



I-694 Snelling Avenue/TH 10 Interchange Reconfiguration

Noise Advisory Committee Meeting
Thursday June 17, 2010
6:00 – 7:30 p.m.
Arden Hills City Hall
1245 W. Highway 96
Arden Hills, Minnesota

Your Destination...Our Priority





Tonight's Agenda

- Welcome
- Summary of 2nd NAC Meeting
- Updated Noise Modeling Results
- Updated Noise Mitigation Analysis





NAC Goals and Objectives

- Provide two-way communication between community and project team
- Provide greater understanding of the noise evaluation process
- Review noise analysis methodology and results
- Provide feedback to City Council and communicate project information to neighborhood residents





Review of June 3rd Meeting

- Discussed noise modeling results
 - MN Noise standards are exceeded at all receptors for existing nighttime conditions and 80% of receptors for existing daytime conditions.
- Provided results of noise barrier effectiveness
- Modeled noise barriers did not meet MnDOT criteria for reasonableness and cost effectiveness





Sound Pressure Level and Decibels

- Sound pressure level (SPL) is used to measure the intensity of sounds
- SPL measured in units called decibels, or dB
- A-weighted decibels, or dBA
 - Gives a scale for noise levels as experienced or perceived by the human ear





Noise Level Changes in an Outdoor Environment

- 1 dBA (increase or decrease) = not noticeable
- 3 dBA (increase or decrease) = threshold of perception
- 5 dBA (increase or decrease) = clearly noticeable
- 10 dBA (increase or decrease) = perceived as twice as loud (or half as loud)

Source: Minnesota Pollution Control Agency. 2008. *A Guide to Noise Control in Minnesota*





Distance Attenuation

- Beyond approximately 50 feet from a sound source such as a highway, doubling of distance will yield:
 - Sound level decrease by 3 dBA over hard ground (pavement, water)
 - 50 feet = 70 dBA
 - 100 feet = 67 dBA
 - Sound level decrease by 4.5 dBA over soft ground (vegetation)
 - 50 feet = 70 dBA
 - 100 feet = 65.5 dBA

Source: Minnesota Pollution Control Agency. 2008. *A Guide to Noise Control in Minnesota*



Minnesota Noise Rules

- Receiver Based Noise Limits (dBA)

	Daytime		Nighttime		
	NAC	L10	L50	L10	L50
1 (Residential)	65	60	55	50	
2 (Commercial)	70	65	70	65	
3 (Industrial)	80	75	80	75	

Minnesota's noise pollution rules are based on statistical calculations that quantify noise levels according to duration over a one-hour monitoring period. The L10 calculation is the noise level that is exceeded for 10%, or 6 minutes, of the hour, and the L50 calculation is the noise level exceeded for 50%, or 30 minutes, of the hour.





How do We Evaluate Traffic Noise?

- Noise Monitoring
 - Document existing noise levels
 - Comparison to model results
- Noise Modeling
 - Receptor sites affected by construction of project
 - Loudest hour of daytime and nighttime periods
 - Existing conditions
 - Future No-Build and Build conditions (generally a 20-year traffic projection)





How do We Evaluate Traffic Noise?

Comparison of 2005 Monitoring to 2010 Modeling

L10 Standards

Receptor	2005 Monitoring		2010 Modeling - Existing Conditions	
	Daytime Peak	Nighttime Peak	Daytime Peak	Nighttime Peak
Site N1	66.8	62.0	68.6	68.2
Site N2	61.0	60.5	66.7	67.2
Site N3	65.3	70.3	68.8	67.9
MN Standard	65	55	65	55

(PM Results) (AM Results)

L50 Standards

Receptor	2005 Monitoring		2010 Modeling - Existing Conditions	
	Daytime Peak	Nighttime Peak	Daytime Peak	Nighttime Peak
Site N1	64.2	59.5	66.1	65.4
Site N2	58.1	58.1	64.3	64.8
Site N3	63.5	68.2	66	65
MN Standard	60	50	60	50

(PM Results) (AM Results)





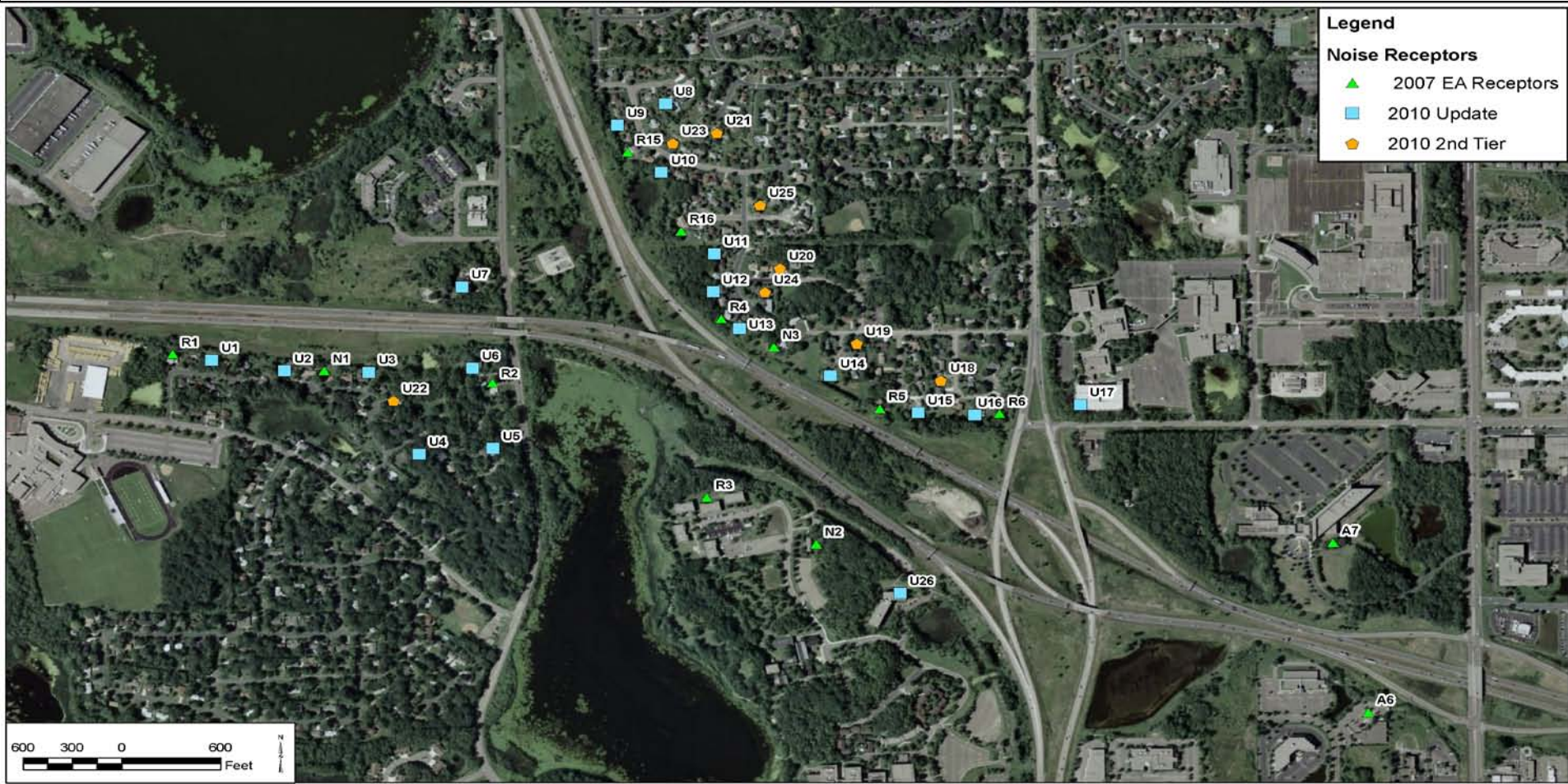
How is Traffic Noise Modeled?

- Noise prediction program “MINNOISE”
 - Traffic volumes
 - Traffic speeds
 - Vehicle types (cars, medium trucks, heavy trucks)
 - Characteristics of roadway (horizontal and vertical alignments)
 - Receptor sites (outdoor place where frequent human use occurs
 - represent residences or businesses)
 - Elevations (receptors, ground lines, noise barriers, berms)





Noise Modeling Methods – Existing Conditions



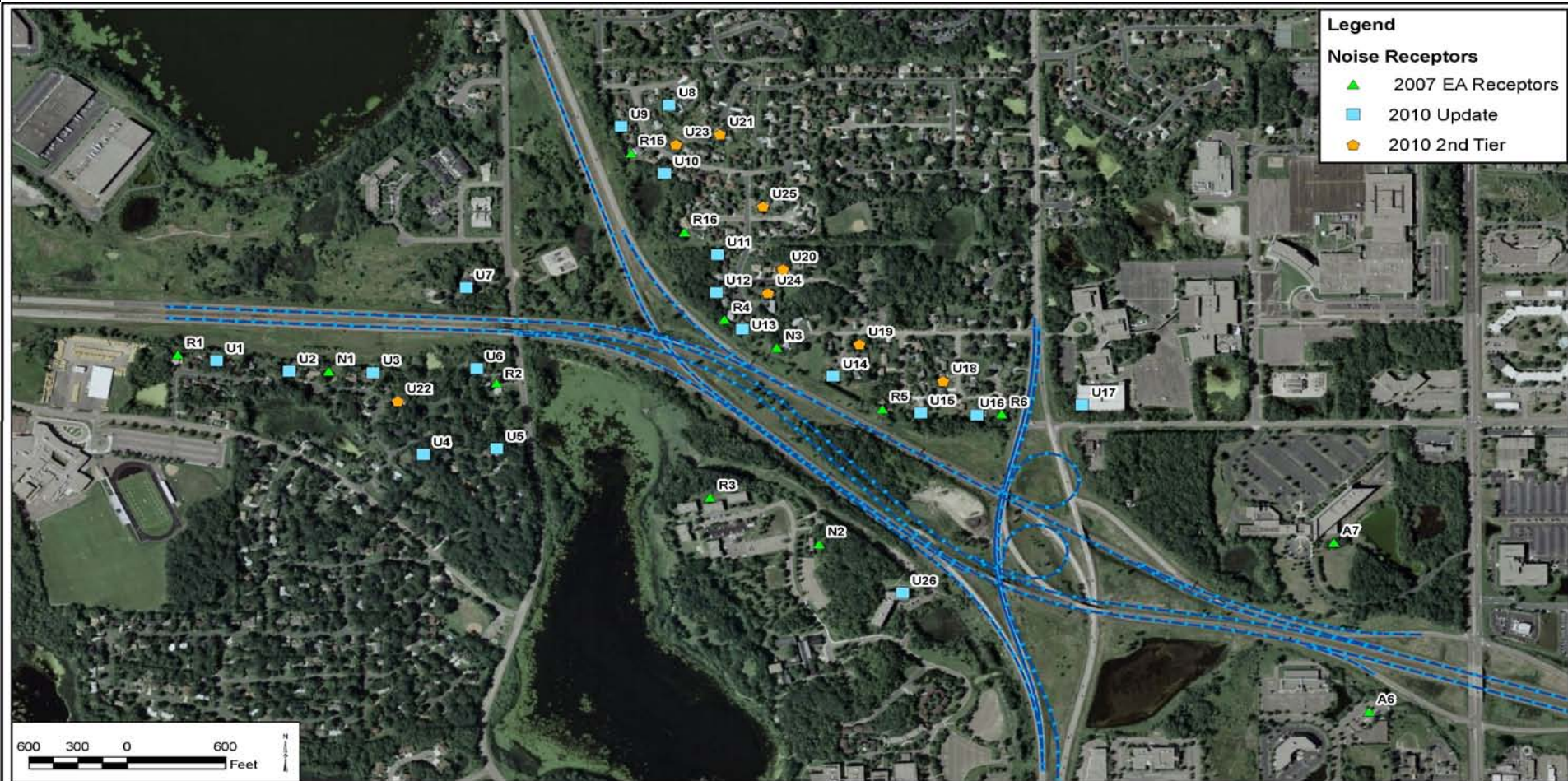
MINNESOTA DEPARTMENT OF TRANSPORTATION
Existing Conditions

JUNE 2010

Figure 1



Noise Modeling Methods – New Alignment



MINNESOTA DEPARTMENT OF TRANSPORTATION
Proposed Alignment

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Figure 1





Noise Modeling Results – Existing vs. Project Conditions

AM Peak Results (Nighttime Standard)							
Receptor Number	RECEIVER	Existing Conditions		2030 No Build		2030 Project Build	
		L10	L50	L10	L50	L10	L50
N1	Lot 1	68.2	65.4	68.5	66.1	68.6	65.9
N2	Lot 2	67.2	64.8	67.5	65.3	68.4	66.4
N3	Lot 3	67.9	65	68.3	65.8	69.5	67.2
R1	Lot 4	69.4	65.9	69.7	66.6	70.2	67.2
R2	Lot 5	67.8	65.3	68.1	66	68.1	65.8
R5	Lot 6	66.7	64.4	67.2	65	68	65.6
R4	Lot 7	70.9	67.7	71.7	68.8	72.4	69.8
A7	Lot 8	61.6	59.3	61.8	59.9	64.7	63
R6	Lot 9	68.8	64.3	69.2	65	69.9	66
R3	Lot 10	64.2	62.3	64.6	62.9	65.5	63.8
R15	Lot 11	66	62	67	63.4	69.4	66.6
A6	Lot 12	60.3	57.5	60.5	58.1	69.5	67.2
R16	Lot 13	65.2	62.8	66	63.8	67.4	65.5
U1	Lot 14	68.9	65.7	69.1	66.4	69.4	66.5
U2	Lot 15	67.8	65.1	68.1	65.8	68.3	65.6
U3	Lot 16	68.3	65.5	68.6	66.2	68.6	66
U6	Lot 17	69.8	66.9	70.1	67.6	70.1	67.3
U7	Lot 18	70.9	67.8	71.2	68.5	71.3	68.3
U8	Lot 19	59.1	56.8	60	57.8	63.5	61.7
U9	Lot 20	64.6	60.2	65.7	61.7	69.3	66.5
U10	Lot 21	63.5	60.8	64.4	61.9	66.4	64.3
U11	Lot 22	64.3	62.3	65	63.2	66.3	64.6
U12	Lot 23	67.7	65.2	68.4	66.2	69.4	67.4
U13	Lot 24	69.4	66.4	70	67.4	71.1	68.7
U14	Lot 25	65.8	62.7	66.2	63.4	67.6	64.9
U15	Lot 26	64.1	62	64.6	62.6	65.6	63.4
U16	Lot 27	65.5	63.3	65.9	63.8	66.9	64.9
U17	Lot 28	64.6	61.5	65	62.1	64.6	62.4
U4	Lot 29	61.2	59.4	61.5	60.1	61.8	60.3
U5	Lot 30	62.1	60.4	62.5	61.1	62.7	61.3
U18	Lot 31	63.1	61.3	63.6	61.9	64.7	63.2
U19	Lot 32	62	60.1	62.4	60.8	64	62.3
U20	Lot 33	61.9	60.1	62.4	60.8	63.7	62.3
U21	Lot 34	58.5	56.6	59.2	57.5	61.5	60.1
U22	Lot 35	65	62.8	65.4	63.4	65.5	63.4
U23	Lot 36	61	58.6	61.9	59.7	64.3	62.5
U24	Lot 37	62	59.8	62.6	60.6	64.5	62.6
U25	Lot 38	60	58.4	60.6	59.2	62.1	60.8
U26	Lot 39	68.2	65.7	68.2	66.1	69.3	67.4
	Nighttime Standard 10pm - 7am	55	50	= Exceedance of MN Noise Standard			



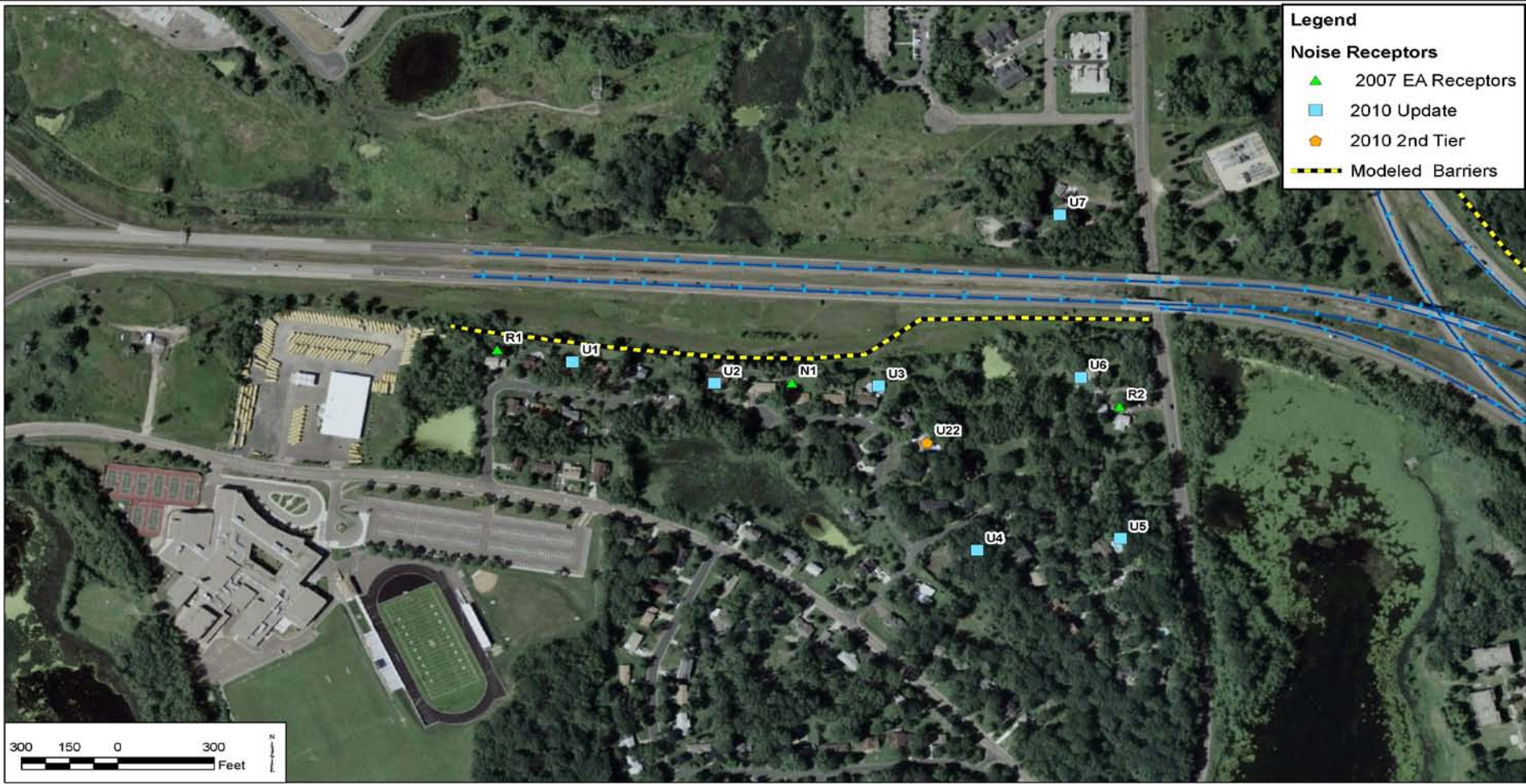


Noise Modeling Results – Existing vs. Project Conditions

PM Peak Results (Daytime Standard)							
Receptor Number	RECEIVER	Existing Conditions		2030 No Build		2030 Project Build	
		L10	L50	L10	L50	L10	L50
N1	Lot 1	68.6	66.1	68.7	66.4	69	66.6
N2	Lot 2	66.7	64.3	67.3	65.1	68.2	66.2
N3	Lot 3	68.8	66	69	66.6	70.5	68.3
R1	Lot 4	69.8	66.5	69.8	66.9	70.6	67.8
R2	Lot 5	68.2	65.9	68.3	66.3	68.5	66.4
R5	Lot 6	67.2	65	67.9	65.8	69	66.7
R4	Lot 7	72.2	69.1	72.9	70	73.4	70.9
A7	Lot 8	61.5	59.2	62	60.1	64.6	63
R6	Lot 9	68.3	64.3	68.7	64.9	70	66.5
R3	Lot 10	64.2	62.3	64.6	63	65.4	63.9
R15	Lot 11	66.9	63	68.1	64.6	69.8	67.1
A6	Lot 12	60.1	57.5	60.5	58.3	69.1	66.8
R16	Lot 13	66	63.6	66.9	64.7	67.9	66
U1	Lot 14	69.3	66.4	69.3	66.7	69.8	67.2
U2	Lot 15	68.3	65.7	68.3	66	68.7	66.3
U3	Lot 16	68.7	66.2	68.8	66.5	69.1	66.6
U6	Lot 17	70.2	67.5	70.3	67.9	70.5	67.9
U7	Lot 18	71.7	68.7	71.6	69	72	69.2
U8	Lot 19	59.9	57.5	60.7	58.6	63.8	62
U9	Lot 20	65.8	61.4	67	63.1	69.7	66.9
U10	Lot 21	64.2	61.6	65.2	62.8	66.7	64.7
U11	Lot 22	65.1	63.1	65.8	64	66.8	65.2
U12	Lot 23	68.7	66.3	69.4	67.2	70.2	68.2
U13	Lot 24	70.4	67.6	70.9	68.3	72.1	69.7
U14	Lot 25	66.4	63.4	66.9	64.2	68.7	66
U15	Lot 26	64.6	62.4	65.2	63.2	66.6	64.4
U16	Lot 27	65.5	63.4	66	64.1	67.4	65.6
U17	Lot 28	65.8	62.5	65.9	62.9	65.1	63.1
U4	Lot 29	61.7	60	61.8	60.4	62.2	60.8
U5	Lot 30	62.6	61	62.7	61.3	63.1	61.8
U18	Lot 31	63.4	61.6	63.9	62.3	65.4	63.9
U19	Lot 32	62.5	60.6	62.9	61.3	64.7	63.1
U20	Lot 33	62.6	60.8	63	61.5	64.3	62.9
U21	Lot 34	59.1	57.3	59.8	58.2	61.8	60.5
U22	Lot 35	65.5	63.5	65.6	63.7	65.9	64
U23	Lot 36	61.7	59.4	62.6	60.5	64.6	62.9
U24	Lot 37	62.9	60.7	63.4	61.4	65.3	63.5
U25	Lot 38	60.6	59.1	61.2	59.8	62.5	61.3
U26	Lot 39	67.6	65.1	68	65.9	69.2	67.4
	Daytime Standard 7am to 10 PM	65	60	= Exceedance of MN Noise Standard			



Noise Modeling Results – Noise Barriers



Legend

Noise Receptors

- ▲ 2007 EA Receptors
- 2010 Update
- ◆ 2010 2nd Tier
- Modeled Barriers



Noise Modeling Results – Noise Barriers



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Barrier Near Bethel College

JUNE 2010

Figure 1





Noise Modeling Results – Near Bethel College

2030 Project Build Summary: EB Hwy 694/10 combined - Barrier Along Shoulder Near Bethel

2030 AM Peak Results		Project Build		10 ft Barrier		15 ft Barrier		20 ft Barrier	
Receptor Number	RECEIVER	L10	L50	L10	L50	L10	L50	L10	L50
N2	Lot 2	68.4	66.4	65.8	63.1	62.9	60.9	60.6	59.1
R3	Lot 10	65.5	63.8	64.8	63.1	63.7	62.1	62.5	61
U26	Lot 39	69.3	67.4	66.3	64.4	65.6	63.6	65.2	63

2030 PM Peak Results		Project Build		10 ft Barrier		15 ft Barrier		20 ft Barrier	
Receptor Number	RECEIVER	L10	L50	L10	L50	L10	L50	L10	L50
N2	Lot 2	68.2	66.2	65.5	63	62.8	61	60.7	59.4
R3	Lot 10	65.4	63.9	64.9	63.4	63.9	62.5	62.9	61.5
U26	Lot 39	69.2	67.4	66.1	64.3	65.5	63.5	65.1	63



Noise Modeling Results – NB Hwy 10: Added 2nd Tier



Legend

Noise Receptors

- ▲ 2007 EA Receptors
- 2010 Update
- 2010 2nd Tier
- Modeled Barriers

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Barrier along NB Hwy 10

JUNE 2010

Figure 1





Noise Modeling Results – NB Hwy 10: Added 2nd Tier

Barrier = 3813 ft

2030 AM Peak Results		Project Build		10 ft Barrier		15 ft Barrier		20 ft Barrier	
Receptor Number	RECEIVER	L10	L50	L10	L50	L10	L50	L10	L50
N3	Lot 3	69.5	67.2	65	63.3	62.9	61.4	60.9	59.6
R5	Lot 6	68	65.6	64.1	62.2	61.7	60.1	59.9	58.5
R4	Lot 7	72.4	69.8	70.8	68.5	67.1	65.1	63.3	61.6
R6	Lot 9	69.9	66	69.7	65.5	69.4	65.1	69.3	64.7
R15	Lot 11	69.4	66.6	64.3	62.3	62.5	60.8	61.2	59.5
R16	Lot 13	67.4	65.5	66.5	64.4	65.6	63.5	64.4	62.1
U8	Lot 19	63.5	61.7	62.5	60.5	61.6	59.7	60.8	59.1
U9	Lot 20	69.3	66.5	64.5	62.1	62.8	60.7	61.8	59.7
U10	Lot 21	66.4	64.3	64.6	62.4	63.3	61.2	61.9	60
U11	Lot 22	66.3	64.6	65.1	63.2	64.2	62.2	63	60.9
U12	Lot 23	69.4	67.4	67.3	65.3	65.5	63.5	63.5	61.6
U13	Lot 24	71.1	68.7	64.6	62.7	61.9	60.2	60	58.4
U14	Lot 25	67.6	64.9	62.8	60.8	60.6	59	59	57.5
U15	Lot 26	65.6	63.4	63.2	61.3	61.3	59.6	59.9	58.2
U16	Lot 27	66.9	64.9	66.2	64	65.3	62.8	64.7	61.9
U18	Lot 31	64.7	63.2	63.6	62	62.6	61	61.6	60
U19	Lot 32	64	62.3	61.4	60	60.1	59	59	57.9
U20	Lot 33	63.7	62.3	62.2	60.6	61.3	59.7	60.3	58.7
U21	Lot 34	61.5	60.1	60.5	59	59.7	58.2	58.9	57.4
U23	Lot 36	65.5	63.4	62.7	60.9	61.6	59.9	60.6	59
U24	Lot 37	64.5	62.6	61.4	59.8	59.9	58.4	58.5	57
U25	Lot 38	62.1	60.8	61.4	60	60.7	59.3	60	58.4

Orange background = 5dB or greater reduction from noise barrier





Noise Modeling Results – NB Hwy 10: Added 2nd Tier

Barrier = 3813 ft

2030 PM Peak Results		Project Build		10 ft Barrier		15 ft Barrier		20 ft Barrier	
Receptor Number	RECEIVER	L10	L50	L10	L50	L10	L50	L10	L50
N3	Lot 3	70.5	68.3	65.9	64.2	63.7	62.3	61.7	60.4
R5	Lot 6	69	66.7	65	63.2	62.6	61	60.8	59.3
R4	Lot 7	73.4	70.9	71.6	69.4	67.9	66	64	62.4
R6	Lot 9	70	66.5	69.7	65.9	69.4	65.4	69.2	65
R15	Lot 11	69.8	67.1	64.6	62.6	62.9	61.2	61.6	60
R16	Lot 13	67.9	66	67	64.9	66.1	64	64.8	62.6
U8	Lot 19	63.8	62	62.6	60.7	61.7	60	61	59.3
U9	Lot 20	69.7	66.9	64.8	62.4	63.1	61.1	62.2	60.1
U10	Lot 21	66.7	64.7	64.8	62.7	63.6	61.6	62.3	60.5
U11	Lot 22	66.8	65.2	65.7	63.9	64.8	62.9	63.6	61.6
U12	Lot 23	70.2	68.2	68.1	66.1	66.2	64.3	64.1	62.3
U13	Lot 24	72.1	69.7	65.5	63.6	62.7	61.1	60.7	59.2
U14	Lot 25	68.7	66	63.7	61.7	61.4	59.8	59.7	58.3
U15	Lot 26	66.6	64.4	64	62.2	62	60.4	60.5	58.9
U16	Lot 27	67.4	65.6	66.6	64.5	65.6	63.3	64.9	62.4
U18	Lot 31	65.4	63.9	64.1	62.5	62.9	61.5	61.9	60.4
U19	Lot 32	64.7	63.1	62.1	60.7	60.7	59.6	59.5	58.5
U20	Lot 33	64.3	62.9	62.8	61.2	61.8	60.3	60.8	59.3
U21	Lot 34	61.8	60.5	60.7	59.3	60	58.5	59.2	57.8
U23	Lot 36	65.9	64	62.8	61.1	61.8	60.2	60.9	59.4
U24	Lot 37	65.3	63.5	62.1	60.5	60.5	59.1	59	57.6
U25	Lot 38	62.5	61.3	61.7	60.4	61.1	59.7	60.4	58.9

Orange background = 5dB or greater reduction from noise barrier





Feasibility and Reasonability Criteria

- “Feasibility” is determined by physical and/or engineering constraints (i.e., could a noise barrier feasibly be constructed on the site)
- “Reasonability” is based on several factors including:
 - Acoustical effectiveness limits
 - Mn/DOT’s cost-effectiveness criteria
 - Desires of affected property owners





Barrier Feasibility Considerations

- Does Mn/DOT have the required right of way to construct the wall?
- Safety concerns such as sight distances and clear zones
- Buried utilities or utility relocation needs
- Impacts to drainage or drainage features within right of way
- Soil types or wetland areas





Mn/DOT Reasonability Criteria

- Acoustical effectiveness:
 - Will the wall provide a substantial reduction in noise (at least 5 dBA)?
- Cost effectiveness:
 - Will the wall meet a cost effectiveness value $\leq \$3,250$ per residence per dBA of reduction?
 - Based on wall costs of \$15/sq ft; \$18/sq ft on bridges
 - Consideration of other costs such as retaining walls, guardrail





Cost-Effectiveness (CE) Calculation

Example #1

- Barrier Cost = \$1,000,000
- Avg. Reduction = 10 dBA
- 10 Benefitting Residences
- \$1,000,000/10 dBA/10 residences
- Barrier CE = \$10,000/dBA/residence

Barrier Exceeds CE Threshold

Example #2

- Barrier Cost = \$300,000
- Avg. Reduction = 10 dBA
- 10 Benefitting Residences
- \$300,000/10 dBA/10 residences
- Barrier CE = \$3,000/dBA/residence

Barrier Meets CE Threshold





Noise Mitigation Results

Eastbound 694 - 20 Foot Barrier

Receptors	Preferred Alternative Daytime L10 Noise Levels (dBA)	Reduction (in dBA) with 20 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N1	69	7.8	2	2					
R1	70.6	10.9	2	2					
R2	68.5	<5	1	0					
U1	69.8	10.9	2	2					
U2	68.7	8.6	4	4	9.6	2299	45,980	\$689,700	\$7,222
U3	69.1	<5	1	0					
U4	62.2	<5	2	0					
U5	63.1	<5	1	0					
U6	70.5	<5	1	0					
U22	65.9	<5	3	0					

Receptors	Preferred Alternative Nighttime L10 Noise Levels (dBA)	Reduction (in dBA) with 20 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N1	68.6	6.9	2	2					
R1	70.2	10.1	2	2					
R2	68.1	<5	1	0					
U1	69.4	10	2	2					
U2	68.3	7.7	4	4	8.7	2299	45,980	\$689,700	\$7,950
U3	68.6	<5	1	0					
U4	61.8	<5	2	0					
U5	62.7	<5	1	0					
U6	70.1	<5	1	0					
U22	65.5	<5	3	0					





Noise Mitigation Results

Eastbound 694 - 15 Foot Barrier

Receptors	Preferred Alternative Daytime L10 Noise Levels (dBA)	Reduction (in dBA) with 15 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N1	69	5.4	2	2					
R1	70.6	8	2	2					
R2	68.5	<5	1	0					
U1	69.8	8	2	2					
U2	68.7	6	4	4	6.9	2299	34,485	\$517,275	\$7,551
U3	69.1	<5	1	0					
U4	62.2	<5	2	0					
U5	63.1	<5	1	0					
U6	70.5	<5	1	0					
U22	65.9	<5	3	0					

Receptors	Preferred Alternative Nighttime L10 Noise Levels (dBA)	Reduction (in dBA) with 15 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N1	68.6	5.5	2	2					
R1	70.2	8	2	2					
R2	68.1	<5	1	0					
U1	69.4	8.1	2	2					
U2	68.3	6.1	4	4	6.9	2299	34,485	\$517,275	\$7,470
U3	68.6	<5	1	0					
U4	61.8	<5	2	0					
U5	62.7	<5	1	0					
U6	70.1	<5	1	0					
U22	65.5	<5	3	0					





Noise Mitigation Results

Eastbound 694 - 10 Foot Barrier

Receptors	Preferred Alternative Daytime L10 Noise Levels (dBA)	Reduction (in dBA) with 10 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N1	69	<5	2	2					
R1	70.6	<5	2	2					
R2	68.5	<5	1	0					
U1	69.8	<5	2	2					
U2	68.7	<5	4	4	NA	NA	NA	NA	NA
U3	69.1	<5	1	0					
U4	62.2	<5	2	0					
U5	63.1	<5	1	0					
U6	70.5	<5	1	0					
U22	65.9	<5	3	0					

Receptors	Preferred Alternative Nighttime L10 Noise Levels (dBA)	Reduction (in dBA) with 10 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N1	68.6	<5	2	0					
R1	70.2	<5	2	0					
R2	68.1	<5	1	0					
U1	69.4	5	2	2					
U2	68.3	<5	4	0	5.0	2299	22,990	\$344,850	\$34,485
U3	68.6	<5	1	0					
U4	61.8	<5	2	0					
U5	62.7	<5	1	0					
U6	70.1	<5	1	0					
U22	65.5	<5	3	0					



Noise Modeling Results – NB Hwy 10: Added 2nd Tier



Legend

Noise Receptors

- ▲ 2007 EA Receptors
- 2010 Update
- 2010 2nd Tier
- Modeled Barriers

MINNESOTA DEPARTMENT OF TRANSPORTATION

Barrier along NB Hwy 10

JUNE 2010

Figure 1





Noise Mitigation Results

Northbound Hwy 10 – 20 Foot Barrier

All Receptors - 2nd tier added. Total Barrier is 3813 ft

Receptors	Preferred Alternative Daytime L10 Noise Levels (dBA)	Reduction (in dBA) with 20 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N3	70.5	8.8	2	2					
R5	69	8.2	4	4					
R4	73.4	9.4	2	2					
R6	70	<5	2	0					
R15	69.8	8.2	3	3					
R16	67.9	<5	4	0					
U8	63.8	<5	3	0					
U9	69.7	7.5	3	3	7.6	3813	76,260	\$1,143,900	\$4,704
U10	66.7	<5	2	0					
U11	66.8	<5	2	0					
U12	70.2	6.1	2	2					
U13	72.1	11.4	2	2					
U14	68.7	9	3	3					
U15	66.6	6.1	4	4					
U16	67.4	<5	2	0					
U18	65.4	<5	2	0					
U19	64.7	5.2	2	2					
U20	64.3	<5	2	0					
U21	61.8	<5	3	0					
U23	65.9	5	3	3					
U24	65.3	6.3	2	2					
U25	62.5	<5	3	0					
Total Homes			57	32					





Noise Mitigation Results

Northbound Hwy 10 – 20 Foot Barrier

All Receptors - 2nd tier added. Total Barrier is 3813 ft

Receptors	Preferred Alternative Nighttime L10 Noise Levels (dBA)	Reduction (in dBA) with 20 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N3	69.5	8.6	2	2					
R5	68	8.1	4	4					
R4	72.4	9.1	2	2					
R6	69.9	<5	2	0					
R15	69.4	8.2	3	3					
R16	67.4	<5	4	0					
U8	63.5	<5	3	0					
U9	69.3	7.5	3	3	7.6	3813	76,260	\$1,143,900	\$5,178
U10	66.4	<5	2	0					
U11	66.3	<5	2	0					
U12	69.4	5.9	2	2					
U13	71.1	11.1	2	2					
U14	67.6	8.6	3	3					
U15	65.6	5.7	4	4					
U16	66.9	<5	2	0					
U18	64.7	<5	2	0					
U19	64	5	2	2					
U20	63.7	<5	2	0					
U21	61.5	<5	3	0					
U23	65.5	<5	3	0					
U24	64.5	6	2	2					
U25	62.1	<5	3	0					
Total Homes			57	29					





Noise Mitigation Results

Northbound Hwy 10 – 15 Foot Barrier

All Receptors - 2nd tier added. Total Barrier is 3813 ft

Receptors	Preferred Alternative Daytime L10 Noise Levels (dBA)	Reduction (in dBA) with 15 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N3	70.5	6.8	2	2					
R5	69	6.4	4	4					
R4	73.4	5.5	2	2					
R6	70	<5	2	0					
R15	69.8	6.9	3	3					
R16	67.9	<5	4	0					
U8	63.8	<5	3	0					
U9	69.7	6.6	3	3	7.0	3813	57,195	\$857,925	\$6,464
U10	66.7	<5	2	0					
U11	66.8	<5	2	0					
U12	70.2	<5	2	0					
U13	72.1	9.4	2	2					
U14	68.7	7.3	3	3					
U15	66.6	<5	4	0					
U16	67.4	<5	2	0					
U18	65.4	<5	2	0					
U19	64.7	<5	2	0					
U20	64.3	<5	2	0					
U21	61.8	<5	3	0					
U23	65.9	<5	3	0					
U24	65.3	<5	2	0					
U25	62.5	<5	3	0					
Total Homes			57	19					





Noise Mitigation Results

Northbound Hwy 10 – 15 Foot Barrier

All Receptors - 2nd tier added. Total Barrier is 3813 ft

Receptors	Preferred Alternative Nighttime L10 Noise Levels (dBA)	Reduction (in dBA) with 15 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N3	69.5	6.6	2	2					
R5	68	6.3	4	4					
R4	72.4	5.3	2	2					
R6	69.9	<5	2	0					
R15	69.4	6.9	3	3					
R16	67.4	<5	4	0					
U8	63.5	<5	3	0					
U9	69.3	6.5	3	3	6.8	3813	57,195	\$857,925	\$6,613
U10	66.4	<5	2	0					
U11	66.3	<5	2	0					
U12	69.4	<5	2	0					
U13	71.1	9.2	2	2					
U14	67.6	7	3	3					
U15	65.6	<5	4	0					
U16	66.9	<5	2	0					
U18	64.7	<5	2	0					
U19	64	<5	2	0					
U20	63.7	<5	2	0					
U21	61.5	<5	3	0					
U23	65.5	>5	3	0					
U24	64.5	>5	2	0					
U25	62.1	>5	3	0					
Total Homes			57	19					





Noise Mitigation Results

Northbound Hwy 10 – 10 Foot Barrier

All Receptors - 2nd tier added. Total Barrier is 3813 ft

Receptors	Preferred Alternative Daytime L10 Noise Levels (dBA)	Reduction (in dBA) with 10 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N3	70.5	<5	2	2					
R5	69	<5	4	0					
R4	73.4	<5	2	0					
R6	70	<5	2	0					
R15	69.8	5.2	3	3					
R16	67.9	<5	4	0					
U8	63.8	<5	3	0					
U9	69.7	<5	3	0	5.9	3813	38,130	\$571,950	\$9,694
U10	66.7	<5	2	0					
U11	66.8	<5	2	0					
U12	70.2	<5	2	0					
U13	72.1	6.6	2	2					
U14	68.7	5	3	3					
U15	66.6	<5	4	0					
U16	67.4	<5	2	0					
U18	65.4	<5	2	0					
U19	64.7	<5	2	0					
U20	64.3	<5	2	0					
U21	61.8	<5	3	0					
U23	65.9	<5	3	0					
U24	65.3	<5	2	0					
U25	62.5	<5	3	0					
Total Homes			57	10					





Noise Mitigation Results

Northbound Hwy 10 – 10 Foot Barrier

All Receptors - 2nd tier added. Total Barrier is 3813 ft

Receptors	Preferred Alternative Nighttime L10 Noise Levels (dBA)	Reduction (in dBA) with 10 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Cost/dBA/Residence
N3	69.5	<5	2	2					
R5	68	<5	4	0					
R4	72.4	<5	2	0					
R6	69.9	<5	2	0					
R15	69.4	5.1	3	3					
R16	67.4	<5	4	0					
U8	63.5	<5	3	0					
U9	69.3	<5	3	0	5.8	3813	38,130	\$571,950	\$14,087
U10	66.4	<5	2	0					
U11	66.3	<5	2	0					
U12	69.4	<5	2	0					
U13	71.1	6.5	2	2					
U14	67.6	<5	3	0					
U15	65.6	<5	4	0					
U16	66.9	<5	2	0					
U18	64.7	<5	2	0					
U19	64	<5	2	0					
U20	63.7	<5	2	0					
U21	61.5	<5	3	0					
U23	65.5	<5	3	0					
U24	64.5	<5	2	0					
U25	62.1	<5	3	0					
Total Homes			57	7					





Noise Mitigation Results

Northbound Hwy 10

- Conducted additional analysis for NB 10 Barriers
- Analyzed shorter barriers that focused on clusters of receptors receiving benefits from barriers.
- Analysis included shorter barrier targeting receptors from U12 to U15 and also U9 to R15
- Results of analysis did not produce a barrier that meets the MnDOT criteria for reasonableness and effectiveness.





Noise Mitigation Results

Eastbound Highway 694/10 – Near Bethel College 20 Foot Barrier

20 ft Barrier

Receptors	Preferred Alternative Daytime L10 Noise Levels (dBA)	Reduction (in dBA) with 20 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Total Cost \$15/sq-ft	Noise Barrier Cost/dBA/Residence
N2	68.2	7.5	6	6	7.5	1806	36,120	\$541,800	\$12,040
R3	65.4	<5	1	0					
U26	69.2	<5	2	0					

Receptors	Preferred Alternative Nighttime L10 Noise Levels (dBA)	Reduction (in dBA) with 20 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Total Cost \$15/sq-ft	Noise Barrier Cost/dBA/Residence
N2	68.4	8.1	6	6	8.1	1806	36,120	\$541,800	\$11,148
R3	65.5	<5	1	0					
U26	69.3	<5	2	0					





Noise Mitigation Results

Eastbound Highway 694/10 – Near Bethel College 15 Foot Barrier

15 ft Barrier

Receptors	Preferred Alternative Daytime L10 Noise Levels (dBA)	Reduction (in dBA) with 15 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost \$15/sq-ft	Noise Barrier Cost/dBA/R residence
N2	68.2	5.6	6	6	5.6	1806	27,090	\$406,350	\$12,094
R3	65.4	<5	1	0					
U26	69.2	<5	2	0					

Receptors	Preferred Alternative Nighttime L10 Noise Levels (dBA)	Reduction (in dBA) with 15 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost \$15/sq-ft	Noise Barrier Cost/dBA/R residence
N2	68.4	5.8	6	6	5.8	1806	27,090	\$406,350	\$11,677
R3	65.5	<5	1	0					
U26	69.3	<5	2	0					





Noise Mitigation Results

Eastbound Highway 694/10 – Near Bethel College 10 Foot Barrier

10 ft Barrier

Receptors	Preferred Alternative Daytime L10 Noise Levels (dBA)	Reduction (in dBA) with 10 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Noise Barrier Cost/dBA/R residence
N2	68.2	<5	6	1	N/A	1806	18,060	\$270,900	N/A
R3	65.4	<5	1	0					
U26	69.2	<5	2	0					

Receptors	Preferred Alternative Nighttime L10 Noise Levels (dBA)	Reduction (in dBA) with 10 ft Noise Barrier	Number of Residences	Number of Affected Residences	Average Decibel Reduction	Noise Barrier Length	Noise Barrier Area (sq-ft)	Noise Barrier Total Cost @ \$15/sq-ft	Noise Barrier Cost/dBA/R residence
N2	68.4	<5	6	1	N/A	1806	18,060	\$270,900	N/A
R3	65.5	<5	1	0					
U26	69.3	<5	2	0					





What is the Final Step in the Noise Barrier Decision Process?

- If a noise barrier meets the Mn/DOT cost-effectiveness criteria and is found to be feasible, then the barrier is constructed with the project
- Unless the affected community formally requests to Mn/DOT that the barrier not be constructed





Documentation

- Environmental Assessment Worksheet (EAW)
 - Results of monitoring and modeling
 - Results of noise mitigation analysis
- Noise Standards Exemption Request
 - Process between Mn/DOT and MPCA
 - Final noise analysis
 - Exceed noise standards even though all reasonably available mitigation measures implemented





Future Meetings

- Public Open House- To Be Announced





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Questions?

Your Destination...Our Priority

