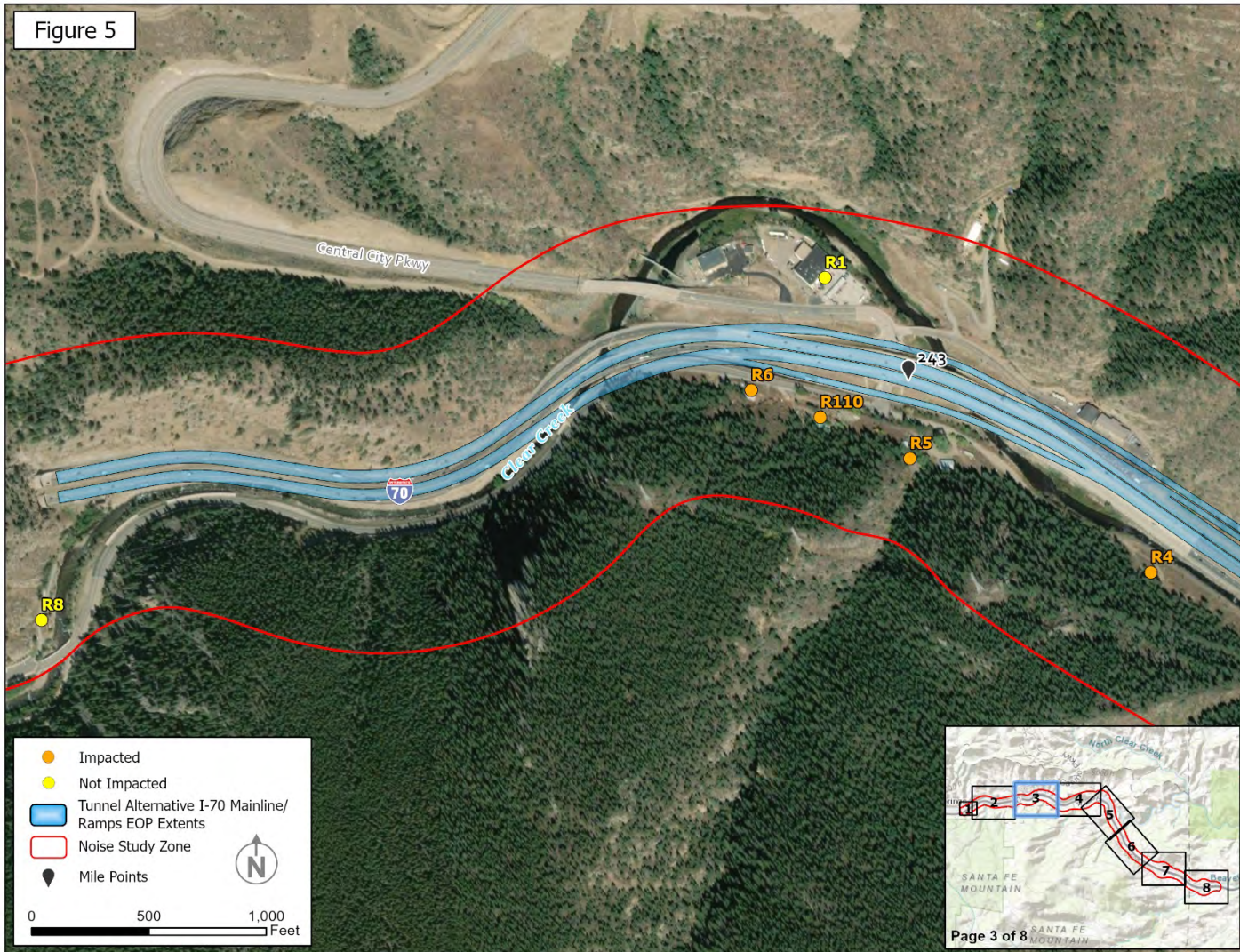




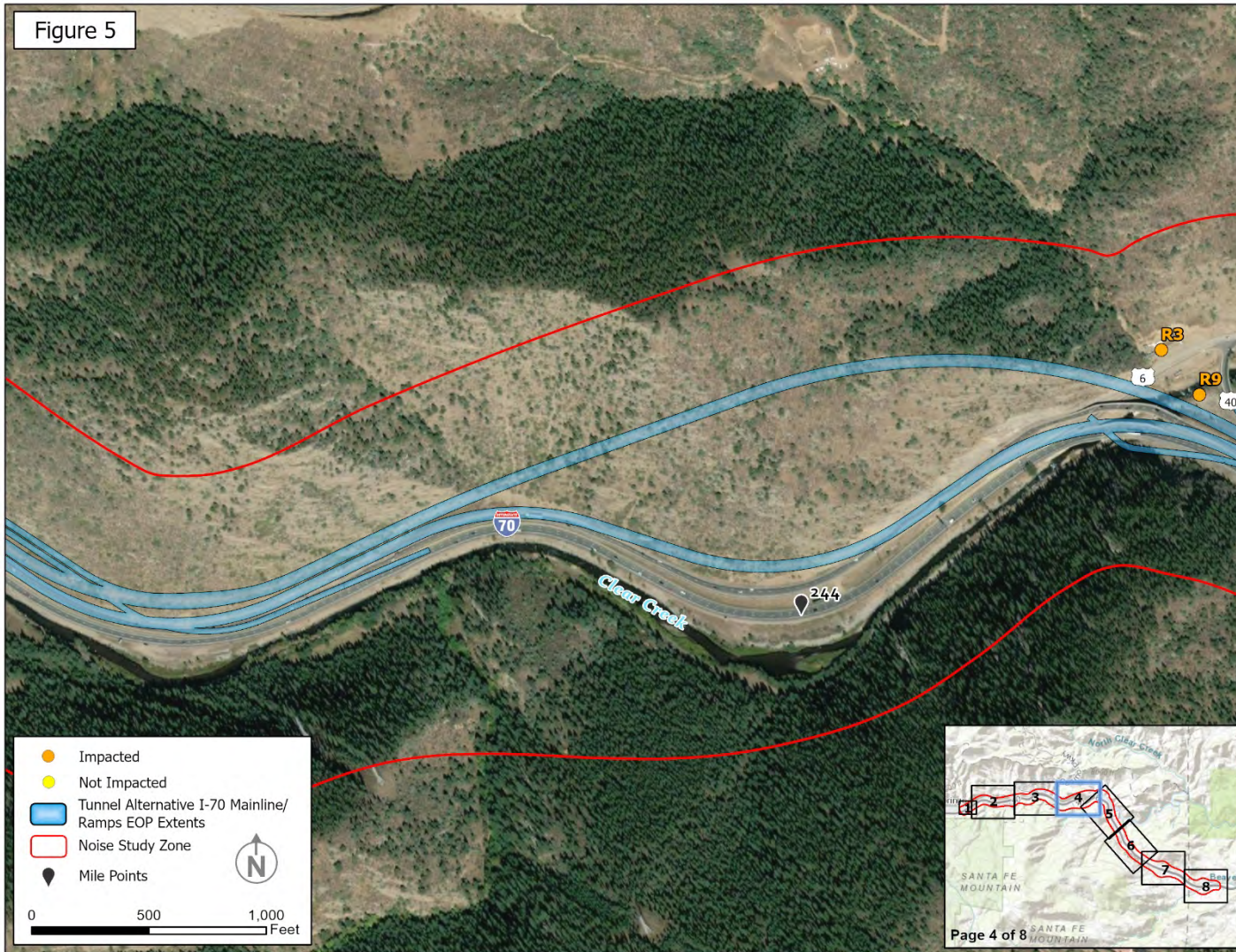
**Figure 5 I-70 Floyd Hill to Veterans Memorial Tunnels Roadways and Receiver Noise Levels for 2045 Tunnel Alternative (Impacts Identified)**



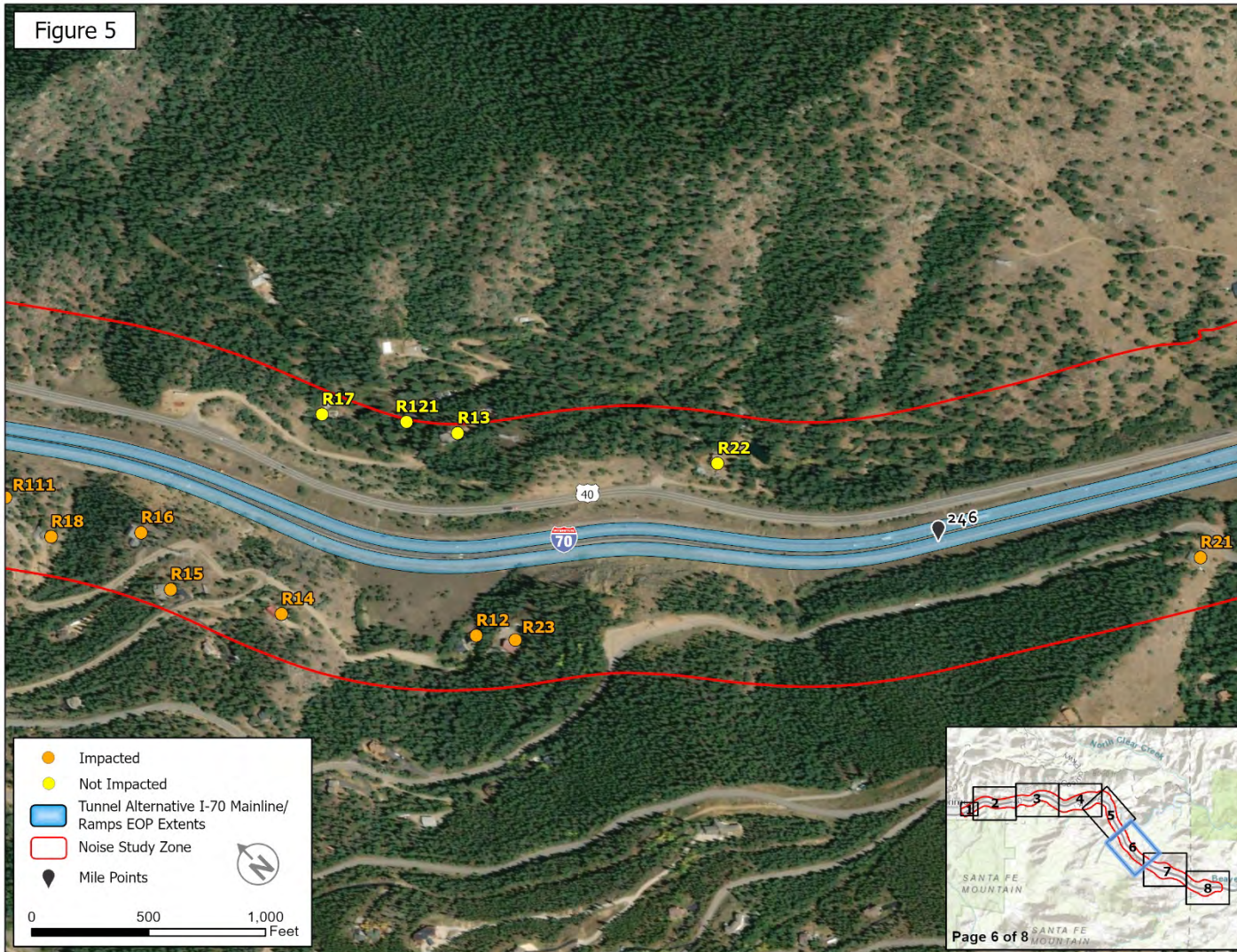


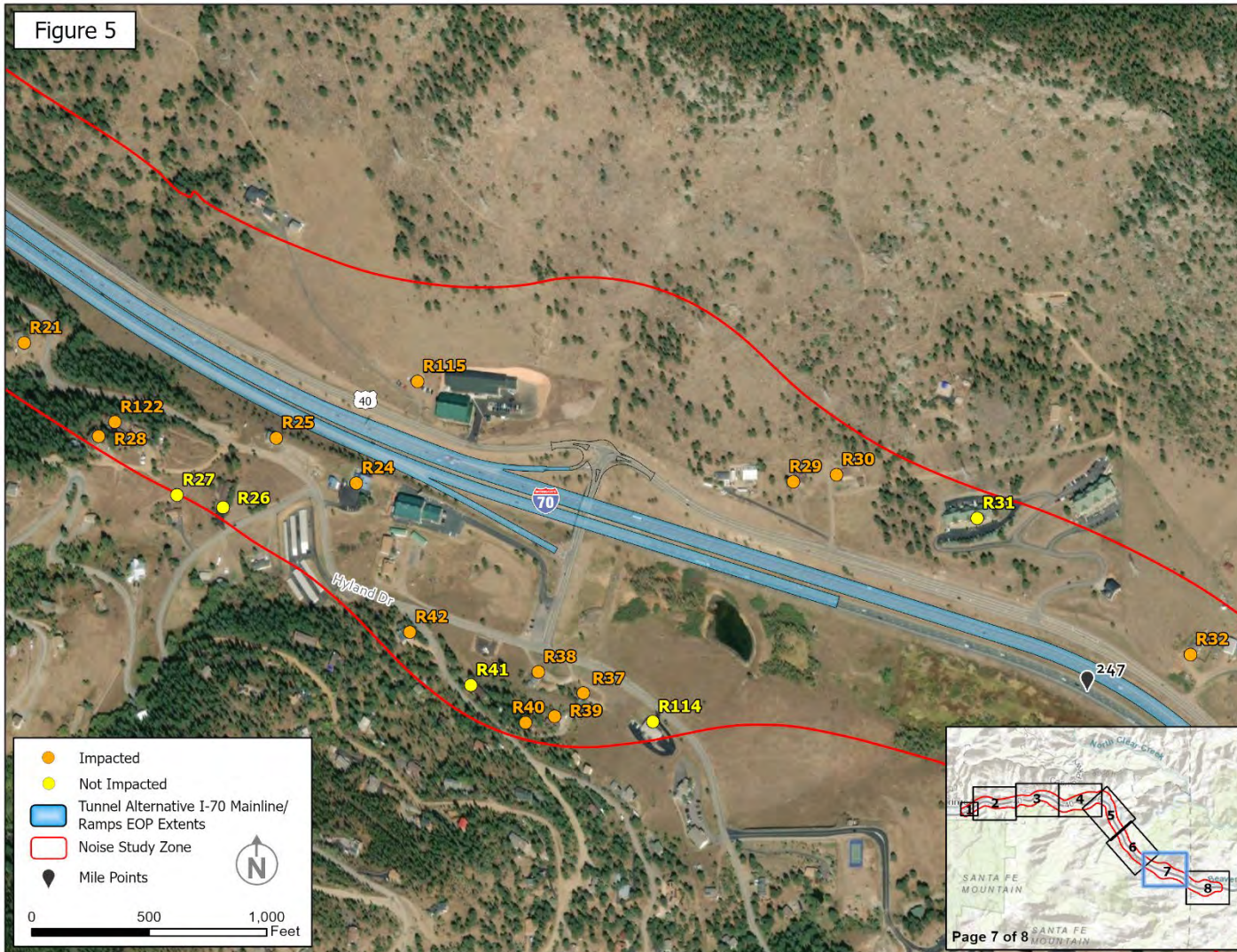


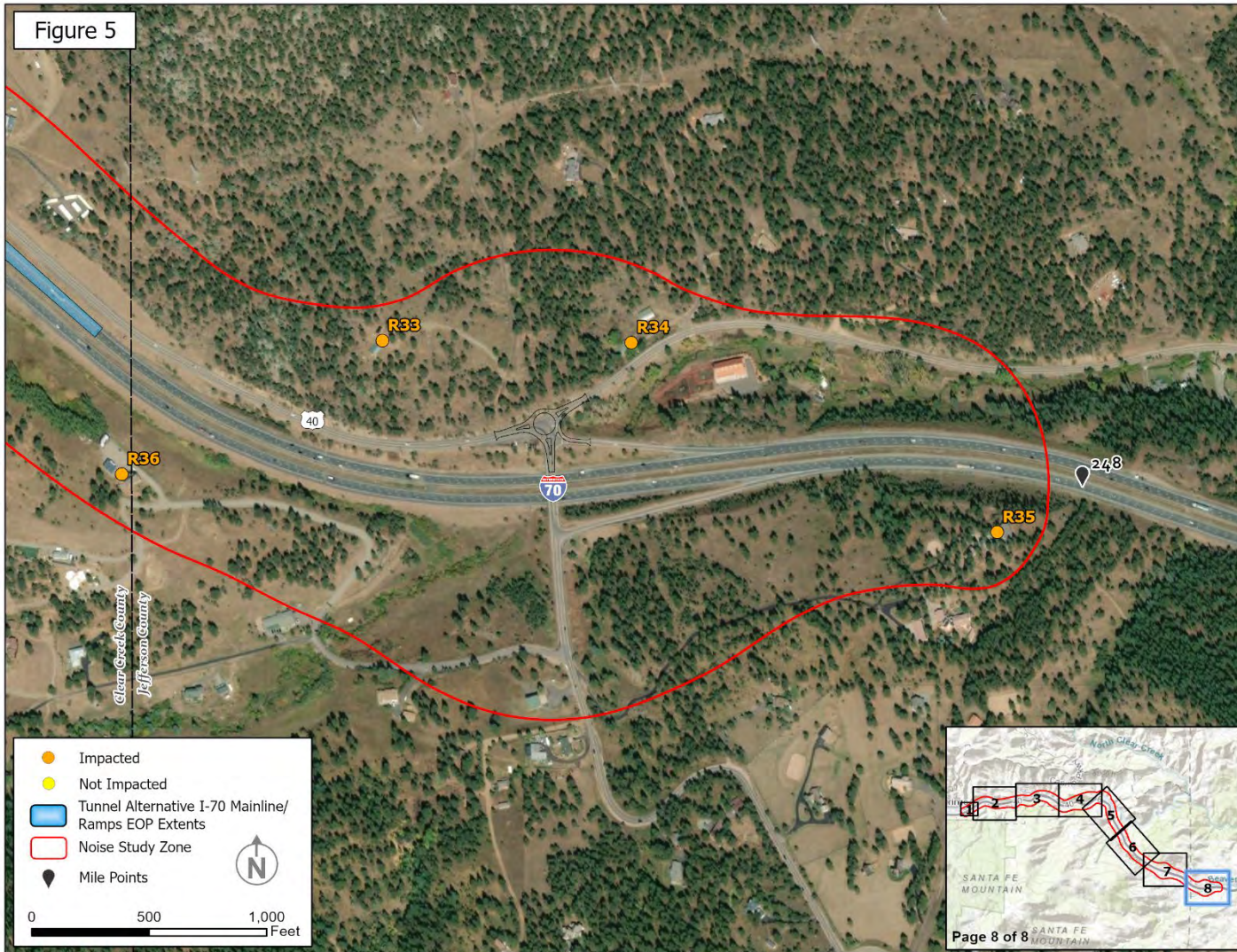




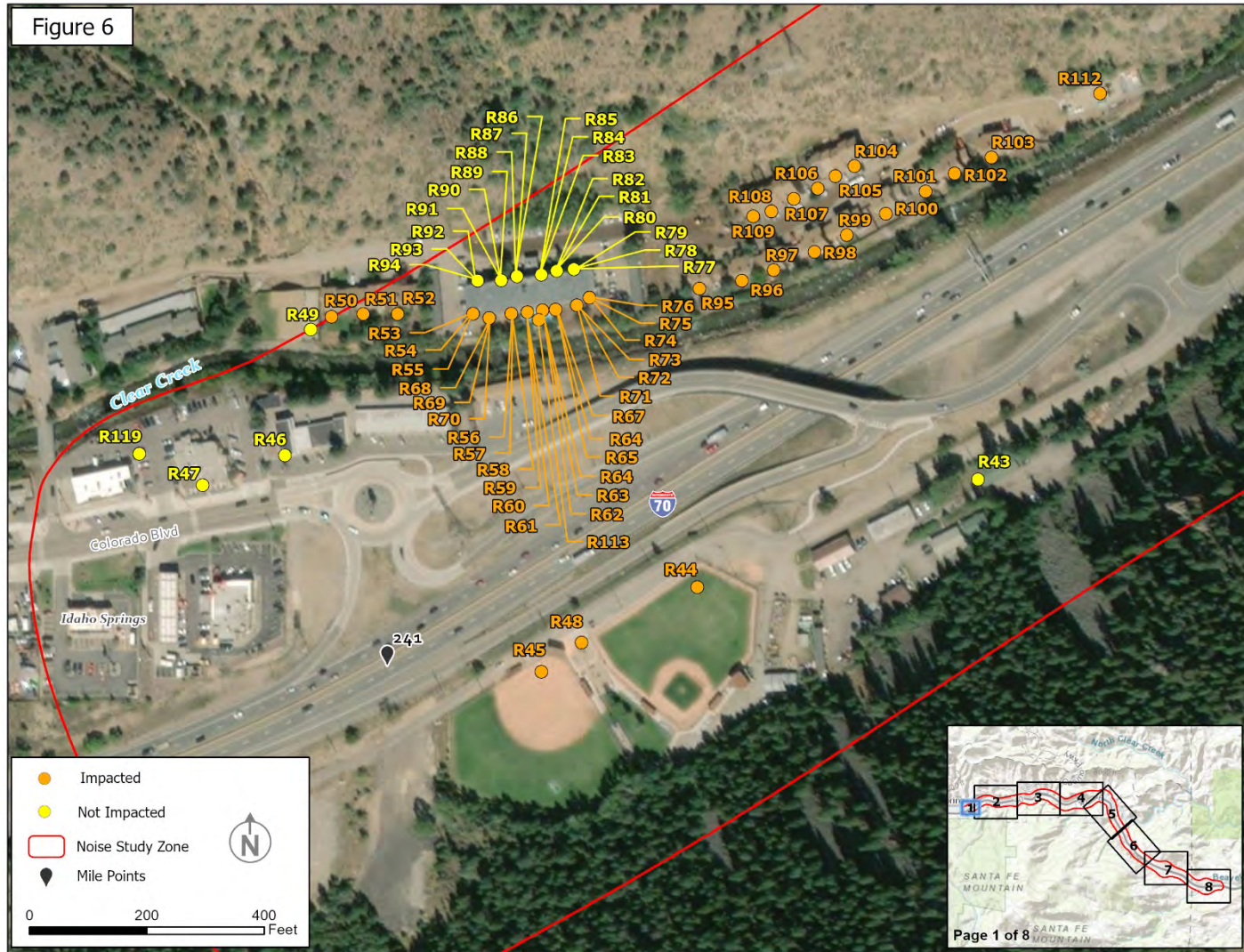


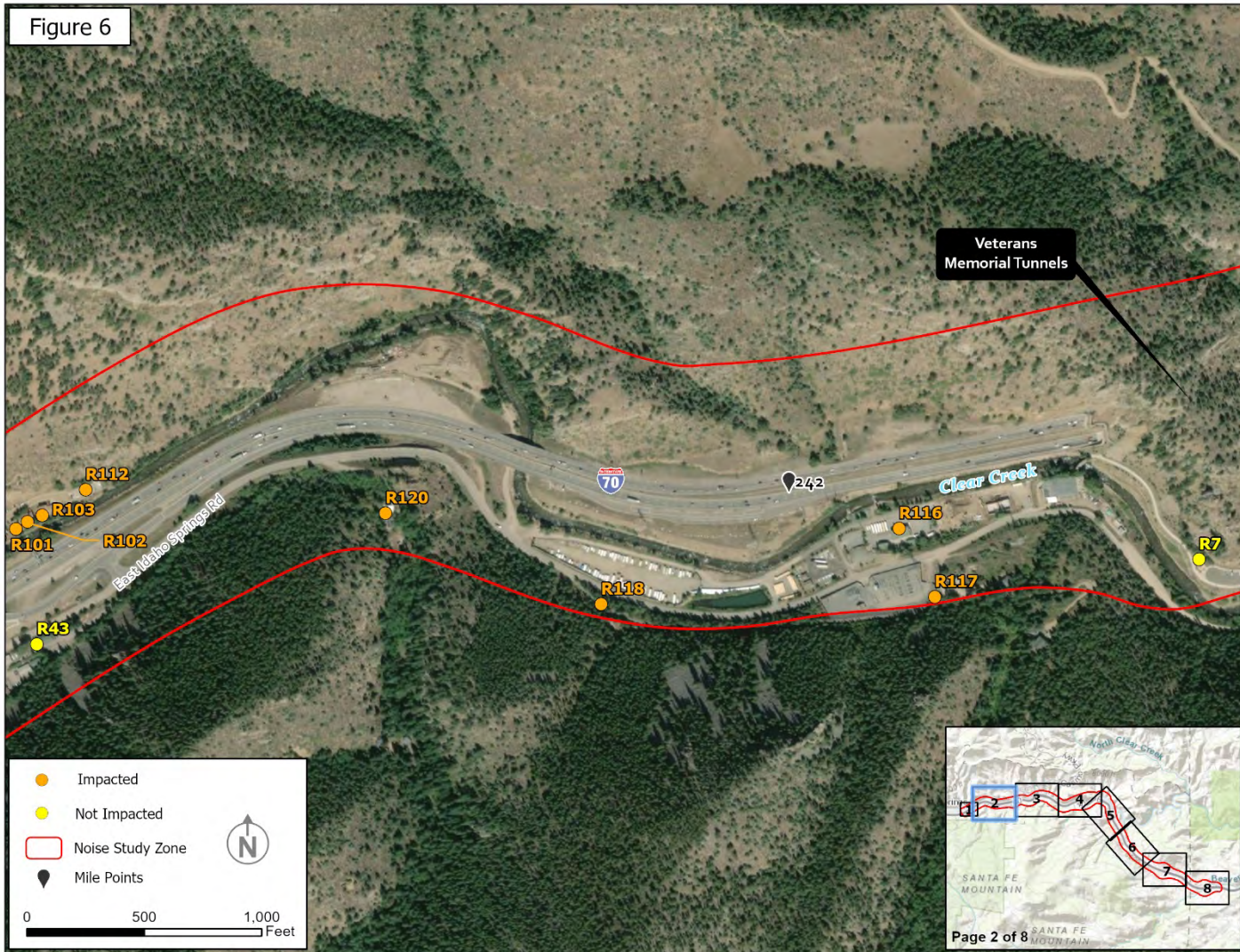


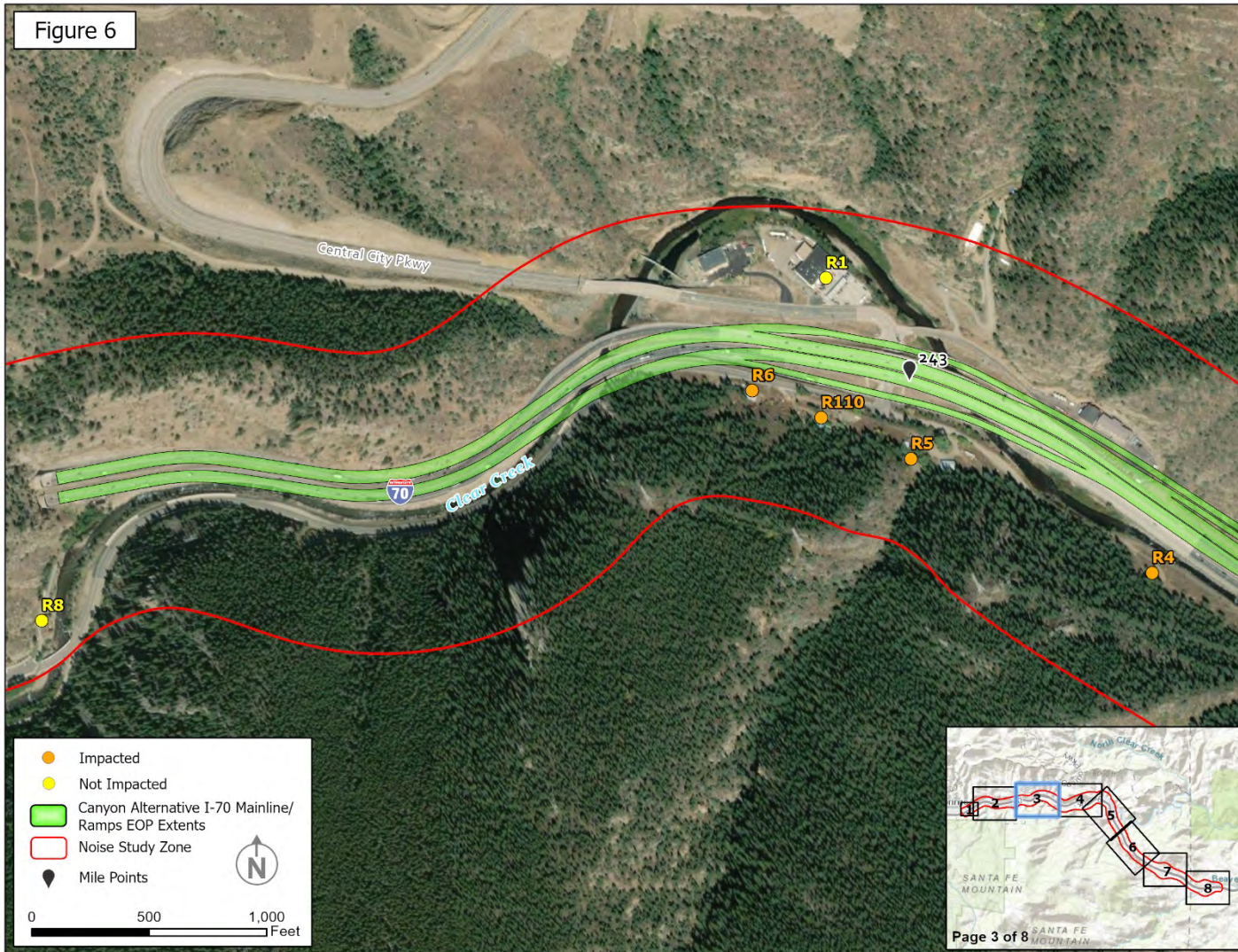




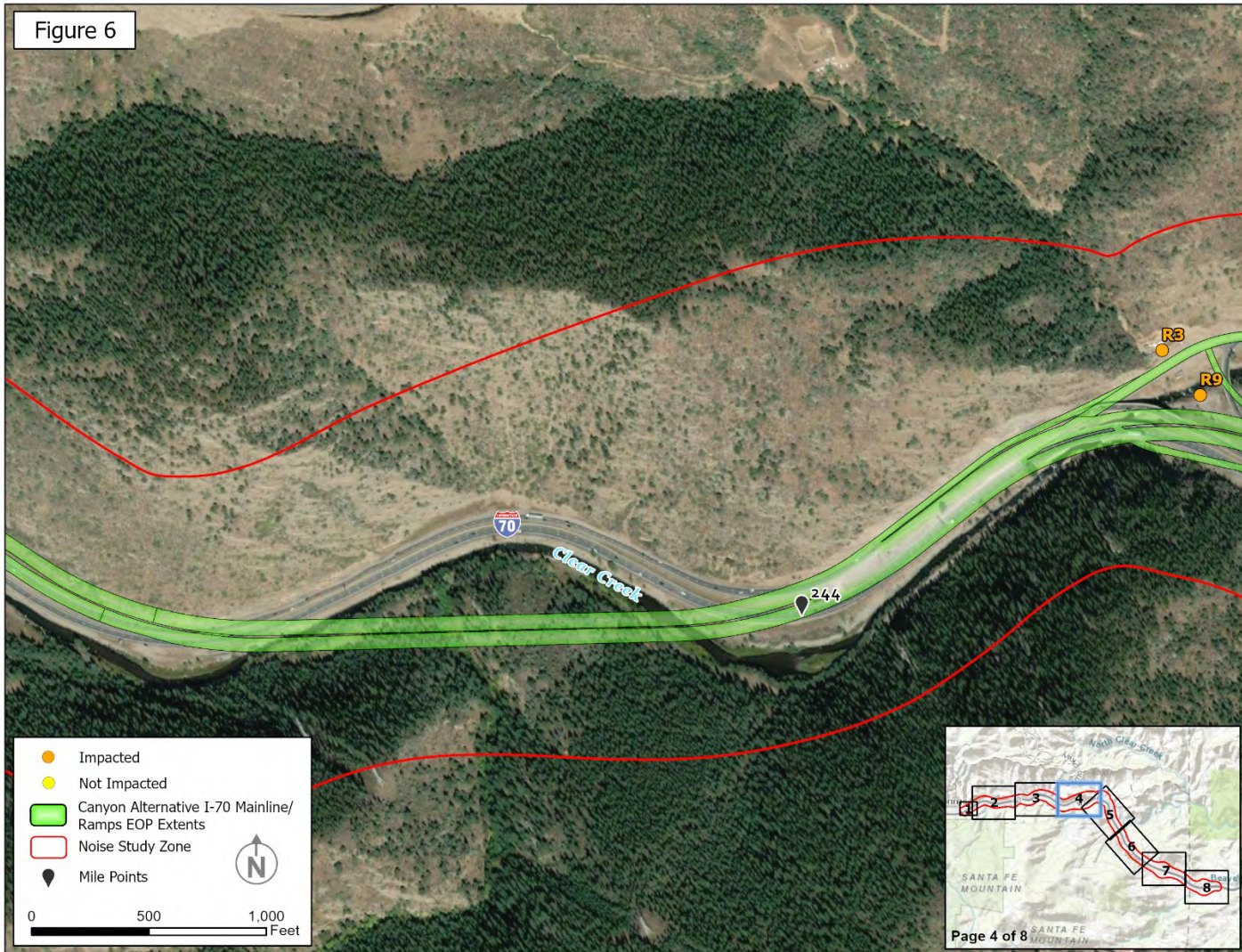
**Figure 6 I-70 Floyd Hill to Veterans Memorial Tunnels Roadways and Receiver Noise Levels for 2045 Canyon Viaduct Alternative (Impacts Identified)**

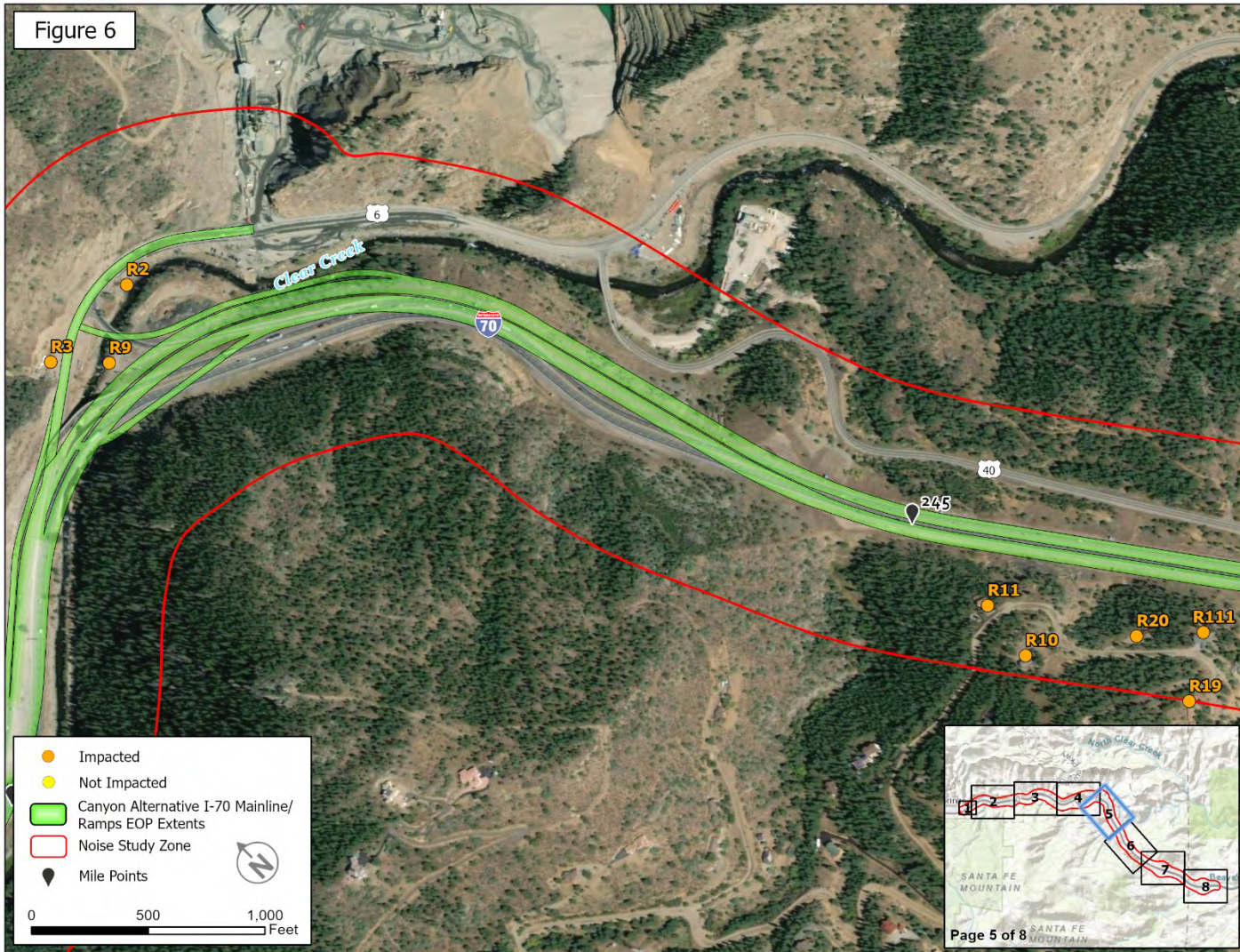


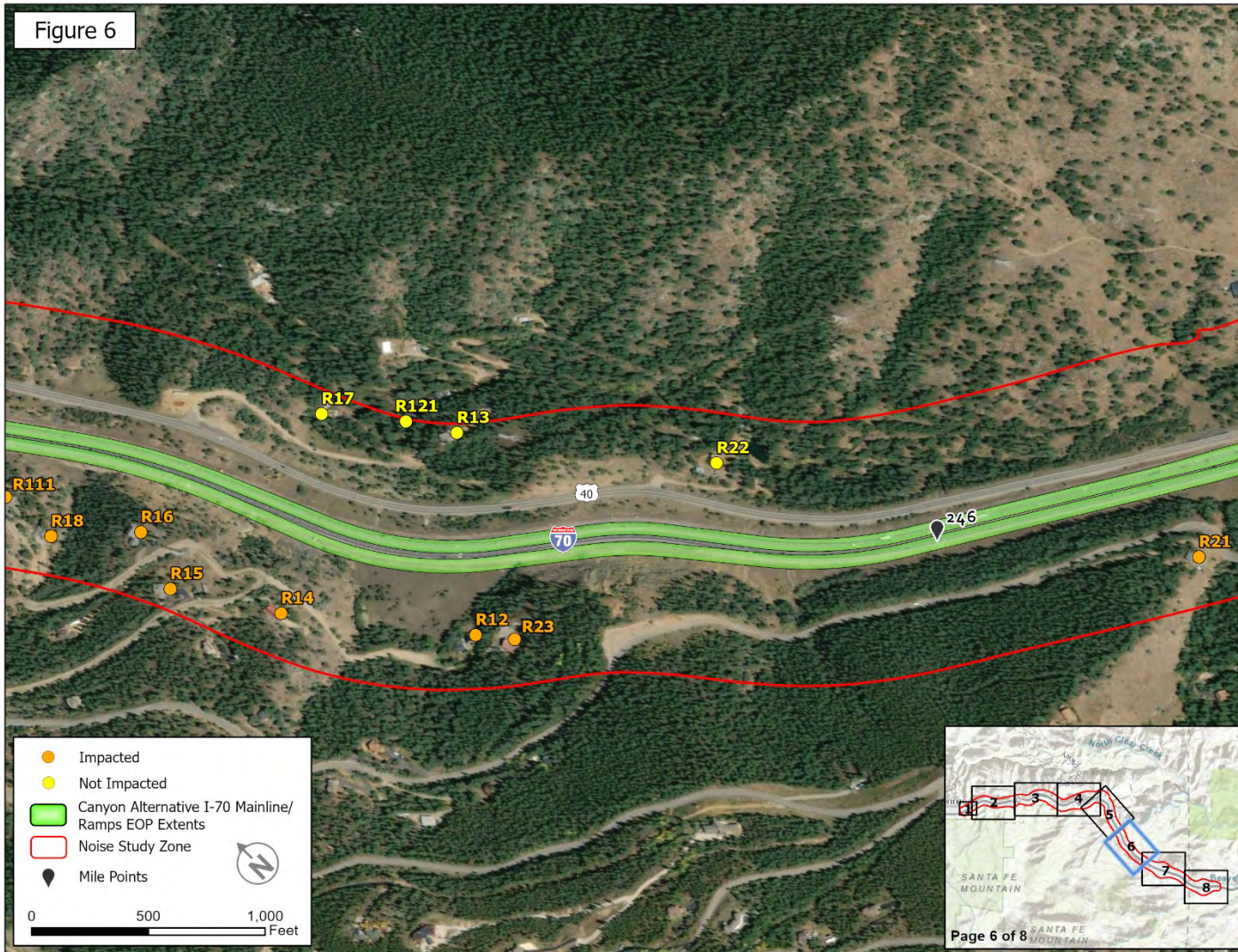


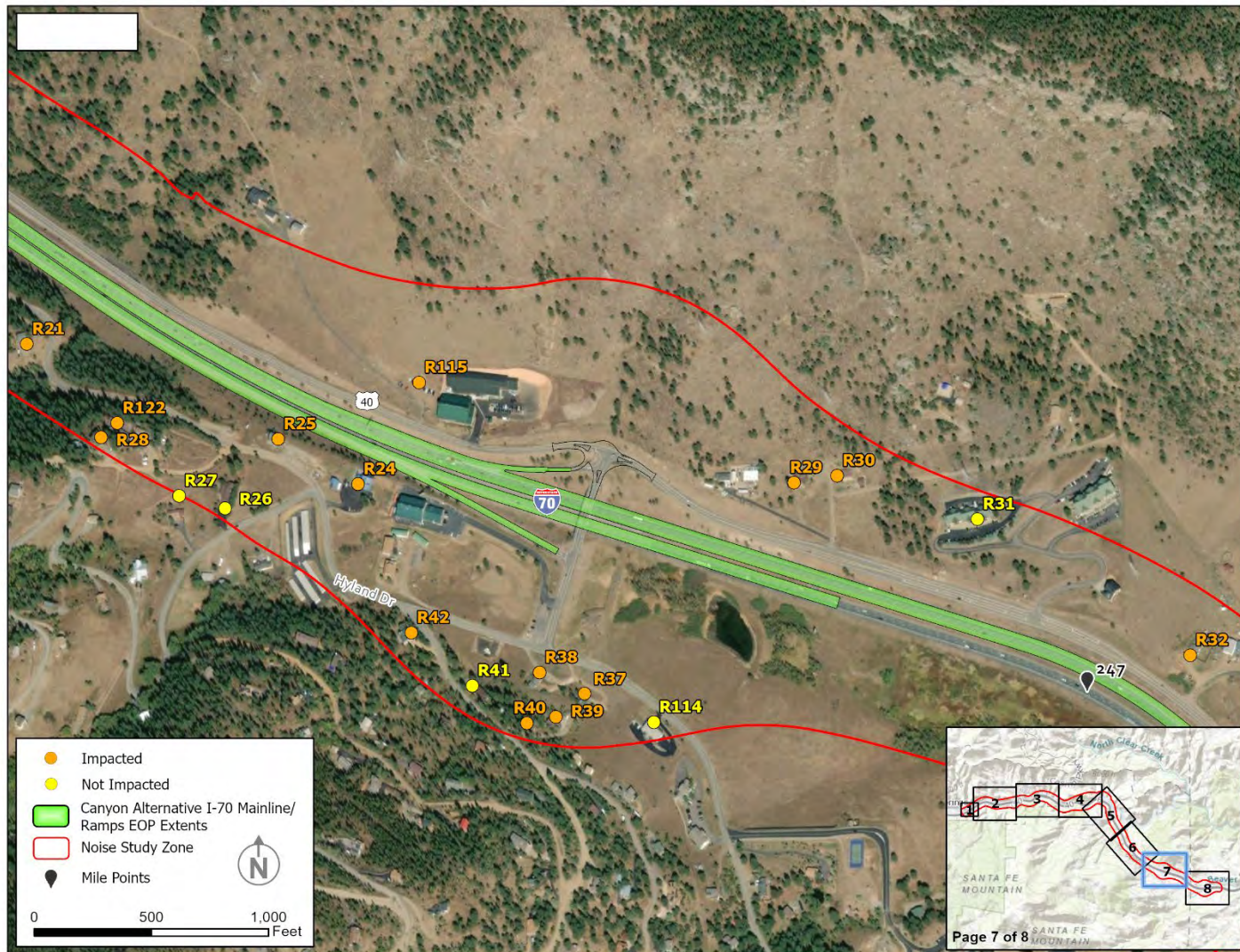












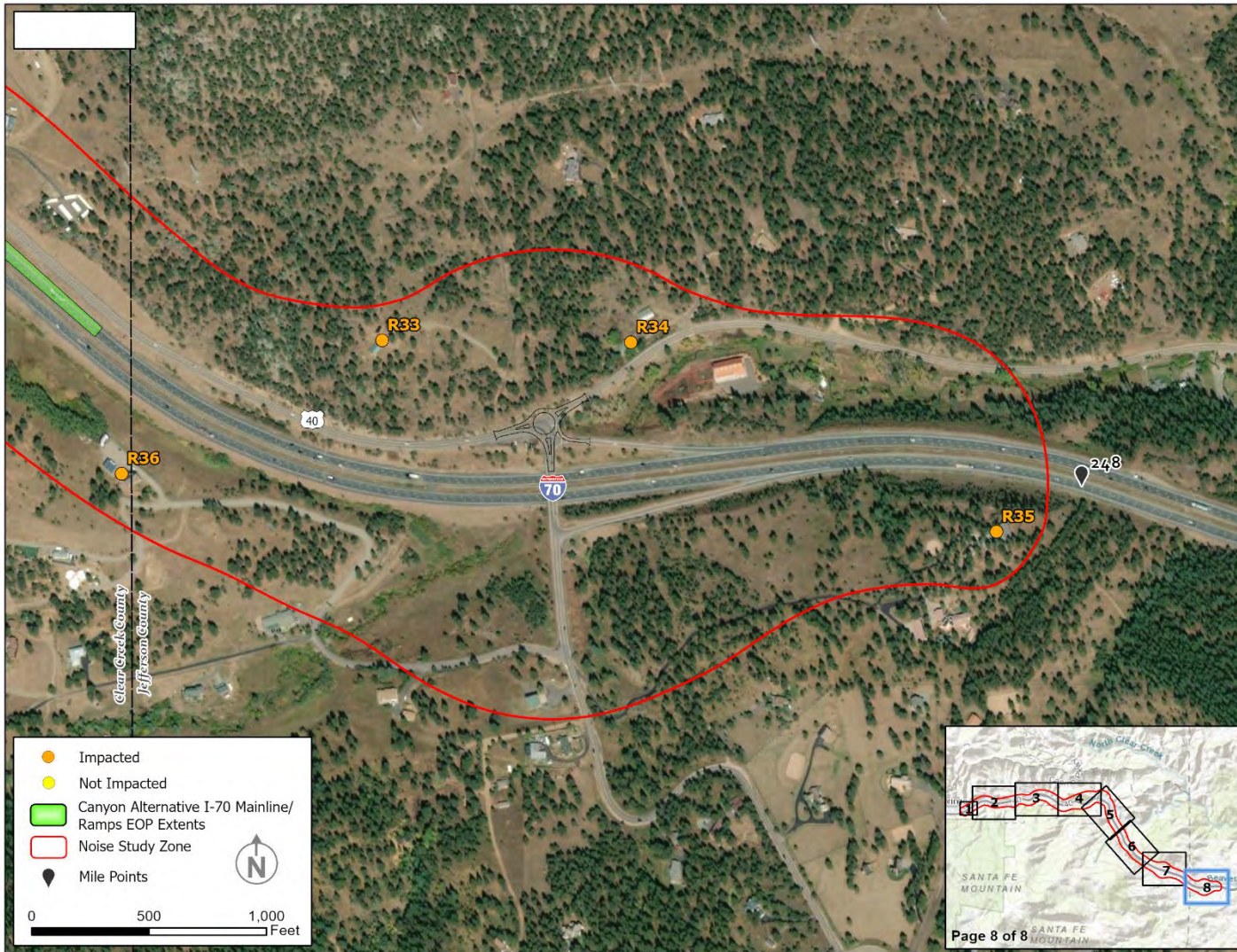
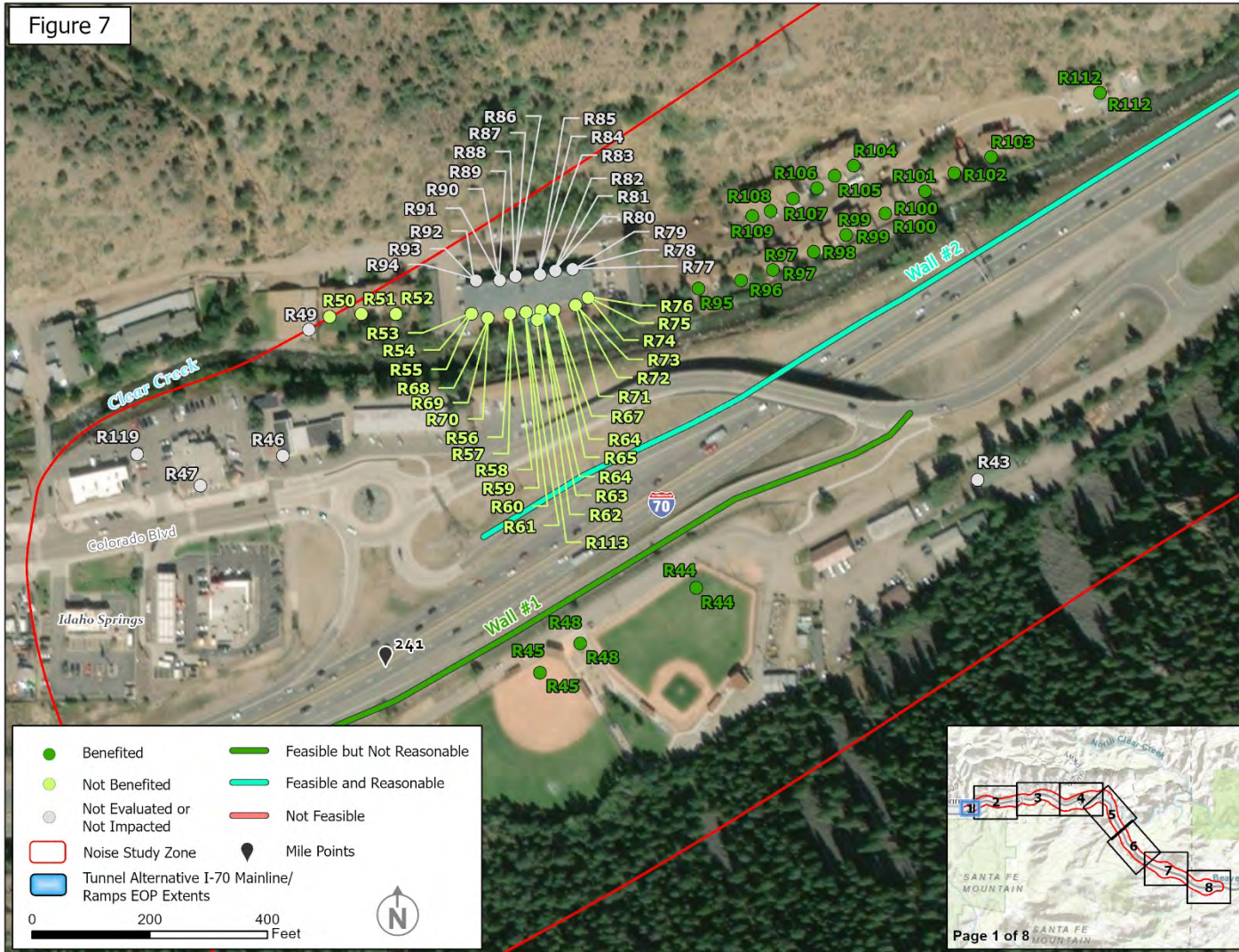
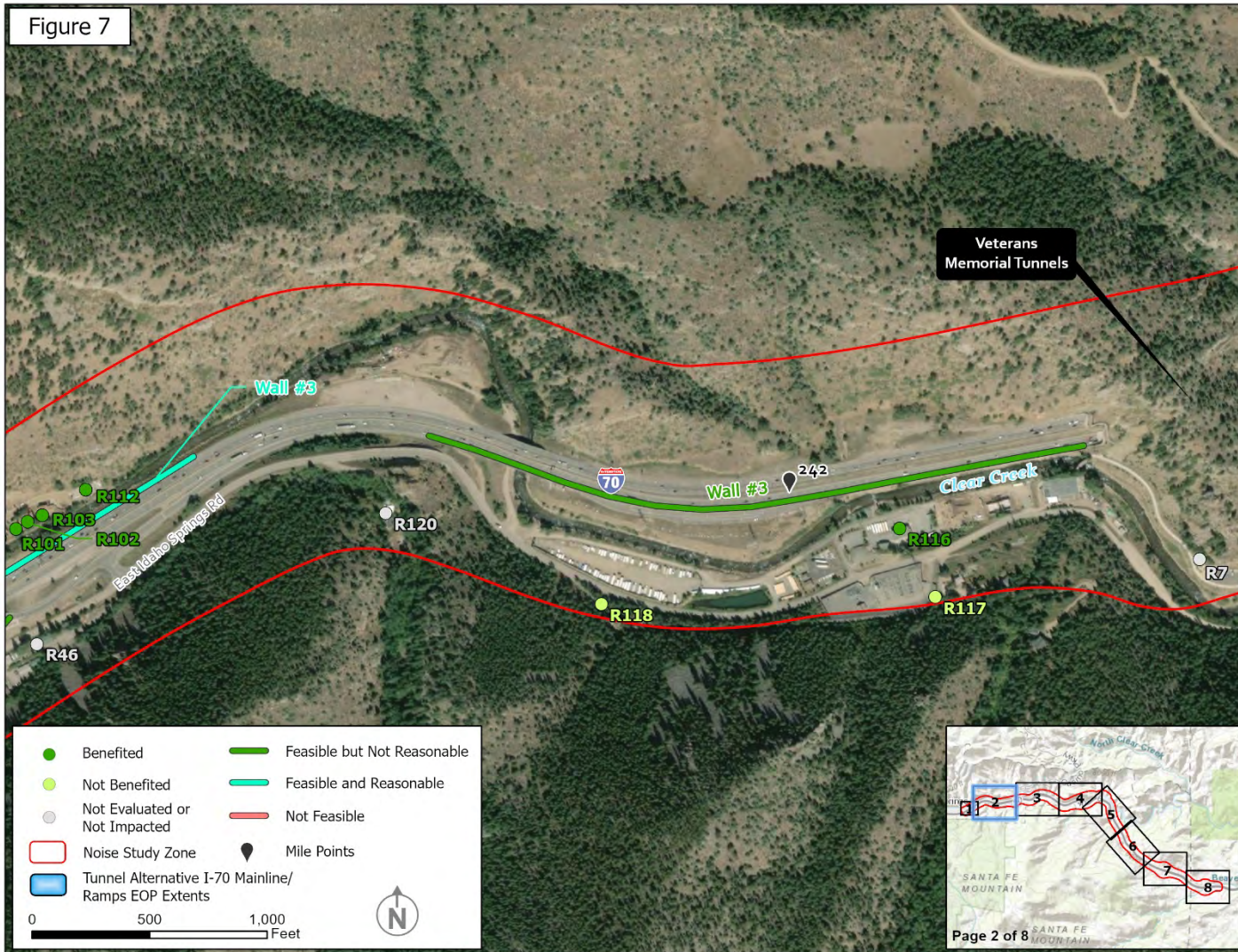
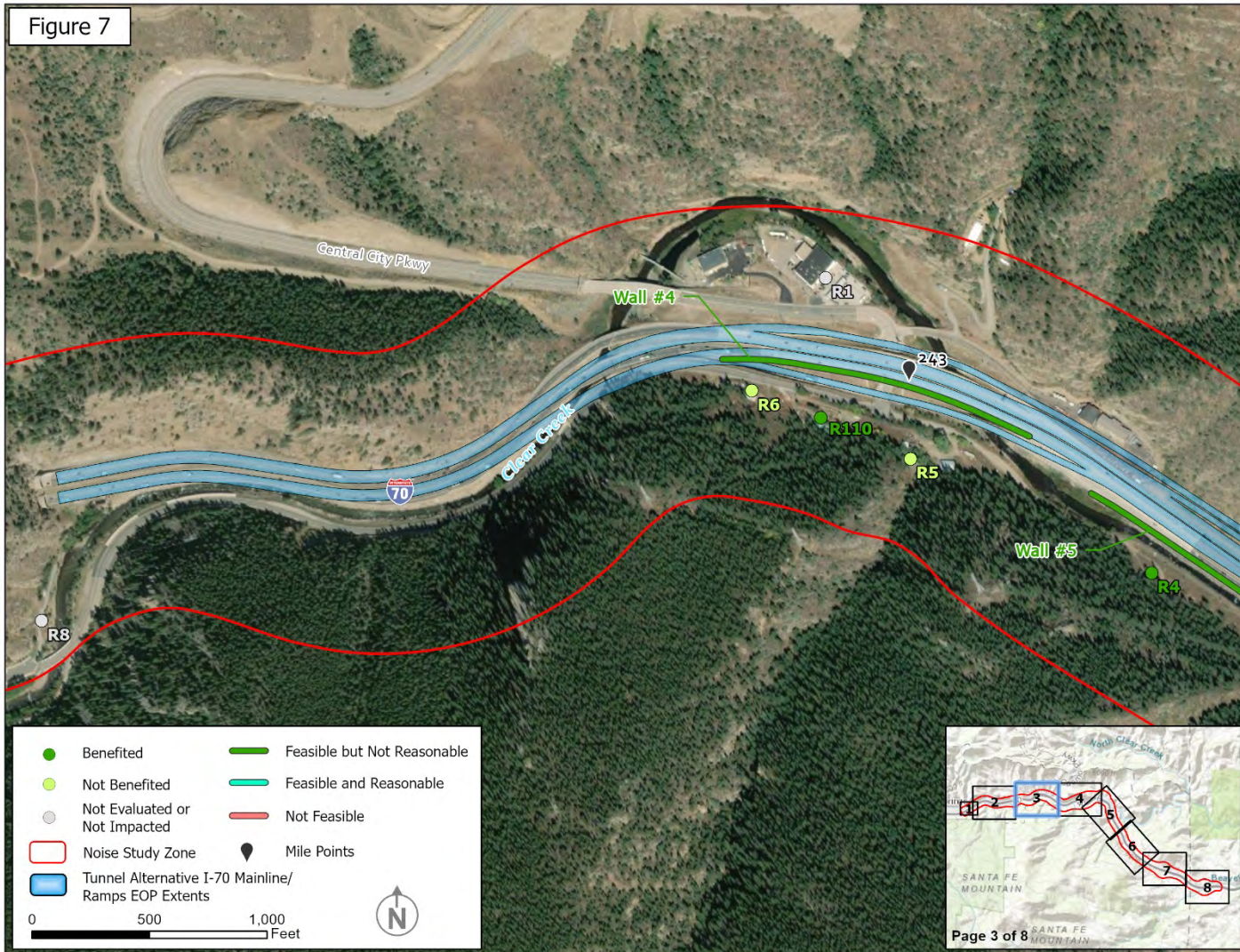


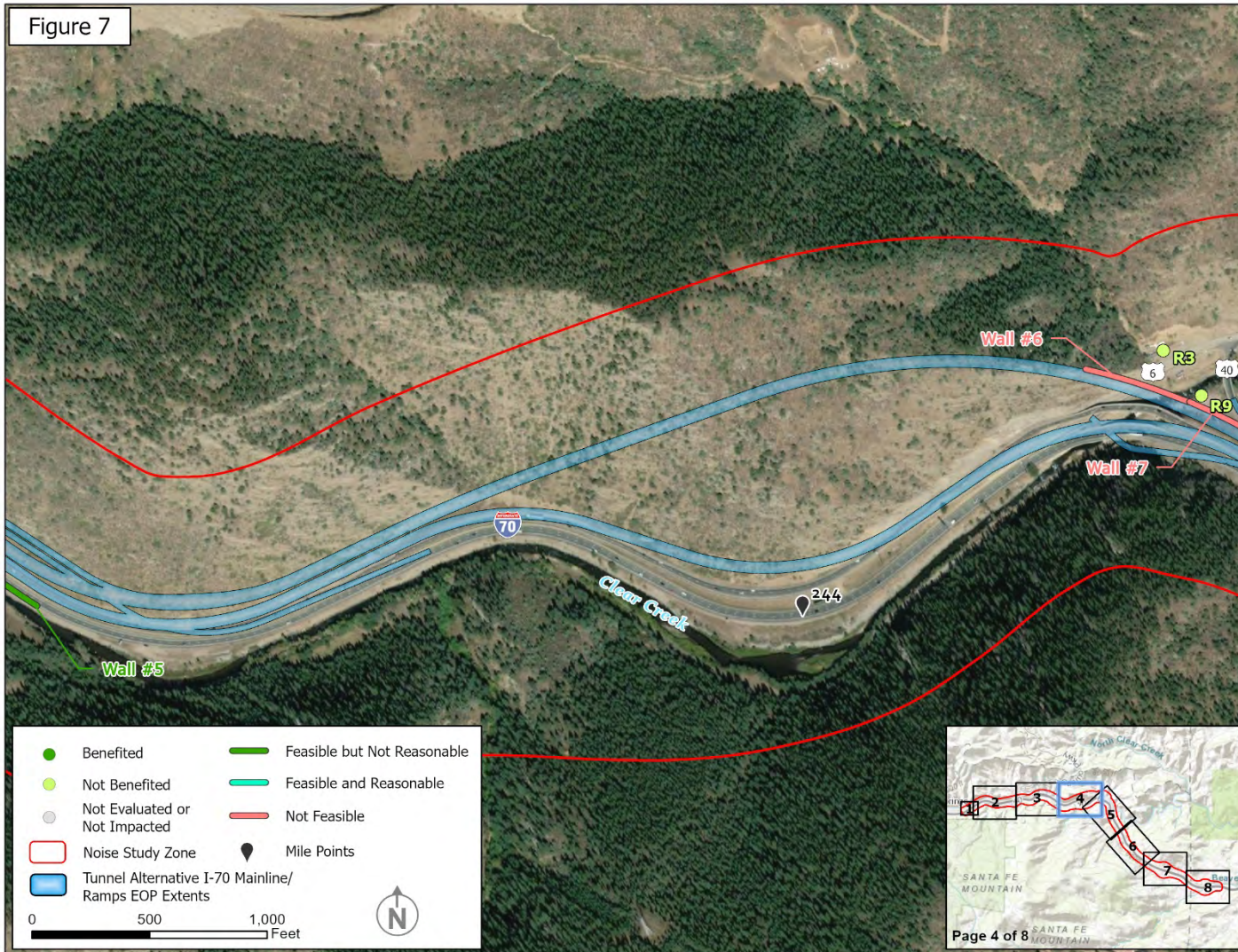
Figure 7 I-70 Floyd Hill to Veterans Memorial Tunnels Noise Barrier Locations for 2045 Tunnel Alternative

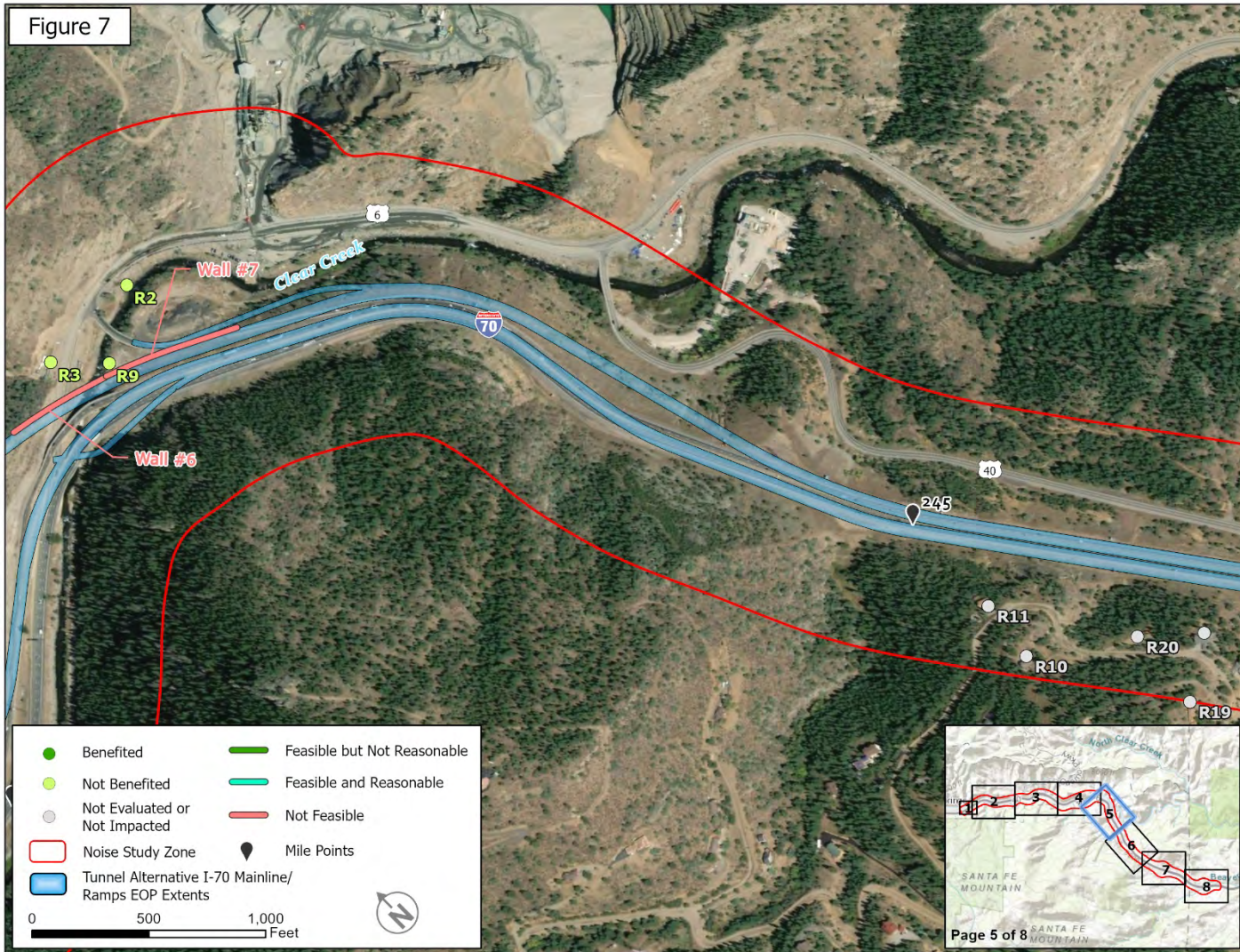


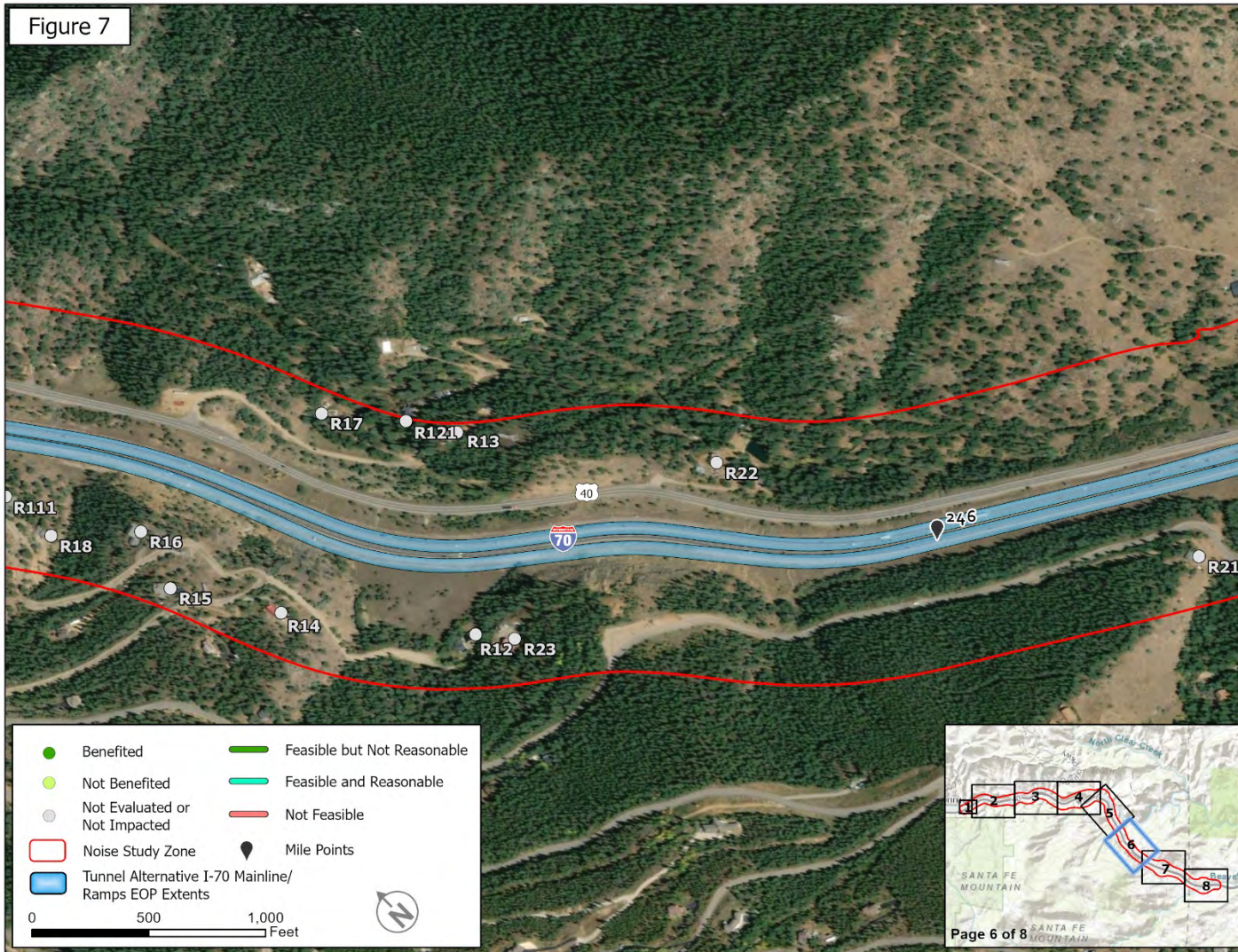


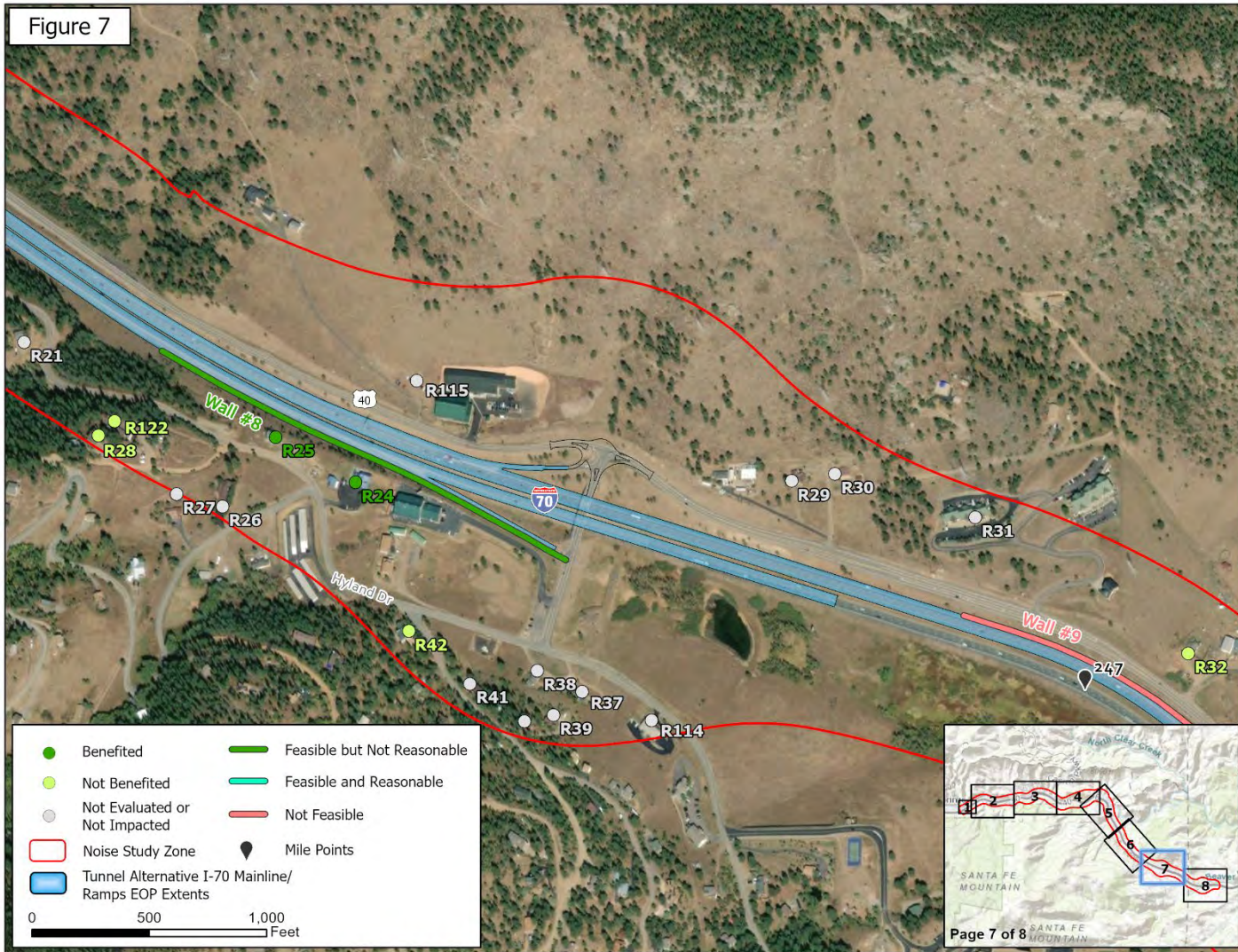


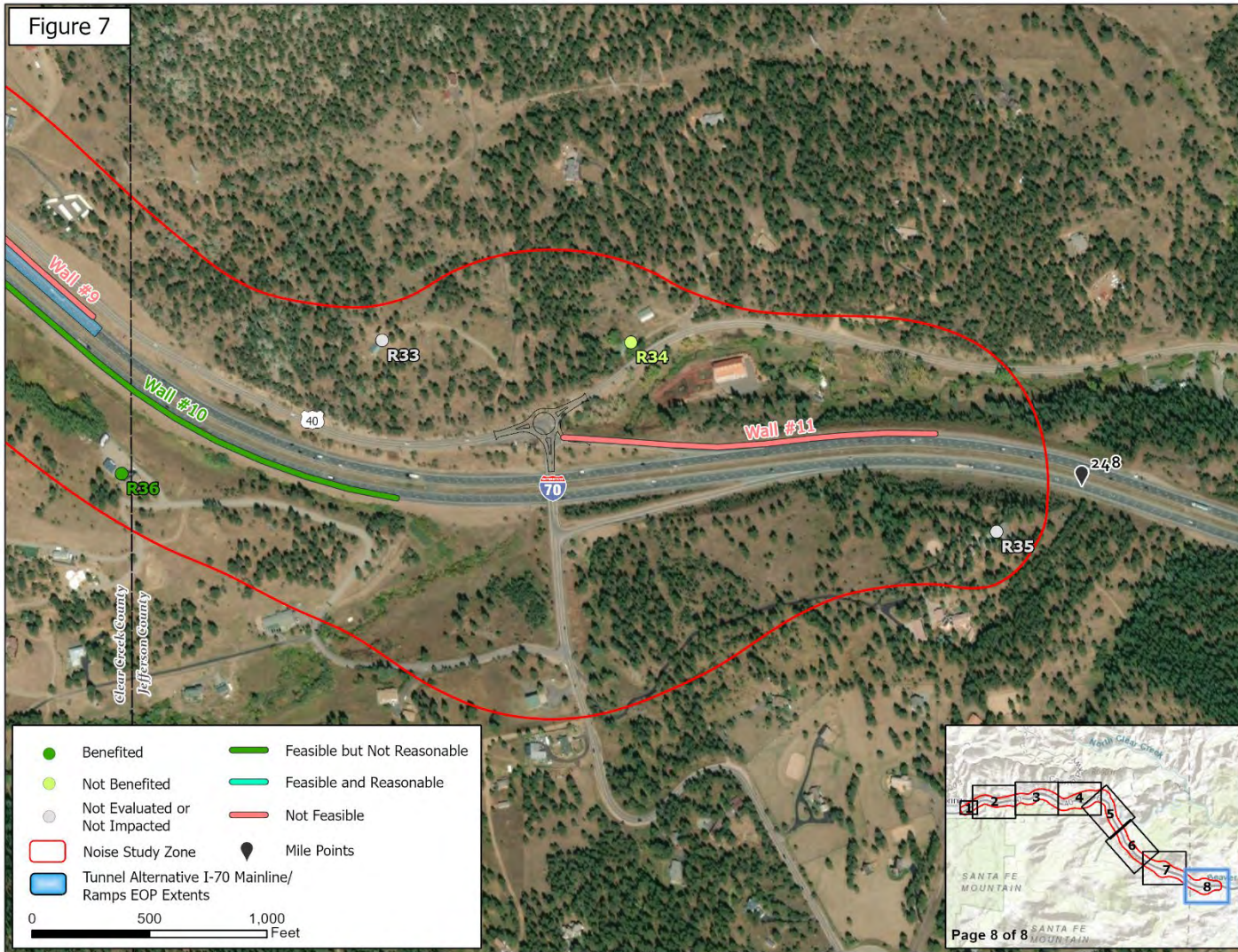




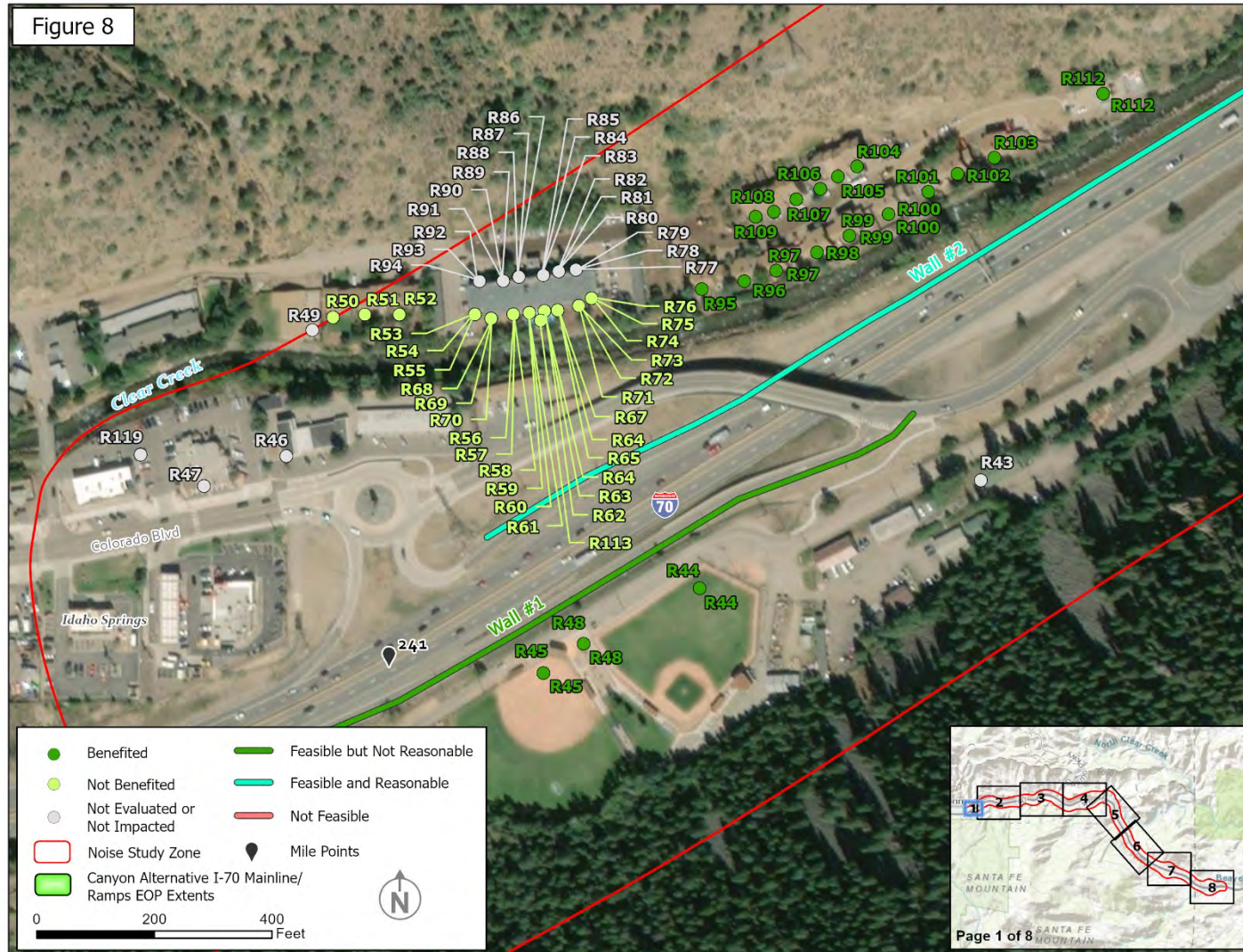


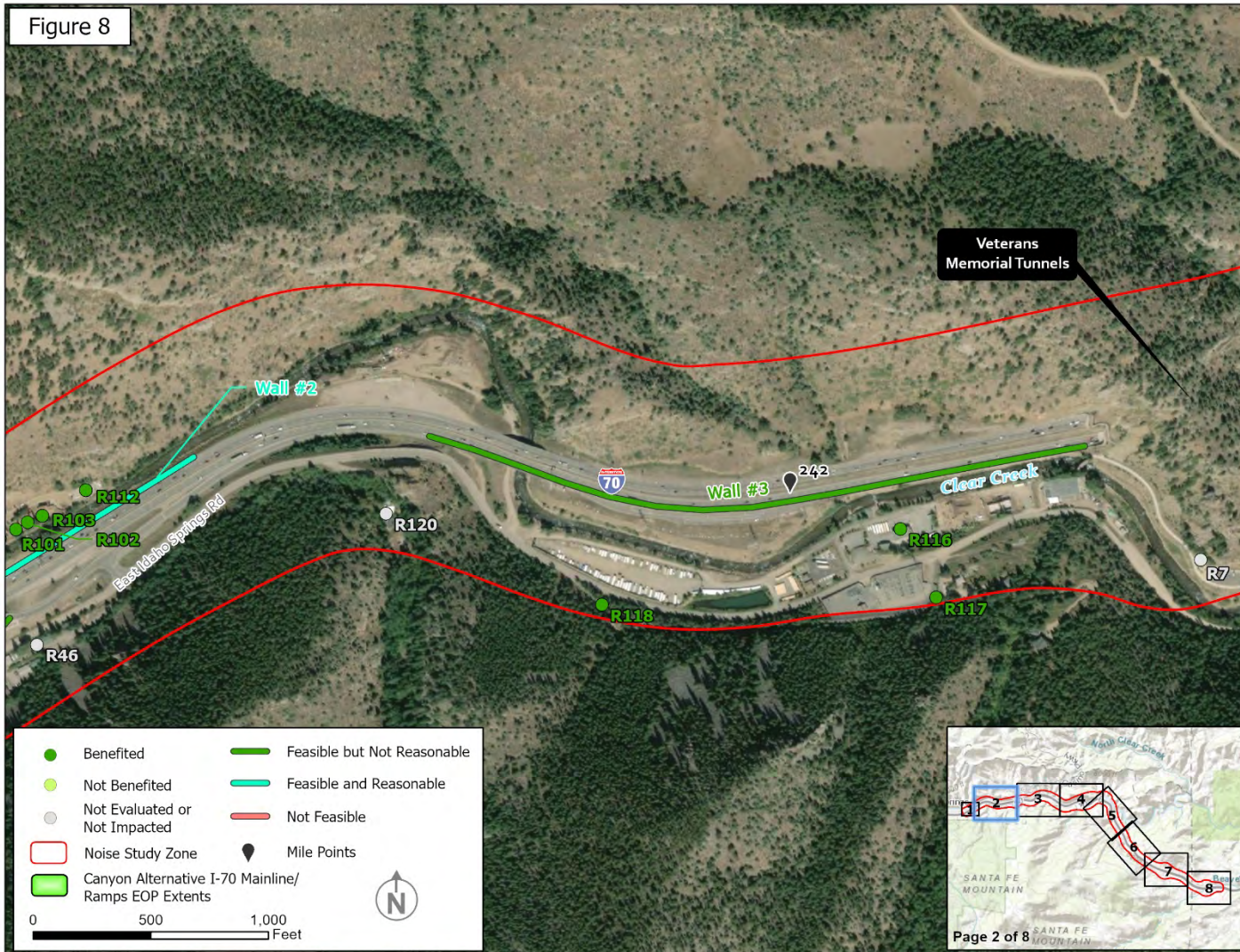


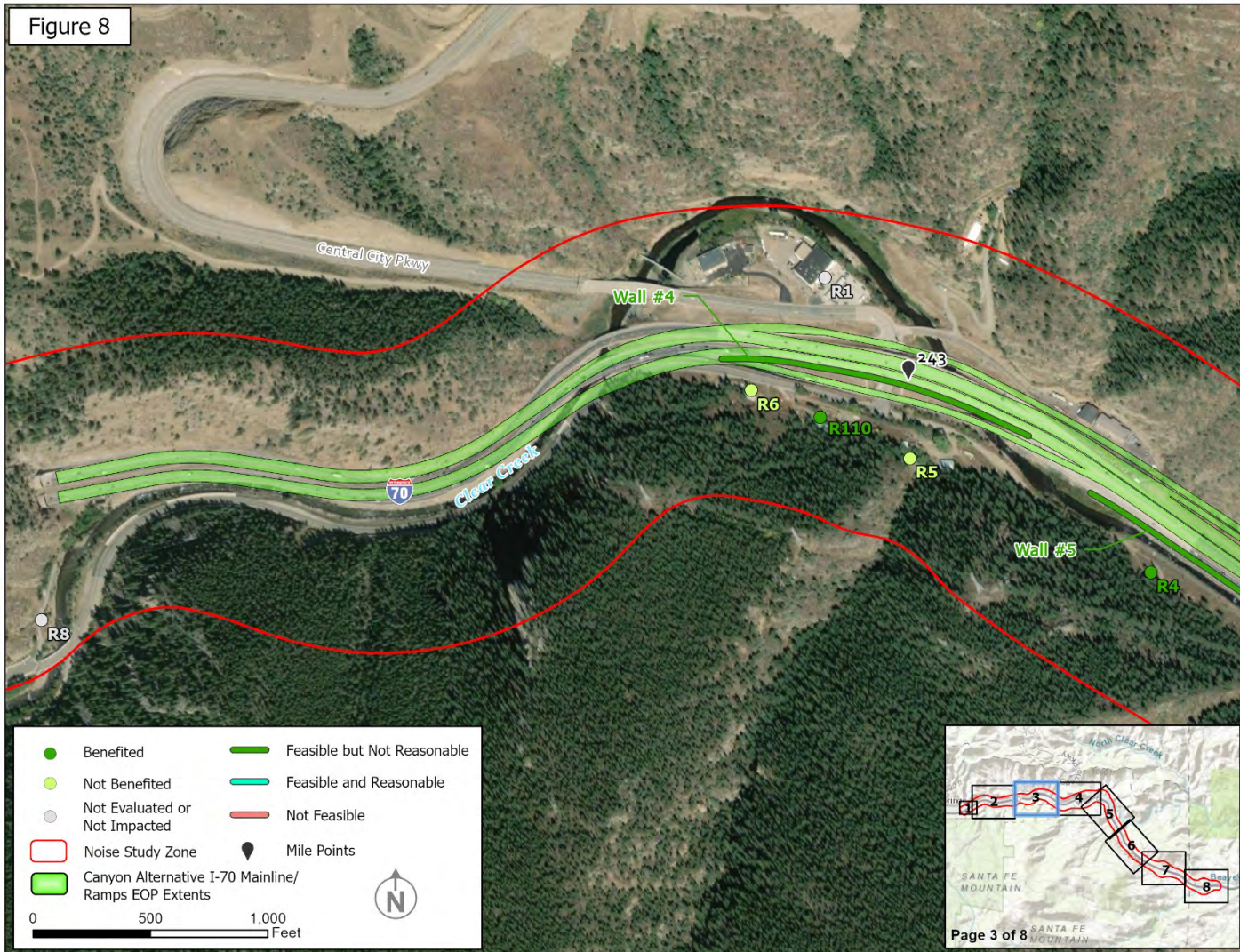




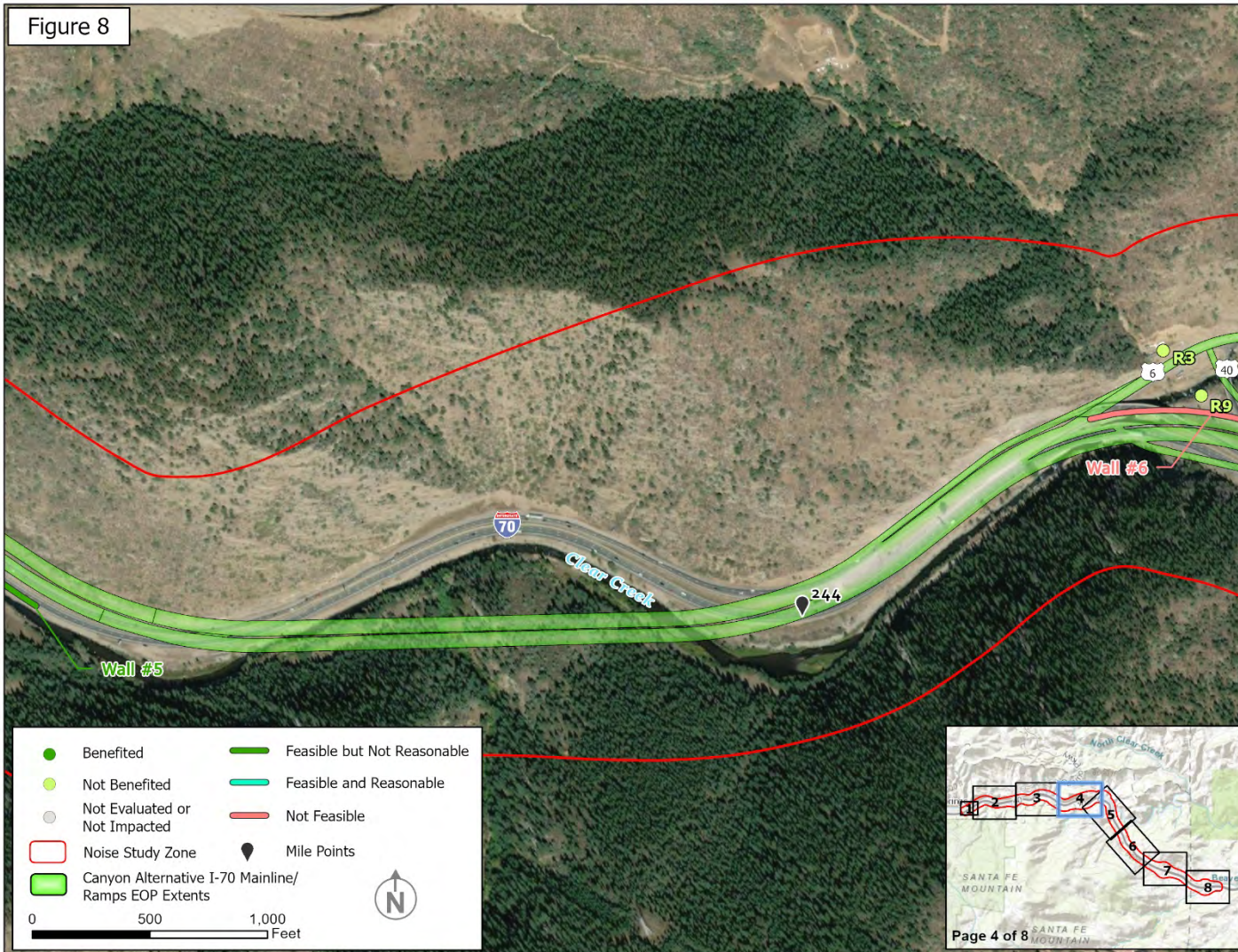
**Figure 8 I-70 Floyd Hill to Veterans Memorial Tunnels Noise Barrier Locations for 2045 Canyon Viaduct Alternative**

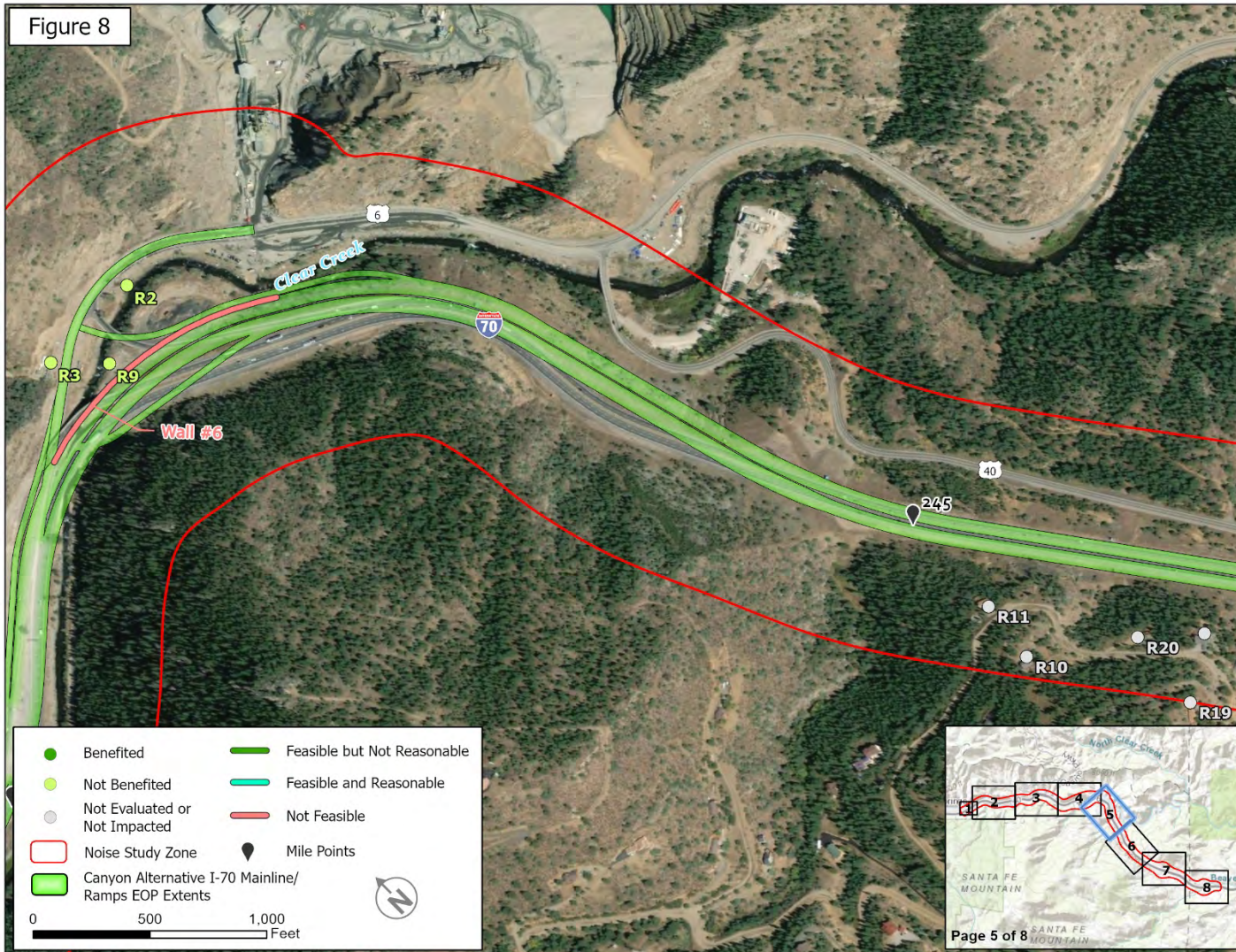


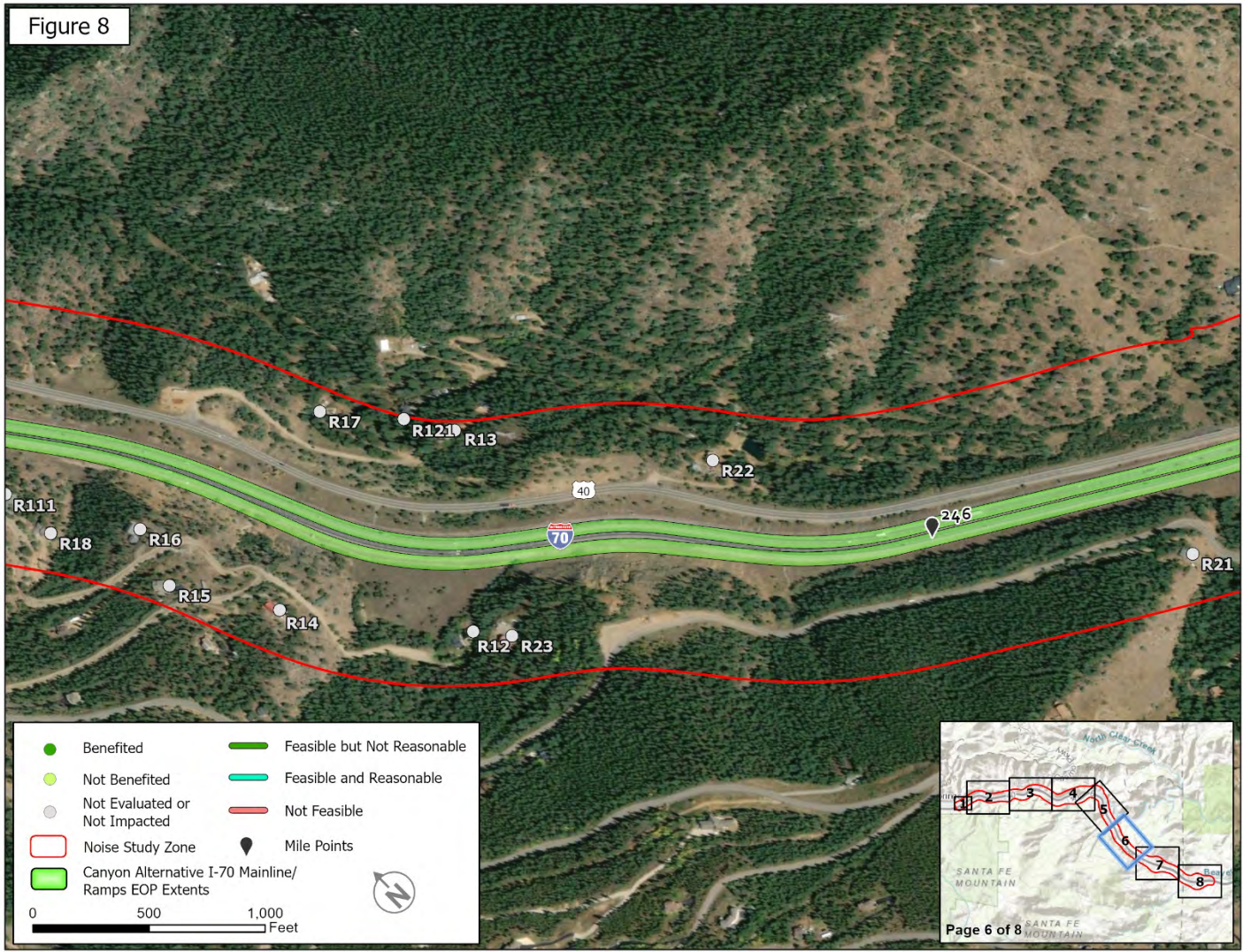


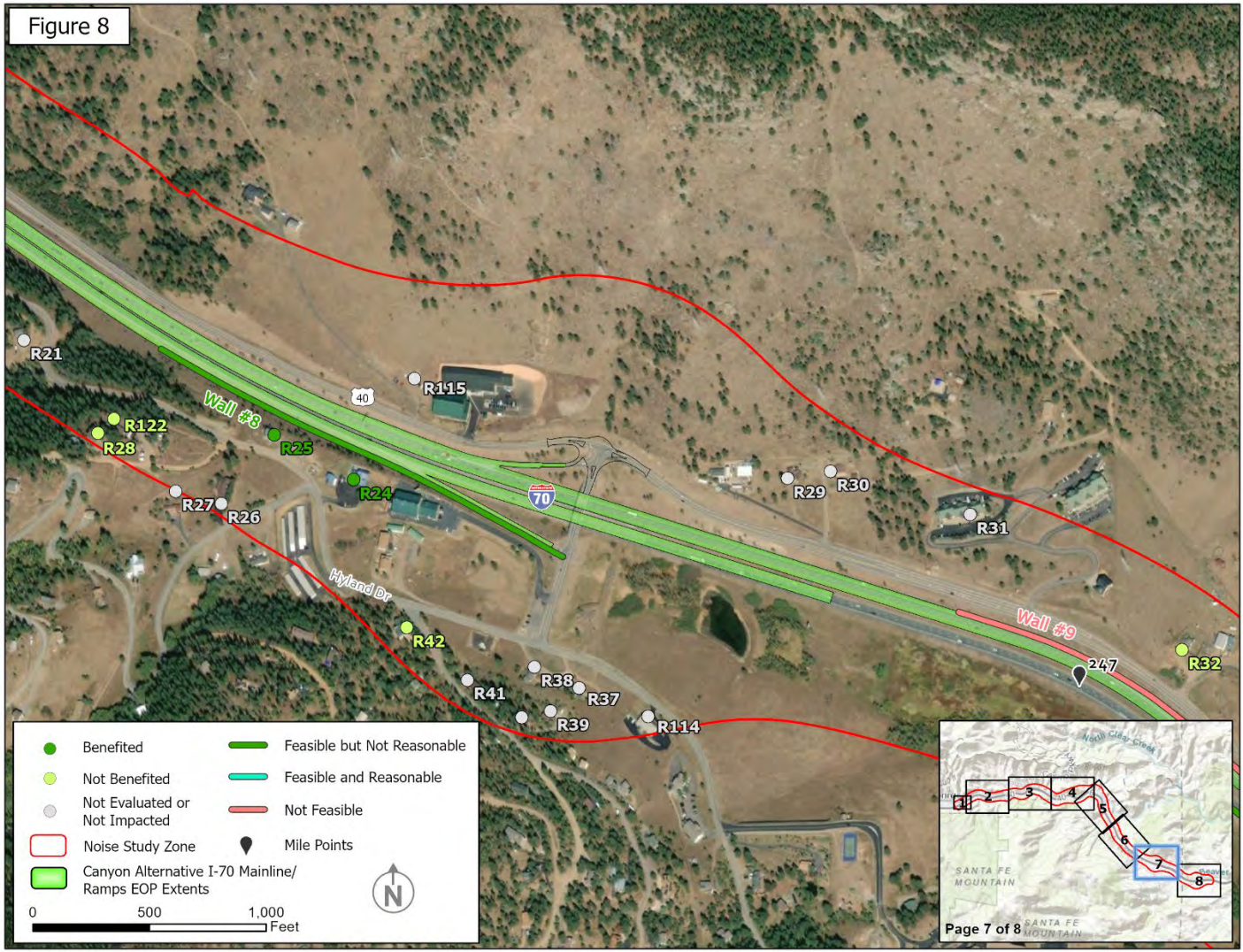


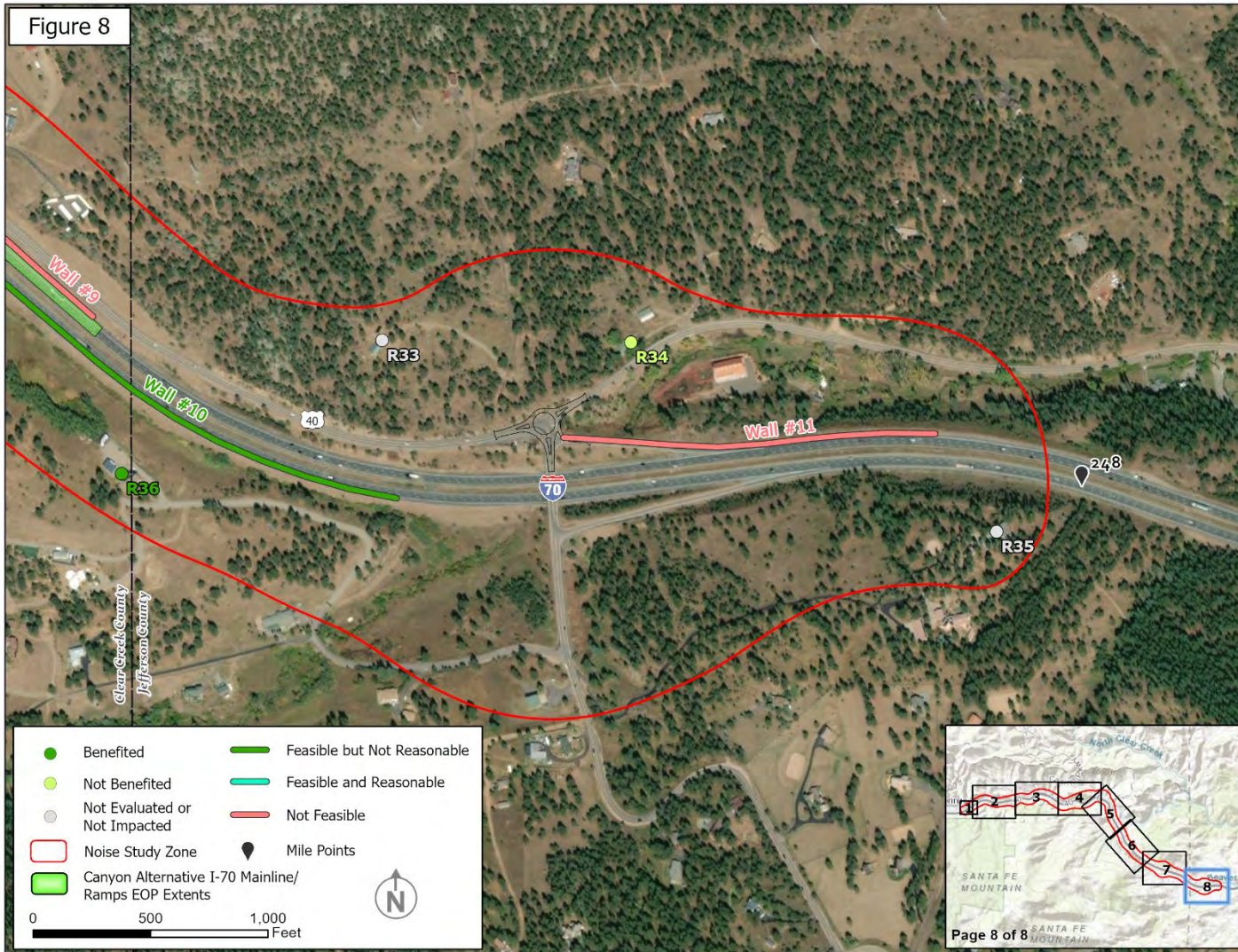




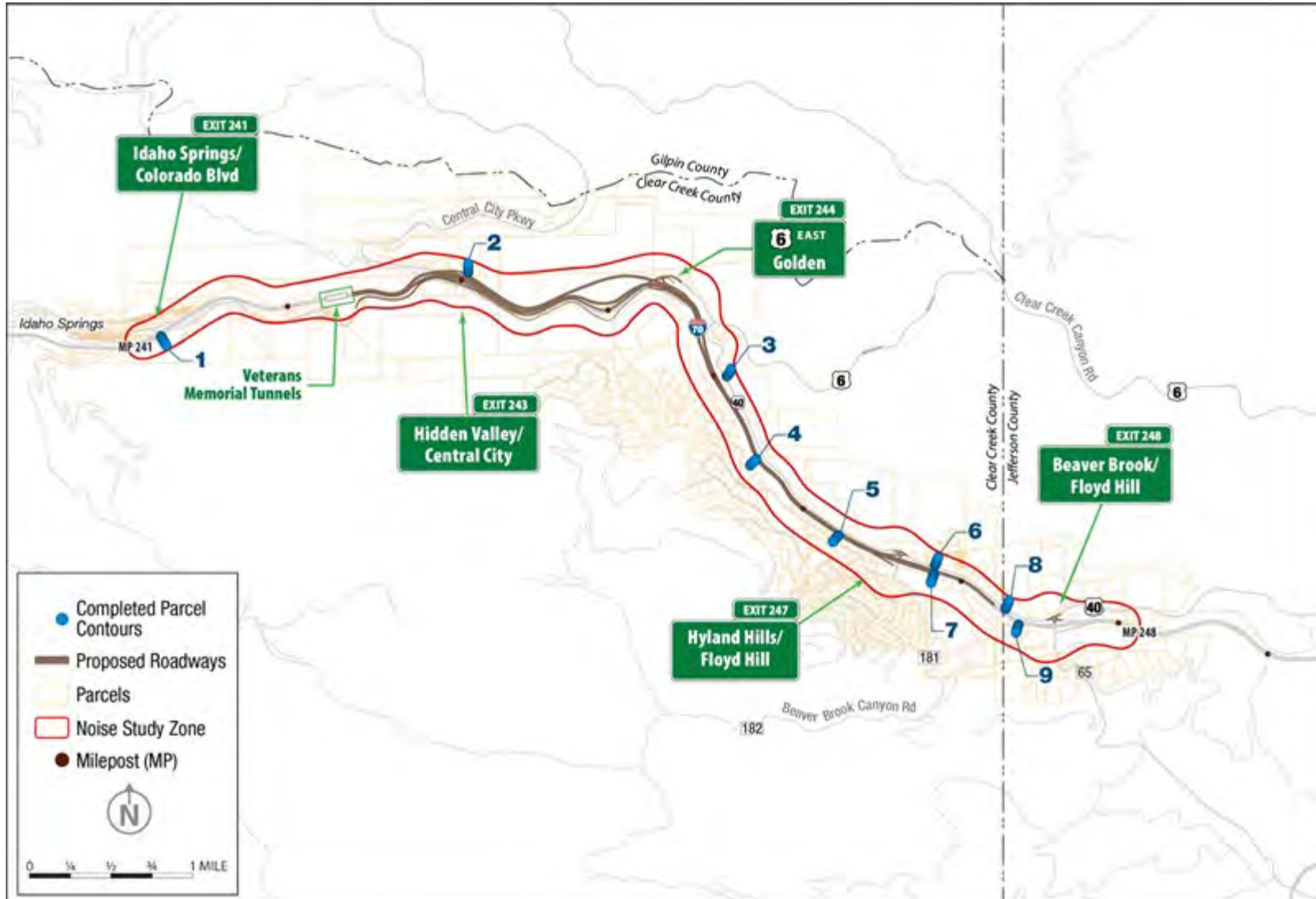




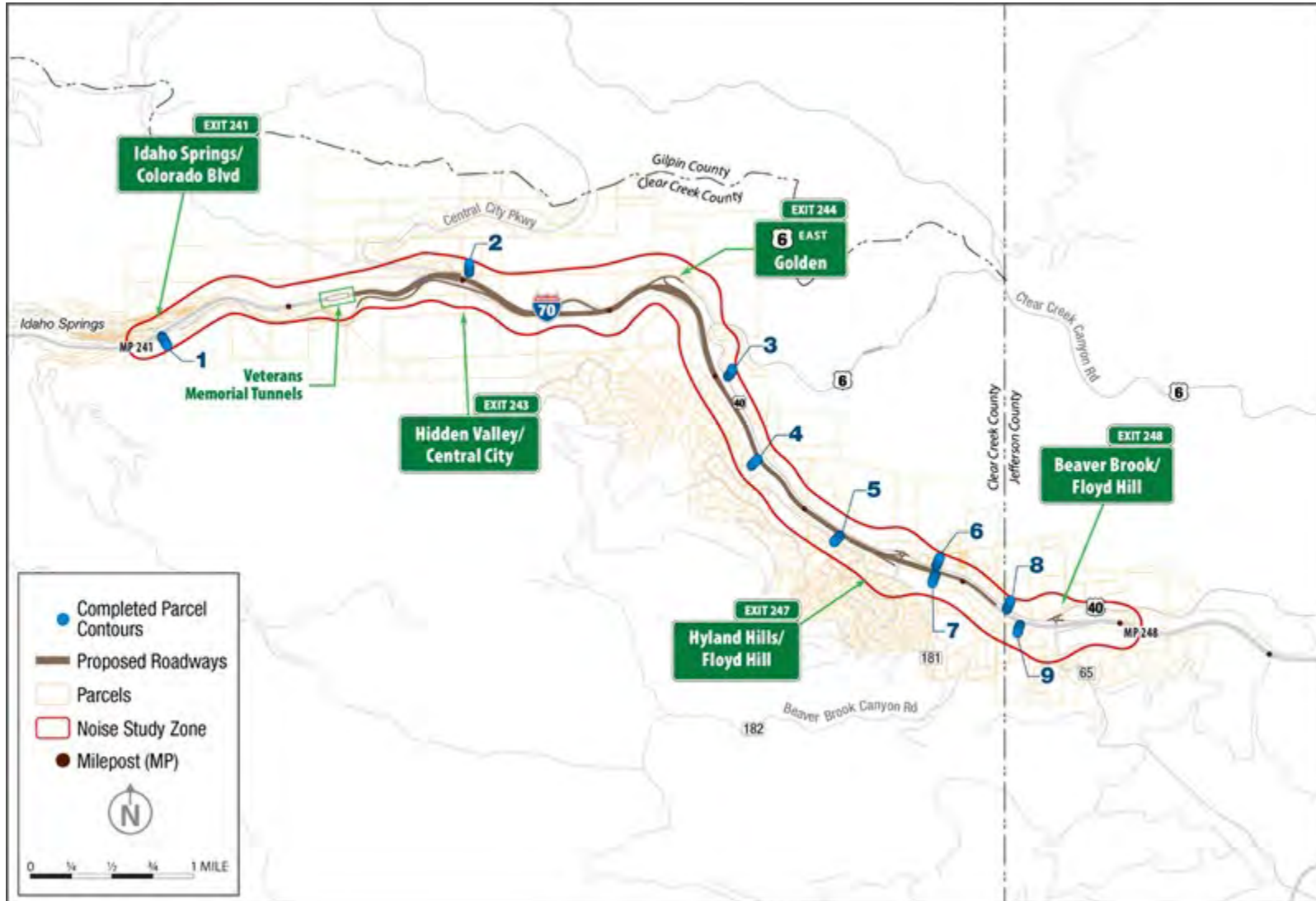




**Figure 9 I-70 Floyd Hill to Veterans Memorial Tunnels 2045 Tunnel Alternative NAC Activity Category G Noise Level Contours**



**Figure 10 I-70 Floyd Hill to Veterans Memorial Tunnels 2045 Canyon Viaduct Alternative NAC Activity Category G Noise Level Contours**



## **APPENDIX A      NOISE MEASUREMENT DATA**



This page is intentionally left blank.

**Table A-1 Noise Measurement Traffic Volumes and Speeds Used in Model Validation**

Roadway	Location ID	Date and Time of Traffic Volume and Speed Measurement	Equivalent Hourly Traffic Volume <sup>1</sup>			Estimated Vehicular Speed <sup>2</sup> (mph)	Posted Speed Limit (mph)
			Cars	Medium Trucks	Heavy Trucks		
I-70_WB_L1	V1	03/28/2018 and 10:00 am to 10:15 am	674	18	50	65	55
I-70_WB_L2	V1	03/28/2018 and 10:00 am to 10:15 am	673	19	51	65	55
I-70_WB_L3	V1	03/28/2018 and 10:00 am to 10:15 am	673	19	51	65	55
I-70_EB_L1	V1	03/28/2018 and 10:00 am to 10:15 am	464	8	48	65	65
I-70_EB_L2	V1	03/28/2018 and 10:00 am to 10:15 am	464	8	48	65	65
I-70_EB_L3	V1	03/28/2018 and 10:00 am to 10:15 am	464	8	48	65	65
WB on-ramp	V1	03/28/2018 and 10:00 am to 10:15 am	20	0	0	45	45
US40_WB	V1	03/28/2018 and 10:00 am to 10:15 am	64	0	0	50	50
US40_EB	V1	03/28/2018 and 10:00 am to 10:15 am	164	0	12	50	50
I-70_WB_L1	V2	03/28/2018 and 10:33 am to 10:48 am	777	18	57	65	55
I-70_WB_L2	V2	03/28/2018 and 10:33 am to 10:48 am	777	18	57	65	55
I-70_WB_L3	V2	03/28/2018 and 10:33 am to 10:48 am	778	20	58	65	55
I-70_EB_L1	V2	03/28/2018 and 10:33 am to 10:48 am	445	5	43	65	65
I-70_EB_L2	V2	03/28/2018 and 10:33 am to 10:48 am	445	5	43	65	65
I-70_EB_L3	V2	03/28/2018 and 10:33 am to 10:48 am	446	6	42	65	65
I-70_WB_L1	V3	03/28/2018 and 11:16 am to 11:31 am	980	14	66	65	55
I-70_WB_L2	V3	03/28/2018 and 11:16 am to 11:31 am	980	14	66	65	55
I-70_EB_L1	V3	03/28/2018 and 11:16 am to 11:31 am	398	8	28	65	55

I-70 Floyd Hill to Veterans Memorial Tunnels Traffic Noise Technical Report V.4  
 Project No. NHPP 0703-446, Sub Account No. 21912  
 May 2021

I-70_EB_L2	V3	03/28/2018 and 11:16 am to 11:31 am	397	8	28	65	55
I-70_EB_L3	V3	03/28/2018 and 11:16 am to 11:31 am	397	8	28	65	55
Overpass/WB off-ramp	V3	03/28/2018 and 11:16 am to 11:31 am	20	0	0	45	45
Overpass/EB on-ramp_L1	V3	03/28/2018 and 11:16 am to 11:31 am	64	2	2	45	45
Overpass/EB on-ramp_L2	V3	03/28/2018 and 11:16 am to 11:31 am	64	2	2	45	45
I-70_WB_L1	V4	03/28/2018 and 11:50 am to 12:05 pm	636	6	28	65	55
I-70_WB_L2	V4	03/28/2018 and 11:50 am to 12:05 pm	636	6	28	65	55
I-70 EB_L1	V4	03/28/2018 and 11:50 am to 12:05 pm	526	12	62	65	55
I-70 EB_L2	V4	03/28/2018 and 11:50 am to 12:05 pm	527	12	61	65	55
I-70 EB_L3	V4	03/28/2018 and 11:50 am to 12:05 pm	527	12	61	65	55
EB off-ramp	V4	03/28/2018 and 11:50 am to 12:05 pm	68	0	0	45	45
WB on-ramp	V4	03/28/2018 and 11:50 am to 12:05 pm	216	4	0	45	45
I-70_WB_L1	V5	03/28/2018 and 1:28 pm to 1:43 pm	1,046	12	58	65	55
I-70_WB_L2	V5	03/28/2018 and 1:28 pm to 1:43 pm	1,046	12	58	65	55
I-70 EB_L1	V5	03/28/2018 and 1:28 pm to 1:43 pm	622	22	38	65	65
I-70 EB_L2	V5	03/28/2018 and 1:28 pm to 1:43 pm	623	21	39	65	65
I-70 EB_L3	V5	03/28/2018 and 1:28 pm to 1:43 pm	623	21	39	65	65

<sup>1</sup> Traffic counts were collected in 15-minute intervals. The 15-minute traffic volumes have been aggregated to hourly volumes and split for each lane on the I-70 mainlines in the validation models.

<sup>2</sup> Estimated vehicular speeds were applied in the validation models.

## **APPENDIX B      TNM NOISE MODELING INPUT DATA**

This page is intentionally left blank.

**Table B-1: Existing Conditions Model Traffic Data (2018)<sup>1</sup>**

Roadway Link	Roadway Segment	Number of Lanes	Cars/ Lane/ Hour	Medium Trucks/ Lane/ Hour	Heavy Trucks/ Lane/ Hour	Speed (mph)
Westbound I-70	Eastern end of area to Homestead Road*	3	1,330	21	79	65
	Homestead Road to third lane drop*	3	1,167	19	69	55
	Third lane drop to speed limit increase*	2	1,167	19	69	55
	Speed limit increase to western end of area*	2	1,272	21	75	60
Eastbound I-70	Western end of area to speed limit decrease*	2	1,272	21	75	60
	Peak Period Shoulder Lane**	1	786	0	0	60
	Speed limit decrease to third lane add*	2	1,167	19	69	55
	Peak Period Shoulder Lane**	1	786	0	0	55
	Third lane add to bottom of Floyd Hill*	3	1,167	19	69	55
	Floyd Hill*	3	1,290	21	76	65
	Top of Floyd Hill to eastern end of study area*	3	1,330	21	79	65
Westbound I-70 Ramps	Off-Ramp to CR 65	1	327	5	19	45
	On-Ramp from Homestead Road	1	376	6	22	45
	Off-Ramp to US 6	1	157	3	9	50

Roadway Link	Roadway Segment	Number of Lanes	Cars/ Lane/ Hour	Medium Trucks/ Lane/ Hour	Heavy Trucks/ Lane/ Hour	Speed (mph)
	On-Ramp from US 6	1	1,006	16	60	50
	Off-Ramp to Central City Parkway (Hidden Valley)	1	301	5	18	50
	On-Ramp from Central City Parkway (Hidden Valley)	1	194	3	11	50
	Off-Ramp to Colorado Boulevard	1	448	7	27	45
	On-Ramp from Colorado Boulevard	1	275	4	16	45
Eastbound I-70 Ramps	Off-Ramp to Colorado Boulevard	1	167	3	10	45
	On-Ramp from Colorado Boulevard	1	412	7	24	45
	Off-Ramp to Central City Parkway (Hidden Valley)	1	102	2	6	50
	On-Ramp from Central City Parkway (Hidden Valley)	1	462	7	27	50
	Off-Ramp to US 6	1	176	3	10	50
	Off-Ramp to Homestead Road	1	113	2	6	45
	On-Ramp from CR 65	1	192	3	11	45
Westbound Colorado Boulevard	Colorado Boulevard west of roundabout	1	207	4	12	45
Eastbound Colorado Boulevard	Colorado Boulevard west of roundabout	1	208	3	12	45

Roadway Link	Roadway Segment	Number of Lanes	Cars/ Lane/ Hour	Medium Trucks/ Lane/ Hour	Heavy Trucks/ Lane/ Hour	Speed (mph)
Westbound E Idaho Springs	East Idaho Springs between Exit 241 and Hidden Valley	1	194	3	11	45
Eastbound E Idaho Springs	East Idaho Springs between Exit 241 and Hidden Valley	1	193	3	12	45
Westbound Central City Parkway (CCP)	CCP WB to Terminus	1 <sup>2</sup>	321	5	19	50
Eastbound CCP	CCP EB to On-Ramp	1 <sup>2</sup>	321	5	19	50
Westbound US 6	US 6 Between WB Off-Ramp and US 40	1	986	16	58	50
Eastbound US 6	US 6 Between WB Off-Ramp and US 40	1	336	5	20	50
Westbound US 40	US 40 Floyd Hill (west of Homestead Road)	1	90	2	5	50
	US 40 Between Homestead Road and CR 65	1	152	2	9	50
	US 40 East of CR 65	1	35	1	2	50
Eastbound US 40	US 40 Floyd Hill (west of Homestead Road)	1	90	1	6	50
	US 40 Between Homestead Road and CR 65	1	151	3	9	50
	US 40 East of CR 65	1	36	0	2	50
Northbound Homestead Road	Homestead Road south of I-70	1	50	0	3	45



Roadway Link	Roadway Segment	Number of Lanes	Cars/ Lane/ Hour	Medium Trucks/ Lane/ Hour	Heavy Trucks/ Lane/ Hour	Speed (mph)
Southbound Homestead Road	Homestead Road south of I-70	1	49	1	3	45
Westbound Hyland Drive	Hyland Drive west of Homestead Road	1	95	2	5	45
Eastbound Hyland Drive	Hyland Drive west of Homestead Road	1	95	1	6	45
Westbound Beaver Brook Canyon Road	Beaver Brook Canyon Road east of Homestead Road	1	36	1	2	45
Eastbound Beaver Brook Canyon Road	Beaver Brook Canyon Road east of Homestead Road	1	36	0	2	45
Northbound CR 65	CR 65 South of I-70	1	134	2	8	35
Southbound CR 65	CR 65 South of I-70	1	134	2	8	35

<sup>1</sup> Existing Conditions traffic data source: All volumes based on highest hourly volume of traffic collected in either Winter or Summer data collection efforts in 2018, with the following exceptions noted in the Table:

\* Mainline I-70 worst noise-hour traffic volumes were calculated in accordance with FHWA regulations (23 CFR 772.9(d)) for assuming a LOS C/D threshold and passenger car equivalent of 3.0-3.5 for heavy vehicles.

\*\* Peak Period Shoulder Lane volume was not available for existing conditions. The volume used was based on second-highest hour of PPSL traffic for the Future 2045 model. Due to the surcharge for multi-axle vehicles, only passenger cars were modeled in the lane.

<sup>2</sup> Both westbound and eastbound Central City Parkway are modeled as one TNM roadway with appropriate width.

**Table B-2 Design Year No Action Model Traffic Data (2045)<sup>1</sup>**

Roadway Link	Roadway Segment	Number of Lanes	Cars /Lane /Hour	Medium Trucks/ Lane /Hour	Heavy Trucks/ Lane /Hour	Speed (mph)
Westbound I-70	Eastern end of area to Homestead Road*	3	1,330	21	79	65
	Eastern end of area to third lane drop*	3	1,167	19	69	55
	Third lane drop to speed limit increase*	2	1,167	19	69	55
	Speed limit increase to western end of area*	2	1,272	21	75	60
	Peak Period Shoulder Lane**	1	786	0	0	60
Eastbound I-70	Western end of area to speed limit decrease*	2	1,272	21	75	60
	Peak Period Shoulder Lane**	1	786	0	0	60
	Speed limit decrease to third lane add*	2	1,167	19	69	55
	Peak Period Shoulder Lane**	1	786	0	0	55
	Third lane add to bottom of Floyd Hill*	3	1,167	19	69	55
	Floyd Hill*	3	1,290	21	76	65
	Top of Floyd Hill to eastern end of study area*	3	1,330	21	79	65
Westbound I-70 Ramps	Off-Ramp to CR 65	1	304	5	18	45
	On-Ramp from Homestead Road	1	160	3	9	45

Roadway Link	Roadway Segment	Number of Lanes	Cars /Lane /Hour	Medium Trucks/ Lane /Hour	Heavy Trucks/ Lane /Hour	Speed (mph)
	Off-Ramp to US 6	1	15	0	1	50
	On-Ramp from US 6	1	631	10	37	50
	Off-Ramp to Central City Parkway (Hidden Valley)	1	454	7	27	50
	On-Ramp from Central City Parkway (Hidden Valley)	1	142	2	8	50
	Off-Ramp to Colorado Boulevard	1	340	5	20	45
	On-Ramp from Colorado Boulevard	1	179	3	11	45
Eastbound I-70 Ramps	Off-Ramp to Colorado Boulevard	1	320	5	19	45
	On-Ramp from Colorado Boulevard	1	840	14	50	45
	Off-Ramp to Central City Parkway (Hidden Valley)	1	132	2	8	50
	On-Ramp from Central City Parkway (Hidden Valley)	1	378	6	22	50
	Off-Ramp to US 6	1	221	4	13	50
	Off-Ramp to Homestead Road	1	187	3	11	45
	On-Ramp from CR 65	1	307	5	18	45
Westbound Colorado Boulevard	Colorado Boulevard west of roundabout	1	398	6	24	45

Roadway Link	Roadway Segment	Number of Lanes	Cars /Lane /Hour	Medium Trucks/ Lane /Hour	Heavy Trucks/ Lane /Hour	Speed (mph)
Eastbound Colorado Boulevard	Colorado Boulevard west of roundabout	1	399	7	23	45
Westbound E Idaho Springs	East Idaho Springs between Exit 241 and Hidden Valley	1	286	5	17	45
Eastbound E Idaho Springs	East Idaho Springs between Exit 241 and Hidden Valley	1	286	4	17	45
Westbound CCP	CCP WB to Terminus	1 <sup>2</sup>	367	6	21	50
Eastbound CCP	CCP EB to On-Ramp	1 <sup>2</sup>	367	6	22	50
Westbound US 6	US 6 Between WB Off-Ramp and US 40	1	371	6	22	50
Eastbound US 6	US 6 Between WB Off-Ramp and US 40	1	370	6	22	50
Westbound US 40	US 40 Floyd Hill (west of Homestead Road)	1	326	6	19	50
	US 40 Between Homestead Road and CR 65	1	417	7	24	50
	US 40 East of CR 65	1	210	4	12	50
Eastbound US 40	US 40 Floyd Hill (west of Homestead Road)	1	326	5	20	50
	US 40 Between Homestead Road and CR 65	1	416	6	25	50
	US 40 East of CR 65	1	209	3	13	50

Roadway Link	Roadway Segment	Number of Lanes	Cars /Lane /Hour	Medium Trucks/ Lane /Hour	Heavy Trucks/ Lane /Hour	Speed (mph)
Northbound Homestead Road	Homestead Road south of I-70	1	154	2	9	45
Southbound Homestead Road	Homestead Road south of I-70	1	153	3	9	45
Westbound Hyland Drive	Hyland Drive west of Homestead Road	1	111	2	6	45
Eastbound Hyland Drive	Hyland Drive west of Homestead Road	1	110	2	7	45
Westbound Beaver Brook Canyon Road	Beaver Brook Canyon Road east of Homestead Road	1	42	0	3	45
Eastbound Beaver Brook Canyon Road	Beaver Brook Canyon Road east of Homestead Road	1	43	1	2	45
Northbound CR 65	CR 65 South of I-70	1	182	3	11	35
Southbound CR 65	CR 65 South of I-70	1	182	3	11	35

<sup>1</sup> No Build traffic data source: All volumes based on highest hourly volume of traffic as modeled in the 2045 No Build Traffic Model, with the following exceptions noted in the Table:

\* Mainline I-70 worst noise-hour traffic volumes were calculated in accordance with FHWA regulations (23 CFR 772.9(d)) for assuming a LOS C/D threshold and passenger car equivalent of 3.0-3.5 for heavy vehicles.

\*\* Peak Period Shoulder Lane (PPSL) volume was based on second-highest hour of PPSL traffic for the Future 2045 model. Due to the surcharge for multi-axle vehicles, only passenger cars were modeled in the lane.

<sup>2</sup> Both westbound and eastbound Central City Parkway are modeled as one TNM roadway with appropriate width.

**Table B-3 Design Year Tunnel Alternative Model Traffic Data (2045)<sup>1</sup>**

Roadway Link	Roadway Segment	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)
Westbound I-70	Eastern end of area to Homestead Road*	3	1,330	21	79	65
	Eastern end of area to third lane drop*	3	1,167	19	69	55
	Third lane drop to speed limit increase*	2	1,167	19	69	55
	From speed limit increase to western end of area*	2	1,272	21	75	60
	Peak Period Shoulder Lane**	1	734	0	0	60
Eastbound I-70	Western end of area to speed limit decrease*	2	1,272	21	75	60
	Peak Period Shoulder Lane**	1	734	0	0	60
	Speed limit decrease to bottom of Floyd Hill*	3	1,167	19	69	55
	Floyd Hill*	3	1,290	21	76	65
	Top of Floyd Hill to eastern end of study area*	3	1,330	21	79	65
Westbound I-70 Ramps	Off-Ramp to CR 65	1	656	11	39	45
	On-Ramp from Homestead Road	1	312	5	18	45
	Off-Ramp to US 6	1	181	3	11	45
	On-Ramp from US 6	1	717	12	42	45

Roadway Link	Roadway Segment	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)
	Off-Ramp to Central City Parkway (Hidden Valley)	1	334	5	20	45
	On-Ramp from Central City Parkway (Hidden Valley)	1	415	7	25	45
	Off-Ramp to Colorado Boulevard	1	411	7	24	45
	On-Ramp from Colorado Boulevard	1	512	8	30	45
Eastbound I-70 Ramps	Off-Ramp to Colorado Boulevard	1	237	4	14	45
	On-Ramp from Colorado Boulevard	1	603	10	36	45
	Off-Ramp to Central City Parkway (Hidden Valley)	1	339	5	20	45
	On-Ramp from Central City Parkway (Hidden Valley)	1	233	4	14	45
	On-Ramp from US 6	1	196	3	12	45
	Off-Ramp to Homestead Road	1	235	4	14	45
	On-Ramp from CR 65	1	185	3	11	45
Westbound Colorado Boulevard	Colorado Boulevard west of roundabout	1	95	1	6	45
Eastbound Colorado Boulevard	Colorado Boulevard west of roundabout	1	96	2	5	45

Roadway Link	Roadway Segment	Number of Lanes	Cars /Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)
Westbound E Idaho Springs	East Idaho Springs between Exit 241 and Hidden Valley	1	206	4	12	30
Eastbound E Idaho Springs	East Idaho Springs between Exit 241 and Hidden Valley	1	207	3	12	30
Westbound CCP	CCP WB to Terminus	1 <sup>2</sup>	355	5	21	50
Eastbound CCP	CCP EB to On-Ramp	1 <sup>2</sup>	354	6	21	50
Westbound US 6	US 6 West of WB Off Ramp	1	702	11	42	40
	US 6 between WB Off-Ramp and US 40	1	698	12	41	50
Eastbound US 6	US 6 West of WB Off Ramp	1	703	12	41	40
	US 6 between WB Off-Ramp and US 40	1	698	11	42	50
Westbound US 40	US 40 Floyd Hill (west of Homestead Road)	1	603	10	36	50
	US 40 east of Homestead Road to eastern end of area	1	1641	27	97	50
Eastbound US 40	US 40 Floyd Hill (west of Homestead Road)	1	602	9	35	50
	US 40 east of Homestead Road to eastern end of area	1	1641	26	97	50
Northbound Homestead Road	Homestead Road south of I-70	1	162	3	9	45



Roadway Link	Roadway Segment	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)
Southbound Homestead Road	Homestead Road south of I-70	1	162	2	10	45
Westbound Hyland Drive	Hyland Drive west of Homestead Road	1	115	2	7	45
Eastbound Hyland Drive	Hyland Drive west of Homestead Road	1	115	2	7	45
Westbound Beaver Brook Canyon Road	Beaver Brook Canyon Road east of Homestead Road	1	46	0	3	45
Eastbound Beaver Brook Canyon Road	Beaver Brook Canyon Road east of Homestead Road	1	46	1	2	45
Northbound CR 65	CR 65 South of I-70	1	218	3	13	35
Southbound CR 65	CR 65 South of I-70	1	217	4	13	35

<sup>1</sup> Build Conditions traffic data source: All volumes based on highest hourly volume of traffic as modeled in the 2045 Tunnel Alternative Build Traffic Model, with the following exceptions noted in the Table:

\* Mainline I-70 worst noise-hour traffic volumes were calculated in accordance with FHWA regulations (23 CFR 772.9(d)) for assuming a LOS C/D threshold and passenger car equivalent of 3.0-3.5 for heavy vehicles.

\*\* Peak Period Shoulder Lane (PPSL) volume was based on second-highest hour of PPSL traffic for the Future 2045 model. Due to the surcharge for multi-axle vehicles, only passenger cars were modeled in the lane.

<sup>2</sup> Both westbound and eastbound Central City Parkway are modeled as one TNM roadway with appropriate width.

**Table B-4 Design Year Canyon Viaduct Alternative Model Traffic Data (2045)<sup>4</sup>**

Roadway Link	Roadway Segment	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)
Westbound I-70	Eastern end of area to Homestead Road*	3	1,330	21	79	65
	Eastern end of area to third lane drop*	3	1,167	19	69	55
	Third lane drop to speed limit increase (after tunnels)*	2	1,167	19	69	55
	From speed limit increase to western end of area*	2	1,272	21	75	60
	Peak Period Shoulder Lane**	1	838	0	0	60
Eastbound I-70	Western end of area to speed limit decrease*	2	1,272	21	75	60
	Peak Period Shoulder Lane**	1	838	0	0	60
	Speed limit decrease to bottom of Floyd Hill*	3	1,167	19	69	55
	Floyd Hill*	3	1,290	21	76	65
	Top of Floyd Hill to eastern end of study area*	3	1,330	21	79	65
Westbound I-70 Ramps	Off-Ramp to CR 65	1	494	8	29	45
	On-Ramp from Homestead Road	1	196	3	12	45
	Off-Ramp to US 6	1	175	3	10	45
	On-Ramp from US 6	1	694	11	41	45

Roadway Link	Roadway Segment	Number of Lanes	Cars /Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)
	Off-Ramp to Central City Parkway (Hidden Valley)	1	369	6	22	45
	On-Ramp from Central City Parkway (Hidden Valley)	1	532	9	31	45
	Off-Ramp to Colorado Boulevard	1	459	7	27	45
	On-Ramp from Colorado Boulevard	1	473	8	28	45
Eastbound I-70 Ramps	Off-Ramp to Colorado Boulevard	1	206	3	12	45
	On-Ramp from Colorado Boulevard	1	671	11	40	45
	Off-Ramp to Central City Parkway (Hidden Valley)	1	336	5	20	45
	On-Ramp from Central City Parkway (Hidden Valley)	1	350	6	21	45
	On-Ramp from US 6	1	193	3	11	45
	Off-Ramp to Homestead Road	1	242	4	14	45
	On-Ramp from CR 65	1	185	3	11	45
Westbound Colorado Boulevard	Colorado Boulevard west of roundabout	1	104	1	6	45
Eastbound Colorado Boulevard	Colorado Boulevard west of roundabout	1	103	2	6	45

Roadway Link	Roadway Segment	Number of Lanes	Cars /Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)
Westbound E Idaho Springs	East Idaho Springs between Exit 241 and Hidden Valley	1	128	2	8	30
Eastbound E Idaho Springs	East Idaho Springs between Exit 241 and Hidden Valley	1	128	2	7	30
Westbound CCP	CCP WB to Terminus	1 <sup>2</sup>	362	6	22	50
Eastbound CCP	CCP EB to On-Ramp	1 <sup>2</sup>	363	6	21	50
Westbound US 6	US 6 West of WB Off Ramp	1	307	5	18	40
	US 6 between WB Off-Ramp and US 40	1	604	10	36	50
Eastbound US 6	US 6 West of WB Off Ramp	1	307	5	18	40
	US 6 between WB Off-Ramp and US 40	1	603	9	35	50
Westbound US 40	US 40 Floyd Hill (west of Homestead Road)	1	234	4	14	50
	US 40 east of Homestead Road to eastern end of area	1	322	5	19	50
Eastbound US 40	US 40 Floyd Hill (west of Homestead Road)	1	233	4	14	50
	US 40 east of Homestead Road to eastern end of area	1	323	5	19	50
Northbound Homestead Road	Homestead Road south of I-70	1	166	2	10	45

Roadway Link	Roadway Segment	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)
Southbound Homestead Road	Homestead Road south of I-70	1	166	3	10	45
Westbound Hyland Drive	Hyland Drive west of Homestead Road	1	117	2	7	45
Eastbound Hyland Drive	Hyland Drive west of Homestead Road	1	117	2	7	45
Westbound Beaver Brook Canyon Road	Beaver Brook Canyon Road east of Homestead Road	1	49	1	3	45
Eastbound Beaver Brook Canyon Road	Beaver Brook Canyon Road east of Homestead Road	1	49	1	3	45
Northbound CR 65	CR 65 South of I-70	1	216	3	13	35
Southbound CR 65	CR 65 South of I-70	1	216	4	13	35

<sup>1</sup> Build Conditions traffic data source: All volumes based on highest hourly volume of traffic as modeled in the 2045 Canyon Viaduct Alternative Build Traffic Model, with the following exceptions noted in the Table:

\* Mainline I-70 worst noise-hour traffic volumes were calculated in accordance with FHWA regulations (23 CFR 772.9(d)) for assuming a LOS C/D threshold and passenger car equivalent of 3.0-3.5 for heavy vehicles.

\*\* Peak Period Shoulder Lane (PPSL) volume was based on second-highest hour of PPSL traffic for the Future 2045 model. Due to the surcharge for multi-axle vehicles, only passenger cars were modeled in the lane.

<sup>2</sup> Both westbound and eastbound Central City Parkway are modeled as one TNM roadway with appropriate width.

## **APPENDIX C      TNM NOISE MODELING RESULTS**

*TNM files, which contain model inputs and outputs, were submitted electronically to CDOT*

**APPENDIX D      NOISE ABATEMENT DETERMINATION WORKSHEETS  
(CDOT FORM 1209)**

This page is intentionally left blank.





COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #1 - South of I-70 in East Idaho Springs

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because the cost of the abatement measure exceeded the CDOT cost-benefit index - the cost benefit index must calculate to a dollar value no more than \$6,800 per receptor per decibel of reduction.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #2 - North of I-70 in East Idaho Springs

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible and reasonable because the cost of the abatement measure was below the CDOT cost-benefit index - the cost benefit index must calculate to a dollar value no more than \$6,800 per receptor per decibel of reduction.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #3 - South of I-70 just west of VMT

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm? [X] YES [ ] NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm? [ ] YES [X] NO
3. Can a noise barrier or berm less than 20 feet tall be constructed? [X] YES [ ] NO

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor? [X] YES [ ] NO
2. Is the Cost Benefit Index below \$6800 per receptor per dBA? [ ] YES [X] NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure? [ ] YES [ ] NO NA

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable? [X] YES [ ] NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D? [ ] YES [X] NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings? [ ] YES [ ] NO

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible? [X] YES [ ] NO
2. Are noise mitigation measures reasonable? [ ] YES [X] NO
3. Is insulation of buildings both feasible and reasonable? [ ] YES [ ] NO NA
4. Shall noise abatement measures be provided? [ ] YES [X] NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because the cost of the abatement measure exceeded the CDOT cost-benefit index - the cost benefit index must calculate to a dollar value no more than \$6,800 per receptor per decibel of reduction.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #4 - South of I-70 near the Hidden Valley/Central City Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm? [X] YES [ ] NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm? [ ] YES [X] NO
3. Can a noise barrier or berm less than 20 feet tall be constructed? [X] YES [ ] NO

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor? [ ] YES [X] NO
2. Is the Cost Benefit Index below \$6800 per receptor per dBA? [ ] YES [X] NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure? [ ] YES [ ] NO NA

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable? [X] YES [ ] NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D? [ ] YES [X] NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings? [ ] YES [ ] NO

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible? [X] YES [ ] NO
2. Are noise mitigation measures reasonable? [ ] YES [X] NO
3. Is insulation of buildings both feasible and reasonable? [ ] YES [ ] NO NA
4. Shall noise abatement measures be provided? [ ] YES [X] NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because it did not meet the minimum noise reduction design goal of at least 7 dBA for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #5 - South of the new frontage road just east of the Hidden Valley/Central City interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm? [X] YES [ ] NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm? [ ] YES [X] NO
3. Can a noise barrier or berm less than 20 feet tall be constructed? [X] YES [ ] NO

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor? [X] YES [ ] NO
2. Is the Cost Benefit Index below \$6800 per receptor per dBA? [ ] YES [X] NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure? [ ] YES [ ] NO NA

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable? [X] YES [ ] NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D? [ ] YES [X] NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings? [ ] YES [ ] NO

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible? [X] YES [ ] NO
2. Are noise mitigation measures reasonable? [ ] YES [X] NO
3. Is insulation of buildings both feasible and reasonable? [ ] YES [ ] NO NA
4. Shall noise abatement measures be provided? [ ] YES [X] NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because the cost of the abatement measure exceeded the CDOT cost-benefit index - the cost benefit index must calculate to a dollar value no more than \$6,800 per receptor per decibel of reduction.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #6 - North of I-70 near US 6 Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered infeasible because it did not provide at least 5 dBA of noise reduction for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #7 - North of I-70 near US 6 Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered infeasible because it did not provide at least 5 dBA of noise reduction for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative Barrier #8 - southwest of the Hyland Hills/Floyd Hill Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm? [X] YES [ ] NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm? [ ] YES [X] NO
3. Can a noise barrier or berm less than 20 feet tall be constructed? [X] YES [ ] NO

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor? [ ] YES [X] NO
2. Is the Cost Benefit Index below \$6800 per receptor per dBA? [ ] YES [X] NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure? [ ] YES [ ] NO NA

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable? [X] YES [ ] NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D? [ ] YES [X] NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings? [ ] YES [ ] NO

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible? [X] YES [ ] NO
2. Are noise mitigation measures reasonable? [ ] YES [X] NO
3. Is insulation of buildings both feasible and reasonable? [ ] YES [ ] NO NA
4. Shall noise abatement measures be provided? [ ] YES [X] NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because it did not meet the minimum noise reduction design goal of at least 7 dBA for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020





COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #9 - North of I-70 just east of the Hyland Hills/Floyd Hill Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered infeasible because it did not provide at least 5 dBA of noise reduction for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #10 - South of I-70 just west of the Beaver Brook/Floyd Hill Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm? [X] YES [ ] NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm? [ ] YES [X] NO
3. Can a noise barrier or berm less than 20 feet tall be constructed? [X] YES [ ] NO

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor? [ ] YES [X] NO
2. Is the Cost Benefit Index below \$6800 per receptor per dBA? [ ] YES [X] NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure? [ ] YES [ ] NO NA

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable? [X] YES [ ] NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D? [ ] YES [X] NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings? [ ] YES [ ] NO

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible? [X] YES [ ] NO
2. Are noise mitigation measures reasonable? [ ] YES [X] NO
3. Is insulation of buildings both feasible and reasonable? [ ] YES [ ] NO NA
4. Shall noise abatement measures be provided? [ ] YES [X] NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because it did not meet the minimum noise reduction design goal of at least 7 dBA for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Tunnel Alternative
Barrier #11 - North of I-70 just east of the Beaver Brook/Floyd Hill Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered infeasible because it did not provide at least 5 dBA of noise reduction for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative
Barrier #1 - South of I-70 in East Idaho Springs

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because the cost of the abatement measure exceeded the CDOT cost-benefit index - the cost benefit index must calculate to a dollar value no more than \$6,800 per receptor per decibel of reduction.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative
Barrier #2 - North of I-70 in East Idaho Springs

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm? [X] YES [ ] NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm? [ ] YES [X] NO
3. Can a noise barrier or berm less than 20 feet tall be constructed? [X] YES [ ] NO

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor? [X] YES [ ] NO
2. Is the Cost Benefit Index below \$6800 per receptor per dBA? [X] YES [ ] NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure? [ ] YES [ ] NO NA

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable? [X] YES [ ] NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D? [ ] YES [X] NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings? [ ] YES [ ] NO

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible? [X] YES [ ] NO
2. Are noise mitigation measures reasonable? [X] YES [ ] NO
3. Is insulation of buildings both feasible and reasonable? [ ] YES [ ] NO NA
4. Shall noise abatement measures be provided? [X] YES [ ] NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible and reasonable because the cost of the abatement measure was below the CDOT cost-benefit index - the cost benefit index must calculate to a dollar value no more than \$6,800 per receptor per decibel of reduction.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative
Barrier #3 - South of I-70 just west of VMT

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because the cost of the abatement measure exceeded the CDOT cost-benefit index - the cost benefit index must calculate to a dollar value no more than \$6,800 per receptor per decibel of reduction.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative Barrier #4 - South of I-70 near the Hidden Valley/Central City Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm? [X] YES [ ] NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm? [ ] YES [X] NO
3. Can a noise barrier or berm less than 20 feet tall be constructed? [X] YES [ ] NO

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor? [ ] YES [X] NO
2. Is the Cost Benefit Index below \$6800 per receptor per dBA? [ ] YES [X] NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure? [ ] YES [ ] NO NA

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable? [X] YES [ ] NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D? [ ] YES [X] NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings? [ ] YES [ ] NO

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible? [X] YES [ ] NO
2. Are noise mitigation measures reasonable? [ ] YES [X] NO
3. Is insulation of buildings both feasible and reasonable? [ ] YES [ ] NO NA
4. Shall noise abatement measures be provided? [ ] YES [X] NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because it did not meet the minimum noise reduction design goal of at least 7 dBA for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative
Barrier #5 - South of the new frontage road just east of the Hidden Valley/Central City interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm? [X] YES [ ] NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm? [ ] YES [X] NO
3. Can a noise barrier or berm less than 20 feet tall be constructed? [X] YES [ ] NO

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor? [ ] YES [X] NO
2. Is the Cost Benefit Index below \$6800 per receptor per dBA? [ ] YES [X] NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure? [ ] YES [ ] NO NA

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable? [X] YES [ ] NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D? [ ] YES [X] NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings? [ ] YES [ ] NO

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible? [X] YES [ ] NO
2. Are noise mitigation measures reasonable? [ ] YES [X] NO
3. Is insulation of buildings both feasible and reasonable? [ ] YES [ ] NO NA
4. Shall noise abatement measures be provided? [ ] YES [X] NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because it did not meet the minimum noise reduction design goal of at least 7 dBA for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020





COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative
Barrier #6 - North of I-70 near US 6 Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered infeasible because it did not provide at least 5 dBA of noise reduction for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative
Barrier #7 - southwest of the Hyland Hills/Floyd Hill interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because the cost of the abatement measure exceeded the CDOT cost-benefit index - the cost benefit index must calculate to a dollar value no more than \$6,800 per receptor per decibel of reduction.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative
Barrier #8 - North of I-70 just east of the Hyland Hills/Floyd Hill Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because the cost of the abatement measure exceeded the CDOT cost-benefit index - the cost benefit index must calculate to a dollar value no more than \$6,800 per receptor per decibel of reduction.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative
Barrier #9 - South of I-70 just west of the Beaver Brook/Floyd Hill Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm? [X] YES [ ] NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm? [ ] YES [X] NO
3. Can a noise barrier or berm less than 20 feet tall be constructed? [X] YES [ ] NO

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor? [ ] YES [X] NO
2. Is the Cost Benefit Index below \$6800 per receptor per dBA? [ ] YES [X] NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure? [ ] YES [ ] NO NA

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable? [X] YES [ ] NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D? [ ] YES [X] NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings? [ ] YES [ ] NO

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible? [X] YES [ ] NO
2. Are noise mitigation measures reasonable? [ ] YES [X] NO
3. Is insulation of buildings both feasible and reasonable? [ ] YES [ ] NO NA
4. Shall noise abatement measures be provided? [ ] YES [X] NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered feasible but not reasonable because it did not meet the minimum noise reduction design goal of at least 7 dBA for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020



COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET
Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # \_\_\_\_\_ Date of Analysis: August 28, 2020

Project Name & Location: I-70 Floyd Hill to Veterans Memorial Tunnels; Canyon Viaduct Alternative
Barrier #10 - North of I-70 just east of the Beaver Brook/Floyd Hill Interchange

A. FEASIBILITY:

- 1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
3. Can a noise barrier or berm less than 20 feet tall be constructed?

B. REASONABLENESS:

- 1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
2. Is the Cost Benefit Index below \$6800 per receptor per dBA?
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?

C. INSULATION CONSIDERATION:

- 1. Are normal noise abatement measures physically infeasible or economically unreasonable?
2. a. Does this project have noise impacts to NAC Activity Category D?
b. If yes, is it reasonable and feasible to provide insulation for these buildings?

D. ADDITIONAL CONSIDERATIONS:

The Noise Study Zone doesn't have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project.

E. STATEMENT OF LIKELIHOOD:

- 1. Are noise mitigation measures feasible?
2. Are noise mitigation measures reasonable?
3. Is insulation of buildings both feasible and reasonable?
4. Shall noise abatement measures be provided?

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

The abatement measure at this location was considered infeasible because it did not provide at least 5 dBA of noise reduction for at least one receptor.

Completed by: Carol Zhou Date: 08/28/2020