



## Project Purpose and Need

### Purpose

The purpose of the project is to improve safety and operations on Eastbound and Westbound I-70 on West Vail Pass.

### Need

This project is needed to address safety concerns and operational issues due to geometric conditions (steep grades and tight curves) and slow-moving vehicle and passenger vehicle interactions that result in inconsistent and slow travel times along the corridor. The I-70 Mountain Corridor Programmatic Environmental Impact Statement (PEIS) identified safety and mobility issues on West Vail Pass related to speed differentials due to slow-moving vehicles. (*Mobility is defined as the ability to travel along the I-70 Mountain Corridor safely and efficiently in a reasonable amount of time.*)

- **Safety Concerns:** A high number of crashes occur along the corridor related to speed, tight curves, narrow roadway area, and inclement weather/poor road conditions. Speed differentials between passenger vehicles and slow-moving vehicles causes erratic lane changes and braking maneuvers resulting in crashes and spin outs. Emergency response is hampered by vehicular speeds and lack of roadway width to provide room for emergency vehicles to pass.
- **Operational Issues:** The steep grades and resulting speed differentials causes slow and unreliable travel times through the corridor. Tight curves also cause drivers to slow down. The corridor is frequently closed by vehicle incidents, due to lack of width to maintain a single lane of traffic adjacent to emergency responders, resulting in substantial traffic backups and delays. During winter months, the travel lanes and shoulders are severely impacted by snow accumulation, impacting the overall capacity of the corridor. (*Operations is intended to describe the flow of traffic at desirable speeds given the geometric and prevailing weather conditions.*)

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*The Purpose and Need is specific to the transportation aspects of a project funded by the Federal Highway Administration. The Purpose is the statement of what the project expects to accomplish, but not the solution (e.g. to relieve congestion, but NOT to add a lane). The Need establishes that there is a problem; it is factual, based on data, and supports the Purpose statement. Elements that are important to a project but not appropriate for the Purpose and Need can be included as project goals and used to evaluate alternatives.*

## Auxiliary Lanes with Full Shoulders, Curve Modifications, and ITS Improvements

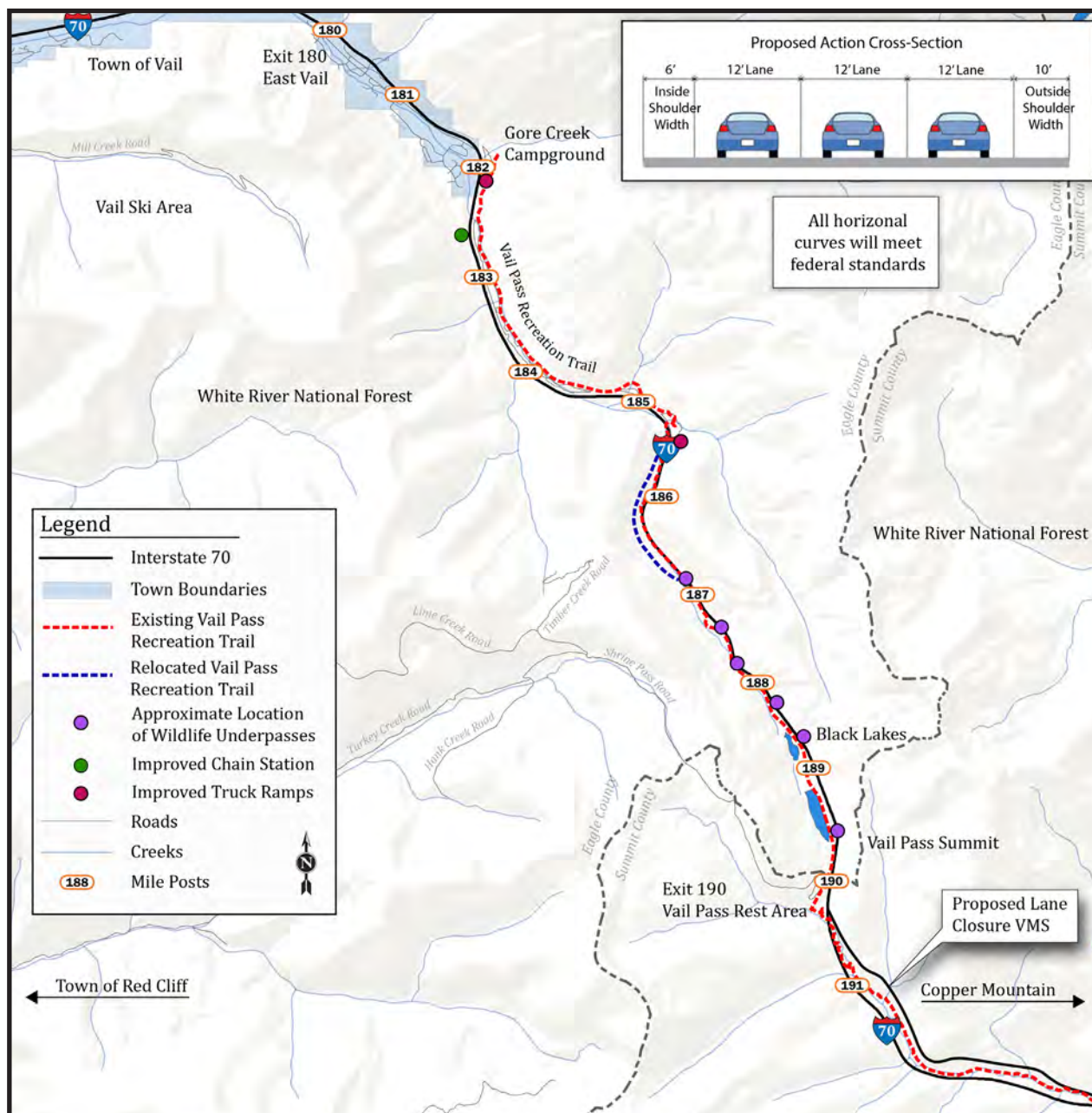
The Proposed Action includes:

- Addition of a 12-foot auxiliary lane, both Eastbound and Westbound, from Mile Post (MP) 180 to MP 190.
- Maintaining existing lane width at 12 feet.
- Widening inside shoulders to a minimum of 6 feet and maintaining outside shoulders at 10 feet.
- Modification of all existing curves as needed to meet current federal design standards.
- Installation of Intelligent Transportation System (ITS) equipment including variable speed limits signs and variable message signs (VMS).

### Additional Elements of the Proposed Action Include:

- Relocation of the impacted portion of the Vail Pass Recreation Trail from approximately MP 185 to MP 187.
- Existing emergency truck ramps will be upgraded to current design standards.
- Six wildlife underpasses and wildlife fencing will be constructed throughout the corridor.
- Additional capacity will be added to the existing commercial truck parking area at the top of Vail Pass.
- Widened shoulders (minimum of eight feet of additional width beyond the 10 foot shoulder) at multiple locations to accommodate emergency pull-offs, emergency truck parking, and staging for tow trucks.
- Improved median emergency turnaround locations to accommodate emergency and maintenance turnaround maneuvers.
- Improved chain station located at approximately MP 182.5 with additional parking, signage, lighting, and separation from the I-70 mainline.
- Avalanche protection located at approximately MP 186.

## Proposed Action







**Proposed Action**  
MP 180.9 to MP 181.9







**Proposed Action**  
MP 179.9 to MP 181.1

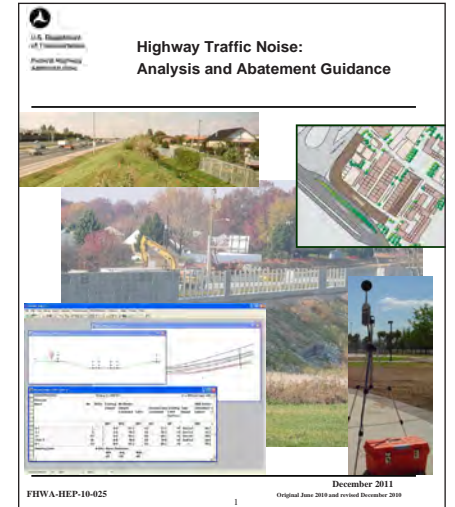
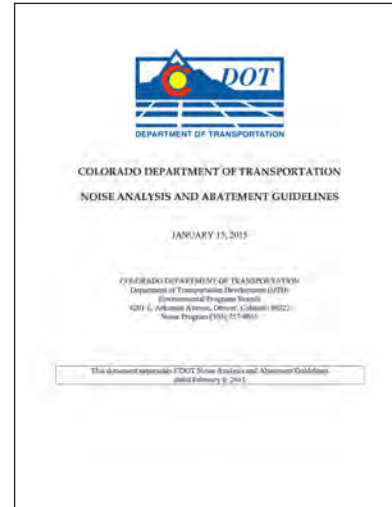




**Noise Analysis Process – Federal and State Requirements**

Analysis conducted per the Code of Federal Regulations (23 CFR Part 772) - Procedures for Abatement of Highway Traffic Noise and Construction Noise

- CDOT’s 2015 Noise Analysis and Abatement Guidance
- FHWA’s 2011 Highway Traffic Noise: Analysis and Abatement Guidance



**Steps in Process**

- 1 Conduct field measurements of existing noise
- 2 Validate noise model with measurements
- 3 Model existing conditions for current I-70 alignment
- 4 Model future Proposed Action (auxiliary lanes) and future No Action
- 5 Complete noise mitigation evaluation

**Why is the West Vail Pass Auxiliary Lanes Project Conducting Noise Analysis?**

- A noise analysis is required on this proposed CDOT project because auxiliary lanes are proposed, which qualifies it as a Type I Project per the Code of Federal Regulations, which is defined as:
  - A new highway built on a new location, interchange modifications, or an existing highway that is significantly altered by substantially changing the horizontal or vertical characteristics of the road, or the number of through traffic lanes being increased or auxiliary lanes added.

**Typical Noise Levels**

Common Outdoor Activities	Noise Level in dBA*	Common Indoor Activities
	--110--	Rock Concert
Jet Fly-over at 1000 ft	--100--	
Gas Lawn Mower at 3 ft	--90--	Food Blender at 3 ft
Diesel Truck at 50 ft, at 50 mph	--80--	Garbage Disposal at 3 ft
Noisy Urban Area, Daytime	--70--	Vacuum Cleaner at 10 ft
Gas Lawn Mower, 100 ft	--60--	Normal Speech at 3 ft
Commercial Area	--50--	Large Business Office
Heavy Traffic at 300 ft	--40--	Dishwasher Next Room
Quiet Urban Daytime	--30--	Theater, Large Conference Room (Background)
Quiet Urban Nighttime	--20--	Library
Quiet Suburban Nighttime	--10--	Bedroom at Night, Concert Hall (Background)
Quiet Rural Nighttime	--0--	Broadcast/Recording Studio
Lowest Threshold of Human		

\*dBA is A-weighted decibels, which are an expression of the relative loudness of sounds in air as perceived by the human ear.

## Conduct Noise Analysis: Steps 1, 2, & 3

### Field Measurements

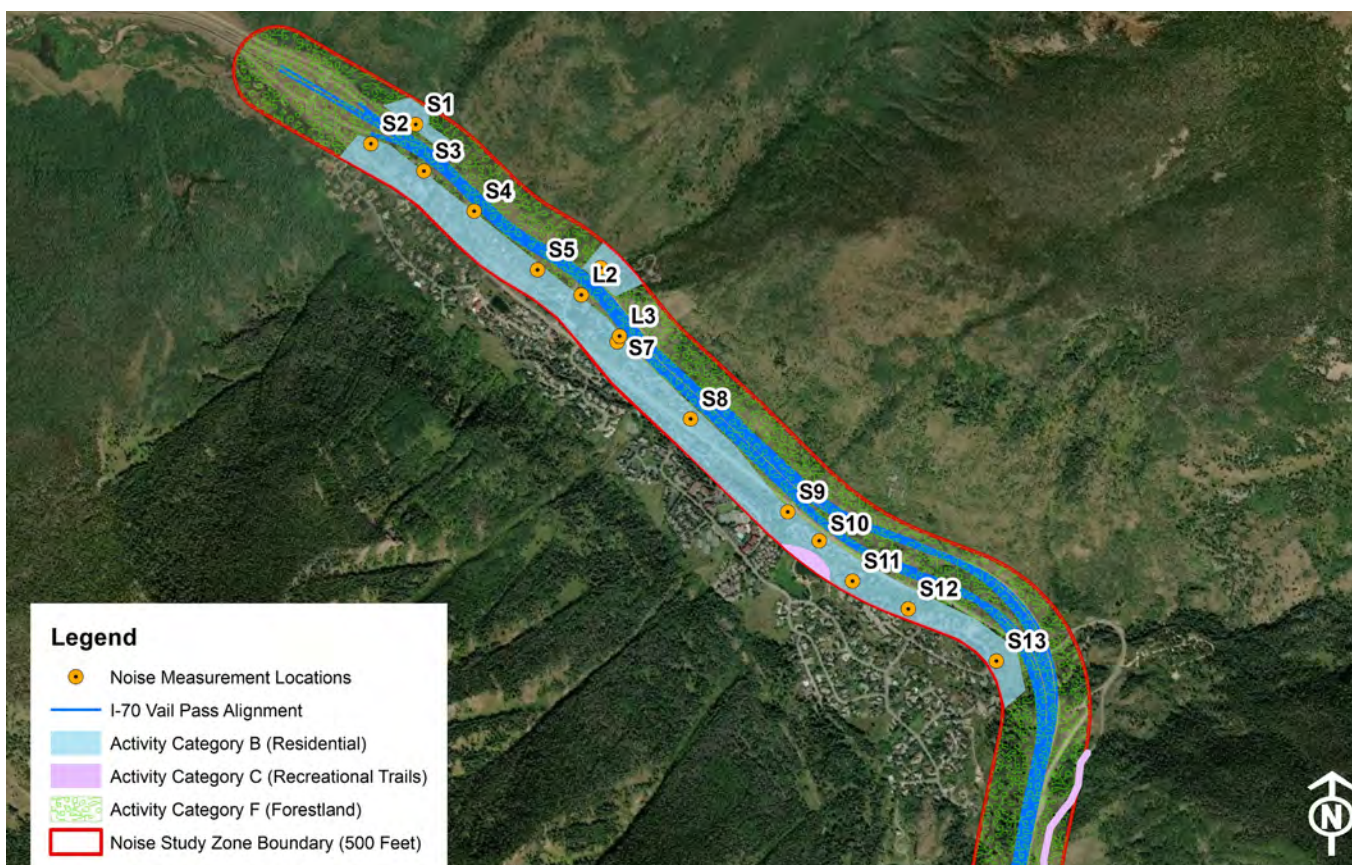
- Noise measurements were collected in June 2018.
- Short-term attended measurements were conducted over 15-minute periods; Two 15-minute measurements at each location (30 minutes total). Traffic counts were conducted concurrent with short-term measurements.
- Long-term measurements were made over periods of several days, including both weekday and weekend periods, to establish the loudest traffic noise hour.
- Conducted at 17 short-term and 3 long-term locations for the entire project area, including 13 short-term and 2 long-term locations in East Vail.
- Short-term measurements made in existing outdoor noise-sensitive use areas.
- Measured traffic noise levels in East Vail ranged from 50 to 65 dBA  $L_{eq}$ .
- Measurements are used to validate the model and do not need to be taken at the worst noise-hour.

*dBA: Units used for sound pressure levels. Stands for A-Weighted decibels.*

*$L_{eq}$ : The average sound level occurring over a specified period of time.*

Noise Measurement Location ID	Location	Measured Leq (dBA)
S1	Lawn area north of Fall Line Drive, Vail	64.3
		65.1
S2	3891 Big Horn Road Units B & C, Vail	53.1
		55
S3	3941-4 & 4011-6 Big Horn Road, Vail	54.9
		57.8
S4	4073 Spruce Way, Vail	57.2
		57.3
S5	4193a Spruce Way, Vail	55.4
		49.8
S6	4396 Columbine Way, Vail	60.8
		61.8
S7	4335 Spruce Way, Vail	54.8
		55.7
S8	4545 Big Horn Road, Vail	56.9
		58
S9	4770 Vail Racquet Club Townhouse Drive, Vail	58
		59
S10	L1 & L3 Condos, Vail Racquet Club Townhouse Drive, Vail	57.1
		55.3
S11	Pool area, Main Gore Place, Vail	50.8
		51.6
S12	5040 Prima Court Unit 1, Vail	51.3
		52.5
S13	5177 Gore Circle, Vail	54.8
		52.1

### Model Validated with Field Measurements



### Model Existing Conditions

Study area extends 500 feet from proposed edge of travel lanes.

Inputs include:

- Roadway alignment
- Number and width of travel lanes
- Traffic volumes, including trucks
- Traffic speeds
- Existing barriers and structures
- Topography
- Ground type
- Receiver locations

*Noise related information and results are based on the most current draft noise technical report for the West Vail Pass Auxiliary Lanes project. Information may change prior to the Environmental Assessment public review.*



## Model Proposed Action and No Action: Step 4

### Traffic Noise Impact Criteria

Traffic noise impact occurs if either of the following conditions is met:

- Proposed Action traffic noise level approaches (i.e., equals) or exceeds CDOT's Noise Abatement Criteria. For residential land, the Noise Abatement Criteria is 66 dBA.
- Proposed Action traffic noise level exceeds the existing highway traffic noise level by 10 dBA.

For residential land uses, only exterior areas of frequent human use are considered.

### Draft Results of Modeling for Proposed Action and No Action in East Vail

- Proposed Action levels ranged from 56 to 72 dBA  $L_{eq(1-hr)}$ .
- No Action levels ranged from 55 to 71 dBA  $L_{eq(1-hr)}$ .
- Proposed Action noise increases above Existing ranged from 1 to 5 dBA (increase due to combination of future traffic increases and Project).
- Proposed Action noise changes from No Action ranged from 2 dBA decrease to 2 dBA increase (increase due to Project only).

*dBA: Units used for sound pressure levels. Stands for A-Weighted decibels.*

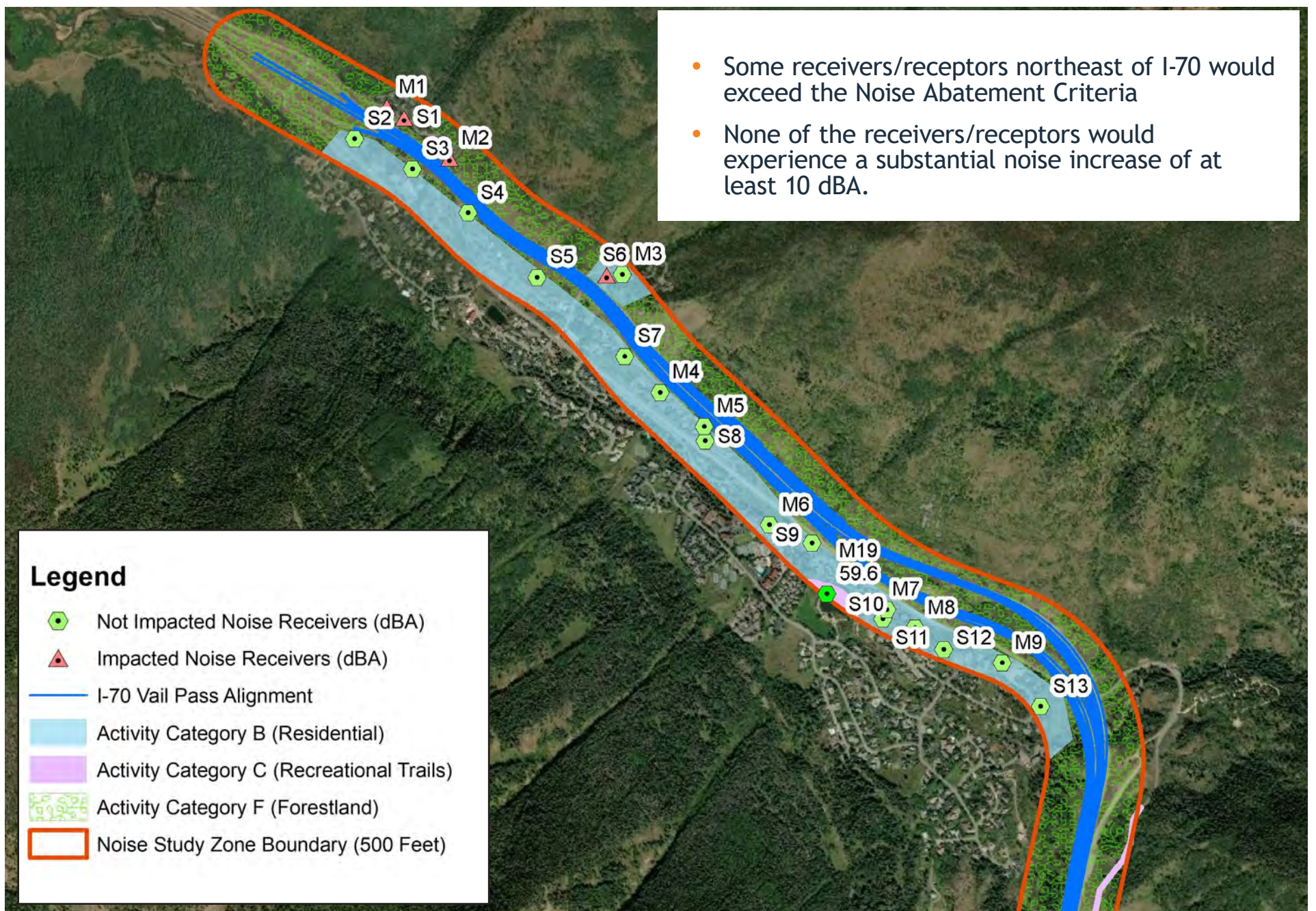
*$L_{eq}$ : The average sound level occurring over a specified period of time.*

Receiver ID <sup>1</sup>	Activity Category / CDOT NAC (dBA)	No Action (2045) $L_{eq}$ (dBA)	Proposed Action (2045) $L_{eq}$ (dBA)	Proposed Action Causes Impact? (Yes or No)
S1	B (66 dBA)	67.9	68.9	Yes
S2	B (66 dBA)	60.7	61.2	No
S3	B (66 dBA)	60.6	60.7	No
S4	B (66 dBA)	62.6	62.9	No
S5	B (66 dBA)	55.1	56.6	No
S6	B (66 dBA)	67.4	69.5	Yes
S7	B (66 dBA)	62.6	61.9	No
S8	B (66 dBA)	62.2	60.4	No
S9	B (66 dBA)	64.3	63.4	No
S10	B (66 dBA)	59.2	57.8	No
S11	B (66 dBA)	56.3	56.0	No
S12	B (66 dBA)	58.7	58.7	No
S13	B (66 dBA)	60.5	59.4	No
M1	B (66 dBA)	67.1	67.9	Yes
M2	B (66 dBA)	70.8	71.7	Yes
M3	B (66 dBA)	60.1	61.7	No
M4	B (66 dBA)	59.4	58.5	No
M5	B (66 dBA)	62.2	62.1	No
M6	B (66 dBA)	64.5	63.1	No
M7	B (66 dBA)	61.2	60.5	No
M8	B (66 dBA)	58.1	57.6	No
M9	B (66 dBA)	62.3	63.1	No
M19	C (66 dBA)	60.3	59.6	No

<sup>1</sup>Measurement locations used as modeled receivers are identified with an "S".

Modeled receiver locations that did not include a measurement are identified with an "M".

### Identified Noise Impacts In East Vail



Noise related information and results are based on the most current draft noise technical report for the West Vail Pass Auxiliary Lanes project. Information may change prior to the Environmental Assessment public review.



**Noise Abatement Evaluation Criteria – Set by FHWA & CDOT**

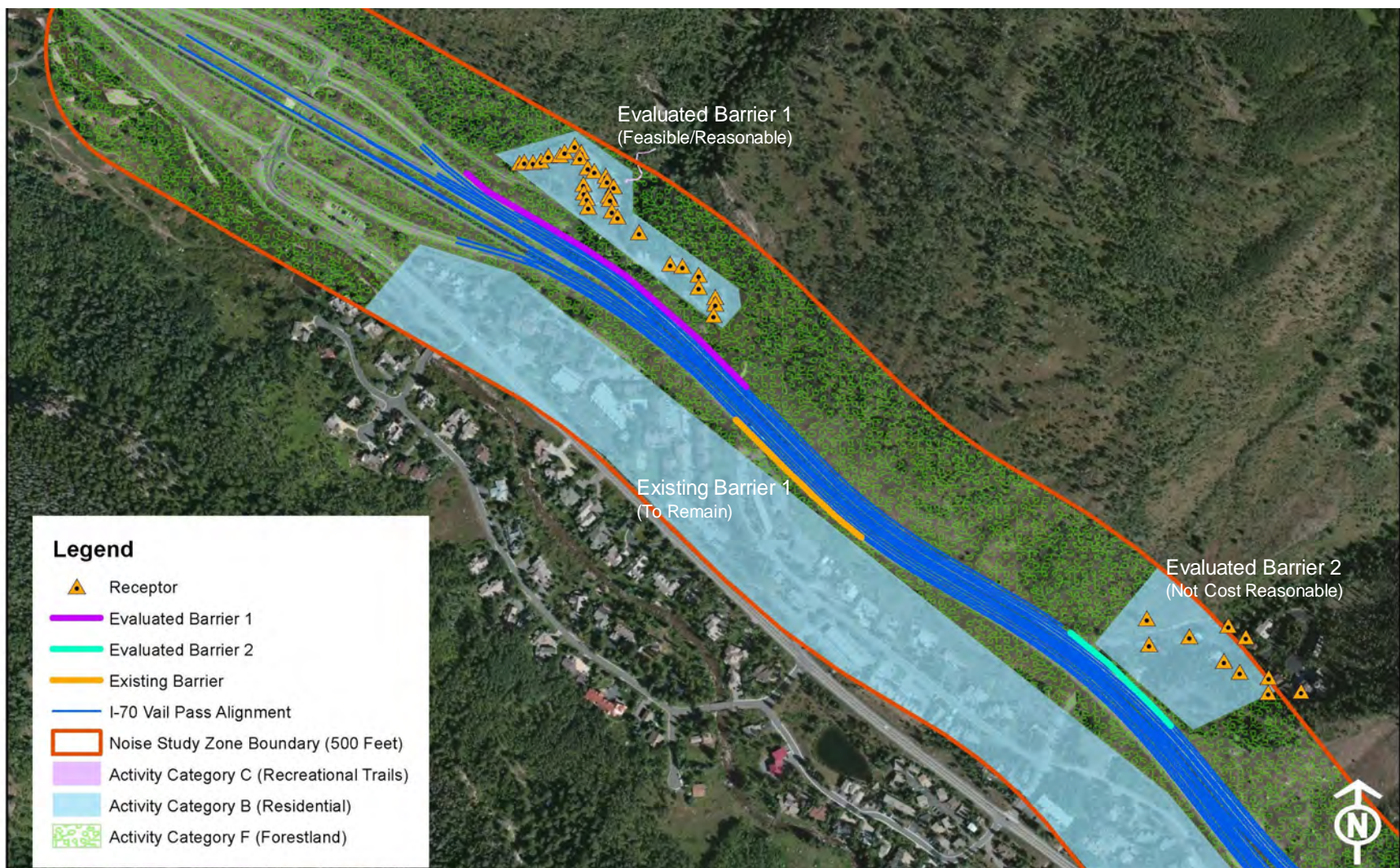
Noise abatement is evaluated for all impacted receptors. However, based on CDOT guidance, abatement is only recommended to be included in the project if it:

- Provides at least 5 dBA of noise reduction for at least one impacted receptor
- Does not have any “fatal flaw” issues (e.g., safety, maintenance, access, drainage)
- Does not exceed 20 feet in height
- 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 determined through benefited receptor preference survey, which may be conducted after the National Environmental Policy Act (NEPA) process if abatement is otherwise feasible and reasonable)

**I-70 West Vail Pass Noise Abatement Evaluation Methodology**

- Noise walls were the only abatement evaluated
- 5 potential barriers were evaluated, including 2 barriers in East Vail
- Barrier placement for each impacted area was considered in multiple locations
- The location determined to be the most acoustically effective for each set of impacted receivers was then optimized for cost reasonableness criteria

**Evaluated Barrier Locations in East Vail**



2 barriers evaluated for impacted receivers/receptors. Feasibility and reasonableness determinations may change due to changes in final project design.

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**Evaluated Barrier 1**



**FEASIBLE/REASONABLE**

Feasibility/reasonableness determinations may change due to changes in final project design

The height of the recommended wall is still being optimized and will be determined by the time the Environmental Assessment undergoes public review.

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# Evaluated Barrier 2



## NOT COST REASONABLE

Feasibility/reasonableness determinations may change due to changes in final project design

Noise related information and results are based on the most current draft noise technical report for the West Vail Pass Auxiliary Lanes project. Information may change prior to the Environmental Assessment public review.





## Complete Noise Mitigation Evaluation: Step 5

### Draft Cost Reasonableness Calculations for Barriers in East Vail

Barrier ID	Evaluated Barrier 1	Evaluated Barrier 2
Barrier Location (approximate)	Barrier is still being optimized but has been found to be feasible and reasonable	WB EOS, MP 180.5
Recommended Barrier Height & Length (feet)		20 ft high x 520 ft long
Barrier Area (square feet)		10,400 ft <sup>2</sup>
Unit Cost		\$45/ft <sup>2</sup>
Total Cost		\$468,000
No. Benefited Receptors		5
Total Decibels of Benefit Provided		39.8
Average Benefit (dBA/receptor)		8.0
Cost Benefit(\$/dBA/receptor)		\$11,759
Design year Leq Range Without Abatement (dBA)		61.7 to 69.5
Design year Leq Range With Abatement (dBA)		52.3 to 59.9

### Draft Results of Noise Abatement Evaluation in East Vail

Abatement Criteria	Evaluated Barrier 1	Evaluated Barrier 2
Provides at least 5 dBA of noise reduction for at least one receptor?	Yes	Yes
Free of "fatal flaw" issues (e.g., safety, maintenance, access, drainage)?	Yes	Yes
Wall is 20 feet in height or less?	Yes	Yes
Meets the minimum noise reduction design goal of at least 7 dBA for at least one receptor?	Yes	Yes
Below or equal to Cost Benefit Index (\$6,800/dBA/receptor)?	Yes	No
Recommended?	Yes	No

### Draft Preliminary Noise Abatement Recommendations

- Evaluated Barrier 1 was found to meet noise abatement criteria. This wall is still being optimized and will be determined by the time the Environmental Assessment undergoes public review.

A Benefited Receptor Preference Survey will be conducted to determine public support and final recommendations would be determined in the final design.

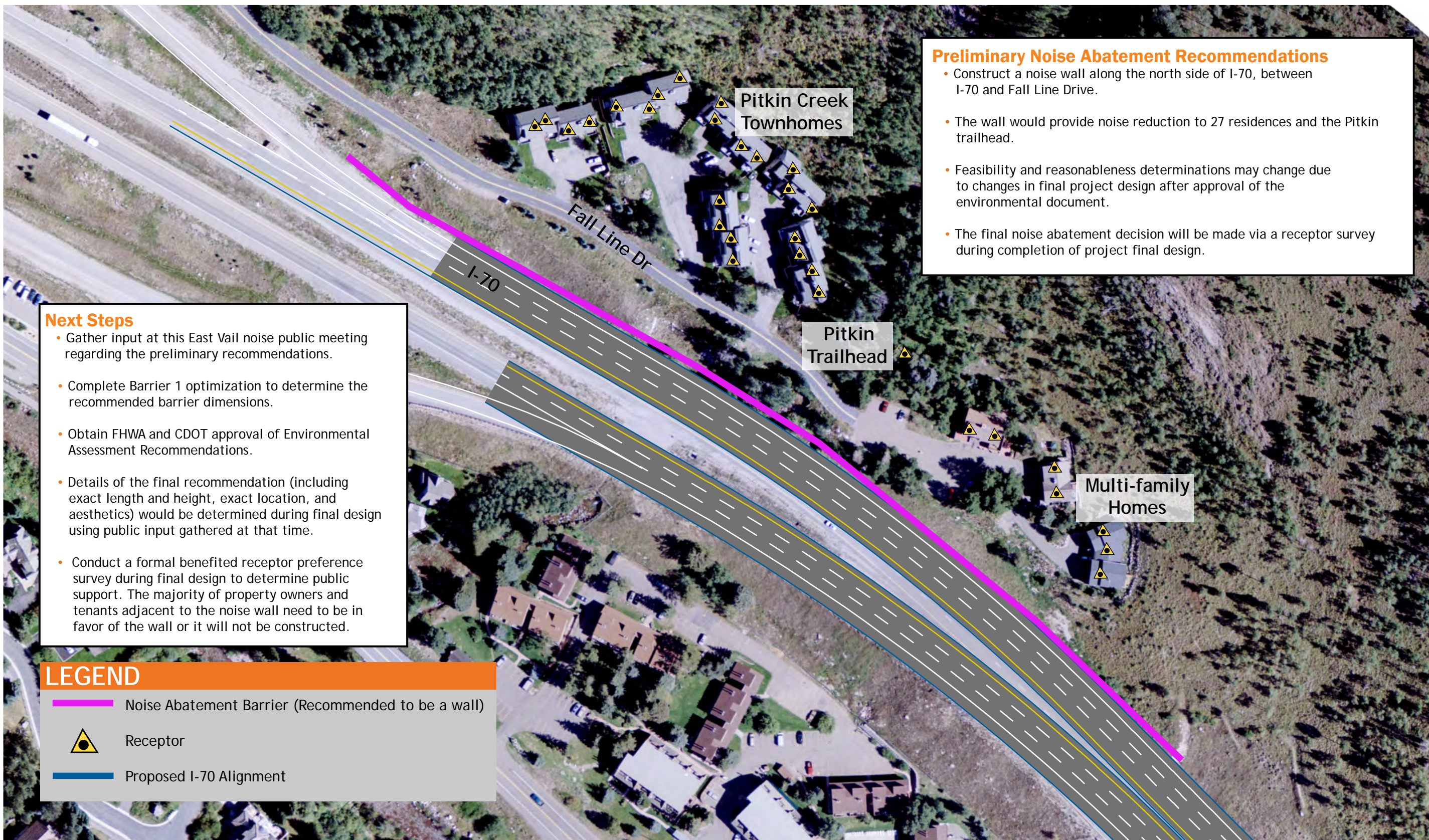
- Evaluated Barrier 2 was not found to be cost reasonable; therefore, will not be constructed as part of the Project, based on CDOT/FHWA Policy.
- Feasibility and reasonableness determinations may change due to changes in final project design after approval of the environmental document.

### Ways to Comment

- Participate in open house portion of this meeting - talk with project team members about your questions or concerns
- Fill out a comment form - leave it tonight or mail it in later
- Submit a comment on the project webpage comment form:  
[www.codot.gov/projects/I-70-West-Vail-Auxiliary-Lanes](http://www.codot.gov/projects/I-70-West-Vail-Auxiliary-Lanes)
- Send an email to: [cdot\\_wvailpassauxlanes@state.co.us](mailto:cdot_wvailpassauxlanes@state.co.us)



## Proposed Noise Abatement Wall



**Preliminary Noise Abatement Recommendations**

- Construct a noise wall along the north side of I-70, between I-70 and Fall Line Drive.
- The wall would provide noise reduction to 27 residences and the Pitkin trailhead.
- Feasibility and reasonableness determinations may change due to changes in final project design after approval of the environmental document.
- The final noise abatement decision will be made via a receptor survey during completion of project final design.

**Next Steps**

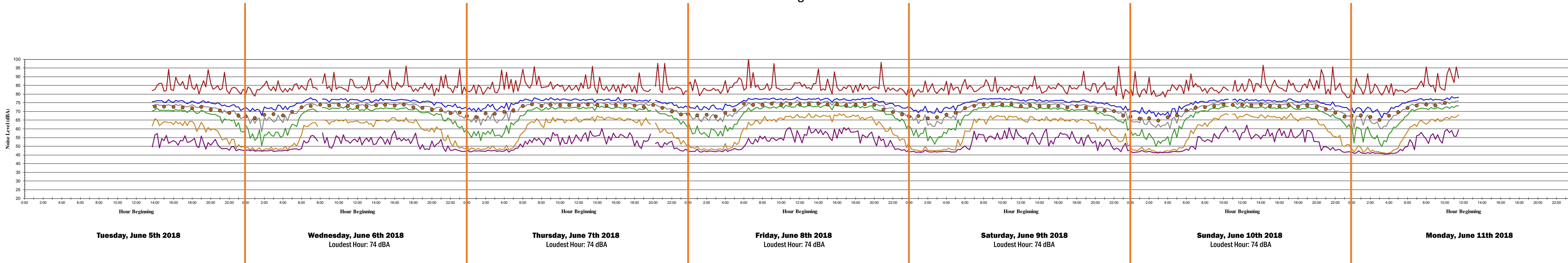
- Gather input at this East Vail noise public meeting regarding the preliminary recommendations.
- Complete Barrier 1 optimization to determine the recommended barrier dimensions.
- Obtain FHWA and CDOT approval of Environmental Assessment Recommendations.
- Details of the final recommendation (including exact length and height, exact location, and aesthetics) would be determined during final design using public input gathered at that time.
- Conduct a formal benefited receptor preference survey during final design to determine public support. The majority of property owners and tenants adjacent to the noise wall need to be in favor of the wall or it will not be constructed.

**LEGEND**

- Noise Abatement Barrier (Recommended to be a wall)
- Receptor
- Proposed I-70 Alignment



**Noise Levels at Noise Measurement Site Lt-1**  
30 Feet West of Edge-of-Sidewalk I-70



**Legend**

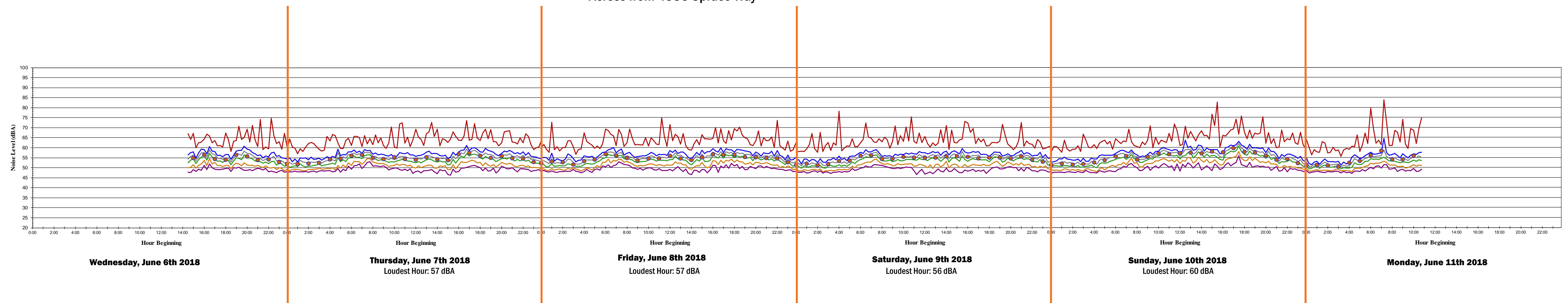
- Lmax
- L(10)
- L(25)
- L(50)
- L(90)
- Lmin
- Leq (hr)

**dBA:** Units used for sound pressure levels. Stands for A-Weighted decibels.

**Leq:** The average sound level occurring over a specified period of time.

**Leq (hr):** The average sound level occurring over a period of one hour.

**Noise Levels at Noise Measurement Site LT-3**  
Across from 4335 Spruce Way



- This data all came from the same field measurements. However, the various lines represent averaging the noise over different time periods.
- This long-term field measured data was used to determine which hour is the loudest at the measurement location. The loudest hour is used to determine the time of day of traffic data to use in the noise model.
- Highway noise at a given location fluctuates from moment to moment. The noise model uses a time period of one hour, so noise is averaged over one hour, as represented by the line labeled Leq(hr).