APPENDIX G

Traffic Noise Analysis

HIGHWAY 169 TRAFFIC NOISE ANALYSIS

The purpose of this analysis is to evaluate and document the potential traffic noise impacts from the proposed Highway 169 project in Elk River and Zimmerman, Minnesota. This analysis includes modeled traffic noise levels for existing (year 2007) and future (year 2030) No-Build and Build conditions. This report is organized into the following sections:

- Introduction (Background Information)
- Analysis Methodology
- Modeling Results
- Noise Mitigation
- Noise Barrier Evaluation
- Conclusions

Introduction

Noise is defined as any unwanted sound. Sound travels in a wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels. Decibels (dB) represent the logarithm of the ratio of a sound energy relative to a reference sound energy. For highway traffic noise, an adjustment, or weighting, of the high- and low- pitched sound is made to approximate the way that an average person hears sound. The adjusted sound levels are stated in units of "A-weighted decibels" (dBA). A sound increase of 3 dBA is barely perceptible by the human ear, a 5 dBA increase is clearly noticeable, and a 10 dBA increase is heard as twice as loud. For example, if the sound energy is doubled (i.e., the amount of traffic doubles), there is a 3 dBA increase in noise, which is just barely noticeable to most people. On the other hand, if traffic increases by a factor of ten times, the resulting sound level will increase by about 10 dBA and be heard to be twice as loud.

In Minnesota, traffic noise impacts are evaluated by measuring and/or modeling the traffic noise levels that are exceeded 10 percent and 50 percent of the time during the hours of the day and/or night that have the loudest traffic scenario. These numbers are identified as the L_{10} and L_{50} levels, respectively. The L_{10} value is the noise level that is exceeded for a total of 10 percent, or 6 minutes, of an hour. The L_{50} value is the noise level that is exceeded for a total of 50 percent, or 30 minutes, of an hour.

The following chart provides a rough comparison of the noise levels of some common noise sources.

Sound Pressure Level (dBA)	Noise Source
140----------	Jet Engine (at 75 feet)
130----------	Jet Aircraft (at 300 feet)
120----------	Rock and Roll Concert
110----------	Pneumatic Chipper
100----------	Jointer/Planer
90 ----------	Chainsaw
80 ----------	Heavy Truck Traffic
70 ----------	Business Office
60 ----------	Conversational Speech
50 ----------	Library
40 ----------	Bedroom
30 ----------	Secluded Woods
20 ----------	Whisper

Source: "A Guide to Noise Control in Minnesota," Minnesota Pollution Control Agency, http://www.pca.state.mn.us/programs/pubs/noise.pdf and "Highway Traffic Noise," FHWA, http://www.fhwa.dot.gov/environment/htnoise.htm.

Along with the volume of traffic and other factors (e.g., topography of the area and vehicle speed) that contribute to the loudness of traffic noise, the distance of a receptor from a sound's source is also an important factor. Sound level decreases as distance from a source increases. A rule of thumb regarding sound level decrease due to increasing distance from a line source (roadway) that is commonly used is: beyond approximately 50 feet from the sound source, each doubling of distance from the line source over hard ground (such as pavement or water) will reduce the sound level by 3 dBA, whereas each doubling of distance over soft ground (such as vegetated or grassy ground) results in a sound level decrease of 4.5 dBA.

Minnesota state noise standards have been established for daytime and nighttime periods. For residential land uses (identified as Noise Area Classification 1 or NAC-1), the Minnesota State standards for L_{10} are 65 dBA for daytime and 55 dBA for nighttime; the standards for L_{50} are 60 dBA for daytime and 50 dBA for nighttime. The MPCA defines daytime as 7:00 a.m. to 10:00 p.m. and nighttime from 10:00 p.m. to 7:00 a.m. State noise standards are depicted in Table G-1. Minnesota State noise standards apply to the outdoor atmosphere (i.e., exterior noise levels).

TABLE G-1
MINNESOTA STATE NOISE STANDARDS

MPCA State Noise Standards					
Land Use	**Code**	**Daytime (7 a.m. – 10 p.m.) dBA**		**Nighttime (10 p.m. – 7 a.m.) dBA**	
Residential	**NAC-1**	L_{10} of 65	L_{50} of 60	L_{10} of 55	L_{50} of 50
Commercial	**NAC-2**	L_{10} of 70	L_{50} of 65	L_{10} of 70	L_{50} of 65
Industrial	**NAC-3**	L_{10} of 80	L_{50} of 75	L_{10} of 80	L_{50} of 75

For residential and parkland uses (Federal Land Use Category B), the Federal L_{10} noise abatement criteria is 70 dBA for both daytime and nighttime. Locations where noise levels are "approaching" or exceeding the criterion level must be evaluated for noise abatement reasonableness. Mn/DOT defines a level as "approaching" the criterion level when it is 1 dBA or less below the criterion level (e.g., 69 dBA is defined as "approaching" the Federal noise abatement criterion for residential land uses). Federal Noise Abatement Criteria (NAC) are shown in Table G-2.

TABLE G-2
FEDERAL NOISE ABATEMENT CRITERIA

FHWA Noise Abatement Criteria		
Category	**L_{10} dBA**	**Land Use**
A	**60**	Special areas requiring serenity
B	**70**	Residential and recreational areas
C	**75**	Commercial and industrial areas
D	**NA**	Undeveloped areas
E	**55***	Residential, hospitals, libraries, etc.

* Applies to interior noise levels. All other land uses are exterior levels.

In addition to the identified noise criteria, the FHWA also defines a noise impact as a "substantial increase" in the future noise levels over the existing noise levels. Mn/DOT considers an increase of 5 dBA or greater a substantial noise level increase.

The State noise standards apply to Highway 169 and Highway 10. Exemptions to state noise standards are found in Minnesota Statutes 2000, Section 116.07 subd. (2a). There is stated the conditions and roadway types that are exempt from the state noise standards. Because Federal funds may be used as part of this project, the Federal noise abatement criteria apply to all roads.

Methodology

Affected Environment

The purpose of this noise analysis is to determine the effect on impacts of the proposed project on traffic-generated noise levels. It is also important to note that the project setting includes other noise sources in the area that may have some affect on ambient noise levels.

The Highway 169 project corridor is located in an urban/suburban area in Elk River from the Mississippi River to 197th Avenue and transitions from this urban/suburban environment to a rural environment as motorists travel north through Livonia Township to the City of Zimmerman. Traffic noise is generated by vehicles traveling on Highway 169 as well as intersecting County and local roadways. Other sources include noise generated by freight trains traveling on the BNSF Railway mainline, which crosses Highway 169 just north of the Highway 10/101/169 system interchange. The BNSF mainline line carries approximately 46 trains per day at 60 miles per hour (mph), as well as additional traffic from the Northstar Commuter Rail service (additional 12 trains per day).[1] In addition to train noise, other location-specific sources include noise generated by operations of the Great River Energy facility at the Highway 10/101/169 interchange, and noise generated by gravel mining operations in the rural portion of Elk River.

Noise Monitoring

Noise level monitoring is commonly performed during a noise study to document existing noise levels. Existing noise levels were monitored at six sites adjacent to proposed construction areas and where chosen to represent areas of outdoor human activity (i.e., residential land uses). Noise monitoring locations are described below.

- Monitoring site 1 (receptor 7) is located along the east side of Highway 169 in Elk River between Main Street and School Street at Baldwin Park (see Figure G-1).
- Monitoring site 2 (receptor 21) is located along the east side of Highway 169 in Elk River between School Street and 193rd Avenue (see Figure G-2).
- Monitoring site 3 (receptor 61) is located along the east side of Highway 169 in Livonia Township south of the existing CSAH 25 alignment (northeast quadrant of the proposed Highway 169/CSAH 19/25 interchange) (see Figure G-4).
- Monitoring site 4 (receptor 76) is located along the east side of Highway 169 north of CSAH 4 in Zimmerman. Monitoring site 4 is located in a residential area along existing Fremont Drive that would be acquired for right of way with the proposed shifted alignment of Highway 169 (see Figure G-5).

[1] Minnesota Department of Transportation. 2008. The Minnesota Department of Transportation website (online). Mn/DOT Metro Railroads Train Volumes and Speeds Map accessed 02-10-2008 at http://www.dot.state.mn.us/ofrw/freightData.html

- Monitoring site 5 (receptor 80) is located east of Highway 169 and north of CSAH 4 along Fremont Lane. Monitoring site 5 represents residences located along the southeast shore of Lake Fremont (see Figure G-5).
- Monitoring site 6 (receptor 84-2) is located east of Highway 169 and north of CSAH 4 along Pine Street and Terrace Drive. Monitoring site 6 is located between the proposed Freemont Drive alignment and Lake Fremont (see Figure G-5).

Daytime noise levels were monitored during daytime hours (from 9:00 a.m. to noon and from 1:00 p.m. to 4:00 p.m.) on August 14, 2007. A trained noise monitoring technician was present at each session for the entire monitoring session to ensure correct operation of the instrumentation.

Daytime noise monitoring results ranged from 50.0 dBA (L_{10}) to 70.0 dBA (L_{10}). Noise monitoring results are presented in Tables G-3A through G-3C along with the results of computer modeling for existing daytime conditions.

Noise Modeling

Traffic noise impacts were assessed by modeling noise levels at receptor sites likely to be affected by the construction of the proposed project. Noise levels were modeled at 92 representative receptor sites along the project corridor. Of the 92 noise model receptor locations, 64 receptor locations represented residential land uses. Other receptor locations represented institutional (church), park, commercial/business, or industrial land uses. The land use at each receptor location is indicated in Tables G-3A through G-3C and G-4A through G-4C. The locations of the model receptor sites are shown in Figures G-1 through G-5. Traffic noise impacts for the proposed project were evaluated based on the three segments (urban Elk River; rural Elk River and Livonia Township; Zimmerman) described in Section III.A of the EA/EAW.

Noise modeling was done using the noise prediction program "MINNOISE," a version of the FHWA "STAMINA" model adapted by Mn/DOT. This model uses traffic volumes, speed, class of vehicle, and the typical characteristics (e.g., roadway horizontal and vertical alignment) of the roadway being analyzed. Noise model input files were developed based on the following assumptions:

- Traffic data input into the MINNOISE model included existing (year 2007)[2] and future (year 2030 No Build and Build conditions) forecasted traffic volumes. Year 2030 was identified as the future year for analysis because this is the design year used for the traffic operations analysis and design of the proposed improvements.
- The peak p.m. hour (4:30 p.m. to 5:30 p.m.) was identified to be the loudest hour during the daytime period. The peak a.m. hour (6:00-7:00 a.m.) during the morning rush hour period was identified to be the loudest hour during the nighttime period.

[2] Traffic data input for existing conditions model input files in Segment 1 (urban Elk River) and Segment 2 (rural Elk River and Livonia Township) are based on year 2007 traffic volumes. Traffic data input for existing conditions model input files in Segment 3 (Zimmerman) are based on year 2006 traffic volumes. Discussions of modeled traffic noise levels under existing conditions will refer to year 2007 for all locations throughout the project area.

- In urban Elk River (Segment One) and rural Elk River (southern half of Segment Two), the peak daytime hour was identified as eight percent of ADT. The peak nighttime hour (6:00 - 7:00 a.m.) was identified as seven percent of ADT. In Livonia Township and Zimmerman (northern half of Segment Two and Segment Three), including the proposed CSAH 25/19 interchange, the peak daytime hour was identified as 12 percent of ADT. The nighttime hour (6:00 – 7:00 am) was identified as nine percent of ADT.
- In urban Elk River (Segment One) and rural Elk River (southern half of Segment Two), the directional split on the directional split on Highway 169 during the daytime peak hour was identified as 70 percent northbound and 30 percent southbound. The directional split during the nighttime hour (6:00 – 7:00 a.m.) was identified as 30 percent northbound and 70 percent southbound.
- In Livonia Township (northern half of Segment Two) and Zimmerman (Segment Three) the directional split on Highway 169 during the daytime peak hour was identified as 70 percent northbound and 30 percent southbound. The directional split during the nighttime hour was identified as 30 percent northbound and 70 percent southbound.
- Existing and No-Build noise model input files assumed that vehicles were traveling through Highway 169 at-grade intersections in Elk River, Livonia Township, and Zimmerman at constant operating speeds as a worst-case scenario.

Peak noise levels also do not always correspond to peak traffic hours. This is the case when increased congestion during the morning and afternoon peak hours causes reduced speeds. To account for this phenomenon, default traffic volumes were used in the noise model input files when traffic models indicated that operational level of service (LOS) on a particular roadway was LOS D or worse. An operational LOS C is considered free-flow conditions for purposes of traffic noise models.

Intersection operations analyses were used as a proxy to determine the LOS on Highway 169 in the urban area of Elk River where existing at-grade intersections are more closely spaced together (i.e., Main Street to 197th Avenue), relative to other locations along the Highway 169 project corridor. Where adjacent at-grade intersections operate at LOS D or worse, traffic queues may prevent vehicles from reaching free-flow speeds between the intersections. In this case, a default volume of 900 vehicles per lane per hour was used in the urban area in Elk River with existing and future No Build conditions.

Intersection operations analyses were also used as a proxy to determine the operational level of service at CSAH 4 in Zimmerman. Under future No Build conditions, the existing Highway 169/CSAH 4 intersection is predicted to operate at LOS F. Under future No Build conditions, projected traffic volumes on Highway 169 in Zimmerman are anticipated to exceed the capacity of the existing expressway facility. As such, traffic queues may prevent vehicles from reaching free-flow speeds on Highway 169 through Zimmerman. In this case, a default volume of 1,200 vehicles per lane per hour was used for Highway 169 through the City of Zimmerman.

Modeling Results

Noise monitoring and modeling results are tabulated in Tables G-3A through G-3C and G-4A through G-4C. Noise modeling results are summarized in Table G-5. Modeling receptor locations are illustrated in Figures G-1 through G-5. While both the L_{10} and L_{50} descriptors are shown in the tables, the discussions of modeling results presented below only reference the L_{10} values, because the L_{10} descriptor is used to define both the State and Federal noise level regulatory thresholds.

Segment One: Urban Elk River

As tabulated in Table G-3A, existing daytime noise levels range from 57.6 dBA to 71.7 dBA, whereas existing nighttime noise levels range from 55.8 dBA to 69.6 dBA. In general, existing nighttime noise levels are approximately 1 dBA to 2 dBA lower than existing daytime levels at modeled receptor locations. Fourteen modeled receptor locations with existing conditions exceed State daytime standards. Twenty-six modeled receptor locations with existing conditions exceed State nighttime standards.

Noise levels for future (year 2030) No-Build conditions generally increase by 1 dBA to 2 dBA over existing conditions for both daytime and nighttime conditions. Future No-Build daytime noise levels are predicted to range from 59.3 dBA to 72.2 dBA, whereas future No-Build nighttime noise levels are predicted to range from 59.6 dBA to 73.6 dBA. Fifteen modeled receptor locations are predicted to exceed State daytime standards with future No-Build conditions. Thirty modeled residential receptor locations are predicted to exceed State nighttime standards with future No-Build conditions (see Table G-3A and Table G-4A).

Construction of the Build Alternative is predicted to increase daytime noise levels approximately 0.7 dBA to 7.4 dBA compared to existing conditions at most modeled locations within Elk River from the Highway 10/101/169 interchange to 197th Avenue. One modeled receptor location east of Highway 169 (receptor 2-1) is predicted to increase by 10.2 dBA. This increase is due in part to the shift in the Highway 169 alignment to the east at this location. In general, noise level increases are predicted because of increases in traffic volumes over time, changes in alignments (vertical and horizontal) of local roadways, and construction of interchanges and interchange ramps.

Some modeled receptor locations are predicted to experience a reduction in daytime noise levels with construction of the Build Alternative in the urban Elk River Segment. In general, these modeled receptor locations are located adjacent to interchange areas where the Highway 169 vertical profile is depressed and retaining walls are proposed with Build conditions.

Segment Two: Rural Elk River and Livonia Township

Existing daytime noise levels range from 52.4 dBA to 73.8 dBA, whereas existing nighttime noise levels range from 51.5 dBA to 72.0 dBA (see Table G-3B). In general, existing nighttime noise levels are up to 2 dBA lower than existing daytime levels at modeled receptor locations. Thirteen modeled residential receptor locations with existing conditions exceed State daytime

standards. Twenty-two modeled receptor locations with existing conditions exceed State nighttime standards.

Noise levels for future (year 2030) No-Build conditions generally increase by 1 dBA to 2 dBA over existing conditions for both daytime and nighttime conditions. Future No-Build daytime noise levels are predicted to range from 53.2 dBA to 73.3 dBA, whereas future No-Build nighttime noise levels are predicted to range from 53.7 dBA to 74.2 dBA. Fifteen modeled residential receptor locations are predicted to exceed State daytime standards under future No-Build conditions. Twenty-three modeled residential receptor locations are predicted to exceed State nighttime standards under future No-Build conditions (see Table G-3B and Table G-4B).

Construction of the Build Alternative is predicted to increase daytime noise levels approximately 1 dBA to 3 dBA at most modeled locations within rural Elk River and Livonia Township. Daytime noise levels are predicted to increase 7.6 dBA and 11.5 dBA at rural receptor locations where local road alignments or frontage road alignments are located adjacent to modeled receptor locations.

Segment Three: Zimmerman

As tabulated in Table G-3C, existing daytime noise levels range from 52.4 dBA to 72.4 dBA, whereas existing nighttime noise levels range from 51.4 dBA to 70.8 dBA. In general, existing nighttime noise levels are approximately 2 dBA lower than daytime levels at modeled receptor locations. Nine modeled residential receptor locations with existing conditions exceed State daytime standards. Fifteen modeled residential receptor locations with existing conditions exceed State nighttime standards.

Noise levels for the future (year 2030) No-Build conditions generally increase by approximately 1 dBA to 2 dBA over existing noise levels for both daytime and nighttime conditions. Future No-Build daytime noise levels are predicted to range from 54.5 dBA to 74.4 dBA, whereas future No-Build nighttime noise levels are predicted to range from 53.9 dBA to 73.2 dBA. Nine modeled residential receptor locations are predicted to exceed State daytime standards under future (year 2030) No-Build. Nineteen modeled residential receptor locations are predicted to exceed State nighttime standards under future No-Build conditions (see Tables G-3C and G-4C).

Construction of the Build Alternative is predicted to decrease noise levels in Zimmerman west of Highway 169 where the highway alignment is shifted to the east. Noise levels are predicted to increase 5.9 dBA to 15.0 dBA over existing conditions at areas east of Highway 169 along Lake Fremont. In general, noise level increases are predicted because of changes in the horizontal alignment of Highway 169 (i.e., shifting the Highway 169 horizontal alignment to accommodate the Highway 169/CSAH 4 interchange under future (year 2030) Build conditions).

TABLE G-3A
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – DAYTIME
SEGMENT ONE: URBAN ELK RIVER

Receptor*	Monitored		Existing (2007)		No-Build (2030)		Difference Between Existing (2007) and No-Build (2030)		Build (2030)		Difference Between Existing (2007) and Build (2030)	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
1-1 (P) (1)			**70.6**	**66.5**	**72.1**	**68.4**	1.5	1.9	**70.0**	**67.4**	-0.6	0.9
1-2 (C) (1)			66.6	63.8	68.0	65.6	1.4	1.8	67.3	64.8	0.7	1.0
1-3 (R/C) (2)			**70.2**	**66.7**	**72.0**	**69.1**	1.8	2.4	**71.4**	**67.5**	1.2	0.8
2-1 (C) (1)			65.3	62.0	66.0	63.2	0.7	1.2	**75.5**	**72.2**	10.2	10.2
3-1 (R) (4)			60.5	58.0	61.5	59.2	1.0	1.2	64.2	**61.9**	3.7	3.9
4-1 (R) (3)			61.4	58.8	62.4	60.0	1.0	1.2	**66.1**	**62.9**	4.7	4.1
5 (C) (4)			68.7	64.4	69.8	65.8	1.1	1.4	NA	NA	NA	NA
6 (R) (3)			**69.5**	**65.0**	**70.0**	**65.9**	0.5	0.9	**69.3**	**66.2**	-0.2	1.2
7 (P) (1)	**67.0**	**63.0**	**69.1**	**64.7**	**69.7**	**65.6**	0.6	0.9	**68.2**	**65.4**	-0.9	0.7
8-1 (R) (6)			**67.8**	**63.6**	**68.9**	**65.0**	1.1	1.4	**69.3**	**66.1**	1.5	2.5
9 (R) (1)			**71.7**	**66.6**	**72.2**	**67.5**	0.5	0.9	**72.9**	**69.1**	1.2	2.5
10 (C) (3)			67.9	63.9	68.6	65.0	0.7	1.1	67.6	63.6	-0.3	-0.3
11 (C) (1)			69.8	**65.3**	**70.7**	**66.5**	0.9	1.2	67.4	61.5	-2.4	-3.8
12 (R) (4)			61.2	58.4	62.1	59.6	0.9	1.2	60.3	58.1	-0.9	-0.3
13 (C) (2)			67.6	63.5	68.8	65.0	1.2	1.5	69.8	**66.2**	2.2	2.7
14 (C) (1)			69.5	64.9	70.8	66.7	1.3	1.8	66.3	63.8	-3.2	-1.1
15 (R) (1)			60.7	58.0	61.8	59.4	1.1	1.4	62.1	59.7	1.4	1.7
16 (R) (4)			**65.1**	**60.6**	**66.9**	**63.0**	1.8	2.4	**65.9**	**61.6**	0.8	1.0
17 (C) (4)			68.1	63.6	69.8	**65.7**	1.7	2.1	68.1	**65.3**	0.0	1.7
18 (C) (3)			64.9	61.5	66.7	63.2	1.8	1.7	66.3	64.0	1.4	2.5
19 (R) (3)			60.3	57.7	61.9	59.3	1.6	1.6	62.6	**60.6**	2.3	2.9
State Standards[(1)]	**65**	**60**	**65**	**60**	**65**	**60**	-	-	**65**	**60**	-	-
State Standards[(2)]	**70**	**65**	**70**	**65**	**70**	**65**	-	-	**70**	**65**	-	-

Bold numbers are above State standards.
(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park
(1) State daytime standards for residential land uses (NAC-1).
(2) State daytime standards for commercial land uses (NAC-2).
* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.
N/A = not applicable. These receptors would be acquired as part of the project.

TABLE G-3A continued
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – DAYTIME
SEGMENT ONE: URBAN ELK RIVER

Receptor*	Monitored		Existing (2007)		No-Build (2030)		Difference Between Existing (2007) and No-Build (2030)		Build (2030)		Difference Between Existing (2007) and Build (2030)	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
20-1 (R) (4)			**68.2**	**64.0**	**70.1**	**65.7**	1.9	1.7	**75.4**	**72.0**	7.2	8.0
21 (R) (4)	**70.0**	**65.5**	**69.5**	**64.9**	**71.4**	**66.6**	1.9	1.7	**76.9**	**73.4**	7.4	8.5
22 (C) (4)			68.3	63.7	70.0	**65.8**	1.7	2.1	**73.9**	**70.5**	5.6	6.8
23 (R) (1)			62.2	59.2	64.0	**61.0**	1.8	1.8	**68.9**	**66.7**	6.7	7.5
24 (R) (4)			57.6	55.4	59.3	57.1	1.7	1.7	64.2	**62.5**	6.6	7.1
25 (R) (3)			59.9	55.2	62.3	57.7	2.4	2.5	64.4	**61.1**	4.5	5.9
26 (R) (2)			61.4	57.0	63.6	59.2	2.2	2.2	64.7	**61.9**	3.3	4.9
27 (C) (3)			65.8	62.1	67.2	63.9	1.4	1.8	69.7	**66.7**	3.9	4.6
28 (R) (1)			61.7	58.0	62.8	59.5	1.1	1.5	63.1	**60.7**	1.4	2.7
29 (C) (1)			68.8	64.3	69.9	**65.6**	1.1	1.3	69.6	**66.2**	0.8	1.9
30 (R) (2)			63.0	59.7	63.8	**60.9**	0.8	1.2	**65.4**	**61.3**	2.4	1.6
31-1 (R) (2)			**66.5**	**62.5**	**67.3**	**63.5**	0.8	1.0	**68.9**	**64.6**	2.4	2.1
32 (C) (1)			67.6	63.6	67.9	64.1	0.3	0.5	65.4	62.0	-2.2	-1.6
33 (R) (3)			59.5	56.7	60.1	57.5	0.6	0.8	64.7	58.9	5.2	2.2
34 (R) (3)			**65.4**	**61.7**	**66.1**	**62.6**	0.7	0.9	**67.0**	**64.3**	1.6	2.6
35 (R) (2)			**70.5**	**65.8**	**70.9**	**66.5**	0.4	0.7	**73.0**	**69.3**	2.5	3.5
36-1 (R) (2)			**66.2**	**61.1**	**66.7**	**61.8**	0.5	0.7	**72.1**	**68.5**	5.9	7.4
37-1 (R) (2)			**67.5**	**62.7**	**68.3**	**63.7**	0.8	1.0	**72.7**	**69.5**	5.2	6.8
State Standards[(1)]	**65**	**60**	**65**	**60**	**65**	**60**	-	-	**65**	**60**	-	-
State Standards[(2)]	**70**	**65**	**70**	**65**	**70**	**65**	-	-	**70**	**65**	-	-

Bold numbers are above State standards.
(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park
(1) State daytime standards for residential land uses (NAC-1).
(2) State daytime standards for commercial land uses (NAC-2).
* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.
N/A = not applicable. These receptors would be acquired as part of the project.

TABLE G-3B
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – DAYTIME
SEGMENT TWO: RURAL ELK RIVER AND SOUTHERN LIVONIA TOWNSHIP

Receptor*	Monitored		Existing (2007)		No-Build (2030)		Difference Between Existing (2007) and No-Build (2030)		Build (2030)		Difference Between Existing (2007) and Build (2030)	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
38 (R) (1)			55.9	52.4	57.9	51.6	2.0	-0.8	58.3	56.1	2.4	3.7
39 (R) (3)			**65.8**	**62.1**	**66.5**	**63.2**	0.7	1.1	**68.5**	**65.9**	2.7	3.8
40 (R) (1)			63.1	59.9	63.8	**60.9**	0.7	1.0	**65.8**	**63.5**	2.7	3.6
41 (R) (1)			58.6	56.0	59.3	57.0	0.7	1.0	61.3	59.5	2.7	3.5
42 (R) (2)			**67.8**	**63.5**	**68.9**	**64.9**	1.1	1.4	**70.3**	**67.2**	2.5	3.7
43 (R) (1)			**69.3**	**64.2**	**70.6**	**65.8**	1.3	1.6	**71.9**	**68.1**	2.6	3.9
44 (I) (1)			66.8	63.1	67.8	64.4	1.0	1.3	69.5	66.9	2.7	3.8
45 (R) (2)			**69.3**	**65.2**	**70.0**	**66.2**	0.7	1.0	**72.3**	**69.3**	3.0	4.1
46 (R) (1)			**71.1**	**66.4**	**72.2**	**67.8**	1.1	1.4	**73.9**	**70.4**	2.8	4
47 (I) (1)			65.4	62.1	66.1	63.1	0.7	1.0	68.3	66.0	2.9	3.9
48 (R) (2)			**71.2**	**66.2**	**72.4**	**67.7**	1.2	1.5	N/A	N/A	N/A	N/A
49 (C) (1)			60.4	57.9	61.2	59.0	0.8	1.1	63.5	**61.9**	3.1	4
50 (R) (1)			52.4	50.6	53.2	51.7	0.8	1.1	63.9	56.9	11.5	6.3
51 (R) (1)			**72.7**	**67.6**	**73.3**	**68.7**	0.6	1.1	**75.4**	**71.5**	2.7	3.9
52 (R) (1)			**67.0**	**62.9**	**67.6**	**63.9**	0.6	1.0	**69.5**	**66.6**	2.5	3.7
53 (I) (1)			69.1	63.9	70.2	65.4	1.1	1.5	71.7	67.7	2.6	3.8
54 (R) (1)			60.4	50.8	63.1	54.2	2.7	3.4	60.8	56.6	0.4	5.8
55 (R) (1)			64.5	**61.4**	**66.0**	**63.4**	1.5	2.0	**67.3**	**65.0**	2.8	3.6
56 (R) (1)			**72.9**	**67.8**	**74.9**	**70.5**	2.0	2.7	**75.0**	**70.4**	2.1	2.6
57 (R) (1)			**73.8**	**68.4**	**75.9**	**71.2**	2.1	2.8	**76.9**	**72.7**	3.1	4.3
58 (R) (3)			**67.9**	**64.2**	**69.3**	**66.2**	1.4	2.0	**71.1**	**68.2**	3.2	4.0
59 (R) (1)			64.0	**61.0**	**65.7**	**63.3**	1.7	2.3	**67.7**	**65.4**	3.7	4.4
60 (C) (1)			**70.8**	**66.4**	**72.7**	**69.0**	1.9	2.6	**73.6**	**70.2**	2.8	3.8
61 (R) (1)	66.0	61.0	**68.4**	**64.6**	**69.8**	**66.7**	1.4	2.1	**71.4**	**68.6**	3.0	4.0
62 (R) (1)			56.4	54.1	58.7	56.7	2.3	2.6	64.0	59.4	7.6	5.3
63 (R) (1)			62.3	59.4	64.4	**61.9**	2.1	2.5	**65.8**	**63.3**	3.5	3.9
64 (R) (1)			**66.6**	**63.1**	**68.3**	**65.5**	1.7	2.4	**69.5**	**66.9**	2.9	3.8
65 (R) (1)			62.7	59.5	64.2	**61.6**	1.5	2.1	**65.8**	**63.5**	3.1	4.0
State Standards[(1)]	**65**	**60**	**65**	**60**	**65**	**60**	-	-	**65**	**60**	-	-
State Standards[(2)]	**70**	**65**	**70**	**65**	**70**	**65**	-	-	**70**	**65**	-	-

Bold numbers are above State standards.

(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park

(1) State daytime standards for residential land uses (NAC-1).

(2) State daytime standards for commercial land uses (NAC-2).

* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.

N/A = not applicable. These receptors would be acquired as part of the project.

TABLE G-3C
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – DAYTIME
SEGMENT THREE: ZIMMERMAN AND NORTHERN LIVONIA TOWNSHIP

Receptor*	Monitored		Existing (2007)		No-Build (2030)		Difference Between Existing (2007) and No-Build (2030)		Build (2030)		Difference Between Existing (2007) and Build (2030)	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
66 (Ch) (1)			**68.4**	**63.7**	**70.4**	**66.5**	2.0	2.8	**71.9**	**68.2**	3.5	4.5
67 (C) (5)			69.5	64.4	**71.6**	**67.3**	2.1	2.9	65.4	63.1	-4.1	-1.3
68 (C) (1)			68.0	63.4	70.0	**66.2**	2.0	2.8	63.3	61.4	-4.7	-2.0
69 (C) (2)			70.0	64.9	**72.1**	**67.9**	2.1	3.0	64.0	62.1	-6.0	-2.8
70 (C)(1)			63.3	60.0	65.1	62.5	1.8	2.5	62.9	60.2	-0.4	0.2
71 (Ch) (1)			63.7	59.9	**65.4**	**62.3**	1.7	2.4	63.8	60.3	0.1	0.4
72 (C) (3)			**70.2**	64.8	**72.3**	**67.8**	2.1	3.0	64.0	62.1	-6.2	-2.7
73 (C) (4)			63.6	59.9	65.5	62.5	1.9	2.6	61.7	60.0	-1.9	0.1
74 (R) (17)			58.4	55.4	60.3	57.9	1.9	2.5	61.4	59.5	3.0	4.1
75 (C) (6)			**72.4**	**66.3**	**74.4**	**69.2**	2.0	2.9	67.4	65.1	-5.0	-1.2
76 (R) (4)	**67.0**	60.0	**69.4**	**64.4**	**71.3**	**67.1**	1.9	2.7	**73.8**	**69.9**	4.4	5.5
77-1 (R) (2)			57.4	54.3	59.2	56.8	1.8	2.5	**70.5**	**67.4**	13.1	13.1
77-2 (R) (2)			56.1	53.3	58.0	55.8	1.9	2.5	**68.1**	**65.4**	12.0	12.1
77-3 (R) (2)			54.6	52.0	56.5	54.5	1.9	2.5	**65.5**	**63.2**	10.9	11.2
77-4 (R) (3)			53.4	51.1	55.4	53.6	2.0	2.5	63.6	**61.5**	10.2	10.4
78-1 (R) (1)			57.0	54.1	58.8	56.6	1.8	2.5	**72.0**	**68.6**	15.0	14.5
78-2 (R) (2)			55.7	53.0	57.6	55.5	1.9	2.5	**68.5**	**65.8**	12.8	12.8
79 (R) (4)			54.0	51.6	56.0	54.1	2.0	2.5	**65.0**	**62.8**	11.0	11.2
80 (R) (8)	50.0	47.0	52.4	50.3	54.5	53.0	2.1	2.7	62.7	**60.8**	10.3	10.5
81 (R) (1)			52.8	50.7	55.1	53.5	2.3	2.8	63.4	**61.4**	10.6	10.7
82 (R) (8)			53.0	50.4	55.8	53.8	2.8	3.4	60.7	59.1	7.7	8.7
83 (R) (6)			59.2	55.8	61.0	58.3	1.8	2.5	**71.6**	**68.3**	12.4	12.5
State Standards[(1)]	**65**	**60**	**65**	**60**	**65**	**60**	-	-	**65**	**60**	-	-
State Standards[(2)]	**70**	**65**	**70**	**65**	**70**	**65**	-	-	**70**	**65**	-	-

Bold numbers are above State standards.
(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park
(1) State daytime standards for residential land uses (NAC-1).
(2) State daytime standards for commercial land uses (NAC-2).
* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.
N/A = not applicable. These receptors would be acquired as part of the project.

TABLE G-3C continued
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – DAYTIME
SEGMENT THREE: ZIMMERMAN AND NORTHERN LIVONIA TOWNSHIP

Receptor*	Monitored		Existing (2007)		No-Build (2030)		Difference Between Existing (2007) and No-Build (2030)		Build (2030)		Difference Between Existing (2007) and Build (2030)	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
84-1 (R) (2)			59.4	56.0	61.2	58.5	1.8	2.5	**69.3**	**66.5**	9.9	10.5
84-2 (R) (1)	57.0	52.5	60.4	56.8	62.2	59.3	1.8	2.5	**69.6**	**66.8**	9.2	10.0
85 (R) (3)			**67.3**	**62.7**	**69.1**	**65.4**	1.8	2.7	**73.2**	**69.5**	5.9	6.8
86 (R) (1)			**68.5**	**63.5**	**70.4**	**66.2**	1.9	2.7	**72.6**	**68.7**	4.1	5.2
87 (R) (3)			**68.0**	**63.2**	**69.8**	**65.9**	1.8	2.7	**71.5**	**68.2**	3.5	5.0
88 (R) (3)			**69.6**	**63.9**	**71.6**	**66.8**	2.0	2.9	**72.4**	**68.1**	2.8	4.2
89 (R) (3)			**68.5**	**63.5**	**70.4**	**66.3**	1.9	2.8	**71.1**	**67.7**	2.6	4.2
90 (R) (3)			**68.3**	**63.4**	**70.2**	**66.1**	1.9	2.7	**71.1**	**67.9**	2.8	4.5
91 (R) (3)			**67.7**	**63.0**	**69.5**	**65.7**	1.8	2.7	**70.9**	**67.8**	3.2	4.8
92 (R) (3)			**69.3**	**64.0**	**71.2**	**66.8**	1.9	2.8	**73.0**	**69.1**	3.7	5.1
State Standards[(1)]	**65**	**60**	**65**	**60**	**65**	**60**	-	-	**65**	**60**	-	-
State Standards[(2)]	**70**	**65**	**70**	**65**	**70**	**65**	-	-	**70**	**65**	-	-

Bold numbers are above State standards.
(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park
(1) State daytime standards for residential land uses (NAC-1).
(2) State daytime standards for commercial land uses (NAC-2).
* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.
N/A = not applicable. These receptors would be acquired as part of the project.

TABLE G-4A
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – NIGHTTIME
SEGMENT ONE: URBAN ELK RIVER

Receptor*	Existing (2007)		2030 No-Build		Difference Between Existing (2007) and 2030 No-Build		2030 Build		Difference Between Existing (2007) and 2030 Build	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
1-1 (P) (1)	**69.6**	**65.7**	**73.6**	**69.8**	4.0	4.1	**69.8**	**66.4**	0.2	0.7
1-2 (C) (1)	66.5	63.4	68.1	65.7	1.6	2.3	67.3	64.4	0.8	1.0
1-3 (R/C) (2)	**68.7**	**65.2**	**71.5**	**68.6**	2.8	3.4	**69.9**	**65.6**	1.2	0.4
2-1 (C) (1)	64.6	61.1	65.8	62.8	1.2	1.7	**72.4**	**68.4**	7.8	7.3
3-1 (R) (4)	**60.4**	**57.6**	**61.5**	**59.2**	1.1	1.6	**63.0**	**60.2**	2.6	2.6
4-1 (R) (3)	**60.7**	**57.9**	**62.4**	**60.0**	1.7	2.1	**64.3**	**60.8**	3.6	2.9
5 (C) (4)	68.8	64.1	69.8	65.8	1.0	1.7	NA	NA	NA	NA
6 (R) (3)	**67.5**	**63.4**	**70.0**	**65.9**	2.5	2.5	**68.5**	**65.0**	1.0	1.6
7 (P) (1)	**67.1**	**63.0**	**69.7**	**65.6**	2.6	2.6	**67.8**	**64.4**	0.7	1.4
8-1 (R) (6)	**67.9**	**63.3**	**68.9**	**65.0**	1.0	1.7	**69.7**	**65.4**	1.8	2.1
9 (R) (1)	**69.4**	**64.7**	**72.2**	**67.5**	2.8	2.8	**71.1**	**67.1**	1.7	2.4
10 (C) (3)	66.0	62.2	67.8	64.0	1.8	1.8	66.5	62.7	0.5	0.5
11 (C) (1)	67.1	62.4	**70.5**	**66.7**	3.4	4.3	64.4	57.3	-2.7	-5.1
12 (R) (4)	**58.8**	**56.2**	**62.5**	**60.2**	3.7	4.0	**58.3**	**55.3**	-0.5	-0.9
13 (C) (2)	66.0	62.1	69.8	**66.3**	3.8	4.2	67.0	62.1	1.0	0.0
14 (C) (1)	68.2	63.8	71.9	67.9	3.7	4.1	63.3	59.5	-4.9	-4.3
15 (R) (1)	**58.4**	**55.8**	**62.1**	**59.8**	3.7	4.0	**59.6**	**56.4**	1.2	0.6
16 (R) (4)	**63.4**	**57.9**	**65.6**	**61.6**	2.2	3.7	**63.9**	**58.2**	0.5	0.3
17 (C) (4)	67.1	62.7	**70.9**	**66.9**	3.8	4.2	64.0	59.3	-3.1	-3.4
18 (C) (3)	62.9	59.3	66.8	63.6	3.9	4.3	62.7	59.1	-0.2	-0.2
19 (R) (3)	**58.4**	**55.7**	**62.2**	**59.8**	3.8	4.1	**59.2**	**56.4**	0.8	0.7
State Standards[(1)]	**55**	**50**	**55**	**50**	-	-	**55**	**50**	-	-
State Standards[(2)]	**70**	**65**	**70**	**65**	-	-	**70**	**65**	-	-

Bold numbers are above State standards.
(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park
(1) State nighttime standards for residential land uses (NAC-1).
(2) State nighttime standards for commercial land uses (NAC-2).
* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.
N/A = not applicable. These receptors would be acquired as part of the proposed project.

TABLE G-4A continued
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – NIGHTTIME
SEGMENT ONE: URBAN ELK RIVER

Receptor*	Existing (2007)		2030 No-Build		Difference Between Existing (2007) and 2030 No-Build		2030 Build		Difference Between Existing (2007) and 2030 Build	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
20-1 (R) (4)	**66.0**	**61.5**	**69.9**	**65.9**	3.9	4.4	**70.6**	**65.5**	4.6	4.0
21 (R) (4)	**67.2**	**62.3**	**71.1**	**66.7**	3.9	4.4	**72.0**	**66.7**	4.8	4.4
22 (C) (4)	67.4	62.8	**71.2**	**67.1**	3.8	4.3	**70.4**	65.0	3.0	2.2
23 (R) (1)	**60.4**	**57.2**	**64.2**	**61.4**	3.8	4.2	**64.7**	**61.2**	4.3	4.0
24 (R) (4)	**55.8**	**53.5**	**59.6**	**57.6**	3.8	4.1	**60.3**	**57.8**	4.5	4.3
25 (R) (3)	**58.1**	**52.5**	**61.7**	**57.6**	3.6	5.1	**62.3**	**57.5**	4.2	5.0
26 (R) (2)	**59.5**	**54.2**	**63.0**	**59.1**	3.5	4.9	**62.6**	**58.6**	3.1	4.4
27 (C) (3)	64.3	60.5	67.7	64.4	3.4	3.9	66.3	61.9	2.0	1.4
28 (R) (1)	**60.0**	**55.8**	**62.5**	**59.5**	2.5	3.7	**60.5**	**56.8**	0.5	1.0
29 (C) (1)	67.7	63.3	**71.4**	**67.3**	3.7	4.0	68.8	64.2	1.1	0.9
30 (R) (2)	**61.4**	**58.2**	**65.0**	**62.2**	3.6	4.0	**64.3**	**59.3**	2.9	1.1
31-1 (R) (2)	**65.1**	**61.2**	**68.8**	**65.3**	3.7	4.1	**67.0**	**61.3**	1.9	0.1
32 (C) (1)	64.5	60.6	68.3	64.9	3.8	4.3	64.0	60.3	-0.5	-0.3
33 (R) (3)	**57.5**	**54.8**	**61.2**	**58.8**	3.7	4.0	**62.5**	**55.6**	5.0	0.8
34 (R) (3)	**63.6**	**59.8**	**67.3**	**63.9**	3.7	4.1	**64.7**	**61.6**	1.1	1.8
35 (R) (2)	**66.6**	**62.1**	**70.4**	**66.4**	3.8	4.3	**70.2**	**66.5**	3.6	4.4
36-1 (R) (2)	**62.5**	**57.5**	**66.3**	**61.9**	3.8	4.4	**69.8**	**65.9**	7.3	8.4
37-1 (R) (2)	**65.8**	**61.0**	**69.6**	**65.3**	3.8	4.3	**71.8**	**67.9**	6.0	6.9
State Standards[(1)]	**55**	**50**	**55**	**50**	-	-	**55**	**50**	-	-
State Standards[(2)]	**70**	**65**	**70**	**65**	-	-	**70**	**65**	-	-

Bold numbers are above State standards.
(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park
(1) State nighttime standards for residential land uses (NAC-1).
(2) State nighttime standards for commercial land uses (NAC-2).
* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.
N/A = not applicable. These receptors would be acquired as part of the proposed project.

TABLE G-4B
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – NIGHTTIME
SEGMENT TWO: RURAL ELK RIVER AND SOUTHERN LIVONIA TOWNSHIP

Receptor*	Existing (2007)		2030 No-Build		Difference Between Existing (2007) and 2030 No-Build		2030 Build		Difference Between Existing (2007) and 2030 Build	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
38 (R) (1)	**56.9**	48.0	**59.9**	**51.8**	3.0	3.8	**56.7**	**53.4**	-0.2	5.4
39 (R) (3)	**64.4**	**60.5**	**66.4**	**63.4**	2.0	2.9	**66.0**	**62.8**	1.6	2.3
40 (R) (1)	**62.3**	**58.4**	**64.5**	**61.3**	2.2	2.9	**63.4**	**60.6**	1.1	2.2
41 (R) (1)	**57.7**	**54.8**	**59.9**	**57.5**	2.2	2.7	**59.1**	**56.8**	1.4	2
42 (R) (2)	**68.9**	**64.3**	**71.0**	**67.3**	2.1	3.0	**70.5**	**66.7**	1.6	2.4
43 (R) (1)	**70.7**	**65.5**	**72.9**	**68.7**	2.2	3.2	**72.4**	**67.9**	1.7	2.4
44 (I) (1)	67.1	62.9	69.2	65.9	2.1	3.0	68.8	65.4	1.7	2.5
45 (R) (2)	**67.4**	**63.1**	**69.5**	**66.1**	2.1	3.0	**69.5**	**66.0**	2.1	2.9
46 (R) (1)	**71.6**	**66.4**	**73.8**	**69.6**	2.2	3.2	**73.5**	**69.1**	1.9	2.7
47 (I) (1)	64.1	60.6	66.2	63.4	2.1	2.8	66.1	63.3	2.0	2.7
48 (R) (2)	**72.0**	**66.6**	**74.2**	**69.8**	2.2	3.2	**74.1**	**69.7**	2.1	3.1
49 (C) (1)	59.3	56.7	61.5	59.4	2.2	2.7	61.5	59.5	2.2	2.8
50 (R) (1)	51.5	49.6	53.7	**52.2**	2.2	2.6	**63.3**	**55.9**	11.8	6.3
51 (R) (1)	**70.4**	**65.2**	**72.7**	**68.4**	2.3	3.2	**72.1**	**67.5**	1.7	2.3
52 (R) (1)	**65.4**	**60.1**	**67.4**	**63.3**	2.0	3.2	**66.1**	**62.7**	0.7	2.6
53 (I) (1)	70.5	65.2	72.6	68.2	2.1	3.0	71.9	67.3	1.4	2.1
54 (R) (1)	**58.5**	48.3	**61.7**	**52.7**	3.2	4.4	**57.3**	**54.8**	-1.2	6.5
55 (R) (1)	**62.8**	**59.3**	**65.2**	**62.6**	2.4	3.3	**65.2**	**62.5**	2.4	3.2
56 (R) (1)	**72.4**	**66.6**	**75.0**	**70.4**	2.6	3.8	**74.1**	**68.9**	1.7	2.3
57 (R) (1)	**73.4**	**67.3**	**76.0**	**71.1**	2.6	3.8	**76.0**	**71.2**	2.6	3.9
58 (R) (3)	**66.0**	**61.9**	**68.5**	**65.3**	2.5	3.4	**68.6**	**65.3**	2.6	3.4
59 (R) (1)	**63.0**	**59.5**	**65.4**	**62.8**	2.4	3.3	**65.8**	**63.2**	2.8	3.7
60 (C) (1)	**70.1**	65.0	**72.6**	**68.7**	2.5	3.7	**72.3**	**68.2**	2.2	3.2
61 (R) (1)	**66.5**	**62.2**	**69.0**	**65.7**	2.5	3.5	**69.0**	**65.9**	2.5	3.7
62 (R) (1)	55.0	**52.2**	**57.9**	**55.8**	2.9	3.6	**60.4**	**56.3**	5.4	4.1
63 (R) (1)	**60.7**	**57.4**	**63.6**	**61.0**	2.9	3.6	**63.2**	**60.7**	2.5	3.3
64 (R) (1)	**65.7**	**61.7**	**68.1**	**65.1**	2.4	3.4	**68.1**	**65.1**	2.4	3.4
65 (R) (1)	**61.1**	**57.4**	**63.5**	**60.7**	2.4	3.3	**63.6**	**60.9**	2.5	3.5
State Standards[(1)]	**55**	**50**	**55**	**50**	**-**	**-**	**55**	**50**	**-**	**-**
State Standards[(2)]	**70**	**65**	**70**	**65**	**-**	**-**	**70**	**65**	**-**	**-**

Bold numbers are above State standards.
(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park
(1) State nighttime standards for residential land uses (NAC-1).
(2) State nighttime standards for commercial land uses (NAC-2).
* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.
N/A = not applicable. These receptors would be acquired as part of the proposed project.

TABLE G-4C
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – NIGHTTIME
SEGMENT THREE: ZIMMERMAN AND NORTHERN LIVONIA TOWNSHIP

Receptor*	Existing (2007)		No-Build (2030)		Difference Between Existing (2007) and No-Build (2030)		Build (2030)		Difference Between Existing (2007) and Build (2030)	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
66 (Ch) (1)	**69.0**	**63.9**	**70.6**	**66.3**	1.6	2.4	**72.2**	**68.2**	3.2	4.3
67 (C) (5)	**70.4**	64.9	**72.0**	**67.3**	1.6	2.4	64.7	62.1	-5.7	-2.8
68 (C) (1)	68.6	63.6	70.3	66.1	1.7	2.5	62.6	60.5	-6.0	-3.1
69 (C) (2)	**70.8**	**65.3**	**72.6**	**68.0**	1.8	2.7	63.8	61.7	-7.0	-3.6
70 (C)(1)	62.9	59.3	64.7	61.8	1.8	2.5	63.2	60.2	0.3	0.9
71 (Ch) (1)	62.8	58.9	64.7	**61.5**	1.9	2.6	64.3	**60.5**	1.5	1.6
72 (C) (3)	**70.7**	64.8	**73.2**	**68.4**	2.5	3.6	63.8	61.7	-6.9	-3.1
73 (C) (4)	63.4	59.3	65.8	62.6	2.4	3.3	61.2	59.2	-2.2	-0.1
74 (R) (17)	**58.1**	**54.8**	**60.5**	**57.9**	2.4	3.1	**61.0**	**58.8**	2.9	4.0
75 (C) (6)	**70.3**	63.8	**72.9**	**67.5**	2.6	3.7	67.0	64.3	-3.3	0.5
76 (R) (4)	**67.6**	**62.3**	**70.0**	**65.8**	2.4	3.5	**74.0**	**69.7**	6.4	7.4
77-1 (R) (2)	**56.2**	**53.0**	**58.6**	**56.1**	2.4	3.1	**69.1**	**65.9**	12.9	12.9
77-2 (R) (2)	55.0	**52.0**	**57.3**	**55.1**	2.3	3.1	**66.8**	**64.0**	11.8	12.0
77-3 (R) (2)	53.6	**50.8**	**55.9**	**53.9**	2.3	3.1	**64.3**	**61.9**	10.7	11.1
77-4 (R) (3)	52.5	49.9	54.8	**52.9**	2.3	3.0	**62.5**	**60.3**	10.0	10.4
78-1 (R) (1)	**55.9**	**52.8**	**58.2**	**55.9**	2.3	3.1	**70.6**	**67.0**	14.7	14.2
78-2 (R) (2)	54.6	**51.8**	**57.0**	**54.8**	2.4	3.0	**67.2**	**64.3**	12.6	12.5
79 (R) (4)	53.0	**50.4**	**55.4**	**53.4**	2.4	3.0	**63.9**	**61.5**	10.9	11.1
80 (R) (8)	51.4	49.1	53.9	**52.2**	2.5	3.1	**61.7**	**59.6**	10.3	10.5
81 (R) (1)	51.8	49.5	54.4	**52.7**	2.6	3.2	**62.4**	**60.3**	10.6	10.8
82 (R) (8)	51.9	49.0	54.9	**52.7**	3.0	3.7	**60.0**	**58.4**	8.1	9.4
83 (R) (6)	**57.9**	**54.4**	**60.2**	**57.5**	2.3	3.1	**70.2**	**66.8**	12.3	12.4
State Standards[(1)]	**55**	**50**	**55**	**50**	-	-	**55**	**50**	-	-
State Standards[(2)]	**70**	**65**	**70**	**65**	-	-	**70**	**65**	-	-

Bold numbers are above State standards.
(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park
(1) State nighttime standards for residential land uses (NAC-1).
(2) State nighttime standards for commercial land uses (NAC-2).
* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.
N/A = not applicable. These receptors would be acquired as part of the proposed project.

TABLE G-4C
HIGHWAY 169 NOISE MONITORING AND MODELING RESULTS – NIGHTTIME
SEGMENT THREE: ZIMMERMAN AND NORTHERN LIVONIA TOWNSHIP

Receptor*	Existing (2007)		No-Build (2030)		Difference Between Existing (2007) and No-Build (2030)		Build (2030)		Difference Between Existing (2007) and Build (2030)	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
84-1 (R) (2)	**58.2**	**54.5**	**60.5**	**57.7**	2.3	3.2	**68.1**	**65.2**	9.9	10.7
84-2 (R) (1)	**59.1**	**55.3**	**61.4**	**58.5**	2.3	3.2	**68.4**	**65.4**	9.3	10.1
85 (R) (3)	**65.6**	**60.9**	**68.0**	**64.3**	2.4	3.4	**71.9**	**68.1**	6.3	7.2
86 (R) (1)	**66.8**	**61.5**	**69.3**	**65.0**	2.5	3.5	**71.3**	**67.2**	4.5	5.7
87 (R) (3)	**66.3**	**61.3**	**68.7**	**64.7**	2.4	3.4	**70.4**	**66.9**	4.1	5.6
88 (R) (3)	**67.9**	**61.8**	**70.5**	**65.4**	2.6	3.6	**71.8**	**66.8**	3.9	5.0
89 (R) (3)	**66.9**	**61.6**	**69.3**	**65.2**	2.4	3.6	**70.2**	**66.5**	3.3	4.9
90 (R) (3)	**66.7**	**61.5**	**69.1**	**65.0**	2.4	3.5	**70.2**	**66.7**	3.5	5.2
91 (R) (3)	**66.1**	**61.2**	**68.4**	**64.7**	2.3	3.5	**69.9**	**66.6**	3.8	5.4
92 (R) (3)	**67.6**	**61.9**	**70.1**	**65.5**	2.5	3.6	**72.1**	**67.7**	4.5	5.8
State Standards[(1)]	**55**	**50**	**55**	**50**	-	-	**55**	**50**	-	-
State Standards[(2)]	**70**	**65**	**70**	**65**	-	-	**70**	**65**	-	-

Bold numbers are above State standards.
(R) – Residential; (C) – Commercial; (I) – Industrial; (Ch) – Church; (P) – Park
(1) State nighttime standards for residential land uses (NAC-1).
(2) State nighttime standards for commercial land uses (NAC-2).
* – Number in parentheses in this column is the number of receptors and/or commercial buildings represented by each receptor.
N/A = not applicable. These receptors would be acquired as part of the proposed project.

TABLE G-5
HIGHWAY 169: TRAFFIC NOISE IMPACT SUMMARY

Type of Impact	Segment 1 Urban Elk River (37 Modeled Receptor Locations)			Segment 2 Rural Elk River and Livonia Township (28 Modeled Receptor Locations)			Segment 3 Zimmerman (27 Modeled Receptor Locations)		
	Existing (Year 2007)	No-Build (Year 2030)	Build (Year 2030)	Existing (Year 2007)	No-Build (Year 2030)	Build (Year 2030)	Existing (Year 2007)	No-Build (Year 2030)	Build (Year 2030)
Modeled Receptors Over State Daytime Standards (L_{10})	14	15	19	14	15	18	12	16	14
Modeled Receptors Over State Nighttime Standards (L_{10})	26	30	28	21	24	25	21	23	21
Modeled Receptors Approaching/ Exceeding Federal Abatement Criteria (69 dBA) [(1)]	6	8	10	7	9	12	3	11	14
Substantial increase from existing (≥5 dBA) to future Build conditions noise levels	N/A	N/A	9	N/A	N/A	2	N/A	N/A	9

N/A = not applicable.

(1) For residential and parkland uses (Federal land use category B). Approaching Federal noise abatement criteria for commercial/industrial receptors (Federal land use category) is defined as 74 dBA (L_{10}).

Noise Mitigation

The future Highway 169 Project in Elk River and Zimmerman is considered a Type I project for purposes of noise mitigation analysis. A Type I project is the construction of a new highway on a new alignment or the physical alteration of an existing highway (e.g., change in horizontal or vertical alignment; increase in number of through lanes). 23 CFR 772.13(c) describes noise abatement measures that are to be considered when a noise impact has been identified with a Type I highway project. These noise abatement measures include:

- 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 land designations);
- Alteration of horizontal and vertical alignments;
- Acquisition of property rights (either in fee or lesser interest) for construction of noise barriers;
- Construction of noise barriers (including landscaping for aesthetic purposes) whether within or outside the highway right-of-way;
- Acquisition of real property or interests therein (predominately unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise; and
- Noise insulation of noise sensitive public use or nonprofit institutional structures.

Noise Barrier Evaluation

Noise barrier construction decisions are based on a study of feasibility and reasonableness. Feasibility is determined by physical and/or engineering constraints (i.e., whether a noise barrier could feasibly be constructed on the site). Reasonableness is a more subjective criterion and is based on a number of factors. Economic reasonableness is determined by consideration of Mn/DOT's cost-effectiveness index in concert with Mn/DOT's noise barrier acoustical effectiveness limits (i.e., noise level reduction capability). If noise mitigation is found to be cost-effective, additional reasonableness factors such as aesthetics and the desires of affected property owners are considered.

The feasibility of noise barrier construction is sometimes dependent on design details that are not known until the final design phase of the project. The following analysis assumes that noise walls could be feasibly constructed up to 20 feet high throughout the project corridor.

For a noise barrier to be considered acoustically effective, it must achieve a noise reduction of 5 dBA or more. To be considered cost-effective, the cost per dBA of reduction per residence should be equal to, or less than $3,250 (in 1997 dollars). The following formula can be used to determine the cost-effectiveness of the barrier:

The cost-effectiveness index is equal to the cost of the noise barrier[1] divided by the product of the average noise level reduction based on those residences that had noise level reductions of 5 dBA or more and the number of residences that had noise level reductions of 5 dBA or more.

[1]The cost of a noise wall is calculated using $15 per square foot of wall, except on structures, where the cost is $18 per square foot.

Only residences that experience a five or greater decibel reduction in noise following construction of a noise barrier are considered in this analysis. The result of the above formula is a cost per decibel per residence. This overall approach is outlined in Mn/DOT Noise Policy for Type I and Type II Federal-Aid Projects as per 23 CFR 772.

There are several steps to assessing the cost-effectiveness of noise barriers. First, the cost-effective noise wall height is determined for each segment of the project area. For this study, three heights of potential noise barriers were analyzed: 20, 15 and 10 feet (except as described under Area 1, below). If a 20-foot noise barrier meets the reasonableness criteria and is feasible, it would be proposed for construction. If the 20-foot barrier does not meet the criteria, a 15-foot barrier is evaluated. Likewise, if a 15-foot barrier does not meet the criteria, a 10-foot barrier is studied. If a 10-foot noise barrier meets the reasonableness criteria and is feasible, it would then be proposed for construction.

State daytime and nighttime noise standards were predicted to be exceeded at modeled receptor locations throughout the project area. As such, noise barriers were evaluated at modeled receptor locations where State standards are predicted to be exceeded with future (2030) Build conditions. The locations of modeled noise walls are shown in Figures G-1 through G-5. Additional model receptor locations were added where necessary for purposes of calculating barrier cost-effectiveness.

Daytime noise barrier cost-effectiveness results are tabulated in Tables G-6 through G-8 (see pages 37 through 48 at the end of this document).

Segment One: Urban Elk River

Area A (Receptors 1-1, 3-1, 3-2, 4-1, 4-2)

Area A is located along the west side of Highway 169 from the Highway 10/101/169 interchange to the Main Street interchange. Area A is bisected by the BNSF Railway mainline. Industrial land uses are located in the northwest quadrant of the Highway 10/101/169 interchange. This is the site of a Great River Energy (GRE) power plant. Operations of this facility are a dominant source of noise at this site. Commercial land uses are located in the southwest quadrant of the Main Street interchange (receptor 3-2). Residential land uses are located to the west along Main Avenue (receptors 3-1 and 4-1). Commercial and residential land uses in the southeast quadrant of the Main Street interchange are predicted to exceed State noise standards with future Build conditions.

Receptor 1-1 represents open space in the southwest quadrant of the Highway 10/101/169 interchange. This is the site of a highway rest area (Babcock Memorial Rest Area) that is currently used as a public water access site. This site is operated and maintained under a limited use permit between the DNR and Mn/DOT. The site is located within the highway right of way. According to the limited use permits, use of the highway rest area in no way establishes a permanent park or recreation area. As such, no noise mitigation was considered at this location.

An approximately 1,160-foot long noise wall was modeled in the southwest quadrant of the Main Street interchange. This modeled wall would shield commercial land uses in the southwest quadrant of the interchange (represented by receptor 3-2). This modeled barrier extends from Main Street to a point located approximately 1,160 feet south of Main Street. This modeled wall was located on a proposed retaining wall in the southwest quadrant of the Main Street interchange.

The 1,160-foot long, 10-foot modeled barrier provides a reduction that varies from 0.2 dBA to 3.6 dBA. The 1,160-foot long, 15-foot high modeled barrier results in reductions that vary from 0.3 dBA to 5.0 dBA in modeled noise levels. The cost-effectiveness for the 15-foot high wall is $25,425/dBA/receptor. The 1,160-foot long, 20-foot high modeled barrier results in reductions that vary from 0.4 dBA to 5.7 dBA in modeled noise levels. The cost-effectiveness for the 20-foot high wall is $29,605/dBA/receptor.

The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Area B (Receptors 1-2, 1-3, 2-1, 2-2, 2-3)

Area B is located along the east side of Highway 169 from the Highway 10/101/169 interchange to the Main Street interchange. Area B is bisected by the BNSF Railway mainline. Land use in the southeast and northeast quadrants of the Highway 10/101/169 interchange is commercial. Land uses in Area B between the BNSF Railway and the Main Street interchange are commercial. Commercial land uses in Area B between the BNSF Railway and Main Street (receptors 2-1, 2-2, 2-3) are predicted to exceed State standards with future Build conditions.

Three noise walls were evaluated for Area B between along the east side of Highway 169 between the Highway 10/101/169 interchange and Main Street. An approximately 550-foot long wall was modeled in the northeast quadrant of the Highway 10/101/169 interchange (Wall B1). An approximately 700-foot long wall was modeled along the east side of Highway 169 north of the BNSF Railway (Wall B2). An approximately 1,700-foot long wall was modeled in the southeast quadrant of the Main Street interchange (Wall B3). The results of the Area B evaluation are summarized below.

- Wall B1 (receptor 1-2): An approximately 550-foot long noise barrier was modeled in the northeast quadrant of the Highway 10/101/169 interchange along a retaining wall east of the

eastbound Highway 10 to northbound Highway 169 ramp. This modeled barrier would shield commercial land uses in the northeast quadrant of the Highway 169 interchange.

The 10-foot and 15-foot high modeled barriers do not meet the minimum 5 dBA reduction threshold to be considered acoustically effective. The 550-foot long, 20-foot high modeled noise barrier results in a 5.1 dBA reduction in modeled noise levels. The cost-effectiveness for the 20-foot high wall is $15,147/dBA/receptor. This modeled wall does not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

- Wall B2 (receptor 2-1): An approximately 700-foot long noise barrier was modeled along the east side of Highway 169, north of the BNSF Railway. This modeled barrier would shield commercial land uses represented by receptor 2-1. The 700-foot long, 10-foot high modeled barrier provides a reduction of 4.0 dBA. The 700-foot long, 15-foot high modeled noise barrier results in a 6.7 dBA reduction in modeled noise levels. The cost-effectiveness for the 15-foot high wall is $22,500/dBA/receptor. The 700-foot long, 20-foot high modeled noise barrier results in a 9.1 dBA reduction in modeled noise levels. The cost-effectiveness for the 20-foot high wall is $22,088/dBA/receptor.

  The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

- Wall B3 (receptors 2-2 and 2-3): An approximately 1,700-foot long noise barrier was modeled in the southeast quadrant of the Main Street interchange. This modeled barrier would shield commercial land uses represented by receptors 2-2 and 2-3. This modeled barrier extends from a point located approximately 1,400 feet south of Main Street to Line Avenue, east of Highway 169. This modeled wall was located on top of a proposed retaining wall in the southeast quadrant of the Main Street interchange.

  The 1,700-foot long, 10-foot high modeled barrier provides a reduction that varies from 2.2 dBA to 3.2 dBA. The 1,700-foot long, 15-foot high modeled noise barrier results in reductions that vary from 4.2 dBA to 5.9 dBA in modeled noise levels. The cost-effectiveness for the 15-foot high wall is $63,686/dBA/receptor. The 1,700-foot long, 20-foot high modeled noise barrier results in reductions that vary from 6.6 dBA to 8.1 dBA in modeled noise levels. The cost-effectiveness for the 20-foot high wall is $12,153/dBA/receptor.

  The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Area C (Receptors 5, 8-1, 8-2, 13, 14, 16)

Area C is located along the west side of Highway 169 between Main Street and School Street. Area C consists of primarily commercial land uses (receptors 5, 13, 14). Residential land uses are located along Highway 169 north of the Main Street interchange area (receptors 8-1 and 8-2) and west of the School Street interchange along the south side of School Street (receptor 16).

Commercial land uses in Area C (receptors 13 and 14) along Highway 169 are predicted to be below State standards with future Build conditions. Residential land uses in Area C (receptors 8-1 and 16) are predicted to exceed State daytime and nighttime standards with future Build conditions.

Receptor 5 represents commercial land uses in the northwest quadrant of the Main Street interchange. A proposed stormwater pond is located at these commercial sites. The commercial sites represented by receptor 5 would be relocated with the project (see Section VII.B).

Receptor 16 is predicted to exceed State daytime and nighttime standards with future Build conditions. Receptor 16 is located approximately 650 feet west of Highway 169 in the southwest quadrant of the School Street/Freeport Street intersection. School Street is a high-volume, locally-owned east-west roadway that functions as the east frontage road between School Street and 193rd Avenue. Freeport Street is a high-volume, locally-owned north-south roadway that functions at the west frontage road between Main Street and School Street. School Street and Freeport Street are the dominant sources of traffic noise for residences represented by receptor 16. As such, there are no reasonable or feasible mitigation measures that could be implemented along Highway 169 that would result in a substantial reduction in noise levels at this location.

An approximately 1,280-foot noise wall was modeled in the northwest quadrant of the Main Street interchange. This modeled wall would shield residential land uses (Guardian Angels) represented by Receptors 8-1 and 8-2. This modeled barrier extends from a point located approximately 200 feet north of Main Street to a point located approximately 1,280 feet north of Main Street. This modeled wall was located on a proposed retaining wall north of the southbound exit ramp to Main Street. In the northwest quadrant of the interchange, the modeled wall was located between a proposed stormwater pond and the southbound exit ramp.

The 1,280-foot long, 10-foot modeled barrier provides a reduction that varies from 1.7 dBA to 4.7 dBA. The 1,280-foot long, 15-foot high modeled noise barrier results in reductions that vary from 2.2 dBA to 6.6 dBA in modeled noise levels. The cost-effectiveness for the 15-foot high wall is $7,102/dBA/receptor. The 1,280-foot long, 20-foot high modeled noise barrier results in reductions that vary from 2.5 dBA to 7.8 dBA in modeled noise levels. The cost-effectiveness for the 20-foot high wall is $7,981/dBA/receptor.

The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Area D (Receptors 6, 7, 9, 10, 11, 12-1, 12-2, 15)

Area D is located along the east side of Highway 169 from the Main Street interchange to the School Street interchange. Area D consists of a mix of commercial and residential land uses. Commercial and residential land uses (receptors 6, 7 and 9) are located in the northeast quadrant of the Main Street interchange. Commercial land uses (receptors 10 and 11) are located between Main and School Streets and in the southeast quadrant of the School Street interchange. Residential land uses (receptors 12-1, 12-2 and 15) are located to the south of School Street east of the relocated Dodge Street.

Residential land uses in the northeast quadrant of the Main Street interchange are predicted to exceed State daytime and nighttime standards with future Build conditions. Modeled receptor locations representing commercial land uses between Main Street and School Street are predicted to be below State standards with future Build conditions. Residential land uses south of School Street at Dodge Street are predicted to exceed State nighttime standards with future Build conditions.

Three noise walls were evaluated for Area D along the east side of Highway 169 between Main Street and School Street. An approximately 910-foot wall was modeled in the northeast quadrant of the Main Street interchange (Wall D1). An approximately 620-foot wall was modeled in the southeast quadrant of the School Street interchange (Wall D2). An alternative 480-foot wall was modeled in the southeast quadrant of the School Street interchange east of relocated Dodge Street (Wall D3). The results of the Area D evaluation are summarized below.

- Wall D1 (receptors 6, 7, 9): An approximately 910-foot noise wall was modeled in the northeast quadrant of the Main Street interchange. This modeled barrier extends from a point located approximately 500 feet north of Main Street to 5th Street (approximately 1,400 feet north of Main Street). This modeled wall does not shield commercial land uses in the northeast quadrant of the Main Street interchange, and does not shield commercial land uses along Dodge Avenue north of 5th Street.

  The 910-foot long, 10-foot high modeled barrier provides a reduction that varies from 2.5 dBA to 3.8 dBA. The 910-foot long, 15-foot high modeled provided a 3.2 dBA to 5.1 dBA reduction in modeled noise levels. The cost-effectiveness for the 15-foot high wall is $4,853/dBA/receptor. The 910-foot long, 20-foot high modeled provided a 3.6 dBA to 5.6 dBA reduction in modeled noise levels. The cost-effectiveness for the 20-foot high wall is $5,859/dBA/receptor.

  The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

  Receptor 7 represents Baldwin Park, a City of Elk River park located along Highway 169 in the northeast quadrant of the Main Street interchange. Modeled noise levels at receptor 7 with future Build conditions are predicted to be 66.0 dBA (L_{10}). Parks are considered special

use areas. It is Mn/DOT policy to provide noise mitigation at special use areas such that modeled noise levels with future Build conditions are below State daytime noise standards.

Baldwin Park would be shielded by 910-foot long noise wall described above. As tabulated in Tables G-6, G-7, and G-8, the 10-foot high, 15-foot high, and 20-foot high modeled barriers did not achieve a substantial reduction (≥ 5 dB A) in noise levels at receptor 7. The City of Elk River has indicated that if redevelopment of this area occurs, Baldwin Park amenities would be relocated. As such, no noise mitigation is proposed at this location.

- Wall D2 (receptors 12-1, 12-2, 15): An approximately 620-foot long noise wall was modeled in the southeast quadrant of the School Street interchange. This modeled barrier follows the relocated Dodge Street alignment in the southeast quadrant of the School Street interchange. This modeled barrier extends from the retaining wall between the northbound exit ramp to School Street and Dodge Street to the School Street/Dodge Street intersection. This modeled wall does not shield commercial land uses along Dodge Street south of the School Street interchange.

  The 10-foot, 15-foot, and 20-foot high modeled barriers do not meet the minimum 5 dBA reduction threshold to be considered acoustically effective. Therefore, none of the analyzed barriers are proposed.

- Wall D3 (receptors 12-1, 12-2, 15): An approximately 480-foot long noise wall was modeled in the southeast quadrant of the School Street interchange east of relocated Dodge Street. This modeled barrier would require the acquisition of additional right of way east of Dodge Street. This modeled wall does not shield commercial land uses along Dodge Street south of the School Street interchange.

  The 10-foot, 15-foot, and 20-foot high modeled barriers do not meet the minimum 5 dBA reduction threshold to be considered acoustically effective. Therefore, none of the analyzed barriers are proposed.

Area E (Receptors 17, 22, 27)

Area E is located along the west side of Highway 169 from the School Street interchange to the 193rd Avenue interchange. Area E consists of commercial land uses (receptors 17, 22, 27). Commercial land uses (receptor 17) in the northwest quadrant of the School Street interchange are predicted to be below State noise standards with future Build conditions. Commercial land uses (receptor 27) in the southwest quadrant of the 193rd Avenue interchange are also predicted to be below State noise standards with future Build conditions.

Commercial land uses in between Freeport Avenue and Highway 169 (receptor 22) are predicted to exceed State noise standard with future Build conditions. An approximately 1,490-foot noise barrier was modeled along the west side of Highway 169 from a point located approximately 950 feet north of School Street (site of municipal water tower) to a point located approximately 1,150 feet south of Jackson Avenue.

The 10-foot modeled barrier provides a reduction that varies from 0 dBA to 3.7 dBA. One commercial receptor (receptor 22) is predicted to achieve a 7.2 dBA reduction with the 15-foot high modeled wall. The cost-effectiveness for the 15-foot wall is $11,406/dBA/receptor. One commercial receptor (receptor 22) is predicted to achieve a 9.9 dBA reduction with the 20-foot high modeled wall. The cost-effectiveness for the 20-foot high wall is $11,203/dBA/receptor.

The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Area F (Receptors 19, 20-1, 20-2, 20-3, 20-4, 20-5, 21, 23, 24, 25)

Area F is located along the east side of Highway 169 from the proposed School Street interchange to the proposed 193rd Avenue interchange. Area F consists of commercial land uses in the northeast quadrant of the School Street interchange and in the southeast quadrant of the 193rd Avenue interchange. Single-family residential land uses are located along the east side of Highway 169 between the proposed interchanges (receptors 20-1, 21 and 23). Residential land uses (receptors 24 and 25) are also located to the east of an open water wetland in the southeast quadrant of the 193rd Avenue interchange.

Commercial land uses in the northeast quadrant of the School Street interchange are predicted to be below State standards with future Build conditions. Commercial property in the southeast quadrant of the 193rd Avenue interchange would be acquired as right of way to accommodate the proposed interchange. Residential land uses in Area F are predicted to exceed State daytime and nighttime standards with future Build conditions.

Receptor 19 is predicted to exceed State nighttime standards with future Build conditions. Receptor 19 is located approximately 500 feet east of Highway 169 along Dodge Street. Dodge Street is a locally-owned roadway. The segment of Dodge Street north of School Street at receptor 19 is characterized by private driveway connections providing access for adjacent residences. The distance between driveways and intersecting local roadways ranges from approximately 50 feet to 100 feet. Gaps in a noise barrier at this location would limit its acoustical effectiveness. As such, there is no feasible mitigation measure that could be implemented along this segment of Dodge Street.

An approximately 1,105-foot long noise barrier was modeled along the east side of Highway 169 near the southeast quadrant of the 193rd Avenue interchange. This modeled barrier extends from a point located approximately 1,000 feet north of School Street to a point located approximately 1,350 feet south of 193rd Avenue. The northern terminus of this wall is located at an open water wetland in the southeast quadrant of the 193rd Avenue interchange. It is not feasible to extend the noise wall beyond this point because of additional fill impacts to this open water wetland. As such, this modeled barrier would not shield residences represented by receptors 24 and 25. The 1,105-foot long noise barrier would effectively shield 19 residences along the east side of Highway 169.

The 1,105-foot long, 20-foot tall modeled barrier at this location results in reductions that vary from 2.6 dBA to 13.3 dBA in modeled noise levels with the. The cost-effectiveness of the 20-foot high wall is $2,153/dBA/receptor (see Table G-8). This 20-foot high wall meets Mn/DOT's cost-effectiveness criteria and is proposed. Traffic noise impacts and mitigation will be re-assessed at the time of project implementation based on conditions in place at that time. Final mitigation decisions will be based on the results of this re-assessment, input from affected residents, community input, and final design considerations.

Area G (Receptors 29, 30, 31-1, 31-2, 31-3, 33)

Area G is located along the west side of Highway 169 between the 193rd Avenue interchange and the 197th Avenue interchange. Land uses in the northwest quadrant of the 193rd Avenue interchange are commercial (receptor 29). Residential land uses are located along Holt Street and Irving Street (receptors 30, 31-2, 31-3, 33), west of the highway. Modeled noise levels for commercial land uses in the northwest quadrant of the 193rd Avenue interchange are predicted to be below State daytime and nighttime standards with future Build conditions. Modeled noise levels for residential land uses are predicted to exceed State daytime and nighttime standards with future Build conditions.

An approximately 2,190-foot noise barrier was modeled along the west side of Highway 169 between 193rd Avenue and 197th Avenue. This modeled barrier extends from a point located approximately 1,000 feet north of 193rd Avenue to 197th Avenue, and is located between the highway right of way limits and proposed retaining walls along the west side of Highway 169. This modeled barrier does not shield commercial land uses in the northwest quadrant of the 193rd Avenue interchange. The 10-foot, 15-foot, and 20-foot high modeled barriers do not meet the minimum 5 dBA reduction threshold to be considered acoustically effective. Therefore, none of the analyzed barriers are proposed.

The modeled barrier was located within Mn/DOT Highway 169 right of way. 197th Avenue, Irving Street, and Holt Street, which are located to the west of Highway 169 and the modeled barrier, contribute to the sound environment for residences in Area G. As such, there are no feasible mitigation measures that could be implemented along Highway 169 that would result in a substantial reduction in noise levels at modeled receptor locations in Area G.

Area H (Receptor 32)

Area H is located along the east side of Highway 169 between the 193rd Avenue interchange and the 197th Avenue interchange. Area H consists of commercial land uses. Modeled noise levels for commercial land uses between 193rd Avenue and 197th Avenue are projected to be below State daytime and nighttime standards with future Build conditions.

Area I (Receptors 34, 37-1, 37-2)

Area I is located along the west side of Highway 169 north of the 197th Avenue interchange. Area I consists of residential land uses (single-family residences). Modeled receptor locations in

Area I are predicted to exceed State daytime and nighttime standards with future Build conditions.

An approximately 2,610-foot noise barrier was modeled along the west side of Highway 169 north of 197th Avenue. This noise barrier was located on a proposed retaining wall in the northwest quadrant of the 197th Avenue interchange. The approximately 2,610-foot long, 10-foot high modeled barrier provides a reduction that varies from 0.1 dBA to 3.7 dBA. The approximately 2,610-foot long, 15-foot high modeled provides a reduction that varies from 1.0 dBA to 4.8 dBA. The 20-foot high, 2,610-foot long modeled barrier results in reductions that vary from 3.1 dBA to 5.8 dBA in modeled noise levels. The cost-effectiveness for the 20-foot high wall is $44,397/dBA/receptor.

The 10-foot high and 15-foot high modeled barriers do not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 20-foot high modeled barrier does not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Area J (Receptors 35, 36-1, 36-2, 36-3, 36-4, 36-5)

Area J is located along the east side of Highway 169 north of the 197th Avenue interchange. Area J consists of residential land uses (single-family residences). Modeled receptor locations in Area J are predicted to exceed State daytime and nighttime standards with future Build conditions.

An approximately 2,500-foot noise barrier was modeled along the east side of Highway 169 north of 197th Avenue. This modeled noise barrier was located on proposed retaining wall in the northeast quadrant of the 197th Avenue interchange. The 10-foot high, 2,500-foot long modeled barrier results in reductions that vary from 0.7 dBA to 5.5 dBA in modeled noise levels. The cost-effectiveness for the 10-foot high wall is $67,636/dBA/receptor. The 15-foot high, 2,500-foot long modeled noise barrier results in reductions that vary from 1.9 dBA to 8.0 dBA in modeled noise levels. The cost-effectiveness for the 15-foot wall is $21,458/dBA/receptor. The 20-foot high, 2,500-foot long modeled noise barrier results in reductions that vary from 2.6 dBA to 9.8 dBA in modeled noise levels. The cost-effectiveness for the 20-foot wall is $14,194/dBA/receptor.

The 10-foot, 15-foot and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

<u>Segment Two: Rural Elk River and Livonia Township</u>

Area K (Receptors 42, 43, 44, 46, 48)

Area K represents rural residential and industrial land uses along the west side of Highway 169 from south of County Road 77 to the 221st Avenue interchange. Industrial land uses from County Road 77 to 221st Avenue are predicted to be below State standards with future Build

conditions. Rural residential uses adjacent to County Road 77 are predicted to exceed State daytime and nighttime standards with future Build conditions.

Two separate noise wall were modeled in Area K adjacent to the existing County Road 77 intersection with Highway 169. The evaluation of these walls is described below.

- Wall K1 (receptor 42): An approximately 895-foot wall was modeled along the west side of Highway 169 south of County Road 77. The approximately 895-foot long, 10-foot high modeled barrier provides a reduction of 2.4 dBA. The approximately 895-foot long, 15-foot high modeled provides a reduction of 4.5 dBA. The 895-foot long, 20-foot high modeled wall results in a reduction of 6.6 dBA in modeled noise levels with future Build conditions. The cost effectiveness of the 20-foot high wall is $19,545/dBA/receptor.

  The 10-foot high and 15-foot high modeled barriers do not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 20-foot high modeled barrier does not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

- Wall K2 (receptor 43): An approximately 790-foot wall was modeled along the west side of Highway 169 at the existing Highway 169/County Road 77 intersection. The approximately 790-foot long, 10-foot high modeled barrier provides a reduction of 1.3 dBA. The approximately 790-foot long, 15-foot high modeled provides a reduction of 3.4 dBA. The 790-foot long, 20-foot high modeled wall results in a reduction of 6.7 dBA in modeled noise levels with future Build conditions. The cost effectiveness of the 20-foot high wall is $33,806/dBA/receptor.

  The 10-foot high and 15-foot high modeled barriers do not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 20-foot high modeled barrier does not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Area L (Receptors 38, 39, 40, 41, 45, 47, 49)

Area L represents rural residential and commercial/industrial land uses along the east side of Highway 169 from Brook Drive to the proposed 221st Avenue interchange. The proposed east frontage road intersects Brook Drive east of Highway 169. Commercial and industrial land uses in the southeast quadrant of the 221st Avenue interchange are predicted to be below State standards with future Build conditions. In general, rural residential uses to the south of the 221st Avenue interchange are predicted to exceed State daytime and nighttime standards with future Build conditions.

Two separate noise walls were modeled in Area L along the east side of Highway 169 south of the 221st Avenue interchange. The evaluation of these walls is described below.

- Wall L1 (receptors 38, 39, 40, 41): An approximately 3,400-foot noise wall was modeled along the east side of Highway 169 at Brook Drive. The traffic noise reduction provided by

the 10-foot and 15-foot high modeled barriers is predicted to be less than the 5 dBA reduction threshold to be considered acoustically effective. The approximately 3,400-foot long, 10-foot high modeled barrier provides a reduction that varies from 0.5 dBA to 1.1 dBA. The approximately 3,400-foot long, 15-foot high modeled provides a reduction that varies from 1.5 dBA to 3.4 dBA. The 3,400-foot long, 20-foot high modeled wall results in reductions that vary from 3.0 dBA to 6.7 dBA in modeled noise levels with future Build conditions. The cost effectiveness of the 20-foot high wall is $50,224/dBA/receptor.

The 10-foot high and 15-foot high modeled barriers do not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 20-foot high modeled barrier does not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

- Wall L2 (receptor 45): An approximately 1,390-foot noise wall was modeled adjacent to the southeast quadrant of the 221st Avenue interchange. The traffic noise reduction provided by the 10-foot, 15-foot, and 20-foot high modeled barriers is predicted to be less than the 5 dBA reduction threshold to be considered acoustically effective. Therefore, none of the analyzed barriers are proposed.

Area M (Receptors 53, 56, 57, 59, 60)

Area M represents industrial and rural residential land uses along the west side of Highway 169 from the proposed 221st Avenue interchange to the CSAH 25/19 interchange. Industrial land uses in the northwest quadrant of the 221st Avenue interchange (receptor 53) are predicted to be below State standards with future Build conditions. Modeled noise levels at rural residential uses in the southwest quadrant of the CSAH 25/19 interchange are predicted to exceed State daytime and nighttime standards with future Build conditions.

Two separate noise walls were modeled in Area M adjacent to the CSAH 25/19 interchange. The evaluation of these walls is described below.

- Wall M1 (receptor 56): An approximately 995-foot noise wall was modeled along the west side of Highway 169 south of 237th Avenue. The noise wall analysis assumes that the existing access to Highway 169 would be closed at this location, and that an alternate access would be provided to the frontage road system with future Build conditions.

  The 995-foot long, 10-foot high modeled noise wall results in a reduction of 6.4 dBA in modeled noise levels with future Build conditions. The cost-effectiveness of the 10-foot high wall is $22,852/dBA/receptor. The 995-foot long, 15-foot high modeled wall results in a reduction of 10.2 dBA in modeled noise levels with future Build conditions. The cost-effectiveness of the 15-foot high wall is $21,287/dBA/receptor. The 995-foot long, 20-foot high modeled wall results in a reduction of 13.9 dBA in modeled noise levels with future Build conditions. The cost effectiveness of the 20-foot high wall is $20,827/dBA/receptor.

  The 10-foot, 15-foot and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

- Wall M2 (receptors 57, 59, 60): An approximately 2,770-foot noise wall was modeled in the southwest quadrant of the Highway 169/CSAH 25/19 interchange from CSAH 25 south to 237th Avenue. The approximately 2,770-foot long, 10-foot high modeled barrier provides a reduction that varies from 1.2 dBA to 4.1 dBA. The 2,770-foot long, 15-foot high modeled wall results in reductions that vary from 2.1 dBA to 7.6 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 15-foot wall is $44,036/dBA/receptor. The 2,770-foot long, 20-foot high modeled wall results in reductions that vary from 3.6 dBA to 10.6 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 20-foot high wall is $43,492/dBA/receptor.

  The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Area N (Receptors 51, 52, 54, 55, 58)

Area N represents rural residential land uses along the east side of Highway 169 from the proposed 221st Avenue interchange to the CSAH 25/19 interchange. In general, modeled noise levels are predicted to exceed State daytime and nighttime standards at this location with future Build conditions.

Four separate noise walls were modeled in Area N. Wall N1 is located in the northeast quadrant of the 221st Avenue interchange. Wall N2 is located to the north of the 221st Avenue interchange along the east side of Highway 169. Walls N3 and N4 are located adjacent to the CSAH 25/19 interchange. The evaluation of these walls is described below.

- Wall N1 (receptor 51): An approximately 830-foot long noise wall was modeled in the northeast quadrant of the 221st Avenue interchange. This modeled barrier shields one rural residence that currently has direct access to Highway 169. The approximately 830-foot long, 10-foot high modeled barrier provides a reduction of 4.4 dBA. The 830-foot long, 15-foot high modeled wall results in a reduction of 8.3 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 15-foot wall is $21,687/dBA/receptor. The 830-foot long, 20-foot high modeled wall results in a reduction of 10.9 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 20-foot high wall is $21,881/dBA/receptor.

  The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

- Wall N2 (receptor 52): An approximately 1,600 foot long noise wall was modeled north of the 221st Avenue interchange along the east side of Highway 169. This modeled barrier shields one rural residence that currently has access to Highway 169 via 225th Avenue. The

10-foot high and 15-foot high modeled barriers do not meet the minimum 5 dBA reduction threshold to be considered acoustically effective. The approximately 1,600-foot long, 10-foot high modeled barrier provides a reduction of 1.0 dBA. The approximately 1,600-foot long, 15-foot high modeled barrier provides a reduction of 3.1 dBA. The 1,600-foot long, 20-foot high modeled wall results in a reduction of 5.8 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 20-foot high wall is $80,948/dBA/receptor.

The 10-foot high and 15-foot high modeled barriers do not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 20-foot high modeled barrier does not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

- Wall N3 (receptors 54 and 55): An approximately 2,250-foot noise wall was modeled along the east side of Highway 169 at 237th Avenue. This modeled barrier would shield two rural residences along the east side of Highway 169, south of the CSAH 25/19 interchange. The approximately 2,250-foot long, 10-foot high modeled barrier provides a reduction that varies from 2.1 dBA to 2.7 dBA. The approximately 2,250-foot long, 15-foot high modeled barrier provides a reduction that varies from 3.6 dBA to 3.7 dBA. The approximately 2,250-foot long, 20-foot high modeled wall results in reductions that vary from 4.8 dBA to 7.2 dBA in modeled noise levels with future Build conditions. The cost effectiveness of the 20-foot high wall is $92,500/dBA/receptor.

  The 10-foot high and 15-foot high modeled barriers do not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 20-foot high modeled barrier does not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

- Wall N4 (receptor 58): An approximately 2,880-foot noise wall was modeled in the southeast quadrant of the Highway 169/ CSAH 25/19 interchange, between the highway and the proposed frontage road. The approximately 2,880-foot long, 10-foot high modeled barrier provides a reduction of 3.3 dBA. The approximately 2,880-foot long, 15-foot high modeled wall results in a reduction of 5.4 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 15-foot wall is $29,688/dBA/receptor. The approximately 2,880-foot long, 20-foot high modeled wall results in a reduction of 6.8 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 20-foot high wall is $31,434/dBA/receptor.

  The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Area O, Wall O1 (Receptor64)

Area O (receptor 64) represents a single residential property along the west side of Highway 169, north of the proposed CSAH 25/19 interchange. This residence is located approximately 500 feet

west of the southbound travel lanes. Modeled noise levels at Receptor R64 are predicted to exceed State daytime and nighttime noise standards with future Build conditions.

An approximately 4,000-foot noise wall (Wall O1) was modeled along the west side of Highway 169 at Receptor R64, north of the proposed CSAH 25/19 interchange. The traffic noise reduction provided by the 10-foot, 15-foot, and 20-foot modeled barriers is predicted to be less than the 5 dBA reduction threshold to be considered acoustically effective. Therefore, none of the analyzed barriers are proposed.

Area P (Receptors 61, 62, 63, 65)

Area P represents rural residential land uses along the east side of Highway 169, north of realigned CSAH 19 and the CSAH 25/19 interchange. In general, modeled noise levels are predicted to exceed State daytime and nighttime standards at this location with future Build conditions.

Three separate noise walls were modeled within Area P. The evaluation of these walls is described below.

- Wall P1 (receptor 61): An approximately 1,270-foot long noise wall was modeled in the northeast quadrant of the Highway 169/CSAH 25/19 interchange, from realigned CSAH 19 to the existing CSAH 19 alignment. The approximately 1,270-foot long, 10-foot high modeled barrier provides a reduction of 2.0 dBA. The approximately 1,270-foot long, 15-foot high modeled barrier provides a reduction of 4.0 dBA. The approximately 1,270-foot long, 20-foot high modeled wall results in a reduction of 6.4 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 20-foot wall is $14,531/dBA/receptor.

  The 10-foot high and 15-foot high modeled barriers do not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 20-foot high modeled barrier does not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

- Wall P2 (receptors 63 and 65): An approximately 2,570-foot long noise wall was modeled along the east side of Highway 169, north of the existing CSAH 19 alignment. This modeled wall would shield residences represented by receptors 63 and 65; these receptors are located approximately 500 feet to 700 feet east of Highway 169. The traffic noise reduction provided by the 10-foot, 15-foot, and 20-foot high modeled barriers is predicted to be less than the 5 dBA reduction threshold to be considered acoustically effective. Therefore, none of the analyzed barriers are proposed.

- Wall P3 (receptor 62): Receptor 62 is located north of relocated CSAH 25, approximately 1,400 feet east of Highway 169. CSAH 25 is a Sherburne County-owned east-west roadway that provides connectivity to Anoka County to the east. An approximately 1,210-foot long noise wall was modeled adjacent to receptor 62 along the north side of realigned CSAH 25. The approximately 1,210-foot long, 10-foot high modeled barrier provides a reduction of 4.1 dBA. The approximately 1,210-foot long, 15-foot high modeled wall results in a

reduction of 5.3 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 15-foot high wall is $50,094/dBA/residence. The approximately 1,210-foot long, 20-foot high modeled wall results in a reduction of 7.1 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 20-foot wall is $49,859/dBA/receptor.

The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Segment Three: Zimmerman

Area O, Wall O2 (Receptor 66)

Area O (receptor 66) represents a church along the west side of Highway 169, south of the proposed Highway 169/CSAH 4 interchange. This church is located adjacent to the point where the proposed realignment of Highway 169 matches the existing alignment south of CSAH 4. Modeled noise levels at receptor 66 are predicted to exceed State daytime and nighttime noise standards with future Build conditions.

An approximately 1,535-foot long noise wall (Wall O2) was modeled along the west side of Highway 169 at receptor 66, south of the proposed 257th Avenue overpass. The approximately 1,535-foot long, 10-foot high modeled barrier provides a reduction of 3.8 dBA. The 1,535-foot long, 15-foot high modeled wall results in a reduction of 6.6 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 15-foot wall is $51,307/dBA/receptor. The 1,535-foot long, 20-foot high modeled wall results in a reduction of 9.1 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 20-foot wall is $49,451/dBA/receptor.

The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Area Q (Receptor 74)

Area Q consists of commercial and residential land uses in the northwest quadrant of the Highway 169/CSAH 4 interchange. Modeled noise levels for commercial receptors are predicted to be below State standards for commercial land uses under future Build conditions (see Tables G-3C and G-4C). Receptor 74 represents 17 first-row residences west of Highway 169. These receptors are located more than 500 feet west of Highway 169. Commercial land uses are planned along Highway 169 between the highway and the modeled receptor location. Modeled noise levels at this receptor are predicted to be below State daytime noise standards under future Build conditions, but are predicted to exceed State nighttime noise standards.

An approximately 2,990-foot noise wall was modeled along the west side of Highway 169 at receptor 74. The traffic noise reduction provided by the 10-foot, 15-foot, and 20-foot high modeled barriers is predicted to be less than 5 dBA reduction threshold to be considered acoustically effective. Therefore, none of the analyzed barriers are proposed

Area R (Receptors 77-1, 77-2, 77-3, 77-4, 78-1, 78-2, 79, 80, 81, 82, 83, 84-1, 84-2, 85, 86, 87, 88, 89, 90, 91, 92)

Area R consists of residential land uses in the northeast quadrant of the Highway 169/CSAH 4 interchange. Modeled receptor locations represent 56 residences along Fremont Drive and Fremont Lane adjacent to Lake Fremont. Modeled noise levels at residential receptors in Area R are predicted to exceed State daytime and nighttime standards (see Tables G-3C and G-4C).

An approximately 4,780-foot noise wall was modeled along the east side of the proposed Highway 169 alignment from the northeast quadrant of the Highway 169/CSAH 4 interchange to a point west of Lake Fremont. The approximately 4,780-foot long, 10-foot high modeled barrier provides a reduction that varies from 0.4 dBA to 4.1 dBA. The 4,780-foot long, 15-foot high modeled wall results in reductions that vary from 0.9 dBA to 6.3 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 15-foot wall is $10,509/dBA/receptor. The 4,780-foot long, 20-foot high modeled wall results in reductions that vary from 1.6 dBA to 8.3 dBA in modeled noise levels with future Build conditions. The cost-effectiveness for the 20-foot wall is $5,765/dBA/receptor.

The 10-foot high modeled barrier does not meet Mn/DOT's minimum 5 dBA reduction threshold to be considered acoustically effective. The 15-foot high and 20-foot high modeled barriers do not meet Mn/DOT's minimum $3,250 cost-effectiveness criteria. Therefore, none of the analyzed barriers are proposed.

Alternative Noise Abatement

Noise abatement measures other than noise barriers were considered for the proposed project. These measures are identified in 23 CRF 772.13c and are listed above. The following describes the evaluation of alternative noise abatement measures.

Traffic Management Measures

Measures such as signing for prohibition of certain vehicle types, time-use restriction for certain vehicle types, and modified speed limits would not be feasible or practicable for this project. To limit the vehicle types, time of use, and vehicle speeds on Highway 169 in Elk River, Livonia Township and Zimmerman would not be consistent with the function of Highway 169 a as principal arterial roadway and a high priority IRC.

Alteration of Horizontal and Vertical Alignments

The proposed Highway 169 freeway design the urban Elk River segment (Main Street to 197th Avenue) includes depressing the mainline (i.e., roadway elevation lower than the surrounding environment. The proposed design includes retaining walls at select locations along the project corridor to minimize right of way impacts to adjacent properties. Highway 169 is depressed up to 20 feet in some locations through the urban Elk River segment. The extent that the freeway section can be depressed is limited by the groundwater elevation. The Highway 169 profiles were designed to maintain seven feet of clearance between the finished centerline elevation and the seasonal high groundwater elevation in order to maintain adequate groundwater separation in the roadside ditches. Depression of the Highway 169 profile provides noise attenuation relative to a profile that is at-grade with the surrounding environment.

The proposed Highway 169 freeway design is located on the current roadway alignment in urban and rural Elk River and Livonia Township. In Zimmerman, the Highway 169 horizontal alignment is shifted to the east of its existing alignment. This alignment shift, along with increases in traffic volumes over time, contribute to the noise increases predicted at modeled receptor locations east of Highway 169 along Lake Fremont. An alternative interchange concept was evaluated in Zimmerman that utilized existing Highway 169 alignment. This alternative was dismissed from consideration because of commercial/business relocations and impacts to the downtown business area as a result of widening CSAH 4. This alternative would also not provide the opportunity to redevelop the existing Highway 169 right of way as part of a cohesive business district.

Land Use Planning and Exclusive Land Use Designations

Land east and west of Highway 169 in rural Elk River, Livonia Township, and Zimmerman is currently undeveloped. A noise analysis was completed to identify future noise levels at representative receptor locations within these undeveloped areas that can be used as a guide for planning by local officials responsible for land use controls to help prevent future traffic noise impacts on currently undeveloped lands within the project area.

For this analysis, the noise model input files assumed no structures or other intervening barriers between the receptor locations and the roadway, and that noise model input files assumed an acoustically soft ground cover between the roadway and modeled receiver locations. These distances should only be used as a reference guide in community planning to help minimize future noise impacts, given the assumptions and traffic volumes that were used to generate the noise model input files and the model output, and do not represent traffic noise levels or distances where State standards or Federal noise abatement criteria for residential and commercial land uses would be exceeded in the future.

Representative daytime traffic noise levels was predicted at representative distances (50 feet, 100 feet, 200 feet, 300 feet, 400 feet and 500 feet) east or west of Highway 169. This analysis was completed at three locations within the project area, chosen to represent areas of planned growth:

- Rural Elk River along the east side of Highway 169 north of the proposed 221st Street interchange.
- Livonia Township along the east side of Highway 169 north of the proposed CSAH 25/19 interchange.
- City of Zimmerman along the west side of Highway 169 north of CSAH 4 and the proposed CSAH 4 interchange.

Daytime and nighttime model results for each of the three locations listed above are tabulated in Table G-9. Distances are measured from Highway 169 right of way limits.

Examples of site plan elements that could reduce noise on residential developments include: berms, fencing, and increased setbacks. Vegetation is only effective if it is at least 100 feet deep, tall enough to block views of the roadway, and dense enough so that the roadway can not been seen through the vegetation (e.g., branches down to ground level with trees/shrubs planted very close together so there are no gaps in the vegetation). As such, the depth, height, and density of vegetation needed make vegetative screening not practical as an element to reduce noise levels. Vegetative screening is more effective in providing aesthetic benefits and acting as a visual barrier. Commercial buildings directly adjoining the roadway would also block some traffic noise for residential receptors, as well as increasing the distance between the roadway and residences, resulting in noise levels potentially meeting State Standards at residential areas closer to the roadway.

Conclusions

In general, construction of the project will result in increases in traffic noise due to increased traffic and changes in the vertical and horizontal alignment of project-area roadways. Some locations are predicted to experience decreases in traffic noise largely due to depression of the Highway 169 roadway through the urban Elk River area. Cost-effectiveness of noise barriers was calculated; one 20-foot high wall located along the east side of Highway 169 near the southeast quadrant of the Highway 169/193rd Avenue interchange that achieved a 5 dBA reduction was found to be cost-effective and is proposed.

Traffic noise impacts and mitigation will be re-assessed in the future at the time of project implementation, based on regulations, conditions and land uses in place at that time. Decisions on noise mitigation to be included in the project will be based on the results of the future noise impact reassessment. Final mitigation decisions will be subject to community input, input from affected property owners, and final design considerations.

TABLE G-6
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
10-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 10 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [1]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (10 ft wall)							
Area A (southwest quadrant of Main Street interchange)									
3-1	64.2	63.3	0.9	4	0	1,160	11,400	$171,000	N/A
3-2	69.4	65.8	3.6	2	0				
4-1	**66.1**	**65.9**	0.2	3	0				
4-2	**66.0**	**65.5**	0.5	2	0				
Area B, Wall B1 (northeast quadrant of Hwy 10/101/169 interchange)									
1-2	**71.4**	**69.6**	1.8	2	0	550	5,300	$79,500	N/A
Area B, Wall B2 (east of Hwy 169 north of BNSF Railway mainline)									
2-1	**75.5**	**71.5**	4.0	1	0	700	6,800	$102,000	N/A
Area B, Wall B3 (southeast quadrant of Main Street interchange)									
2-2	**71.3**	69.1	2.2	5	0	1,700	16,800	$252,000	N/A
2-3	69.3	66.1	3.2	1	0				
Area C (northwest quadrant of Main Street interchange)									
8-1	**69.3**	64.6	4.7	6	0	1,280	12,600	$189,000	N/A
8-2	62.7	61.0	1.7	10	0				
Area D, Wall D1 (northeast quadrant of Main Street interchange)									
6	**67.0**	64.5	2.5	6	0	910	8,900	$133,500	N/A
7	**66.0**	63.3	2.7	1	0				
9	**70.0**	**66.2**	3.8	8	0				
Area D, Wall D2 (southeast quadrant of School Street interchange)									
12-1	60.3	60.3	0.0	4	0	620	6,000	$90,000	N/A
12-2	61.4	61.0	0.4	1	0				
15	62.1	61.6	0.5	1	0				
Area D, Wall D3 (south of School Street, east of Dodge Street) [2]									
12-1	60.3	60.2	0.1	4	0	480	4,600	$69,000	N/A
12-2	61.4	61.3	0.1	1	0				
15	62.1	61.4	0.7	1	0				

Bold numbers exceed State daytime noise standards.

N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.

[1] Surface area includes wall taper at each end.

[2] Wall located outside of proposed right of way. Right of way costs not included with total cost of wall.

TABLE G-6 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
10-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 10 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [(1)]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (10 ft wall)							
Area E (west of Hwy 169, between School Street and 193rd Avenue interchanges)									
17	68.1	68.1	0.0	4	0	1,490	14,700	$220,500	N/A
22	**73.9**	**70.2**	3.7	4	0				
27	69.7	69.6	0.1	3	0				
Area F (east of Hwy 169, south of Hwy 169/193rd Avenue interchange)									
20-1	**75.4**	**71.0**	4.4	3	0	1,105	10,850	$162,750	$5,200
20-2	**70.0**	**67.4**	2.6	2	0				
20-3	**77.2**	**70.9**	6.3	3	3				
20-4	**71.0**	**67.5**	3.5	5	0				
20-5	**66.5**	64.7	1.8	4	0				
21	**76.9**	**70.7**	6.2	2	2				
23	**68.9**	**67.3**	1.6	1	0				
Area G (west of Hwy 169, between 193rd Avenue and 197th Avenue interchanges)									
29	69.6	69.5	0.1	1	0	2,190	21,700	$325,500	N/A
30	**65.4**	65.0	0.4	2	0				
31-1	**68.9**	**67.7**	1.2	2	0				
31-2	61.2	59.9	1.3	4	0				
31-3	61.6	60.1	1.5	2	0				
33	64.7	64.1	0.6	3	0				
Area I (west of Hwy 169, north of 197th Avenue interchange)									
34	**67.0**	63.3	3.7	3	0	2,610	25,900	$388,500	N/A
37-1	**72.7**	**70.9**	1.8	2	0				
37-2	**72.0**	**71.9**	0.1	4	0				

Bold numbers exceed State daytime noise standards.
N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.
(1) Surface area includes wall taper at each end.

TABLE G-6 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
10-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 10 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [1]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (10 ft wall)							
Area J (east of Hwy 169, north of 197th Avenue interchange)									
35 [2]	**73.0**	**67.5**	5.5	1	1	2,500	24,800	$372,000	$67,636
36-1	**72.1**	**68.9**	3.2	2	0				
36-2	**68.7**	**68.0**	0.7	3	0				
36-3	**76.3**	**72.6**	3.7	1	0				
36-4	**70.9**	**69.9**	1.0	1	0				
Area K, Wall K1 (west of Hwy 169, south of County Road 77)									
42	**70.1**	**67.7**	2.4	2	0	895	8,750	$131,250	N/A
Area K, Wall K2 (west of Hwy 169 at County Road 77)									
43	**71.9**	**70.6**	1.3	1	0	790	7,700	$115,500	N/A
Area L, Wall L1 (east of Hwy 169 at Brook Drive)									
38	58.3	57.8	0.5	1	0	3,400	33,800	$507,000	N/A
39	**68.5**	**67.4**	1.1	3	0				
40	**65.8**	65.0	0.8	1	0				
41	61.3	60.8	0.5	1	0				
Area L, Wall L2 (east of Hwy 169 south of 221st Avenue interchange)									
45	**72.3**	**71.5**	0.8	1	0	1,390	13,700	$205,500	N/A
Area M, Wall M1 (west of Hwy 169, south of 237th Avenue)									
56	**75.0**	**68.6**	6.4	1	1	995	9,750	$146,250	$22,852
Area M, Wall M2 (southwest quadrant of Hwy 169/CSAH 25/19 interchange)									
57	**76.9**	**72.8**	4.1	1	0	2,770	27,500	$412,500	N/A
59	**67.7**	**66.5**	1.2	2	0				
60	**73.6**	**69.9**	3.7	1	0				
Area N, Wall N1 (northeast quadrant of Hwy 169/221st Avenue interchange)									
51	**75.4**	**71.0**	4.4	1	0	830	8,100	$121,500	N/A

Bold numbers exceed State daytime noise standards.

N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.

[1] Surface area includes wall taper at each end.

[2] Barrier cost-effectiveness for Area J calculated based on Receptor R35 representing one residence because of right of way impacts and residential relocations associated with the proposed 197th Avenue interchange (see Figure 9B in Appendix A and right of way impact tables in Appendix I.)

TABLE G-6 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
10-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 10 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [(1)]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (10 ft wall)							
Area N, Wall N2 (east of Hwy 169, north of Hwy 169/221st Avenue interchange)									
52	**69.4**	**68.4**	1.0	1	0	1,600	15,800	$237,000	N/A
Area N, Wall N3 (east of Hwy 169, south of 237th Avenue)									
54	60.8	58.1	2.7	1	0	2,250	22,300	$334,500	N/A
55	**67.3**	**65.2**	2.1	1	0				
Area N, Wall N4 (southeast quadrant of Hwy 169/CSAH 25/19 interchange)									
58	**71.1**	**67.8**	3.3	4	0	2,880	28,600	$429,000	N/A
Area O, Wall O1 (northwest quadrant of Hwy 169/CSAH 25/19 interchange)									
64	**69.5**	**68.6**	0.9	1	0	4,000	39,800	$597,000	N/A
Area O, Wall O2 (west of Hwy 169, south of CSAH 4 – Zimmerman)									
66	**71.9**	**68.1**	3.8	1	0	1,535	15,150	$227,250	N/A
Area P, Wall P1 (northeast quadrant of Hwy 169/CSAH 25/19 interchange)									
61	**71.4**	**69.4**	2.0	4	0	1,270	12,500	$187,500	N/A
Area P, Wall P2 (east of Hwy 169, north of existing CSAH 19 intersection with Hwy 169)									
63	**65.8**	64.5	1.3	3	0	2,570	25,500	$382,500	N/A
65	**65.8**	**64.8**	1.0	2	0				
Area P, Wall P3 (east of Hwy 169, north of realigned CSAH 25)									
62	64.0	59.9	4.1	1	0	1,210	11,900	$178,500	N/A
Area Q (west of Hwy 169, north of CSAH 4 – Zimmerman)									
74	61.4	61.2	0.2	17	0	2,290	22,700	$340,500	N/A

Bold numbers exceed State daytime noise standards.
N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.
(1) Surface area includes wall taper at each end.

TABLE G-6 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
10-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 10 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [(1)]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (10 ft wall)							
Area R (northeast quadrant Hwy 169/CSAH 4 interchange – Zimmerman)									
77-1	**70.5**	**68.2**	2.3	2	0				
77-2	**68.1**	**65.9**	2.2	2	0				
77-3	**65.5**	64.0	1.5	2	0				
77-4	63.6	62.4	1.2	3	0				
78-1	**72.0**	**69.8**	2.2	1	0				
78-2	**68.5**	**67.0**	1.5	2	0				
79	65.0	63.7	1.3	4	0				
80	62.7	61.9	0.8	8	0				
81	63.4	62.6	0.8	1	0				
82	60.7	60.3	0.4	8	0				
83	**71.6**	**69.2**	2.4	6	0	4,780	47,600	$714,000	N/A
84-1	**69.3**	**66.7**	2.6	2	0				
84-2	**69.6**	**66.4**	3.2	1	0				
85	**73.2**	**69.8**	3.4	3	0				
86	**72.6**	**68.5**	4.1	3	0				
87	**71.5**	**68.5**	3.0	3	0				
88	**72.4**	**70.1**	2.3	2	0				
89	**71.1**	**68.5**	2.6	3	0				
90	**71.1**	**68.4**	2.7	3	0				
91	**70.9**	**68.2**	2.7	3	0				
92	**73.0**	**70.6**	2.4	3	0				

Bold numbers exceed State daytime noise standards.
N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.
(1) Surface area includes wall taper at each end.

TABLE G-7
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
15-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 15 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [1]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (15 ft wall)							
Area A (southwest quadrant of Main Street interchange)									
3-1	64.2	62.9	1.3	4	0	1,160	16,950	$254,250	$25,425
3-2	69.4	64.4	5.0	2	2				
4-1	**66.1**	**65.8**	0.3	3	0				
4-2	**66.0**	**65.3**	0.7	2	0				
Area B, Wall B1 (northeast quadrant of Hwy 10/101/169 interchange)									
1-2	**71.4**	**67.5**	3.9	2	0	550	7,800	$117,000	N/A
Area B, Wall B2 (east of Hwy 169 north of BNSF Railway mainline)									
2-1	**75.5**	68.8	6.7	1	1	700	10,050	$150,750	$22,500
Area B, Wall B3 (southeast quadrant of Main Street interchange)									
2-2	**71.3**	67.1	4.2	5	0	1,700	25,050	$375,750	$63,686
2-3	69.3	63.4	5.9	1	1				
Area C (northwest quadrant of Main Street interchange)									
8-1	**69.3**	62.7	6.6	6	6	1,280	18,750	$281,250	$7,102
8-2	62.7	60.5	2.2	10	0				
Area D, Wall D1 (northeast quadrant of Main Street interchange)									
6	**67.0**	63.8	3.2	6	0	910	13,200	$198,000	$4,853
7	**66.0**	62.3	3.7	1	0				
9	**70.0**	64.9	5.1	8	8				
Area D, Wall D2 (southeast quadrant of School Street interchange)									
12-1	60.3	60.2	0.1	4	0	620	8,850	$132,750	N/A
12-2	61.4	60.7	0.7	1	0				
15	62.1	61.3	0.8	1	0				
Area D, Wall D3 (south of School Street, east of Dodge Street) [2]									
12-1	60.3	60.1	0.2	4	0	480	6,750	$101,250	N/A
12-2	61.4	60.9	0.5	1	0				
15	62.1	61.0	1.1	1	0				

Bold numbers exceed State daytime noise standards.

N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.

[1] Surface area includes wall taper at each end.

[2] Wall located outside of proposed right of way. Right of way costs not included with total cost of wall.

TABLE G-7 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
15-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 15 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [(1)]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (15 ft wall)							
Area E (west of Hwy 169, between School Street and 193rd Avenue interchanges)									
17	68.1	68.1	0.0	4	0	1,490	21,900	$328,500	$11,406
22	**73.9**	66.7	7.2	4	4				
27	69.7	69.5	0.2	3	0				
Area F (east of Hwy 169, southeast quadrant of Hwy 169/193rd Avenue interchange)									
20-1	**75.4**	**67.2**	8.2	3	3	1,105	16,125	$241,875	$2,098
20-2	**70.0**	**65.1**	4.9	2	2				
20-3	**77.2**	**66.7**	10.5	3	3				
20-4	**71.0**	**65.2**	5.8	5	5				
20-5	**66.5**	64.2	2.3	4	0				
21	**76.9**	**66.7**	10.2	2	2				
23	**68.9**	**66.6**	2.3	1	0				
Area G (west of Hwy 169, between 193rd Avenue and 197th Avenue interchanges)									
29	69.6	69.5	0.1	1	0	2,190	32,400	$486,000	N/A
30	**65.4**	64.8	0.6	2	0				
31-1	**68.9**	**66.8**	2.1	2	0				
31-2	61.2	59.3	1.9	4	0				
31-3	61.6	59.1	2.5	2	0				
33	64.7	63.6	1.1	3	0				
Area I (west of Hwy 169, north of 197th Avenue interchange)									
34	**67.0**	62.2	4.8	3	0	2,610	38,700	$580,500	N/A
37-1	**72.7**	**70.0**	2.7	2	0				
37-2	**72.0**	**71.0**	1.0	4	0				

Bold numbers exceed State daytime noise standards.
N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.
(1) Surface area includes wall taper at each end.

TABLE G-7 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
15-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 15 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [1]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (15 ft wall)							
Area J (east of Hwy 169, north of 197th Avenue interchange)									
35 [2]	**73.0**	65.0	8.0	1	1	2,500	37,050	$555,750	$21,458
36-1	**72.1**	**66.7**	5.4	2	2				
36-2	**68.7**	**66.3**	2.4	3	0				
36-3	**76.3**	**69.2**	7.1	1	1				
36-4	**70.9**	**69.0**	1.9	1	0				
Area K, Wall K1 (west of Hwy 169, south of County Road 77)									
42	**70.1**	**65.6**	4.5	2	0	895	12,975	$194,625	N/A
Area K, Wall K2 (west of Hwy 169 at County Road 77)									
43	**71.9**	**68.5**	3.4	1	0	790	11,400	$171,000	N/A
Area L, Wall L1 (east of Hwy 169 at Brook Drive)									
38	58.3	56.8	1.5	1	0	3,400	50,550	$758,250	N/A
39	**68.5**	**65.1**	3.4	3	0				
40	**65.8**	63.5	2.3	1	0				
41	61.3	59.6	1.7	1	0				
Area L, Wall L2 (east of Hwy 169 south of 221st Avenue interchange)									
45	**72.3**	**69.9**	2.4	1	0	1,390	20,400	$306,000	N/A
Area M, Wall M1 (west of Hwy 169, south of 237th Avenue)									
56	**75.0**	64.8	10.2	1	1	995	14,475	$217,125	$21,287
Area M, Wall M2 (southwest quadrant of Hwy 169/CSAH 25/19 interchange)									
57	**76.9**	**69.3**	7.6	1	1	2,770	41,100	$616,500	$44,036
59	**67.7**	**65.6**	2.1	2	0				
60	**73.6**	**67.2**	6.4	1	1				
Area N, Wall N1 (northeast quadrant of Hwy 169/221st Avenue interchange)									
51	**75.4**	**67.1**	8.3	1	1	830	12,000	$180,000	$21,687

Bold numbers exceed State daytime noise standards.

N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.

[1] Surface area includes wall taper at each end.

[2] Barrier cost-effectiveness for Area J calculated based on Receptor R35 representing one residence because of right of way impacts and residential relocations associated with the proposed 197th Avenue interchange (see Figure 9B in Appendix A and right of way impact tables in Appendix I.)

TABLE G-7 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
15-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 15 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [(1)]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (15 ft wall)							
Area N, Wall N2 (east of Hwy 169, north of Hwy 169/221st Avenue interchange)									
52	**69.4**	**66.3**	3.1	1	0	1,600	23,550	$353,250	N/A
Area N, Wall N3 (east of Hwy 169, south of 237th Avenue)									
54	60.8	57.2	3.6	1	0	2,250	33,300	$499,500	N/A
55	**67.3**	63.6	3.7	1	0				
Area N, Wall N4 (southeast quadrant of Hwy 169/CSAH 25/19 interchange)									
58	**71.1**	**65.7**	5.4	4	4	2,880	42,750	$641,250	$29,688
Area O, Wall O1 (northwest quadrant of Hwy 169/CSAH 25/19 interchange)									
64	**69.5**	**67.3**	2.2	1	0	4,000	59,550	$893,250	N/A
Area O, Wall O2 (west of Hwy 169, south of CSAH 4 – Zimmerman)									
66	**71.9**	**65.3**	6.6	1	1	1,535	22,575	$338,625	$51,307
Area P, Wall P1 (northeast quadrant of Hwy 169/CSAH 25/19 interchange)									
61	**71.4**	**67.4**	4.0	4	0	1,270	18,600	$279,000	N/A
Area P, Wall P2 (east of Hwy 169, north of existing CSAH 19 intersection with Hwy 169)									
63	**65.8**	64.0	1.8	3	0	2,570	38,100	$571,500	N/A
65	**65.8**	63.7	2.1	2	0				
Area P, Wall P3 (east of Hwy 169, north of realigned CSAH 25)									
62	64.0	58.7	5.3	1	1	1,210	17,700	$265,500	$50,094
Area Q (west of Hwy 169, north of CSAH 4 – Zimmerman)									
74	61.4	60.4	1.0	17	0	2,290	33,900	$508,500	N/A

Bold numbers exceed State daytime noise standards.
N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.
(1) Surface area includes wall taper at each end.

TABLE G-7 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
15-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 15 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [(1)]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (15 ft wall)							
Area R (northeast quadrant Hwy 169/CSAH 4 interchange – Zimmerman)									
77-1	**70.5**	**65.6**	4.9	2	0				
77-2	**68.1**	63.4	4.7	2	0				
77-3	**65.5**	61.8	3.7	2	0				
77-4	63.6	60.4	3.2	3	0				
78-1	**72.0**	**67.4**	4.6	1	0				
78-2	**68.5**	**65.0**	3.5	2	0				
79	65.0	61.6	3.4	4	0				
80	62.7	60.5	2.2	8	0				
81	63.4	61.4	2.0	1	0				
82	60.7	59.8	0.9	8	0				
83	**71.6**	**66.4**	5.2	6	6	4,780	71,250	$1,068,750	$10,509
84-1	**69.3**	63.7	5.6	2	2				
84-2	**69.6**	63.3	6.3	1	1				
85	**73.2**	**67.1**	6.1	3	3				
86	**72.6**	**67.1**	5.5	3	3				
87	**71.5**	**66.6**	4.9	3	0				
88	**72.4**	**68.5**	3.9	2	0				
89	**71.1**	**66.9**	4.2	3	0				
90	**71.1**	**66.7**	4.4	3	0				
91	**70.9**	**66.3**	4.6	3	0				
92	**73.0**	**69.4**	3.6	3	0				

Bold numbers exceed State daytime noise standards.
N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.
(1) Surface area includes wall taper at each end.

TABLE G-8
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
20-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 20 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [1]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (20 ft wall)							
Area A (southwest quadrant of Main Street interchange)									
3-1	64.2	62.6	1.6	4	0	1,160	22,500	$337,500	$29,605
3-2	69.4	63.7	5.7	2	2				
4-1	**66.1**	**65.7**	0.4	3	0				
4-2	**66.0**	**65.1**	0.9	2	0				
Area B, Wall B1 (northeast quadrant of Hwy 10/101/169 interchange)									
1-2	71.4	66.3	5.1	2	2	550	10,300	$154,500	$15,147
Area B, Wall B2 (east of Hwy 169 north of BNSF Railway mainline)									
2-1	**75.5**	66.4	9.1	1	1	700	13,400	$201,000	$22,088
Area B, Wall B3 (southeast quadrant of Main Street interchange)									
2-2	**71.3**	64.7	6.6	5	5	1,700	33,300	$499,500	$12,153
2-3	69.3	61.2	8.1	1	1				
Area C (northwest quadrant of Main Street interchange)									
8-1	**69.3**	61.5	7.8	6	6	1,280	24,900	$373,500	$7,981
8-2	62.7	60.2	2.5	10	0				
Area D, Wall D1 (northeast quadrant of Main Street interchange)									
6	**67.0**	63.4	3.6	6	0	910	17,500	$262,500	$5,859
7	**66.0**	61.8	4.2	1	0				
9	**70.0**	64.4	5.6	8	8				
Area D, Wall D2 (southeast quadrant of School Street interchange)									
12-1	60.3	60.1	0.2	4	0	620	11,700	$175,500	N/A
12-2	61.4	60.4	1.0	1	0				
15	62.1	61.1	1.0	1	0				
Area D, Wall D3 (south of School Street, east of Dodge Street) [2]									
12-1	60.3	60.0	0.3	4	0	480	8,900	$133,500	N/A
12-2	61.4	60.5	0.9	1	0				
15	62.1	60.7	1.4	1	0				

Bold numbers exceed State daytime noise standards.

N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.

[1] Surface area includes wall taper at each end.

[2] Wall located outside of proposed right of way. Right of way costs not included with total cost of wall.

TABLE G-8 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
20-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 20 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [(1)]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (20 ft wall)							
Area E (west of Hwy 169, between School Street and 193rd Avenue interchanges)									
17	68.1	68.1	0.0	4	0	1,490	29,100	$436,500	$11,023
22	**73.9**	64.0	9.9	4	4				
27	69.7	69.4	0.3	3	0				
Area F (east of Hwy 169, southeast quadrant of Hwy 169/193rd Avenue interchange)									
20-1	**75.4**	64.5	10.9	3	3	1,105	21,400	$321,000	$2,153
20-2	**70.0**	63.5	6.5	2	2				
20-3	**77.2**	63.9	13.3	3	3				
20-4	**71.0**	63.5	7.5	5	5				
20-5	**66.5**	63.9	2.6	4	0				
21	**76.9**	63.9	13.0	2	2				
23	**68.9**	**66.3**	2.6	1	0				
Area G (west of Hwy 169, between 193rd Avenue and 197th Avenue interchanges)									
29	69.6	69.5	0.1	1	0	2,190	43,100	$646,500	N/A
30	**65.4**	64.7	0.7	2	0				
31-1	**68.9**	**66.1**	2.8	2	0				
31-2	61.2	58.9	2.3	4	0				
31-3	61.6	58.4	3.2	2	0				
33	64.7	63.4	1.3	3	0				
Area I (west of Hwy 169, north of 197th Avenue interchange)									
34	**67.0**	61.2	5.8	3	3	2,610	51,500	$772,500	$44,397
37-1	**72.7**	**69.3**	3.4	2	0				
37-2	**72.0**	**68.9**	3.1	4	0				

Bold numbers exceed State daytime noise standards.
N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.
(1) Surface area includes wall taper at each end.

TABLE G-8 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
20-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 20 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [1]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (20 ft wall)							
Area J (east of Hwy 169, north of 197th Avenue interchange)									
35 [2]	**73.0**	63.4	9.6	1	1	2,500	49,300	$739,500	$14,194
36-1	**72.1**	64.0	8.1	2	2				
36-2	**68.7**	63.2	5.5	3	3				
36-3	**76.3**	**66.5**	9.8	1	1				
36-4	**70.9**	**68.3**	2.6	1	0				
Area K, Wall K1 (west of Hwy 169, south of County Road 77)									
42	**70.1**	63.5	6.6	2	2	895	17,200	$258,000	$19,545
Area K, Wall K2 (west of Hwy 169 at County Road 77)									
43	**71.9**	**65.2**	6.7	1	1	790	15,100	$226,500	$33,806
Area L, Wall L1 (east of Hwy 169 at Brook Drive)									
38	58.3	55.3	3.0	1	0	3,400	67,300	$1,009,500	$50,224
39	**68.5**	61.8	6.7	3	3				
40	**65.8**	60.9	4.9	1	0				
41	61.3	57.3	4.0	1	0				
Area L, Wall L2 (east of Hwy 169 south of 221st Avenue interchange)									
45	**72.3**	**67.8**	4.5	1	0	1,390	27,100	$406,500	N/A
Area M, Wall M1 (west of Hwy 169, south of 237th Avenue)									
56	**75.0**	**61.1**	13.9	1	1	995	19,300	$289,500	$20,827
Area M, Wall M2 (southwest quadrant of Hwy 169/CSAH 25/19 interchange)									
57	**76.9**	66.3	10.6	1	0	2,770	54,800	$822,000	$43,492
59	**67.7**	64.1	3.6	2	0				
60	**73.6**	**65.3**	8.3	1	0				
Area N, Wall N1 (northeast quadrant of Hwy 169/221st Avenue interchange)									
51	**75.4**	64.5	10.9	1	1	830	15,900	$238,500	$21,881

Bold numbers exceed State daytime noise standards.

N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.

[1] Surface area includes wall taper at each end.

[2] Barrier cost-effectiveness for Area J calculated based on Receptor R35 representing one residence because of right of way impacts and residential relocations associated with the proposed 197th Avenue interchange (see Figure 9B in Appendix A and right of way impact tables in Appendix I.)

TABLE G-8 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
20-foot Modeled Walls

Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 20 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [(1)]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (20 ft wall)							
Area N, Wall N2 (east of Hwy 169, north of Hwy 169/221st Avenue interchange)									
52	**69.4**	63.6	5.8	1	1	1,600	31,300	$469,500	$80,948
Area N, Wall N1 (east of Hwy 169, south of 237th Avenue)									
54	60.8	56.0	4.8	1	0	2,250	44,400	$666,000	$92,500
55	**67.3**	60.1	7.2	1	0				
Area N, Wall N2 (southeast quadrant of Hwy 169/CSAH 25/19 interchange)									
58	**71.1**	64.3	6.8	4	0	2,880	57,000	$855,000	$31,434
Area O, Wall O1 (northwest quadrant of Hwy 169/CSAH 25/19 interchange)									
64	**69.5**	64.7	4.8	1	0	4,000	79,400	$1,191,000	N/A
Area O, Wall O2 (west of Hwy 169, south of CSAH 4 – Zimmerman)									
66	**71.9**	62.8	9.1	1	1	1,535	30,000	$450,000	$49,451
Area P, Wall P1 (northeast quadrant of Hwy 169/CSAH 25/19 interchange)									
61	**71.4**	65.0	6.4	4	0	1,270	24,800	$372,000	$14,531
Area P, Wall P2 (east of Hwy 169, north of existing CSAH 19 intersection with Hwy 169)									
63	**65.8**	62.9	2.9	3	0	2,570	50,800	$762,000	N/A
65	**65.8**	61.5	4.3	2	0				
Area P, Wall P3 (east of Hwy 169, north of realigned CSAH 25)									
62	64.0	56.9	7.1	1	1	1,210	23,600	$354,000	$49,859
Area Q (west of Hwy 169, north of CSAH 4 – Zimmerman)									
74	61.4	58.9	2.5	17	0	2,290	45,100	$676,500	N/A

Bold numbers exceed State daytime noise standards.
N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.
(1) Surface area includes wall taper at each end.

TABLE G-8 continued
NOISE MITIGATION COST EFFECTIVENESS RESULTS (DAYTIME)
20-foot Modeled Walls

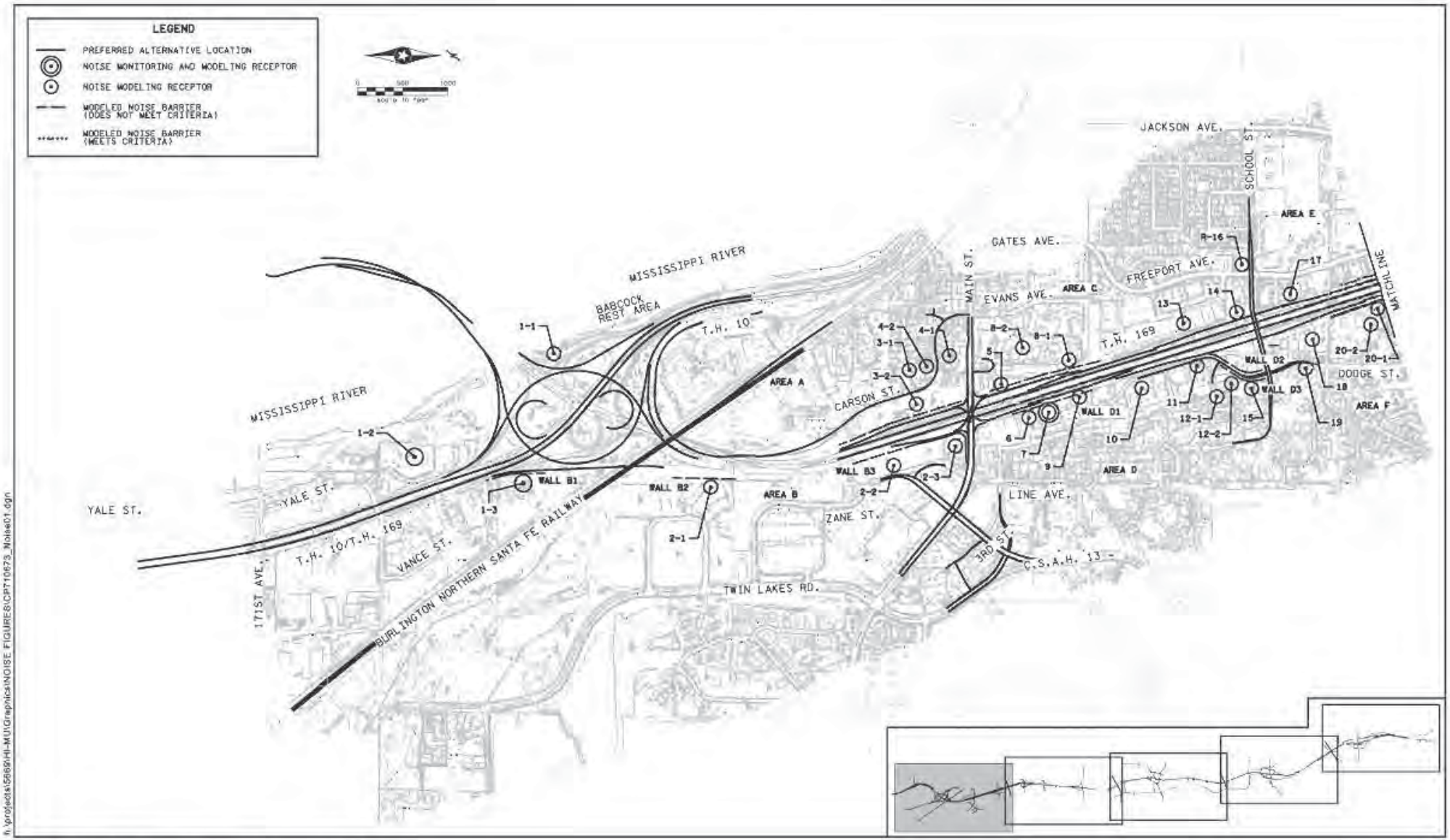
Receptors	Daytime L_{10} Noise (dBA)		Reduction (in dBA) with 20 ft noise wall	Number of residences	Number of affected residences	Length of wall (feet)	Wall surface area (sq ft) [(1)]	Total cost of wall ($15/sq ft)	Cost/dBA/ receptor
	Pref. Alt. year 2030 (no wall)	Pref. Alt. year 2030 (20 ft wall)							
Area R (northeast quadrant Hwy 169/CSAH 4 interchange – Zimmerman)									
7-1	**70.5**	63.3	7.2	2	2				
77-2	**68.1**	61.2	6.9	2	2				
77-3	**65.5**	59.8	5.7	2	2				
77-4	63.6	58.7	4.9	3	0				
78-1	**72.0**	**65.5**	6.5	1	1				
78-2	**68.5**	63.0	5.5	2	2				
79	65.0	59.7	5.3	4	4				
80	62.7	59.2	3.5	8	0				
81	63.4	60.2	3.2	1	0				
82	60.7	59.1	1.6	8	0				
83	**71.6**	64.2	7.4	6	6	4,780	94,900	$1,423,500	$5,765
84-1	**69.3**	61.5	7.8	2	2				
84-2	**69.6**	61.3	8.3	1	1				
85	**73.2**	**65.6**	7.6	3	3				
86	**72.6**	**66.1**	6.5	3	3				
87	**71.5**	**65.4**	6.1	3	3				
88	**72.4**	**67.7**	4.7	2	0				
89	**71.1**	**65.9**	5.2	3	3				
90	**71.1**	**65.8**	5.3	3	3				
91	**70.9**	**65.4**	5.5	3	3				
92	**73.0**	**68.8**	4.2	3	0				

Bold numbers exceed State daytime noise standards.
N/A = not applicable because all receptors adjacent to the modeled wall did not meet the minimum 5 dBA threshold to be considered acoustically effective.
(1) Surface area includes wall taper at each end.

TABLE G-9
HIGHWAY 169 NOISE MODELING RESULTS
DISTANCE FROM ROADWAY (daytime and nighttime)

Distance from Hwy 169 Right of Way Limits [1]	Future Build Conditions Rural Elk River North of 221st St East of Hwy 169				Future Build Conditions Livonia Township North of CSAH 25/19 West of Hwy 169 [3]				Future Build Conditions Zimmerman North of CSAH 4 West of Hwy 169			
	Daytime (2030)		Nighttime (2030)		Daytime (2030)		Nighttime (2030)		Daytime (2030)		Nighttime (2030)	
	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
50 feet	75.6	71.8	72.3	67.8	76.5	72.4	74.2	69.6	75.3	70.9	75.8	71.1
100 feet	73.4	70.0	70.4	66.5	74.1	70.6	72.0	68.1	73.2	69.4	73.4	69.3
200 feet	70.4	67.6	67.7	64.4	70.9	68.1	69.1	65.9	70.2	67.1	70.3	66.8
300 feet	68.2	65.7	65.8	62.8	68.8	66.4	67.1	64.4	68.1	65.3	68.0	64.9
400 feet	66.5	64.3	64.2	61.6	67.5	65.2	66.0	63.2	66.4	63.9	66.2	63.4
500 feet	65.1	63.1	62.9	60.5	69.2	63.4	67.7	61.0	65.1	62.7	64.8	62.2
State Standards[1]	**65**	**60**	**55**	**50**	**65**	**60**	**55**	**50**	**65**	**60**	**55**	**50**
State Standards[2]	**70**	**65**	**70**	**65**	**70**	**65**	**70**	**65**	**70**	**65**	**70**	**65**

[1] State daytime and nighttime standards for residential land uses (NAC-1).
[2] State daytime and nighttime standards for commercial land uses (NAC-2).
[3] Modeled noise levels in the northeast quadrant of the CSAH 25/19 interchange are predicted to increase from 400 feet to 500 feet from the Highway 169 right of way limits because the point located 500 feet from Highway 169 approaches a local frontage road. Final locations for local frontage roads will be determined in the future with development of adjacent lands.



NOISE RECEPTOR AND MODELED BARRIER LOCATIONS

ENVIRONMENTAL ASSESSMENT

T.H. 169 - SP 7106-73 and 7106-71

Figure G 1

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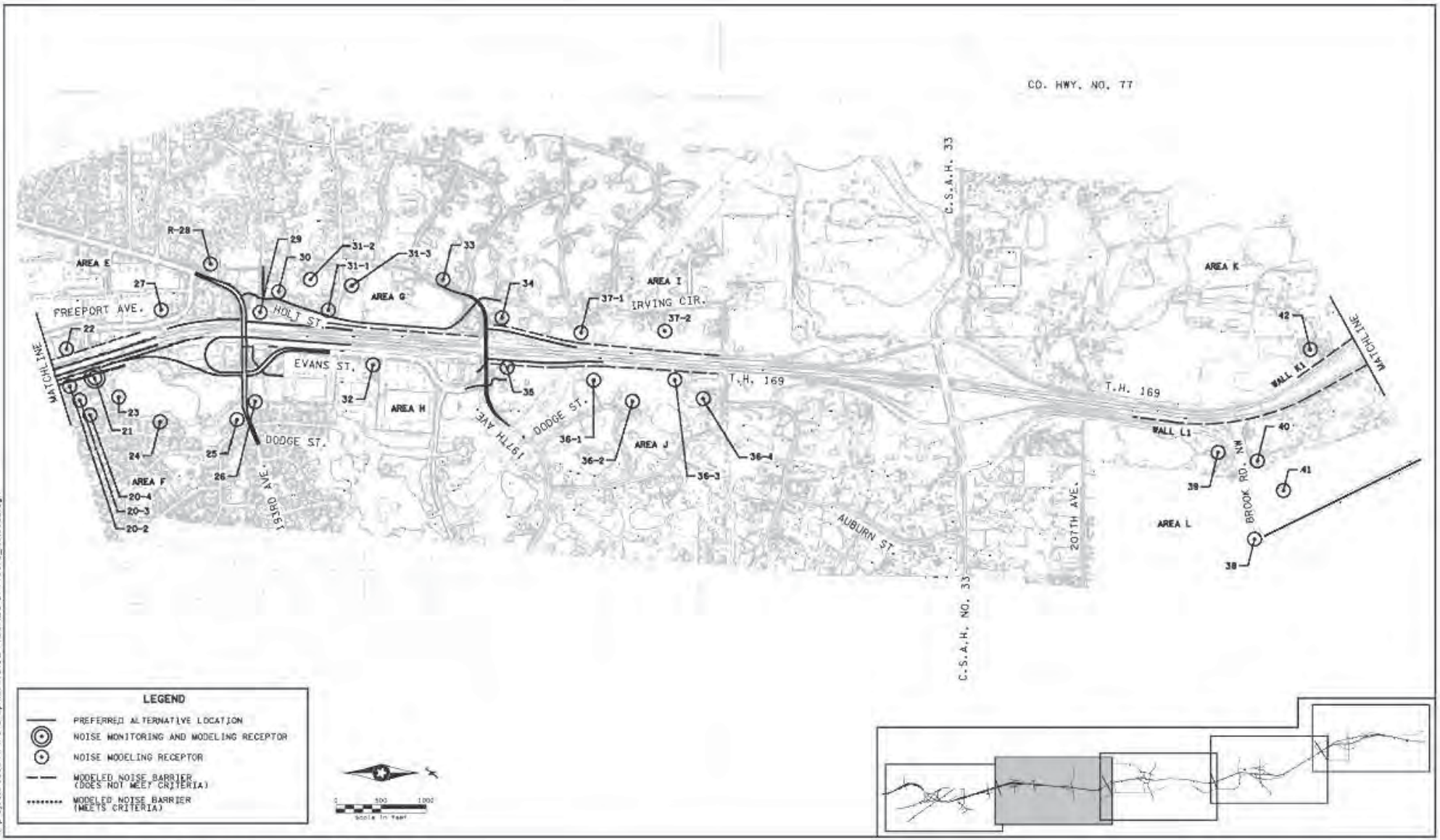

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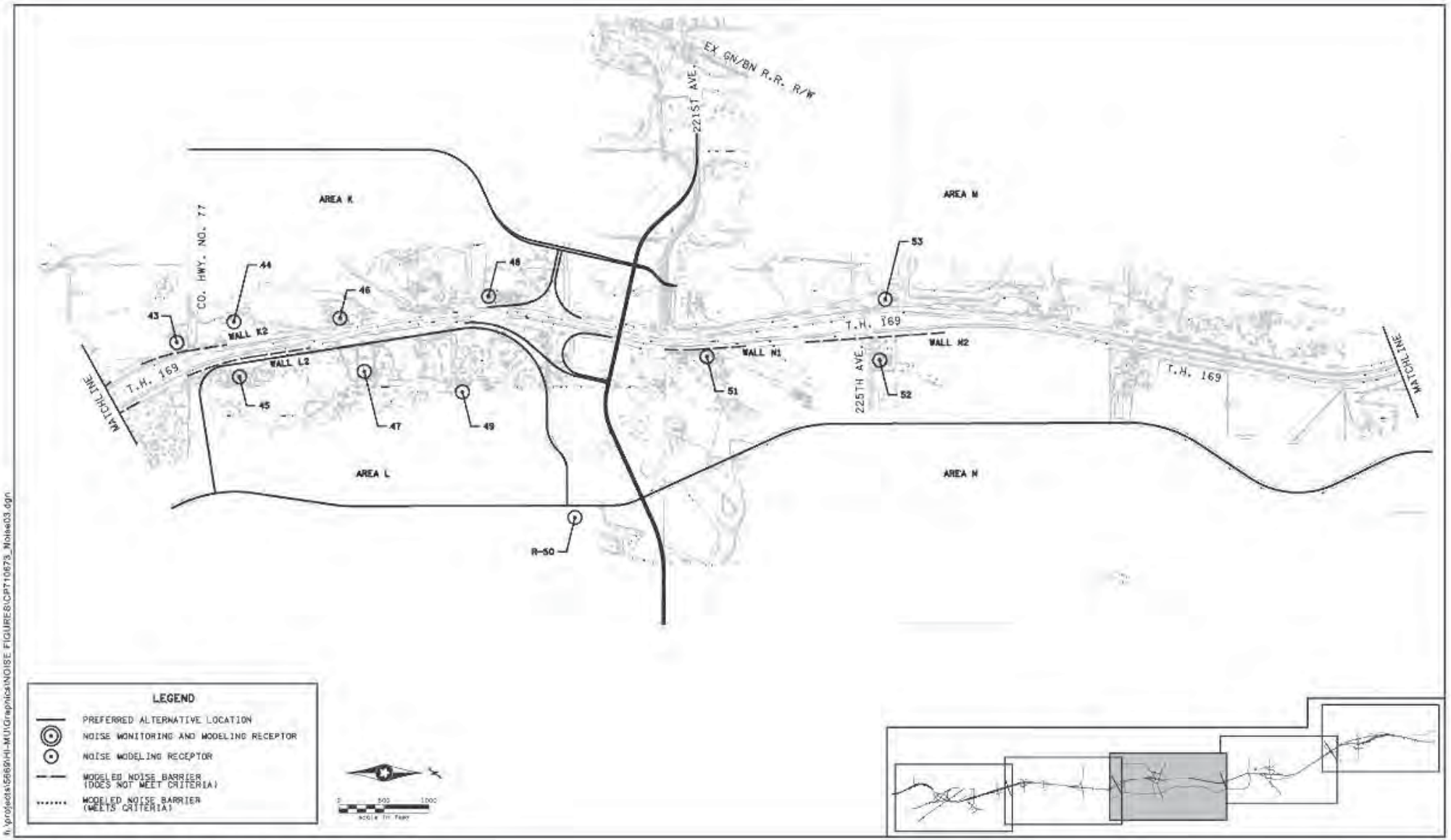
NOISE RECEPTOR AND MODELED BARRIER LOCATIONS

ENVIRONMENTAL ASSESSMENT
T.H. 169 - SP 7106-73 and 7106-71

Figure G 2



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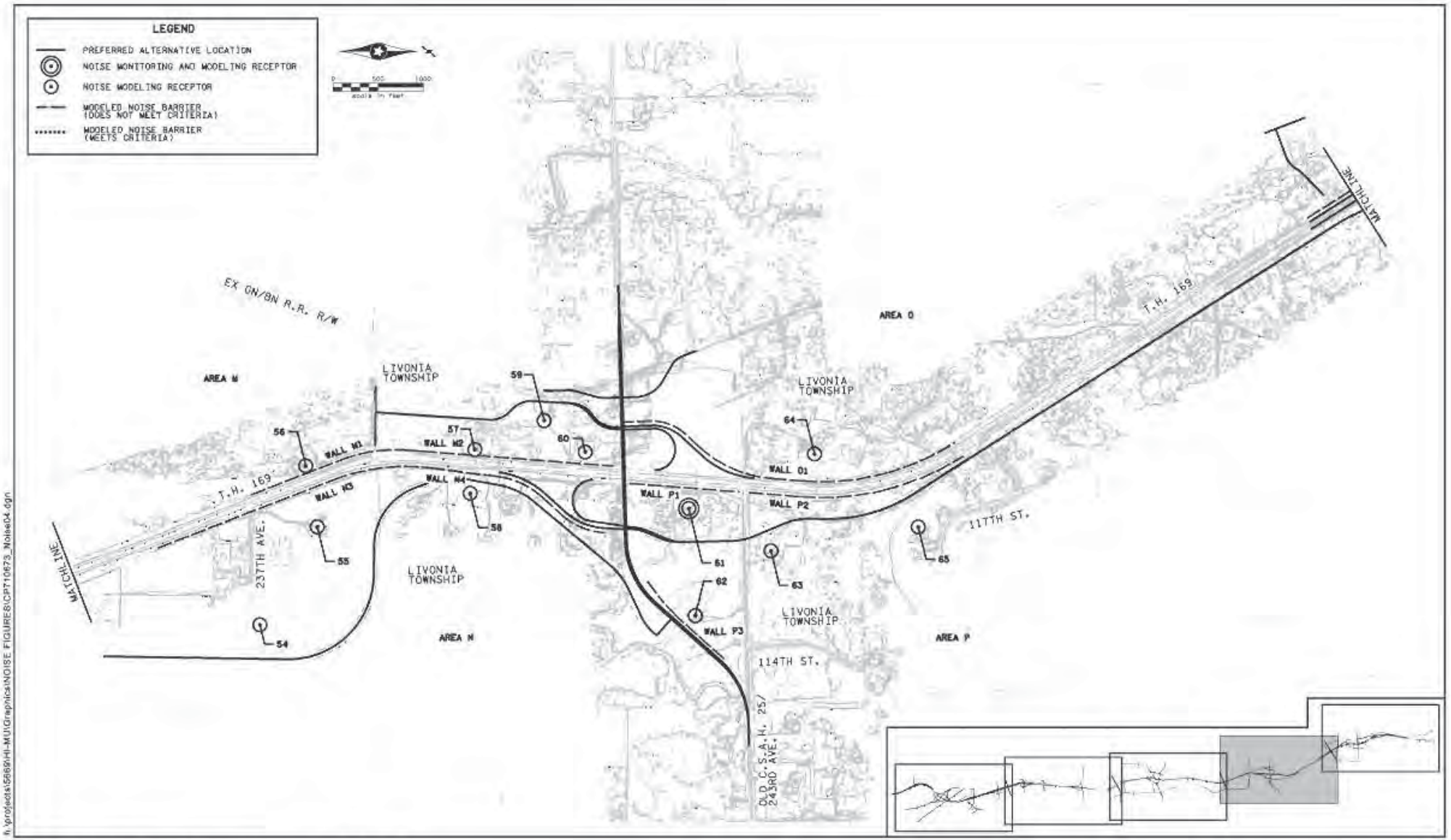
NOISE RECEPTOR AND MODELED BARRIER LOCATIONS

ENVIRONMENTAL ASSESSMENT
T.H. 169 - SP 7106-73 and 7106-71

Figure G 3



NOISE RECEPTOR AND MODELED BARRIER LOCATIONS

ENVIRONMENTAL ASSESSMENT

T.H. 169 - SP 7106-73 and 7106-71

Figure G4

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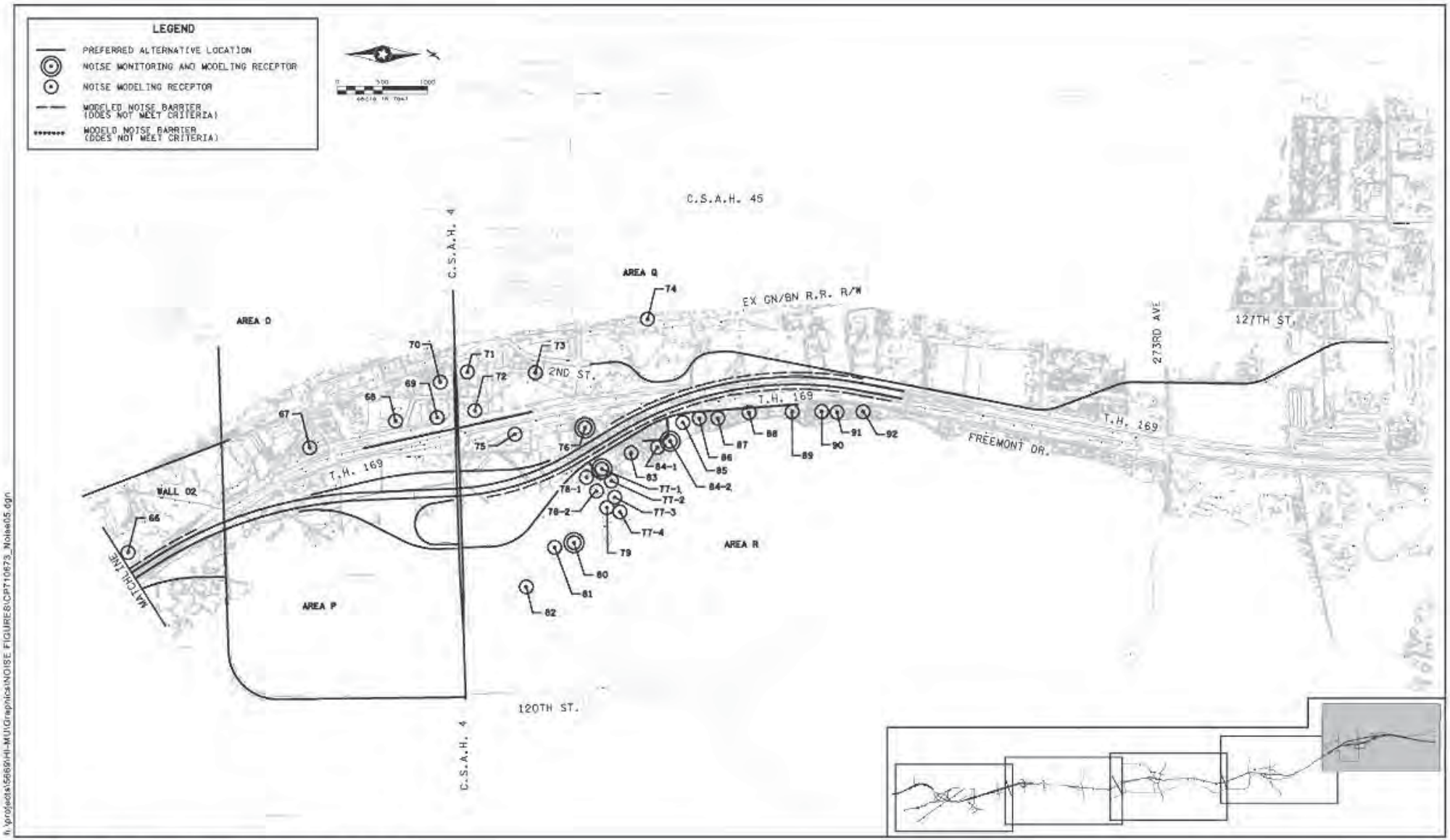

NOISE RECEPTOR AND MODELED BARRIER LOCATIONS

ENVIRONMENTAL ASSESSMENT
T.H. 169 - SP 7106-73 and 7106-71

Figure G5

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