

# **APPENDIX A21**

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## **TRAFFIC NOISE TECHNICAL MEMORANDUM**

**FOR THE**

### **State Highway 9 Iron Springs Alignment Environmental Assessment**

**Prepared for**

**COLORADO DEPARTMENT OF TRANSPORTATION**

**FEDERAL HIGHWAY ADMINISTRATION**

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## ACRONYMS

AADT	Average Annual Daily Traffic
CDOT	Colorado Department of Transportation
dBA	Noise Level - Decibel "A" Weighted
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
NAC	Noise Abatement Criteria
ROD	Record of Decision
SH 9	State Highway 9
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
VPH	Vehicles Per Hour

1   **INTRODUCTION**

2   State Highway (SH) 9 reconstruction, including recommended noise abatement between the  
3   Town of Breckenridge and the southern project limit, has been completed. The last phase of  
4   SH 9 construction will include the final roadway configuration and recommended noise  
5   abatement measures at Frisco Bay and Waterdance condominiums north of the reevaluation  
6   project limit. This noise memorandum looks at SH 9 on the new alignment and is, by definition, a  
7   Type I noise project requiring traffic noise analysis.

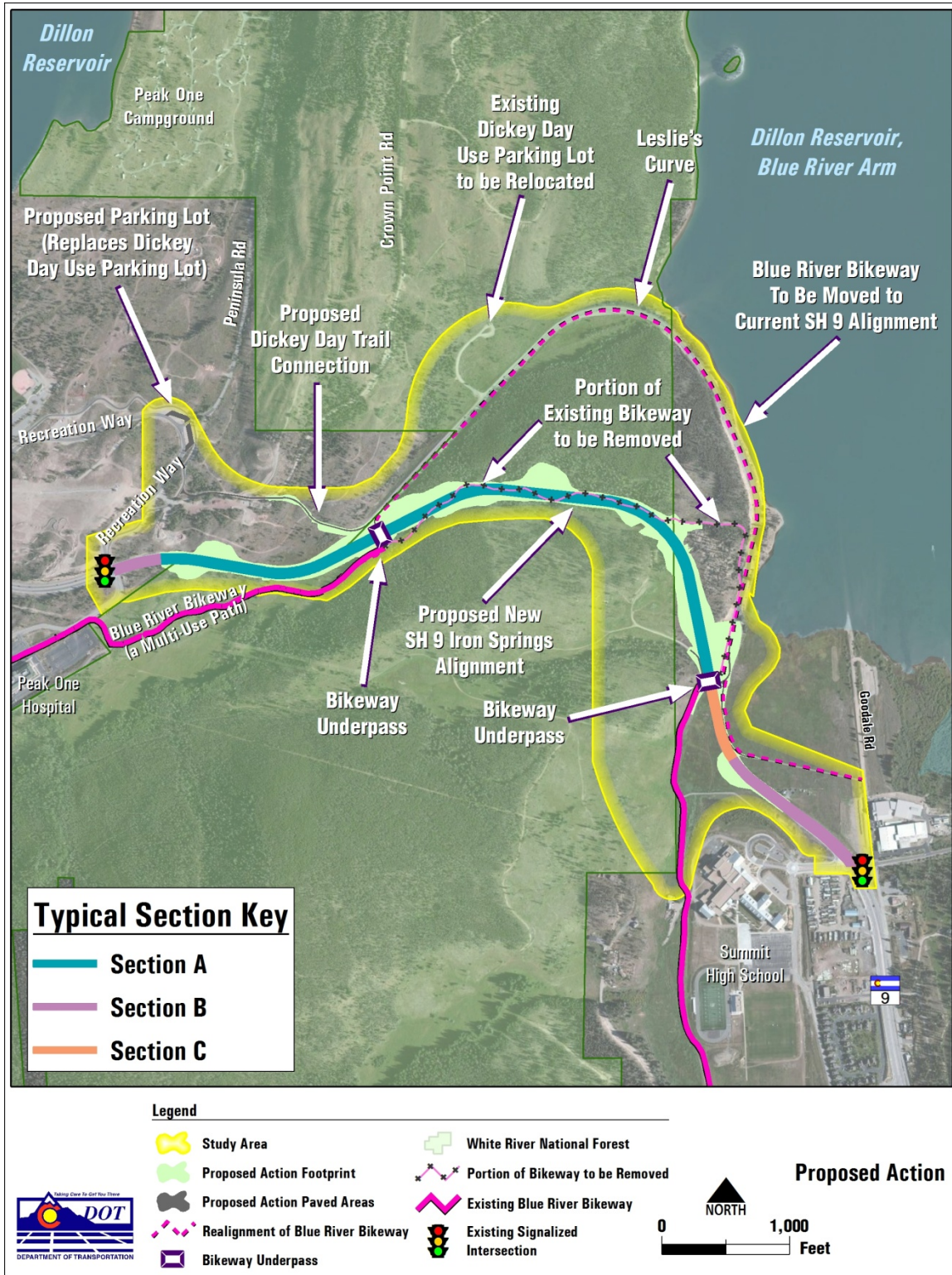
8   **PROPOSED ACTION**

9   As part of implementation of the SH 9 improvements between Frisco and Breckenridge, the  
10   Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA)  
11   are proposing to realign approximately 1.3 miles of existing SH 9 just south of the Town of  
12   Frisco, Colorado (see **Figure 1**). This stretch of SH 9, which falls between mileposts 93 and 95,  
13   would be realigned to provide a four-lane reduced section roadway away from Dillon Reservoir.  
14   This Proposed Action, also referred to as the Iron Springs Alignment, would shorten SH 9 by  
15   approximately 0.4 mile. The Proposed Action would provide roadway safety benefits, as well as  
16   water quality and drinking water protection benefits, as a result of straightening the highway to  
17   remove a tight, compound curve (known, as Leslie’s Curve), which is in close proximity to Dillon  
18   Reservoir. The existing condition on Leslie’s Curve is considered substandard and contributes to  
19   accidents in the area.

20   The Proposed Action would include realignment of a portion of the existing Frisco-Farmer’s  
21   Korner-Blue River Bikeway (also referred to herein for brevity as the Blue River Bikeway or  
22   bikeway). This portion of the bikeway would be moved to the alignment currently occupied by  
23   SH 9, would be approximately 0.4 mile longer than the existing bikeway, and would be at a  
24   gentler grade than the current alignment. In addition, the Dickey Day Use Parking Lot would be  
25   moved west to a new parking lot to be constructed as part of the project, with access provided  
26   via Recreation Way using the existing signalized intersection at SH 9 and Recreation Way. A new  
27   trail connection would be provided to link the proposed parking lot with the realigned bikeway  
28   and existing trail, which currently begins at the old Dickey Day Use Parking Lot.

29   Additional detail regarding the Proposed Action, including typical sections, is provided in the EA  
30   main text and the project drawings provided in Appendix A1 of the EA.

1 **Figure 1 Proposed Action**



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1 NO ACTION ALTERNATIVE

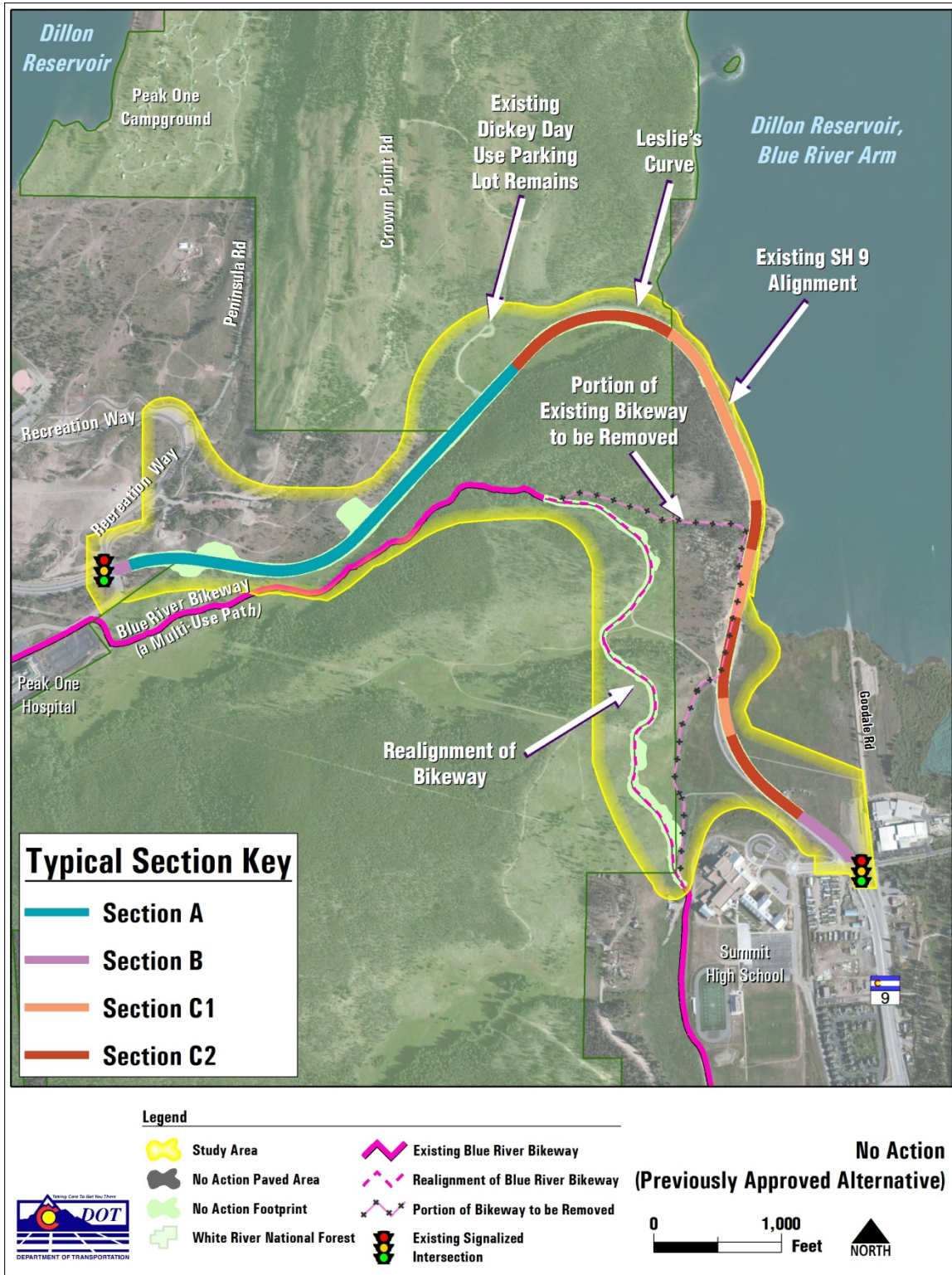
2 If the Proposed Action is not selected for implementation, SH 9 would be widened to provide a  
3 four-lane reduced section roadway along the existing alignment as previously approved in the  
4 SH 9 Frisco to Breckenridge Environmental Impact Statement (EIS) and Record of Decision (ROD)  
5 (CDOT and FHWA, 2004a; 2004b) (**Figure 2**). The 2004 Preferred Alternative is considered the  
6 “No Action Alternative” for this EA and is used as a baseline for comparison with the Proposed  
7 Action. These improvements would be implemented if the Proposed Action is not selected.

8 Widening along the existing alignment would require large rock cuts and retaining walls  
9 (problematic to design and construct), and the highway would remain in close proximity to  
10 Dillon Reservoir. The length of SH 9 would remain the same as that of the existing highway. The  
11 tight Leslie’s Curve would not be eliminated; however, safety features such as a barrier between  
12 opposing lanes would be installed to improve safety.

13 With this alternative, approximately 0.8 mile of the existing Blue River Bikeway would be  
14 realigned to allow space for the highway widening. The length of bikeway would not change  
15 appreciably and the current relatively steep grades on the path would remain.

16 Additional detail regarding the No Action Alternative, including typical sections, is provided in  
17 the EA main text and the project drawings provided in Appendix A1 of the EA.

1 Figure 2 No Action Alternative (Previously Approved)



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1 **NOISE EVALUATION**

2 *Changed Conditions*

3 The No Action Alternative evaluated a design year of 2020 using older STAMINA2.0 modeling  
 4 software. This evaluation used noise regulations 23 Code of Federal Regulations 772 revised in  
 5 2010, updated *CDOT Noise Analysis and Abatement Guidelines* (2013), FHWA approved TNM 2.5  
 6 modeling software, existing condition (2013) traffic, and design year 2035 traffic.

7 Because this evaluation will result in a new National Environmental Policy Act decision  
 8 document, all existing and permitted receptors along the reevaluation corridor will be  
 9 incorporated into this evaluation under federally compliant guidance of the CDOT Noise Analysis  
 10 and Abatement Guidelines (2013).

11 **Noise Model Validation**

12 TNM Version 2.5 noise modeling software was used to predict hourly-averaged equivalent ( $L_{eq}$ )  
 13 traffic noise levels. A calibrated, integrating-type sound level meter meeting American National  
 14 Standards Institute Type II specifications was deployed for 2012 field measurements. The noise  
 15 monitoring results were used to validate the TNM model by comparing the predicted (modeled)  
 16 and measured noise levels at monitoring locations using the traffic count data obtained during  
 17 the measurement periods. The model is considered valid when the difference between noise  
 18 readings and modeled noise levels are within 3 A-weighted decibels (dBA) as shown in **Table 1**.

19 **Table 1 Validation Model Results**

Validation Reading Site	Noise Level (dBA)		
	Measured	Modeled	Tolerance
Summit County Medical Center M1 Located 75 feet from EOP along Medical Center Road	67.4	67.0	0.4
School Road M2 Located 80 feet from SH 9	64.3	63.4	1.0

20 *Traffic Data*

21 Traffic volumes and composition for the predictive 2011 and 2035 analyses were taken from  
 22 CDOT Statewide Traffic Data Tables. **Table 2** summarizes the traffic data used in the evaluation.

23 **Table 2 Traffic Data used in Analyses**

Roadway Milepost	2011 AADT	Directional 2011 (VPH)			2035 AADT	Directional 2035 (VPH)			Speed (MPH)
		Auto	MT	HT		Auto	MT	HT	
90-92.8	21,000	1013	21	16	36,372	1755	36	28	45
92.8-95.9	18,000	953	25	13	31,392	1661	43	22	45
95.9-96.0	22,000	1172	24	14	38,368	2043	42	25	45

Source: CDOT, 2013a

Note: AADT=Average Annual Daily Traffic. VPH=Vehicles per Hour. MT=Medium Trucks-2 axle.  
 HT=Heavy Duty Trucks with more than 2 axles. MPH=Miles per Hour.

24 *Noise Receptors*

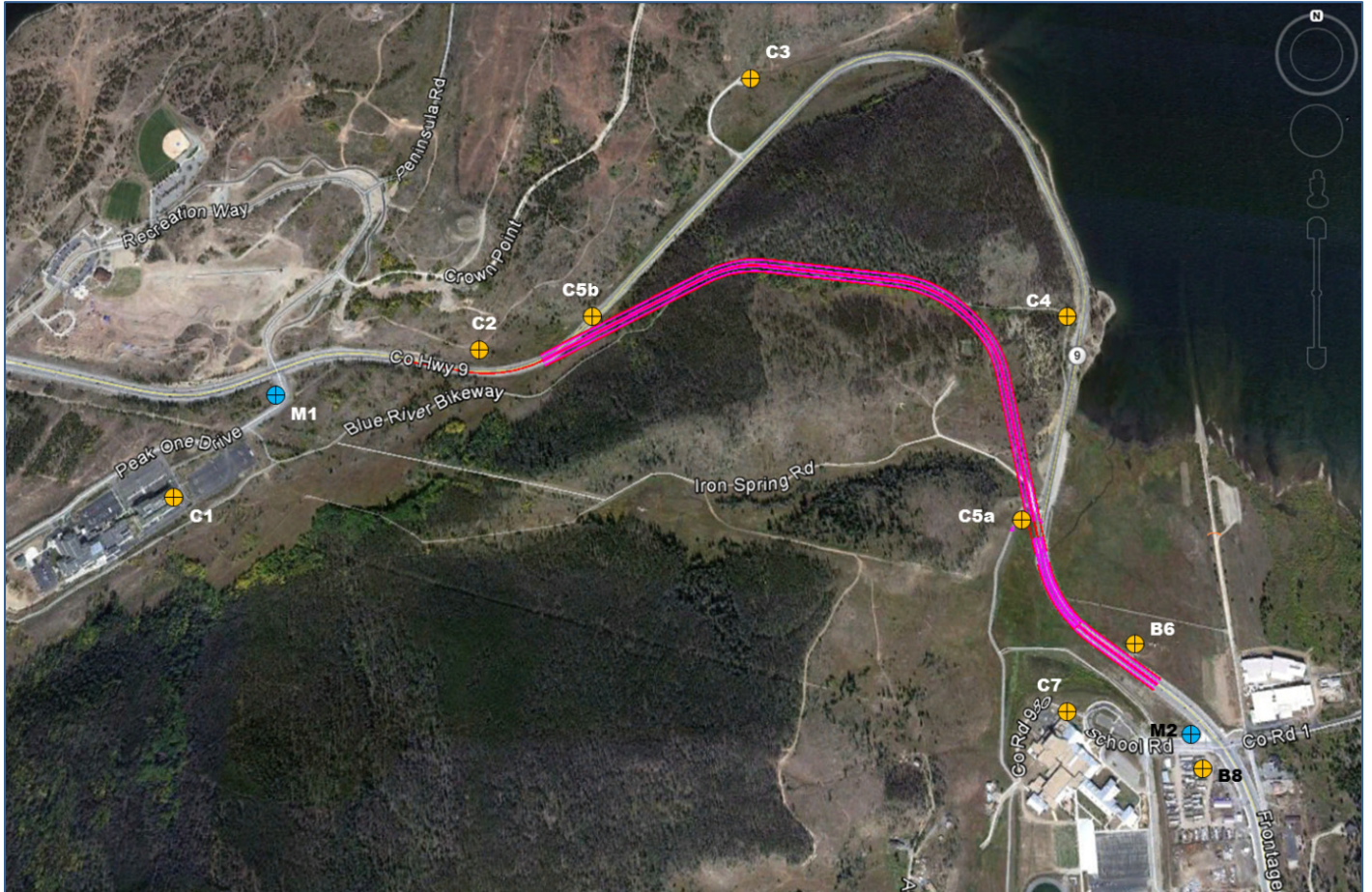
25 The St. Anthony’s Summit County-Peak One medical complex (C1), a private residence referred  
 26 to locally as Antler House (B6), Summit County High School (C7), and a mobile home park (B8)  
 27 were identified as noise sensitive receptors within the project area. Recreational noise sensitive  
 28 receptors were also identified for the nearest point along an vehicle track/informal trail at the



## Traffic Noise for the State Highway 9 Iron Springs Alignment EA

1 Frisco Adventure Park (C2), trailhead at Dickey Day Use Parking Lot (C3), at two localities along  
2 the existing Blue River Bikeway (C4, C5a), and at trail crossings for the proposed Iron Springs  
3 alignment (C5b, C5c). These receptors are noted on the aerial photograph (**Figure 3**). Please  
4 note Points M1 and M2 are locations for field measurements, and C5c is located in the same  
5 area as C5a.

6 **Figure 3 Noise Receptor Locations and Identification Numbers**



7 *Noise Impacts*

8 **Existing Condition**

9 Noise levels today range from 51.9 to 70.2 dBA at the identified noise sensitive receptors. Many  
10 changes have occurred to the USDA-USFS Peninsula Recreation Area landscape since the Final  
11 EIS was completed. Timber salvage as a result of mountain pine beetle kill has changed the focus  
12 of the Frisco Nordic Center (now the Frisco Adventure Park) and Peninsula Recreational Area to  
13 a more built outdoor recreational environment, while a portion of National Forest land was  
14 converted to house the new St. Anthony's Summit County Medical Center and Peak One medical  
15 complex. **Table 3** includes current 2012 noise levels for Noise Abatement Criteria (NAC)  
16 residential (B) and special activity use (C) receptors. The Antler House B6, mobile home park B8,  
17 and segments of the Blue River Bikeway adjacent to SH 9 at C4 and C5a are impacted under  
18 current conditions.

**Traffic Noise for the State Highway 9 Iron Springs Alignment EA**

**1 Table 3 Noise Analysis Results**

Receptor	NAC (dBA)	Map ID No.	Average One-Hour Noise Levels (dBA)					
			Existing Condition 2012	No Action Alternative 2020	No Action Alternative 2035	Proposed Action 2035	Difference between 2012 to 2035 Iron Springs	Proposed Action Impact? <sup>1</sup>
West side of St. Anthony's Summit County & Peak One Medical Complex	66	C1	51.9	NA	54.6	54.6	2.7	No
Frisco Adventure Park	66	C2	65.0	NA	<b>66.2</b>	<b>65.8</b>	0.8	Yes
Blue River Bikeway crossing at MP 94.6	66	C5b	NA	NA	NA	64.0	NA	No
Dickey Day Use Trailhead	66	C3	57.2	NA	60.2	42.4	-14.8	No
Blue River Bikeway near Lake Dillon	66	C4	67.6	NA	NA	38.7	-28.9	No
Blue River Bikeway crossing at MP 93.2	66	C5a	70.2	NA	NA	64.0	-6.2	No
Antler House (Originally identified as B94)	66	B6	<b>69.7</b>	<b>71.6</b>	<b>73.4</b>	<b>66.5</b>	-3.2	Yes
Summit High School	66	C7	54.4	NA	57.5	56.1	1.7	No
North side of Mobile Home Park (Originally identified as B92b)	66	B8	<b>67.3</b>	65.6	<b>69.8</b>	<b>69.7</b>	2.4	Yes

<sup>1</sup> Noise impact is defined as a noise level (rounded to the nearest whole dBA) equal to or exceeding the NAC. Noise levels equal to or exceeding the NAC are shown in **bold** in this table.

NAC=Noise Abatement Criteria. dBA=decibel "A" weighted.

NA = Not appropriate, as this feature either did not exist at the time of the SH 9 EIS or was not evaluated in the SH 9 EIS (CDOT and FHWA, 2004a).

1 *No Action Alternative*

2 The existing alignment of SH 9 would be expanded to four-lanes under the No Action  
3 Alternative. Noise sensitive activity areas along the corridor are residential and recreational.  
4 Noise sensitive receptors were identified within the reevaluation area as shown in **Figure 3** and  
5 summarized in **Table 3**.

6 Future 2035 noise levels ranged from 54.6 to 73.4 dBA. In the Peninsula area, the Blue River  
7 Bikeway would be relocated over Iron Spring Hill culminating at a juncture with the existing trail  
8 adjacent to the high school and would experience noise levels between 56 to 58 dBA. Impacts  
9 would be experienced at Antler House B6 and the mobile home park B8, which consists of two  
10 separate dwelling units. Because the noise levels at these receptors would be above the NAC B  
11 threshold of 66 dBA, mitigation must be considered (see the **Mitigation** section for more detail).

12 Please note that the Antler House has been identified as a full property acquisition for the No  
13 Action Alternative, due to access constraints. This would remove this residence and the  
14 associated noise impacts. The need for full acquisition will be reviewed and confirmed in final  
15 design. The house has been included in this impact evaluation in case final design details do not  
16 confirm the need for full acquisition.

17 *Proposed Action*

18 The new alignment would cross undeveloped National Forest land that has not been managed  
19 for developed recreation. Future 2035 noise levels ranged from 38.7 to 69.7 dBA. The Blue River  
20 Bikeway would be relocated to the old SH 9 alignment between mileposts 93.1 and 94.6 and  
21 cross the new alignment through underpasses at the west and east termini of the new  
22 alignment. Noise impacts were assessed at points 50 feet away from these new highway  
23 crossings at receptors C5a (east) and C5b (west). Noise levels were below the NAC C threshold of  
24 66 dBA. Notable benefit to the Dickey Day Use Parking Lot and bikeway recreational facilities is  
25 derived from the new alignment. Noise levels for trailheads and bikeway locations previously  
26 adjacent to the old SH 9 alignment would be reduced under the Proposed Action between -6.2  
27 and -28.9 dBA.

28 Impact would remain at Antler House B6 and the mobile home park B8. Mitigation options for  
29 the Proposed Action would not be feasible or reasonable, similar to those discussed under the  
30 No Action Alternative.

31 Please note that the Antler House has been identified as a full property acquisition for the  
32 Proposed Action due to access constraints. This would remove this residence and the associated  
33 noise impacts. The need for full acquisition will be reviewed and confirmed in final design. The  
34 house has been included in this impact evaluation in case final design details do not confirm the  
35 need for full acquisition.

1 MITIGATION

2 As discussed in the previous section, predicted design-year noise levels equal or exceed CDOT's  
3 NAC at six Category B and one Category C locations. Per CDOT policy, the feasibility and  
4 reasonableness of constructing noise mitigation measures for these impacted receptors was  
5 analyzed.

6 Feasibility of abatement reviews the physical consideration and concerns with the construction  
7 of an acoustically effective noise barrier at a particular site. These criteria include:

- 8 • Does the proposed mitigation measure provide at least 5 dBA of noise reduction to a  
9 front row receptor?
- 10 • Are there any "fatal flaw" safety or maintenance issues involved with the proposed  
11 mitigation measure?
- 12 • Are there any obvious constructability issues with the proposed mitigation measure?

13 Reasonableness of abatement evaluates the combination of environmental, economic, and  
14 social factors associated with noise abatement measures. Reasonableness criteria include:

- 15 • Does the proposed mitigation measure provide a minimum of 7 dBA for one benefitted  
16 receptor?
- 17 • Is the proposed mitigation cost-reasonable? Is the cost benefit index (cost per receptor  
18 per decibel of reduction) no more than \$6,800?
- 19 • What are the desires of benefitted residents and owners?

20 *C2 Frisco Adventure Park Trail*

21 This informal trail is a dirt wheel track that runs parallel to the existing SH 9 within the park  
22 boundary. At this time the trail is a vehicle track and has no designated recreational use.  
23 However, if a future recreational trail at or near this location is developed, noise impacts will be  
24 reevaluated and mitigation considered. The proposed Dickey trail connection (see **Figure 1**)  
25 would be farther from the proposed SH 9 alignment than receptor location C2 and, therefore,  
26 would have a lower noise level that would not exceed the NAC.

27 *B6 Antler House*

28 As described previously, the Antler House has been identified as a full property acquisition for  
29 both the No Action Alternative and the Proposed Action. If the full acquisition is confirmed  
30 through final design, the residence and associated noise impacts will be removed. However,  
31 mitigation has been considered in this evaluation in case final design details do not confirm the  
32 need for full acquisition.

33 Noise walls were the only mitigation remedy considered at Antler House due to the close  
34 proximity of the roadway to the home (**Figure 4**). The noise barrier was situated along the  
35 outside shoulder of the roadway and would shift the driveway access south to accommodate  
36 the proposed noise barrier. A feasible noise barrier, 6 feet tall and 217 feet long, provided the  
37 required 7.0 dBA design goal reduction. However, the cost benefit ratio for the optimized  
38 dimensions was \$8,382 per receptor per decibel reduced, exceeding the \$6,800 reasonableness  
39 threshold (**Table 4**). Therefore, noise abatement at this location does not meet the reasonable  
40 and feasible criteria for providing noise abatement under FHWA compliant CDOT Noise Analysis  
41 and Abatement Guidelines (2013) and no noise abatement is recommended.

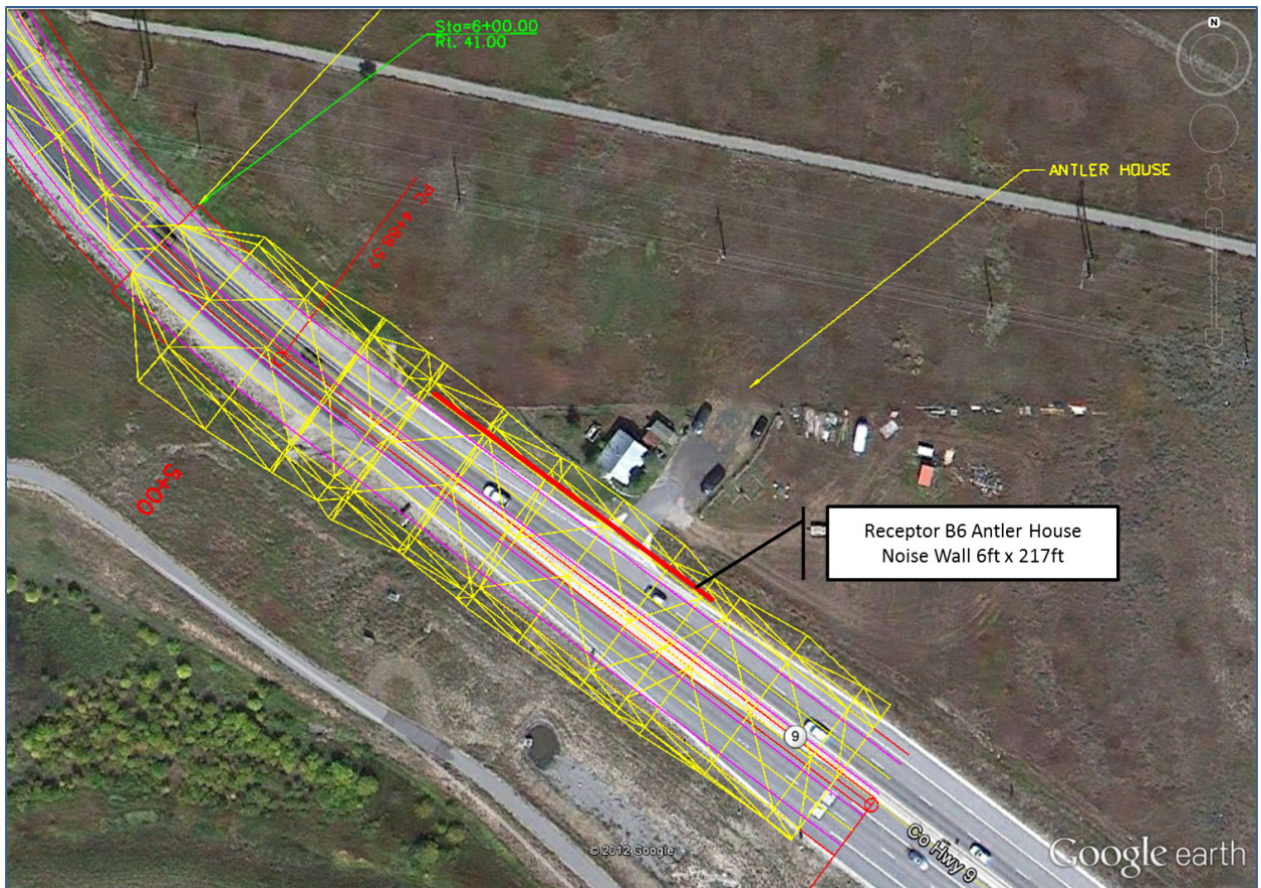
1 **Table 4 Cost Benefit Index Calculations for Noise Abatement Measure at**  
 2 **Receptor B6**

Wall Height In Feet	Wall Length In Feet	Unit Cost per SF	Wall Cost	Reduction In dBA	Cost Benefit Index
10	357	\$45	\$160,852	9.5	\$16,932
10	281	\$45	\$126,393	9.3	\$13,591
6	281	\$45	\$ 75,836	7.5	\$ 10,111
6	217	\$45	\$ 58,672	7.0	\$ 8,382

Note: SF=Square Feet

3

4 **Figure 4 Location of B6 Antler House Noise Wall**



5 **B8 Mobile Home Park**

6 Due to accessibility constraints within the mobile home park and at School Road, only a noise  
 7 wall was considered for noise abatement at this site (see **Figure 5**). The noise barrier would be  
 8 situated along the internal access road within the mobile home park property, not at the  
 9 roadway edge due to intervening property activity. A feasible wall under CDOT guidelines  
 10 cannot be more than 20 feet in height. A wall 20 feet tall and 180 feet long would not provide  
 11 the five front row trailers within the mobile home park feasible noise reduction. Therefore, a  
 12 wall at this locality is not feasible and reasonable under FHWA compliant CDOT Noise Analysis  
 13 and Abatement Guidelines (CDOT, 2013b) and no wall is recommended.

1 **Figure 5 Location of B8 Mobile Home Park Noise Wall**



2

### 3 CONCLUSIONS

4 The realignment of SH 9 will reduce noise levels and provide benefit to several recreational  
5 facilities. Although two residential receptors B6 and B8 are impacted by noise associated with  
6 the Proposed Action and No Action Alternative alignments, noise abatement measures were  
7 evaluated and determined to not be feasible and reasonable. Therefore, no noise mitigation is  
8 recommended.

### 9 REFERENCES

10 Colorado Department of Transportation (CDOT). 2013a. CDOT Online Transportation  
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12 <http://dtdapps.coloradodot.info/Otis/TrafficData>

13 Colorado Department of Transportation (CDOT). 2013b. CDOT Noise Analysis and Abatement  
14 Guidelines. Accessed April 2013.  
15 [http://www.coloradodot.info/programs/environmental/noise/guidelines-](http://www.coloradodot.info/programs/environmental/noise/guidelines-policies/110616_Final_Colorado_DOT_Noise_Guidance.pdf/view)  
16 [policies/110616\\_Final\\_Colorado\\_DOT\\_Noise\\_Guidance.pdf/view](http://www.coloradodot.info/programs/environmental/noise/guidelines-policies/110616_Final_Colorado_DOT_Noise_Guidance.pdf/view)

17 Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA).  
18 2004a. *State Highway 9 Frisco to Breckenridge Final Environmental Impact Statement and 4(f)*  
19 *Evaluation*. February. [Note: This document is an abbreviated Final EIS which incorporates the  
20 Draft EIS, constituting the complete Final EIS.]

21 Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA).  
22 2004b. *State Highway 9 Frisco to Breckenridge Record of Decision*. May.