Northbound Results Addendum to the OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Noise Technical Report

Prepared for: Oregon Department of Transportation

Key 18841

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Oregon Department of Transportation

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Oregon Department of Transportation
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Portland, OR 97209

This document has been prepared by SLR International Corporation. The material and data in this report were prepared under the supervision and direction of the undersigned.

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GLOSSARY

Activity Category B NAAC	The exterior noise impact criterion for Activity Category B is Leq 65 dBA. This ODOT standard defines the noise levels constituting an impact for residences.
Activity Category C NAAC	The exterior noise impact criterion for Activity Category C is Leq 65 dBA. This ODOT standard defines the noise levels constituting an impact for active sports arenas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio stations, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
Activity Category D NAAC	The interior noise impact criterion for Activity Category D is Leq 50 dBA. This ODOT standard defines the noise levels constituting an impact for auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio stations, recording studios, schools, and television studios.
Activity Category E NAAC	The exterior noise impact criterion for Activity Category E activities is Leq 70 dBA. This ODOT standard defines the noise levels constituting an impact for hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A—D or F.
Ambient Noise	The background sound of an environment in relation to which all foreground sounds are heard. Ambient noise level is a measure of the background noise of an environment over a given period of time, in decibels.
A-Weighted Decibel (dBA)	This scale accounts for humans' ability to hear only a limited range of frequencies by filtering out those frequencies that the human ear does not respond to.
Decibel (dB)	The unit used to measure the loudness of sound is a decibel.
Cumulative Impacts	The impact on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.
Leq	Hourly equivalent sound pressure level.
Receptor	An activity or unit represented by a measured or modeled receiver, also called an equivalent unit (subset of receiver).
Receiver	Modeling or measurement location that represents noise sensitive land uses; can represent multiple receptors or equivalent units.

ACRONYMS

CFR	Code of Federal Regulations
dB	Decibel
dBA	A-Weighted Decibel
FHWA	Federal Highway Administration
NAC	Noise Abatement Criteria
NAAC	Noise Abatement Approach Criteria
NTR	Noise Technical Report
ODOT	Oregon Department of Transportation
TNM	Federal Highway Administration Traffic Noise Model

SUMMARY

The OR 217 Auxiliary Lane Project consists of two separate sub-projects in the same project area. OR 217: OR 10 – OR 99W Auxiliary Lane Project is a public safety and congestion reduction project in the southwest portion of the Portland metro area in the cities of Beaverton and Tigard. The project includes the extension of the southbound auxiliary lane from just south of the Beaverton Hillsdale Highway (OR 10)/SPRR overcrossing structure to OR 99W and creation of a barrier-separated collector/distributor road between Allen Boulevard and Denney Road in the southbound direction. This is referred to as the "Southbound Auxiliary Lane Project." The OR 217: Progress (Scholls Ferry Road) Interchange – Tigard (OR 99W) Interchange Northbound Auxiliary Lane Project will extend the Northbound Auxiliary Lane from the OR 99W exit to the Scholls Ferry Road Exit. An additional auxiliary lane will be created from the Northbound OR 99W loop entrance ramp to the Greenburg Road exit ramp. This is referred to as the "Northbound Auxiliary Lane Project."

This report has been prepared as an addendum to the OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W Noise Technical Report (NTR) to present the modeling and analysis of the Northbound Auxiliary Lane Project impacts and abatement.

Traffic noise levels for Existing conditions (2017) and for the No Build and Build Alternatives in the design year (2040) were predicted for the Northbound Auxiliary Lane Project area. As shown in Table 1, existing noise levels in the Northbound Auxiliary Lane Project area are predicted to exceed the Oregon Department of Transportation (ODOT) noise abatement approach criteria (NAAC) at 61 receptors, No Build noise levels are predicted to exceed the NAAC at 85 receptors and Build noise levels are predicted to impact 82 receptors. These differences in noise levels from Existing to No Build conditions result from projected increases in traffic volumes on OR 217. Changes in noise levels predicted under the Build conditions when compared to the Existing conditions are only predicted to increase by up to 2 dBA. Between the No Build and Build Alternatives sound level changes are predicted to range from a decrease of 1 dBA up to an increase of 1 dBA, with the majority of receivers experiencing no change in sound levels between Build and No Build conditions. Changes in sound levels between No Build and Build conditions result from changes in OR 217 travel lane locations and the other roadway alignment changes associated with the Northbound Project.

Table 1
Summary of Predicted Noise Levels (Leq - dBA) and Number of Receptors where ODOT Noise Abatement Approach Criteria (NAAC) is Exceeded in the Northbound OR 217 Auxiliary Lanes Project Area

Condition	Minimum Noise Level (dBA)	Maximum Noise Level (dBA)	Noise Level Difference between Existing and Build Condition	Noise Level Difference between No Build and Build Condition	Number of Receptors where ODOT Noise Abatement Approach Criteria (NAAC) is exceeded
Existing	47	75	-	-	61
No Build	48	76	-	-	85
Build	48	76	0 to 2	-1 to 1	82

Noise impacts are predicted at 2 residences located adjacent to OR 217 in the Northbound Auxiliary Lane Project area on SW 95th Avenue, south of SW Oak Street. Mitigation in the form of a noise barrier was evaluated for the impacts to residential receptors. The SW 95th Avenue barrier does not meet ODOT reasonable and feasible criteria, and the barrier is not recommended.

Noise impacts are predicted at 67 residences located along OR 217 in the Northbound Auxiliary Lane Project area northwest of the SW Hall Boulevard overcrossing. Mitigation in the form of a noise barrier was evaluated for the impacts to residential receptors. The St. James barrier meets ODOT reasonable and feasible criteria, and the barrier is recommended. 57 of the 67 impacted residences will receive 5 dBA or greater insertion loss from the abatement.

Noise impacts are predicted at 11 residences and a school located along OR 217 in the Northbound Auxiliary Lane Project area between SW Pfaffle Street and Pacific Highway (OR 99W). Mitigation in the form of a noise barrier was evaluated for the impacts to residential receptors. The Carriage House barrier meets ODOT reasonable and feasible criteria, and the barrier is recommended. 10 of the 11 impacted properties will receive 5 dBA or greater insertion loss from the abatement.

Noise impacts are predicted at 2 residences located along OR 217 in the Northbound Auxiliary Lane Project area between SW Hall Boulevard and Pacific Highway (OR 99W) on the west side of OR 217. Mitigation in the form of a noise barrier was evaluated for the impacts to residential receptors. The Hall barrier does not meet ODOT reasonable and feasible criteria, and the barrier is not recommended.

Unabated noise impacts will remain where noise barriers did not meet ODOT reasonable and feasible criteria and the barriers are not recommended for construction. This includes two residential noise impacts on SW 95th Avenue and two residential noise impacts on SW Hall Boulevard.

Construction noise levels for the improvements to OR 217 would result from normal construction activities. Noise levels for these activities can be expected to range from 70-100 dBA at sites 50 feet from the activities. Standard construction noise abatement measures will be included in the project specifications.

The distance to the 65 dBA NAAC for property on OR 217 within the project area is approximately 230 feet to 410 feet, depending on the topography. The distance to the 70 dBA NAAC is approximately 215 feet from the OR 217 centerline. The findings of this Addendum will be shared with local governments so that they can consider these sound levels in approving any land use redevelopment in the future. Copies of this noise study will be provided by ODOT to the City of Tigard and City of Beaverton so that local government officials may consider the information in this noise analysis.

1. INTRODUCTION

The OR 217: Progress (Scholls Ferry Road) Interchange – Tigard (OR 99W) Interchange Northbound Auxiliary Lane Project will extend the Northbound Auxiliary Lane from the OR 99W exit to the Scholls Ferry Road Exit. An additional auxiliary lane will be created from the northbound OR 99W loop entrance ramp to the Greenburg Road exit ramp. Work on the northbound side will also include reconnecting the mainline to the entrance and exit ramps to the interchanges at OR 99W, Greenberg Road, and Scholls Ferry Road. This is referred to as the "Northbound Auxiliary Lane Project."

The Northbound Project will also replace the SW Hall Boulevard structure. The Hall overpass structure replacement is part of the Northbound Auxiliary Lane portion of the project.

This Addendum addresses the additional model validation, the modeling results, and the mitigation analysis for the northbound project improvements. The methodology, land use, traffic data, and construction mitigation are the same as discussed in the OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W Noise Technical Report (NTR).

Refer to Figure 1 for a graphical representation of the proposed lane improvements. The analysis area for the southbound improvements extends from OR 10 to the SW Hall Boulevard overcrossing. The analysis for the northbound improvements extends from the Scholls Ferry Road exit south to OR 99W, and also includes the SW Hall Boulevard overcrossing improvements.

OR 217 SB and NB Auxiliary Lanes
K18841

9/19/2017

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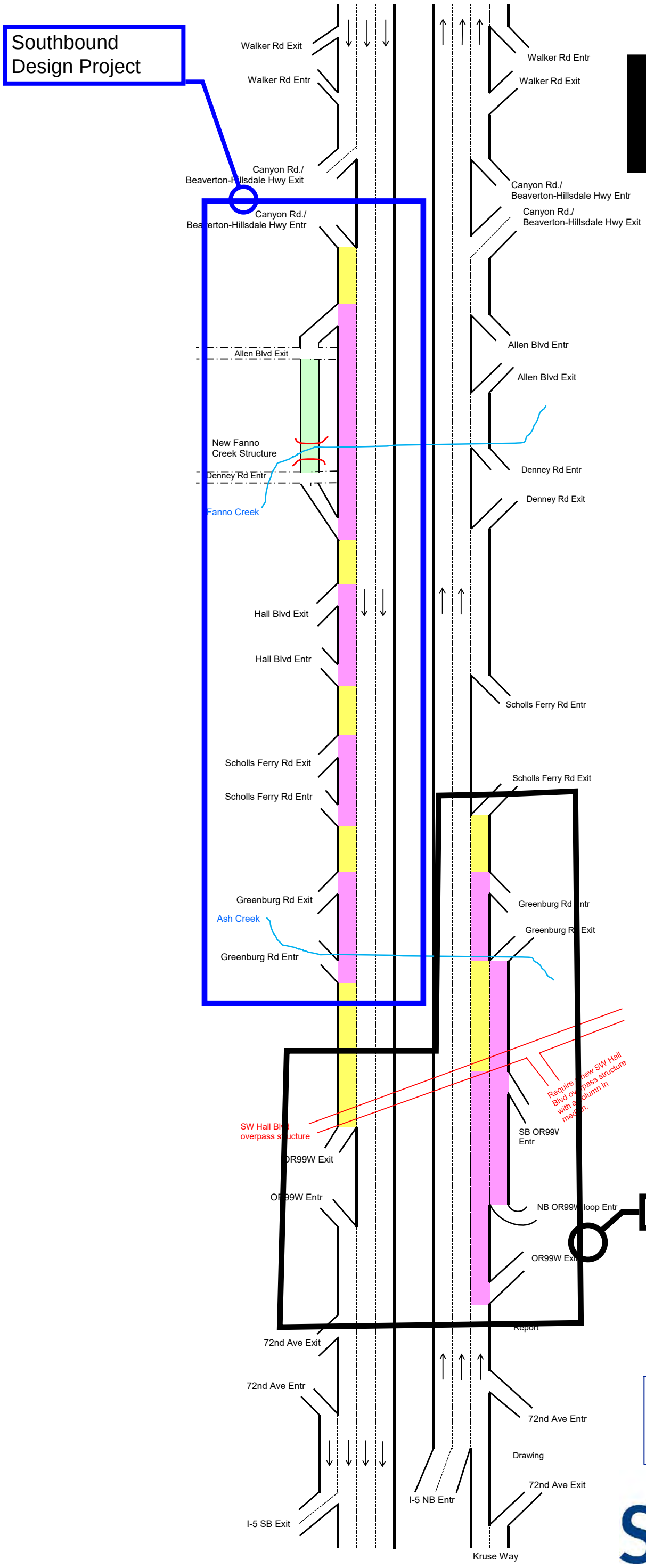
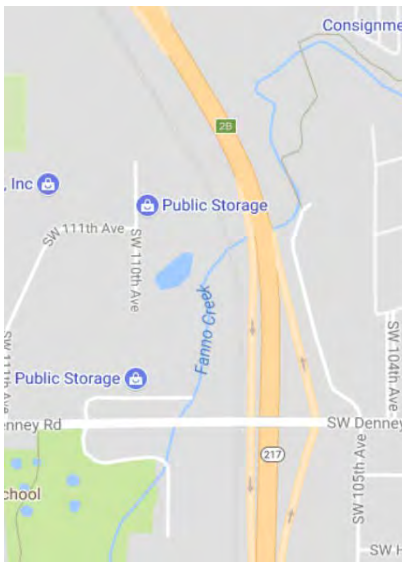
DESIGN PHASE

Southbound Design Project



Northbound Design Project

Fanno Creek

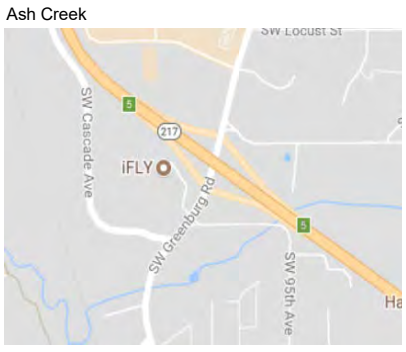


Existing Aux Lane

Build Aux Lane Extension by widening

New Allen - Denney CD Road

Ash Creek



Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR-99W

Drawing

Drawring

Graphic of Lane Configurations

Fig. No. 1

SLR

OR 217 SB and NB Auxiliary Lanes
K18841

9/19/2017

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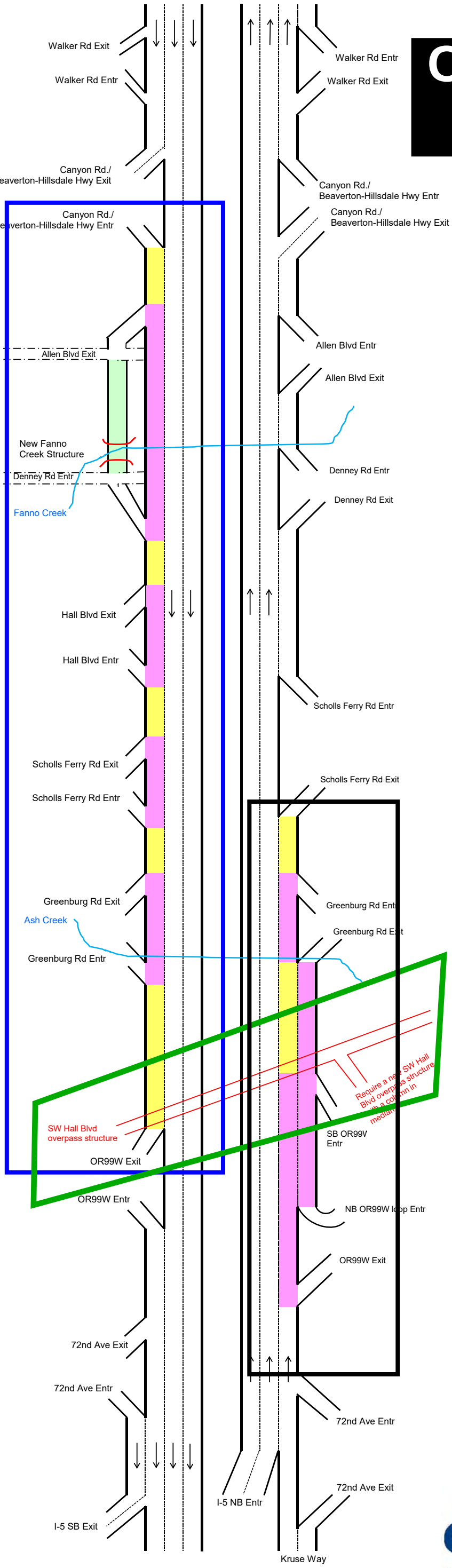
CONSTRUCTION PHASE

STAGE 1 - SB

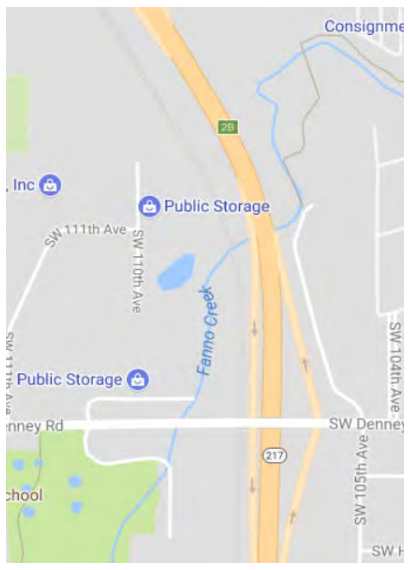
>Construct all SB including 99 Off

>One mobilization for SB

>Provides widened SB for bridge construction traffic handling



Fanno Creek

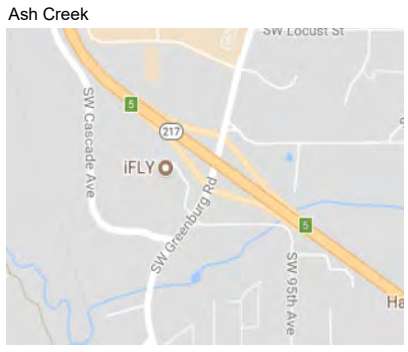


Existing Aux Lane

Build Aux Lane Extension by widening

New Allen - Denney CD Road

Ash Creek



STAGE 2

>Construct Hall Bridge using widening SB

>New bridge provides width/opening for NB Aux

>Can be constructed separately and before SB with inefficiencies in mobilization, temporary pavement and negative public perception.

STAGE 3

>Existing bridge columns conflict

>Construct bridge first

>Construct NB Aux

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR-99W

SLR

Drawring

Graphic of Lane Configurations

Fig. No. 1

2. NORTHBOUND PROJECT AREA EXISTING CONDITIONS

2.1 EXISTING NOISE LEVELS

Model validation was presented under Section 3, 'Project Area Existing Conditions' in the NTR. Additional validation model runs were performed for the monitoring locations located on the east side of OR 217 for the Northbound Auxiliary Lane Project area analysis, because additional shielding in the form of terrain lines and building shielding was added to the model when the northbound receivers were developed. Validation runs were performed for monitoring locations M2, M4, and M5 to confirm that TNM-predicted sound levels were still within 3 dBA of the measured sound levels at those modeling sites. The monitoring locations are shown in Figures 2a through 2g.

A comparison of noise levels predicted for the monitoring locations using the noise model and noise levels measured in the field is shown in Table 2. The modeled results are within 3 dBA, confirming the model is considered to reasonably predict noise levels for the Northbound Auxiliary Lane Project area. Monitoring data and equipment calibration certificates are included in Appendix C of the primary Noise Technical Report. The updated validation run TNM output files are included in Appendix A in this Addendum.

Table 2
Monitored and Predicted Noise Levels in the Northbound OR 217 Auxiliary Lanes Project Area (Leq - dBA)

Monitoring Site	Location	Date/Start Time	Duration	Measured Noise Level	Predicted Noise Level (model validation)	Difference
M2	10620 SW 95th Avenue, Tigard, OR	12/14/17 11:44 am	15 min	66	66	0
M4	11155 SW Hall Boulevard	12/08/17 10:30 am	15 min	70	72	2
M5	8410 SW Pfaffle Street	12/14/17 12:17 pm	15 min	63	62	1

Following validation, existing sound levels were predicted at 105 receivers (representing 337 receptors) in the Northbound Auxiliary Lane Project area. Monitoring locations M2, M4, and M5 are modeled as receivers in the northbound analysis area.

Sound levels were predicted at 5 feet above ground level for first floor residences and 15 feet for second floor residences. An additional 15 feet of height is added to receivers for each floor above the second floor. Existing terrain was included in the model and provided shielding for the receivers. Building rows or buildings modeled as barriers were also added to the model in areas where large buildings or dense residences provide shielding for residences located behind them. Predicted existing peak noise hour sound levels at receivers located within the project area are listed in Table 3. The TNM model files are

included in electronic format in Appendix A. A project-wide view of area receiver locations is shown in Figures 2a through 2g.

Under Existing peak noise hour conditions, 20 receivers (representing 60 residences and one school) are predicted to have sound levels exceeding the NAAC.

Proposed Build Alternative Lane Lines

Receiver Location

0 200 400 600 feet

SLR

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

Receiver Locations

Date	September 20, 2018	Scale	AS SHOWN	Fig. No.	2a
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012		

Proposed Build Alternative Lane Lines

Receiver Location

0 200 400 600 feet

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

Receiver Locations

SLR

Date	September 20, 2018	Scale	AS SHOWN	Fig. No.	2b
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012		

Proposed Build Alternative Lane Lines

Receiver Location

0 200 400 600 feet

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

Receiver Locations

SLR

Date	September 20, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. 2c

Proposed Build Alternative Lane Lines

Receiver Location

0 200 400 600 feet

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

Receiver Locations

Date	September 20, 2018	Scale	AS SHOWN	Fig. No. 2d
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	

Proposed Build Alternative Lane Lines
Receiver Location
Receiver Site at 5 feet above ground level

0 200 400 600 feet

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

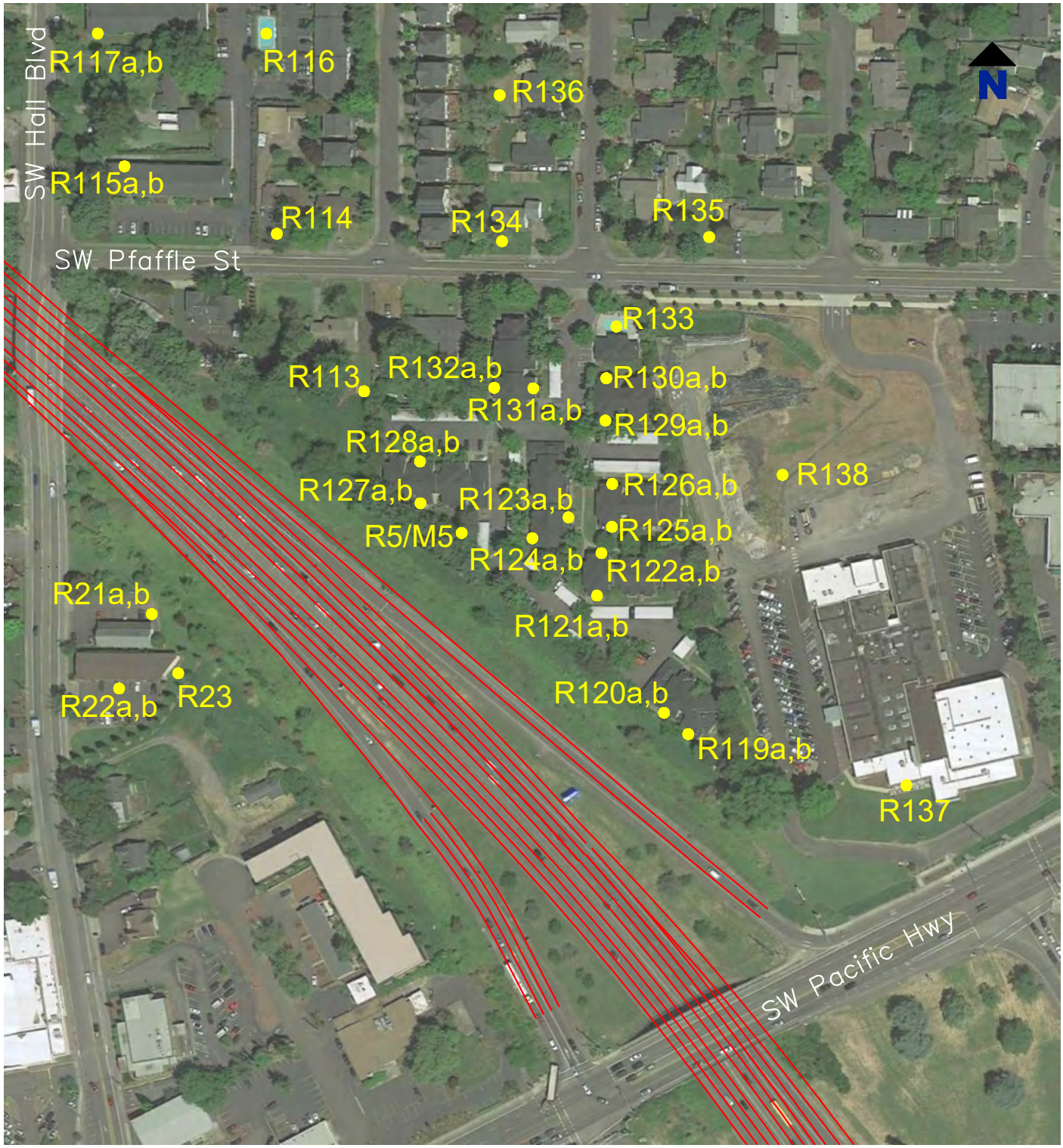
Drawing

Receiver Locations

Date	October 25, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. 2e

SLR



0 200 400 600 feet

Proposed Build Alternative Lane Lines

Receiver Location

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

Receiver Locations

Date	October 25, 2018	Scale	AS SHOWN	Fig. No. 2f
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	

Proposed Build Alternative Lane Lines

Receiver Location

0 200 400 600 feet

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

Receiver Locations

Date	September 20, 2018	Scale	AS SHOWN	Fig. No. 2g
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	

SLR

Table 3
Predicted Existing Peak Noise Hour Sound Levels in the Project Area

Receiver	Location	Activity Category	Oregon NAAC	Number of Receptors	TNM Noise Level (Leq – dBA)*
M2/R2	1st Row House on SW 95th Ave South of SW Oak St.	B	65	2	**66**
M4/R4	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St.	B	65	Info	**72**
M5/R5	1st Row Apartment Complex on SW Pfaffle St.	B	65	1	62
R21a	1st Row Apartment Complex on SW Mandamus Ct. 1st Floor Patio	B	65	2	63
R21b	1st Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	2	**71**
R22a	1st Row Apartment Complex on SW Hall Blvd. 1st Floor Patio	B	65	5	58
R22b	1st Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	5	60
R23	1st Row Apartment Complex on SW Hall Blvd.	B	65	1	60
R37	1st Row Restaurant on SW Washington Square Rd.	E	70	1	63
R41	2nd Row Restaurant on SW Washington Square Rd.	E	70	1	51
R42	2nd Row Restaurant on SW Greenburg Rd. North of SW Washington Square Rd.	E	70	1	57
R43	3rd Row Restaurant on SW Greenburg Rd. North of SW Washington Square Rd.	E	70	2	55
R44	2nd Row Restaurant on SW Greenburg Rd. North of SW Washington Square Rd.	E	70	1	59
R45	1st Row Restaurant on SW Greenburg Rd. South of SW Washington Square Rd.	E	70	1	63
R46	1st Row Restaurant on SW Greenburg Rd. North of SW Pfaffle Rd.	E	70	1	59
R47	1st Row College on SW Oak St West of SW 95th Ave.	C	65	1	60
R48	2nd Row House on SW 95th Ave South of SW Oak St.	B	65	1	62
R49	2nd Row House on SW 95th Ave. South of SW Oak St.	B	65	3	59
R50a	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	**73**
R50b	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	**75**

Table 3
Predicted Existing Peak Noise Hour Sound Levels in the Project Area

Receiver	Location	Activity Category	Oregon NAAC	Number of Receptors	TNM Noise Level (Leq – dBA)*
R51a	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	63
R51b	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	**68**
R52a	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	63
R52b	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	**67**
R53a	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	64
R53b	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	**68**
R54a	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	3	61
R54b	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	64
R55a	3rd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	2	60
R55b	3rd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	2	63
R56a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	**67**
R56b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	**73**
R57a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	64
R57b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	**69**
R58a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	**65**
R58b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	**69**
R59a	4th Row Apartment Complex on SW Hall	B	65	4	62

Table 3
Predicted Existing Peak Noise Hour Sound Levels in the Project Area

Receiver	Location	Activity Category	Oregon NAAC	Number of Receptors	TNM Noise Level (Leq – dBA)*
	Blvd. South of SW Thorn St. 1st Floor Balcony				
R59b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	**65**
R60a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	59
R60b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	63
R61	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. Playground and Pool	B	65	1	62
R62a	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St.1st Floor Balcony	B	65	4	60
R62b	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	**65**
R86a	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	57
R86b	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	63
R102a	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	55
R102b	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	59
R103a	6th Row House on SW 89th Ave. South of SW Thorn St.	B	65	2	58
R103b	6th Row House on SW 89th Ave. South of SW Thorn St.	B	65	3	55
R104	7th Row House on SW 89th Ave. North of SW Thorn St.	B	65	2	57
R105a	8th Row Apartment Complex on SW Oak St. Back of Building 1st Floor Balcony	B	65	5	54
R105b	8th Row Apartment Complex on SW Oak St. Back of Building 2nd Floor Balcony	B	65	5	58
R105c	8th Row Apartment Complex on SW Oak St. Back of Building 3rd Floor Balcony	B	65	5	60

Table 3
Predicted Existing Peak Noise Hour Sound Levels in the Project Area

Receiver	Location	Activity Category	Oregon NAAC	Number of Receptors	TNM Noise Level (Leq – dBA)*
R105d	8th Row Apartment Complex on SW Oak St. Back of Building 4th Floor Balcony	B	65	5	61
R105e	8th Row Apartment Complex on SW Oak St. Back of Building 5th Floor Balcony	B	65	5	62
R106	1st Row House on SW Hall Blvd. North of SW Pfaffle St.	B	65	1	64
R107	2nd Row House on SW Hall Blvd. North of SW Pfaffle St.	B	65	2	61
R108b	3rd Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	8	59
R109	3rd Row Apartment Complex on SW Hall Blvd.	B	65	1	57
R110b	4th Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	10	59
R111b	4th Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	8	60
R112	5th Row House on SW Hall Blvd. South of SW Lucille Ct.	B	65	2	57
R113	2nd Row House on SW Pfaffle St. East of SW Hall Blvd.	B	65	3	57
R114	3rd Row House on SW Pfaffle St. West of SW 84th Ave.	B	65	5	57
R115a	3rd Row Apartment Complex on SW SW Pfaffle St. Back of Building 1st Floor Patio	B	65	4	61
R115b	3rd Row Apartment Complex on SW Pfaffle St. Back of Building 2nd Floor Balcony	B	65	3	64
R116	4th Row House on SW 84th Ave. Back of Building	B	65	7	53
R117a	4th Row Apartment Complex on SW SW Pfaffle St. Back of Building 1st Floor Patio	B	65	3	61
R117b	4th Row Apartment Complex on SW SW Pfaffle St. Back of Building 2nd Floor Balcony	B	65	3	63
R118	5th Row House on SW Hall Blvd. North of SW Pfaffle St.	B	65	2	64
R119a	1st Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	**66**
R119b	1st Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	**71**
R120a	1st Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	64

Table 3
Predicted Existing Peak Noise Hour Sound Levels in the Project Area

Receiver	Location	Activity Category	Oregon NAAC	Number of Receptors	TNM Noise Level (Leq – dBA)*
R120b	1st Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	**71**
R121a	2nd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	56
R121b	2nd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	62
R122a	2nd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	52
R122b	2nd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	55
R123a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	51
R123b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	55
R124a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	56
R124b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	63
R125a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	51
R125b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	52
R126a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	49
R126b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	52
R127a	1st Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	62
R127b	1st Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	**72**
R128a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	56
R128b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	62
R129a	4th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	50
R129b	4th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	52
R130a	4th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	47

Table 3
Predicted Existing Peak Noise Hour Sound Levels in the Project Area

Receiver	Location	Activity Category	Oregon NAAC	Number of Receptors	TNM Noise Level (Leq – dBA)*
R130b	4th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	49
R131a	5th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	49
R131b	5th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	51
R132a	5th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	53
R132b	5th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	55
R133	5th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	1	50
R134	6th Row House on SW Pfaffle St. West of SW 83rd Ave.	B	65	6	49
R135	6th Row House on SW Pfaffle St. East of SW 83rd Ave.	B	65	6	51
R136	7th Row House on SW Pfaffle St. West of SW 83rd Ave.	B	65	8	48
R137	1st Row School on SW Pfaffle St.	C	65	1	**66**
R138	3rd Row School on SW Pfaffle St. Playground	C	65	1	54
R139	1st Row Coffee Shop on SW Pacific Hwy.	E	70	1	63
Number of receptors with sound levels exceeding the NAAC under Existing conditions:					**60 residences and 1 school**

Note: Receivers predicted to exceed the NAAC are shown in bold type.

3. TRAFFIC NOISE ANALYSIS AND NOISE IMPACTS

3.1 NORTHBOUND FUTURE SOUND LEVELS AND TRAFFIC NOISE IMPACTS

Future noise levels (2040) were predicted at the 105 receiver sites (at 5 feet above ground level or higher for additional stories) for the No Build and Build Alternatives. The same topographical shielding and building shielding was used in the No Build and Build modeling that was used in the validation and Existing model runs. Predicted peak noise hour sound levels are shown in Table 4 for No Build and Build conditions. TNM model files are included in electronic format in Appendix A. Noise impacts occur under Build conditions when the NAAC is exceeded or when predicted future levels for the Build Alternative increase by 10 dBA or more over Existing conditions. Predicted noise levels that exceed the NAAC are shown in bold in Table 4. No substantial noise increases are predicted. Receiver locations are shown in Figures 2a through 2g for the Northbound Auxiliary Lane project area. Appendix B includes a summary table of the model results.

Table 4
Predicted Peak Noise Hour Sound Levels for Existing, No Build, and Build Conditions in the Project Area

Receiver	Activity Category	Oregon NAAC	Number of Receptors	Existing (Leq – dBA)	No Build 2040 (Leq – dBA)	Build 2040 (Leq – dBA)
M2/R2	B	65	2	**66**	**67**	**66**
M4/R4	B	65	0	**72**	**73**	**72**
M5/R5	B	65	1	62	63	63
R21a	B	65	2	63	64	64
R21b	B	65	2	**71**	**72**	**71**
R22a	B	65	5	58	59	59
R22b	B	65	5	60	61	61
R23	B	65	1	60	61	60
R37	E	70	1	63	64	63
R41	E	70	1	51	51	51
R42	E	70	1	57	58	58
R43	E	70	2	55	56	56
R44	E	70	1	59	60	60
R45	E	70	1	63	64	63
R46	E	70	1	59	58	59
R47	C	65	1	60	61	60
R48	B	65	1	62	63	62
R49	B	65	3	59	60	60
R50a	B	65	4	**73**	**74**	**73**
R50b	B	65	4	**75**	**76**	**76**

Table 4
Predicted Peak Noise Hour Sound Levels for Existing, No Build, and Build Conditions in the Project Area

Receiver	Activity Category	Oregon NAAC	Number of Receptors	Existing (Leq – dBA)	No Build 2040 (Leq – dBA)	Build 2040 (Leq – dBA)
R51a	B	65	4	63	64	64
R51b	B	65	4	**68**	**69**	**69**
R52a	B	65	4	63	**65**	**65**
R52b	B	65	4	**67**	**69**	**69**
R53a	B	65	4	64	**65**	**65**
R53b	B	65	4	**68**	**69**	**69**
R54a	B	65	3	61	62	62
R54b	B	65	4	64	**66**	**65**
R55a	B	65	2	60	61	60
R55b	B	65	2	63	64	64
R56a	B	65	4	**67**	**68**	**68**
R56b	C	65	4	**73**	**74**	**73**
R57a	B	65	4	64	**65**	**66**
R57b	B	65	4	**69**	**70**	**70**
R58a	B	65	4	**65**	**66**	**67**
R58b	B	65	4	**69**	**70**	**70**
R59a	B	65	4	62	63	63
R59b	B	65	4	**65**	**66**	**66**
R60a	B	65	4	59	60	60
R60b	B	65	4	63	64	63
R61	B	65	1	62	63	63
R62a	B	65	4	60	61	61
R62b	B	65	4	**65**	**66**	**66**
R86a	B	65	4	57	58	59
R86b	B	65	4	63	64	63
R102a	B	65	4	55	56	56
R102b	B	65	4	59	60	60
R103a	C	65	2	58	59	59
R103b	B	65	3	55	57	56
R104	B	65	2	57	58	58
R105a	B	65	5	54	55	55
R105b	B	65	5	58	59	58
R105c	B	65	5	60	61	60

Table 4
Predicted Peak Noise Hour Sound Levels for Existing, No Build, and Build Conditions in the Project Area

Receiver	Activity Category	Oregon NAAC	Number of Receptors	Existing (Leq – dBA)	No Build 2040 (Leq – dBA)	Build 2040 (Leq – dBA)
R105d	B	65	5	61	62	61
R105e	B	65	5	62	62	62
R106	B	65	1	64	**65**	**66**
R107	B	65	2	61	62	62
R108b	B	65	8	59	61	60
R109	B	65	1	57	58	58
R110b	B	65	10	59	60	60
R111b	B	65	8	60	61	61
R112	B	65	2	57	59	58
R113	B	65	3	57	58	59
R114	B	65	5	57	58	57
R115a	B	65	4	61	63	62
R115b	B	65	3	64	**65**	64
R116	B	65	7	53	55	54
R117a	B	65	3	61	63	62
R117b	B	65	3	63	64	64
R118	B	65	2	64	**66**	**66**
R119a	B	65	2	**66**	**67**	**67**
R119b	B	65	2	**71**	**72**	**72**
R120a	B	65	2	64	**65**	**65**
R120b	B	65	2	**71**	**72**	**72**
R121a	B	65	4	56	57	57
R121b	B	65	4	62	63	63
R122a	B	65	4	52	53	52
R122b	B	65	4	55	56	56
R123a	B	65	4	51	52	52
R123b	B	65	4	55	56	56
R124a	B	65	4	56	57	57
R124b	B	65	4	63	64	63
R125a	B	65	3	51	52	52
R125b	B	65	3	52	53	53
R126a	B	65	3	49	50	50
R126b	B	65	3	52	53	53

Table 4
Predicted Peak Noise Hour Sound Levels for Existing, No Build, and Build Conditions in the Project Area

Receiver	Activity Category	Oregon NAAC	Number of Receptors	Existing (Leq – dBA)	No Build 2040 (Leq – dBA)	Build 2040 (Leq – dBA)
R127a	B	65	2	62	63	63
R127b	B	65	2	**72**	**73**	**72**
R128a	B	65	2	56	57	58
R128b	B	65	2	62	63	63
R129a	B	65	2	50	51	51
R129b	B	65	2	52	53	53
R130a	B	65	2	47	48	48
R130b	B	65	2	49	50	50
R131a	B	65	3	49	50	50
R131b	B	65	3	51	52	52
R132a	B	65	3	53	54	54
R132b	B	65	3	55	56	56
R133	B	65	1	50	51	51
R134	B	65	6	49	50	50
R135	B	65	6	51	52	51
R136	B	65	8	48	49	48
R137	C	65	1	**66**	**67**	**67**
R138	C	65	1	54	55	55
R139	E	70	1	63	64	64
Total Number of Receptors >NAAC:				**60 res 1 school**	**84 res 1 school**	**81 res 1 school**

Note: M4/R4 predictions are provided for informational purposes only.

3.1.1 NO BUILD ALTERNATIVE NOISE LEVELS

The No Build sound levels range from 48 dBA to 76 dBA at the receivers. The No Build Alternative shows increases in sound levels of up to 2 dBA over existing sound levels as a result of traffic volume increases between 2017 and 2040. A 3 dBA change in sound levels is barely perceptible to most people. Twenty-eight receivers representing 85 residences and one school are predicted to have sound levels approaching or exceeding the NAAC under the No Build Alternative. No Build sound levels are shown for each receiver in the figures in Appendix B.

3.1.2 BUILD ALTERATIVE IMPACTS

The Build sound levels range from 48 dBA to 76 dBA. The Build Alternative shows increases in sound levels of up to 2 dBA at the modeled receivers as a result of traffic volume increases between 2017 and 2040. Sound levels were predicted to decrease by 1 dBA from the No Build to Build Alternatives at 30 receivers indicating that the project will slightly improve future sound levels in many locations. The Build sound levels will not be perceptibly different than current sound levels in the Northbound Auxiliary Lane Project area.

Twenty-six receivers representing 81 residences and a school are predicted to be noise impacted under Build conditions. No substantial increases in noise impacts are expected. Build sound levels are shown for each receiver in the figures in Appendix B. All receivers predicted to be impacted under Build conditions are also predicted to exceed the NAAC under No Build conditions, except for R115b, which is impacted under the No Build scenario but not the Build scenario. The movement of the auxiliary lane closer to the apartment building and the changes to the Hall overpass structure are likely providing the 1 dBA reduction in sound levels for R115b through a change in the shielding for the line of sight.

3.1.3 SUMMARY OF RESULTS

Table 5 is a summary of total numbers of properties where sound levels are predicted to exceed the NAAC under Existing and No Build conditions and the total number of noise impacts predicted for Build conditions for the Northbound Auxiliary Lane project area. Between No Build and Build conditions, there is a difference of 3 in the total number of locations of properties with noise levels that will exceed the NAAC. The primary source of noise in the project area is the traffic on OR 217. Changes to the northbound lane alignments with the addition of the auxiliary lane will not result in notable changes to the ambient noise environment. A full summary of all modeling results are available in Appendix B.

Table 5
Summary of Results for Northbound Auxiliary Lane Project Area

Alternative	Existing Conditions (2017)	No Build Alternative (2040)	Build Alternative (2040)
Sound Levels > NAAC Activity B	60	84	81
Sound Levels > NAAC Activity C	1	1	1
Sound Levels > NAAC Activity D	0	0	0
Sound Levels > NAAC Activity E	0	0	0
Substantial Increase Impacts	N/A	N/A	0

4. RANGE OF POTENTIAL MITIGATION MEASURES

Predicted future noise levels exceed noise impact levels and an analysis of mitigation has been completed for the Build Alternative in the Northbound Auxiliary Lane project area.

4.1 TRAFFIC NOISE ABATEMENT

Mitigation was considered for this noise analysis where noise impacts from the Build Alternative have been identified. Noise impacts result when the ODOT NAACs are exceeded, or when a substantial noise increase (10 dBA or greater) over Existing conditions is predicted.

The following noise abatement selection criteria are used when considering potential noise mitigation for noise impacts:

- Noise abatement benefits
- Opinions of impacted property owners
- Land use and zoning
- Controlled and uncontrolled access
- Cost of abatement
- Environmental impacts
- Absolute noise levels
- Non-traffic noise

Several options were considered for traffic noise abatement for the impacts to the Northbound Auxiliary Lane Project area. These include truck restrictions, speed restrictions, and alignment changes. Truck restrictions are infeasible because OR 217 is a major route for freight movement. The posted speed limit on OR 217 is 55 miles per hour, resulting in high levels of traffic noise. Reducing posted speed limits is unlikely to reduce actual travel speeds and would defeat the goal of efficient traffic movement through the project area.

Changes in alignment can be considered to prevent traffic noise impacts but generally, changes in alignment shift impacts to other properties. The prevention of impacts is an important part of noise control. In this project area the most substantial contribution of traffic noise to the nearby sensitive receptors comes from the OR 217 mainline traffic volumes. The addition of the auxiliary lane in the Northbound Project area results in a maximum increase over No Build sound levels of 1 dBA, indicating that the project will have an imperceptible effect on sound levels. Many receivers are predicted to have a 1 dBA decrease in sound levels.

Noise barriers are common considerations in project areas like the OR 217 corridor. ODOT guidance states a noise barrier must meet feasibility and reasonableness criteria to be recommended for construction. Feasibility or constructability of an abatement measure includes acoustical and engineering factors. For the abatement to be feasible, ODOT requires that a simple majority of impacted receptors achieve at least a 5dBA reduction in noise levels. ODOT also considers engineering factors such as barrier height, safety, topography, drainage, utilities, and access issues when determining feasibility. ODOT considers barriers of all heights but those exceeding 25 feet would likely exceed the reasonable criteria for cost-effectiveness.

ODOT considers three factors to determine whether a noise barrier is reasonable. These three factors include the viewpoints of the residents and property owners that benefit from the proposed abatement, the cost-effectiveness of the abatement measure, and the ODOT noise reduction design goal for abatement. All three criteria must be met to satisfy the reasonableness criteria.

If a barrier meets the criteria for recommendation, ODOT distributes a survey by mail to benefitted residents to determine the residents' desire for abatement. If a majority (>50%) of those property owners and renters responding to the survey do not want the noise barrier, it would not be recommended for construction. A 'no' decision means that federal funds would not be available for future abatement at that location unless there was a project near the location that was defined as Type I (as defined by 23 CFR 772 and the ODOT Noise Manual).

The second reasonableness criterion is the cost-effectiveness of the proposed abatement. All benefitted residences are considered in the calculation of cost-effectiveness. A benefitted residence is any impacted or non-impacted residence that receives a noise reduction of 5 dBA or more. A reasonable cost is considered to be a maximum of $25,000 per benefitted residence. A cost of $20 per square foot for post and panel walls is used for walls up to and including 16 feet in height.

Noise barriers typically only meet this criterion of $25,000 maximum per benefited residence where residences are located close together such that several benefit from the noise barrier. Single residences or sparsely distributed residences on large lots seldom meet the cost-effectiveness criteria. If the cost of the proposed noise mitigation exceeds allowable limits, a noise barrier would not be recommended.

Under special circumstances the typical maximum for reasonable cost of $25,000 per benefitted residence can be increased to a maximum of $35,000 per benefitted residence. To exceed the $25,000 limit, one of the following optional reasonableness criteria must be met:

- Large increases of 10 dBA or more in noise with the future Build condition over the existing condition;
- High noise levels, Leq 70 dBA or higher;
- Areas of mixed land use zoning may not be recommended for mitigation because land use may change and long-term land use may be uncertain.

The third reasonableness criterion is the ODOT design goal. At least one benefited receptor must achieve the noise reduction goal of 7 dBA.

ODOT will place noise barriers in the right-of-way near noise-impacted residences if the barriers are predicted to meet both the feasible and reasonableness criteria.

Mitigation was considered for all impacts identified for the OR 217 Northbound Auxiliary Lane Project where noise impacts from the Build Alternative were identified. Mitigation for the impacted residential receivers was analyzed in the form of noise barriers.

4.1.1 SW 95TH AVENUE BARRIER

A sound wall was analyzed to mitigate the predicted noise impacts to the residential receptors located on SW 95th Avenue, south of SW Oak Street, represented by receiver M2/R2.

A barrier, 804 feet long was modeled along the edge of OR 217 ROW and analyzed to mitigate the sound levels to the impacted residences. Two residences were impacted in the area where the barrier was modeled. The barrier was analyzed at heights of 12 to 16 feet. The barrier would benefit two residences, which is 100 percent of impacted residences. However, the barrier does not meet the design goal of a 7-dBA noise reduction for receptors at 16 feet tall. In addition, the SW 95th Avenue barrier would not meet the cost reasonableness criteria. The SW 95th Avenue Barrier is not recommended for construction.

Table 6 shows the barrier information for the SW 95th Avenue Barrier. Detailed barrier analysis data are included in Appendix C. Electronic barrier TNM files are included in Appendix A. The barrier location is shown in Figure 3.

Table 6
Barrier Analysis Results - SW 95th Avenue Barrier

Barrier Name	Barrier Length (ft.)	Barrier Height (ft.)	Barrier Cost ($)	Number of Impacted Residences (>=65 dB)	Number of Impacted Residences Benefitted (>=65 dB)	Number of Benefitted Residences (5 dB)	Percent Feasible (%)	Meets Design Goal?	Cost Per Benefitted Residence ($)
SW 95th Avenue	804	16	$257,280	2	2	2	100	No	$128,640/res

Proposed Build Alternative Lane Lines
Barrier Modeled
Receiver Location

0 200 400 600 feet

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

SW 95th Avenue Barrier

Date	September 20, 2018	Scale	AS SHOWN	Fig. No. 3
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	

SLR

4.1.2 ST. JAMES BARRIER

A sound wall was analyzed to mitigate the predicted noise impacts to the residential receptors located to the northwest of SW Hall Boulevard on the east side of OR 217, represented by receivers M4/R4, R50a, R50b, R51b, R52a, R52b, R53a, R53b, R54b, R56a, R56b, R57a, R57b, R58a, R58b, R59b, R62b, R106, and R118.

A barrier, 1,320 feet long was modeled along the edge of ROW and analyzed to mitigate the sound levels to the impacted residences. Sixty seven residences were impacted in the area where the barrier was modeled. The barrier was analyzed at heights of 12 to 16 feet. At 16 feet, the barrier would benefit 57 impacted residences, which is 85 percent of impacted residences. The St. James Barrier provides a small reduction in noise level to R118, however this receptor is located in close proximity to SW Hall Boulevard, therefore traffic noise impacts at this receptor are affected by the traffic on SW Hall Boulevard and the mitigation does not benefit those residences.

The barrier would meet the design goal of a 7-dBA noise reduction for several receptors. In addition, the barrier would also meet the cost reasonableness criteria. The St. James Barrier is recommended for construction.

Table 7 shows the barrier information for the St. James Barrier. Detailed barrier analysis data are included in Appendix C. Electronic barrier TNM files are included in Appendix A. The barrier location is shown in Figure 4.

Table 7
Barrier Analysis Results - St. James Barrier

Barrier Name	Barrier Length (ft.)	Barrier Height (ft.)	Barrier Cost ($)	Number of Impacted Residences (>=65 dB)	Number of Impacted Residences Benefitted (5 dB)	Number of Benefitted Residences (5 dB)	Percent Feasible (%)	Meets Design Goal?	Cost Per Benefitted Residence ($)
St. James	1,320	16	$422,400	67	57	65	85	Yes	$6,498/res

Proposed Build Alternative Lane Lines
Barrier Modeled
Receiver Location

0 200 400 600 feet

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

St James Barrier

SLR

Date	October 25, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. 4

4.1.3 CARRIAGE HOUSE BARRIER

A sound wall was analyzed to mitigate the predicted noise impacts to the residential receptors and the school located between SW Pfaffle Street and Pacific Highway. The impacts in this area are grouped with R137 (the school lunch patio) and the condominiums represented by R119a, R119b, and R120b being located in fairly close proximity. An additional receiver, R127b, which represents the balconies of two upstairs condominiums is also impacted but is located farther to the north.

A barrier, 1,400 feet long was modeled along the edge of ROW and analyzed to mitigate the sound levels to the impacted residences and school. Ten residences and the school were impacted in the area where the barrier was modeled. The Carriage House Barrier was analyzed at heights of 12 to 16 feet. At 16 feet, the barrier would benefit 91 percent of impacted residences. The barrier would meet the design goal of a 7-dBA noise reduction for several receptors. The barrier would also meet the cost reasonableness criteria. The Carriage House Barrier is recommended for construction.

In final design and the ROW phase, the southern terminus of the Carriage House barrier will need to be decided. With the current configuration of the barrier, the high school cafeteria patio outdoor use area (R137) is impacted but not benefitted. A longer barrier may benefit the school.

Table 8 shows the barrier information for the Carriage House Barrier. Detailed barrier analysis data are included in Appendix C. Electronic barrier TNM files are included in Appendix A. The barrier location is shown in Figure 5.

Table 8
Barrier Analysis Results - Carriage House Barrier

Barrier Name	Barrier Length (ft.)	Barrier Height (ft.)	Barrier Cost ($)	Number of Impacted Residences (>=65 dB)	Number of Impacted Residences Benefitted (5 dB)	Number of Benefitted Residences (5 dB)	Percent Feasible (%)	Meets Design Goal?	Cost Per Benefitted Residence ($)
Carriage House	1,400	16	$448,000	11	10	23	91	Yes	$19,478/res

Proposed Build Alternative Lane Lines
Barrier Modeled
Receiver Location

0 200 400 600 feet

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

Carriage House Barrier

Date	October 25, 2018	Scale	AS SHOWN	Fig. No. 5
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	

4.1.4 SW HALL BARRIER

A sound wall was analyzed to mitigate the predicted noise impacts to the residential receptors located between SW Hall Blvd. and Pacific Highway on the west side of OR 217, represented by receiver R21b.

A barrier, 400 feet long was modeled along the edge of ROW and analyzed to mitigate the sound levels to the impacted upstairs residences. Two residences were impacted in the area where the barrier was modeled. The barrier was analyzed at heights of 12 to 16 feet. At 16 feet, the barrier would benefit two impacted residences, which is 100 percent of impacted residences. The barrier would meet the design goal of a 7-dBA noise reduction for those receptors. The barrier would not meet the cost reasonableness criteria. The SW Hall Barrier is not recommended for construction.

Table 9 shows the barrier information for the SW Hall Barrier. Detailed barrier analysis data are included in Appendix C. Electronic barrier TNM files are included in Appendix A. The barrier location is shown in Figure 6.

Table 9
Barrier Analysis Results - SW Hall Barrier

Barrier Name	Barrier Length (ft.)	Barrier Height (ft.)	Barrier Cost ($)	Number of Impacted Residences (>=65 dB)	Number of Impacted Residences Benefitted (7 dB)	Number of Benefitted Residences (5 dB)	Percent Feasible (%)	Meets Design Goal?	Cost Per Benefitted Residence ($)
SW Hall	400	16	$128,000	2	2	2	100	Yes	$64,000/res

0 200 400 600 feet

Proposed Build Alternative Lane Lines
Barrier Modeled
Receiver Location

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

SW Hall Barrier

SLR

Date	October 25, 2018	Scale	AS SHOWN	Fig. No. 6
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	

4.2 SUMMARY OF IMPACTS

Noise mitigation was considered for all impacted residential receivers and the school in the Northbound Auxiliary Lane Project area.

If ODOT determines that it will be feasible to construct the St. James Barrier, this sound wall would benefit 57 impacted residences. Ten of the predicted noise impacted residences at this location would not receive a 5-dBA insertion loss. These impacts would receive some noise reduction.

If ODOT determines that it will be feasible to construct the Carriage House Barrier, this sound wall would provide abatement for ten impacted residences. The noise impacted school cafeteria patio at this location would not receive a 5-dBA insertion loss. A longer wall, assuming no access and ROW issues might benefit the school and should be investigated during final design.

Unabated noise impacts will remain where noise barriers did not meet ODOT reasonable and feasible criteria and the barriers are not recommended for construction. This includes two residential noise impacts on SW 95th Avenue and two residential noise impacts on SW Hall Boulevard.

5. COORDINATION WITH LOCAL GOVERNMENT OFFICIALS

One of the requirements of the FHWA regulations in Title 23 Part 772.15 and of the ODOT Noise Manual is to supply information to local governments on noise impacts and potential noise impacts so the information can be used in guiding local land use decisions. Copies of this noise study Addendum will be provided by ODOT to the Cities of Tigard and Beaverton so that local government officials may consider the information in this noise analysis. Some land uses in the project area may not be compatible with the projected noise environment unless noise is considered in the plans and designs for development of the properties. Areas immediately adjacent to OR 217 or the ramps have sound levels which exceed, and will continue to exceed in the future, the residential noise impact criterion of 65 dBA.

The TNM analysis results were used to evaluate the distance from the OR 217 centerline to the Activity Category B NAAC of 65 dBA. Depending on the topography of residential receivers in relation to the roadway elevation, the approximate distance to the noise impact contour varies from 180 feet to 235 feet from OR 217 centerline. Provision of noise abatement measures for new developments becomes the responsibility of local governments, developers, and land owners, after the date of public knowledge of the project.

6. STATEMENT OF LIKELIHOOD

Based on the noise technical report for this project, ODOT intends to install highway traffic noise abatement measures in the form of the St. James barrier for the residences located immediately north of SW Hall Boulevard and the Carriage House barrier for residences located north of SW Pacific Highway on the northbound side of OR 217. The possibility of the likely abatement measure is based upon preliminary design work for a barrier cost of approximately $448,000 for the Carriage House barrier that would reduce the noise level by at least 5 dBA and up to 14 dBA for 23 residences and approximately $422,400 for the St. James barrier that would reduce the noise level by at least 5 dBA and up to 12 dBA for 65 residences. If during ODOT's final design process these conditions have substantially changed, the abatement measure might not be provided. A final decision for the installation of the abatement measure will be made upon completion of the project's final design, a cost estimating process, and the public involvement process.

7. REFERENCES

Oregon Department of Transportation. July 2011. ODOT Noise Manual.

U.S. Code of Federal Regulations (CFR). July 8, 1982. Procedures for Abatement of Highway Traffic Noise and Construction Noise. 23 CFR Part 772.

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8. REPORT AUTHOR AND REVIEWER

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APPENDIX A

NORTHBOUND ELECTRONIC TNM FILES

Noise Technical Report

Oregon Department of Transportation
123 NW Flanders Street
Portland, OR 97209

November 2018

APPENDIX B

NORTHBOUND MODEL RESULTS AND RECEIVER LOCATION FIGURES

Noise Technical Report

Oregon Department of Transportation
123 NW Flanders Street
Portland, OR 97209

November 2018

Noise Technical Report
OR 217 Northbound Auxiliary Lane
Existing, No Build, and Build Alternative Noise Levels - Peak Truck Hour

Receiver	Receiver Description	Activity Category	Oregon NAAC	Number of Receptors	Existing (2017)		No Build (2040)			Build Alternative (2040)					
					TNM Noise Level (dBA)	Existing Rec > NAAC	TNM Noise Level (dBA)	Increase Over Existing (dBA)	No Build Rec > NAAC	TNM Noise Level (dBA)	Increase Over Existing (dBA)	Change from No Build (dBA)	Number of Impacts	Mitigation Analysis?	Mitigated TNM Noise Level (dBA)
R2/M2	1st Row House on SW 95th Ave South of SW Oak St.	B	65	2	66	2	67	1	2	66	0	-1	2	SW 95th Avenue Barrier	62
R4/M4	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St.	B	65	Info	72	Info	73	1	Info	72	0	-1	Info	Info	64
R5/M5	1st Row Apartment Complex on SW Pfaffle St.	B	65	1	62	0	63	1	0	63	1	0		No	
R21a	1st Row Apartment Complex on SW Hall Blvd. 1st Floor Patio	B	65	2	63	0	64	1	0	64	1	0		No	
R21b	1st Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	2	71	2	72	1	2	71	0	-1	2	Hall - 99W Barrier	71
R22a	1st Row Apartment Complex on SW Hall Blvd. 1st Floor Patio	B	65	5	58	0	59	1	0	59	1	0		No	
R22b	1st Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	5	60	0	61	1	0	61	1	0		No	
R23	1st Row Apartment Complex on SW Hall Blvd.	B	65	1	60	0	61	1	0	60	0	-1		No	
R37	1st Row Restaurant on SW Washington Square Rd.	E	70	1	63	0	64	1	0	63	0	-1		No	
R41	2nd Row Restaurant on SW Washington Square Rd.	E	70	1	51	0	51	0	0	51	0	0		No	
R42	2nd Row Restaurant on SW Greenburg Rd. North of SW Washington Square Rd.	E	70	1	57	0	58	1	0	58	1	0		No	
R43	3rd Row Restaurant on SW Greenburg Rd. North of SW Washington Square Rd.	E	70	2	55	0	56	1	0	56	1	0		No	
R44	2nd Row Restaurant on SW Greenburg Rd. North of SW Washington Square Rd.	E	70	1	59	0	60	1	0	60	1	0		No	
R45	1st Row Restaurant on SW Greenburg Rd. South of SW Washington Square Rd.	E	70	1	63	0	64	1	0	63	0	-1		No	
R46	1st Row Restaurant on SW Greenburg Rd. North of SW Pfaffle Rd.	E	70	1	59	0	58	-1	0	59	0	1		No	
R47	1st Row College on SW Oak St West of SW 95th Ave.	C	65	1	60	0	61	1	0	60	0	-1		No	
R48	2nd Row House on SW 95th Ave South of SW Oak St.	B	65	1	62	0	63	1	0	62	0	-1		No	
R49	2nd Row House on SW 95th Ave. South of SW Oak St.	B	65	3	59	0	60	1	0	60	1	0		No	
R50a	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	73	4	74	1	4	73	0	-1	4	St. James Barrier	64
R50b	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	75	4	76	1	4	76	1	0	4	St. James Barrier	69
R51a	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	63	0	64	1	0	64	1	0		No	
R51b	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	68	4	69	1	4	69	1	0	4	St. James Barrier	63
R52a	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	63	0	65	2	4	65	2	0	4	St. James Barrier	60
R52b	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	67	4	69	2	4	69	2	0	4	St. James Barrier	64
R53a	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	64	0	65	1	4	65	1	0	4	St. James Barrier	62
R53b	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	68	4	69	1	4	69	1	0	4	St. James Barrier	65
R54a	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	3	61	0	62	1	0	62	1	0		No	
R54b	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	64	0	66	2	4	65	1	-1	4	St. James Barrier	62
R55a	3rd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	2	60	0	61	1	0	60	0	-1		No	
R55b	3rd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	2	63	0	64	1	0	64	1	0		No	
R56a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	67	4	68	1	4	68	1	0	4	St. James Barrier	65
R56b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	73	4	74	1	4	73	0	-1	4	St. James Barrier	70
R57a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	64	0	65	1	4	66	2	1	4	St. James Barrier	63
R57b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	69	4	70	1	4	70	1	0	4	St. James Barrier	67
R58a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	65	4	66	1	4	67	2	1	4	St. James Barrier	62
R58b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	69	4	70	1	4	70	1	0	4	St. James Barrier	65
R59a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	62	0	63	1	0	63	1	0			
R59b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	65	4	66	1	4	66	1	0	4	St. James Barrier	62
R60a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	59	0	60	1	0	60	1	0		No	
R60b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	63	0	64	1	0	63	0	-1		No	
R61	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. Playground and Pool	B	65	1	62	0	63	1	0	63	1	0		No	
R62a	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St.1st Floor Balcony	B	65	4	60	0	61	1	0	61	1	0		No	
R62b	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	65	4	66	1	4	66	1	0	4	St. James Barrier	63
R86a	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	57	0	58	1	0	59	2	1		No	
R86b	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	63	0	64	1	0	63	0	-1		No	
R102a	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	55	0	56	1	0	56	1	0		No	
R102b	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	59	0	60	1	0	60	1	0		No	
R103a	6th Row House on SW 89th Ave. South of SW Thorn St.	B	65	2	58	0	59	1	0	59	1	0		No	
R104	7th Row House on SW 89th Ave. North of SW Thorn St.	B	65	2	57	0	58	1	0	58	1	0		No	
R105a	8th Row Apartment Complex on SW Oak St. Back of Building 1st Floor Balcony	B	65	5	54	0	55	1	0	55	1	0		No	
R105b	8th Row Apartment Complex on SW Oak St. Back of Building 2nd Floor Balcony	B	65	5	58	0	59	1	0	58	0	-1		No	
R105c	8th Row Apartment Complex on SW Oak St. Back of Building 3rd Floor Balcony	B	65	5	60	0	61	1	0	60	0	-1		No	
R105d	8th Row Apartment Complex on SW Oak St. Back of Building 4th Floor Balcony	B	65	5	61	0	62	1	0	61	0	-1		No	
R105e	8th Row Apartment Complex on SW Oak St. Back of Building 5th Floor Balcony	B	65	5	62	0	62	0	0	62	0	0		No	
R106	1st Row House on SW Hall Blvd. North of SW Pfaffle St.	B	65	1	64	0	65	1	1	66	2	1	1	St. James Barrier	62
R107	2nd Row House on SW Hall Blvd. North of SW Pfaffle St.	B	65	2	61	0	62	1	0	62	1	0		No	
R108b	3rd Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	8	59	0	61	2	0	60	1	-1		No	
R109	3rd Row Apartment Complex on SW Hall Blvd.	B	65	1	57	0	58	1	0	58	1	0		No	
R110b	4th Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	10	59	0	60	1	0	60	1	0		No	
R111b	4th Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	8	60	0	61	1	0	61	1	0		No	
R112	5th Row House on SW Hall Blvd. South of SW Lucille Ct.	B	65	2	57	0	59	2	0	58	1	-1		No	
R113	2nd Row House on SW Pfaffle St. East of SW Hall Blvd.	B	65	3	57	0	58	1	0	59	2	1		No	
R114	3rd Row House on SW Pfaffle St. West of SW 84th Ave.	B	65	5	57	0	58	1	0	57	0	-1		No	
R115a	3rd Row Apartment Complex on SW SW Pfaffle St. Back of Building 1st Floor Patio	B	65	4	61	0	63	2	0	62	1	-1		No	
R115b	3rd Row Apartment Complex on SW Pfaffle St. Back of Building 2nd Floor Balcony	B	65	3	64	0	65	1	3	64	0	-1		No	

Noise Technical Report
OR 217 Northbound Auxiliary Lane
Existing, No Build, and Build Alternative Noise Levels - Peak Truck Hour

Receiver	Receiver Description	Activity Category	Oregon NAAC	Number of Receptors	Existing (2017)		No Build (2040)			Build Alternative (2040)					
					TNM Noise Level (dBA)	Existing Rec > NAAC	TNM Noise Level (dBA)	Increase Over Existing (dBA)	No Build Rec > NAAC	TNM Noise Level (dBA)	Increase Over Existing (dBA)	Change from No Build (dBA)	Number of Impacts	Mitigation Analysis?	Mitigated TNM Noise Level (dBA)
R116	4th Row House on SW 84th Ave. Back of Building	B	65	7	53	0	55	2	0	54	1	-1		No	
R117a	4th Row Apartment Complex on SW SW Pfaffle St. Back of Building 1st Floor Patio	B	65	3	61	0	63	2	0	62	1	-1		No	
R117b	4th Row Apartment Complex on SW SW Pfaffle St. Back of Building 2nd Floor Balcony	B	65	3	63	0	64	1	0	64	1	0		No	
R118	5th Row House on SW Hall Blvd. North of SW Pfaffle St.	B	65	2	64	0	**66**	2	2	**66**	2	0	2	St. James Barrier	65
R119a	1st Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	**66**	2	**67**	1	2	**67**	1	0	2	Carriage House Barrier	60
R119b	1st Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	**71**	2	**72**	1	2	**72**	1	0	2	Carriage House Barrier	67
R120a	1st Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	64	0	**65**	1	2	**65**	1	0	2	Carriage House Barrier	59
R120b	1st Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	**71**	2	**72**	1	2	**72**	1	0	2	Carriage House Barrier	65
R121a	2nd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	56	0	57	1	0	57	1	0		No	
R121b	2nd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	62	0	63	1	0	63	1	0		No	
R122a	2nd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	52	0	53	1	0	52	0	-1		No	
R122b	2nd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	55	0	56	1	0	56	1	0		No	
R123a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	51	0	52	1	0	52	1	0		No	
R123b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	55	0	56	1	0	56	1	0		No	
R124a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	56	0	57	1	0	57	1	0		No	
R124b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	63	0	64	1	0	63	0	-1		No	
R125a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	51	0	52	1	0	52	1	0		No	
R125b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	52	0	53	1	0	53	1	0		No	
R126a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	49	0	50	1	0	50	1	0		No	
R126b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	52	0	53	1	0	53	1	0		No	
R127a	1st Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	62	0	63	1	0	63	1	0		No	
R127b	1st Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	**72**	2	**73**	1	2	**72**	0	-1	2	Carriage House Barrier (Long)	61
R128a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	56	0	57	1	0	58	2	1		No	
R128b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	62	0	63	1	0	63	1	0		No	
R129a	4th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	50	0	51	1	0	51	1	0		No	
R129b	4th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	52	0	53	1	0	53	1	0		No	
R130a	4th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	47	0	48	1	0	48	1	0		No	
R130b	4th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	49	0	50	1	0	50	1	0		No	
R131a	5th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	49	0	50	1	0	50	1	0		No	
R131b	5th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	51	0	52	1	0	52	1	0		No	
R132a	5th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	53	0	54	1	0	54	1	0		No	
R132b	5th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	55	0	56	1	0	56	1	0		No	
R133	5th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	1	50	0	51	1	0	51	1	0		No	
R134	6th Row House on SW Pfaffle St. West of SW 83rd Ave.	B	65	6	49	0	50	1	0	50	1	0		No	
R135	6th Row House on SW Pfaffle St. East of SW 83rd Ave.	B	65	6	51	0	52	1	0	51	0	-1		No	
R136	7th Row House on SW Pfaffle St. West of SW 83rd Ave.	B	65	8	48	0	49	1	0	48	0	-1		No	
R137	1st Row School on SW Pfaffle St.	C	65	1	**66**	1	**67**	1	1	**67**	1	0	1	Carriage House Barrier	67
R138	3rd Row School on SW Pfaffle St. Playground	C	65	1	54	0	55	1	0	55	1	0		No	
R139	1st Row Coffee Shop on SW Pacific Hwy.	E	70	1	63	0	64	1	0	64	1	0		No	
R103b	6th Row House on SW 89th Ave. South of SW Thorn St.	B	65	3	55	0	57	2	0	56	1	-1		No	
				Min	47		48			48					
				Max	75		76			76					
				>NAAC		61			85				82		

Sound level exceeds NAAC

RECEIVER LOCATION FIGURES

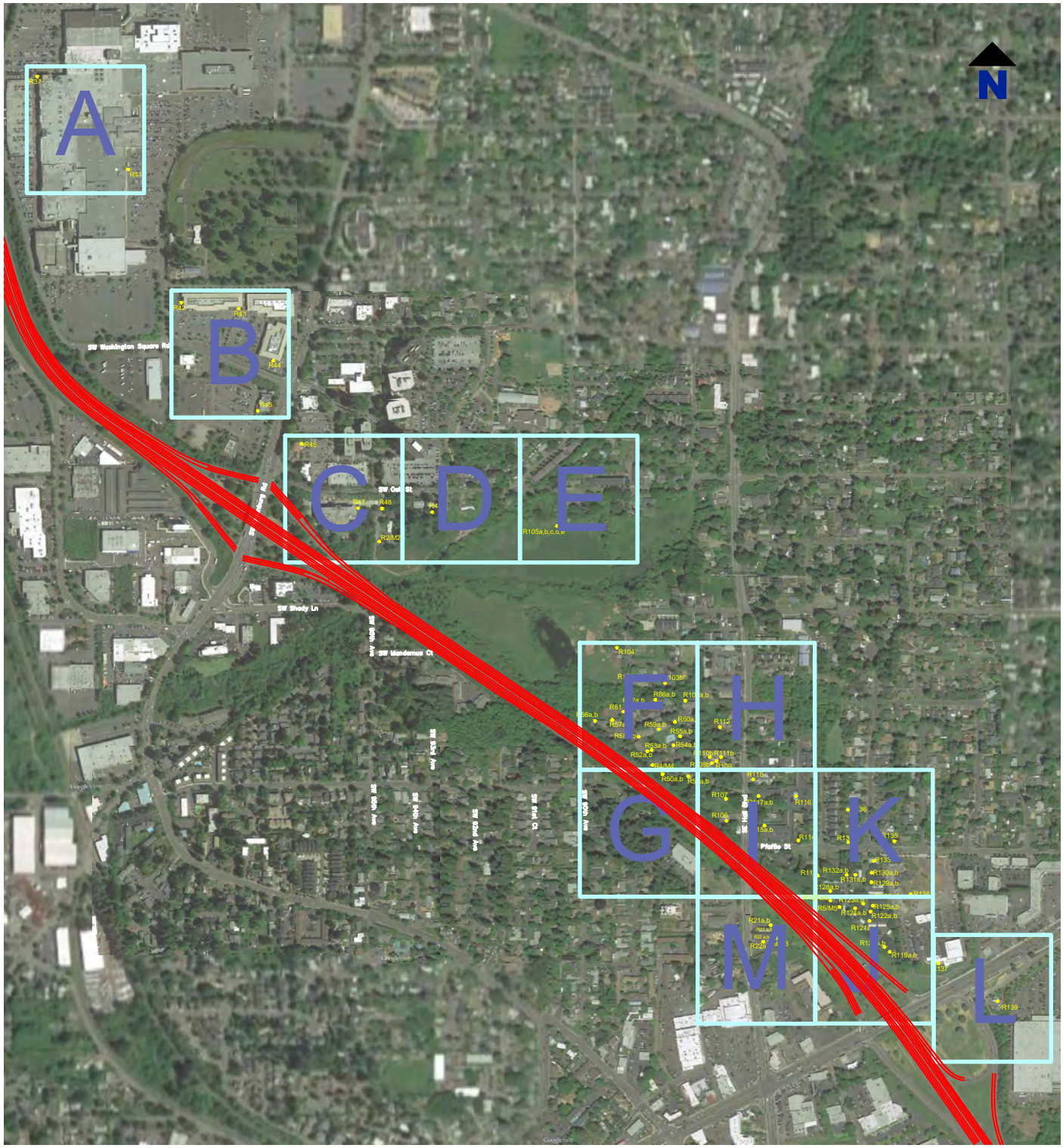
- All in 1:100 scale
- Grid figure provided to reference location of each figure within the area of potential effect.
- “a” represents receiver sites at 5 feet above ground level.
- “b” represents receiver sites at 15 feet above ground level.
- “c” represents receiver sites at 25 feet above ground level.
- “d” represents receiver sites at 35 feet above ground level.
- “e” represents receiver sites at 45 feet above ground level.

Sound Level Key

Existing Sound Levels

No Build Alternative Sound Levels

Build Alternative Sound Levels



Proposed Build Alternative Lane Lines
Receiver Location

0 1000 2000 3000 feet

Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

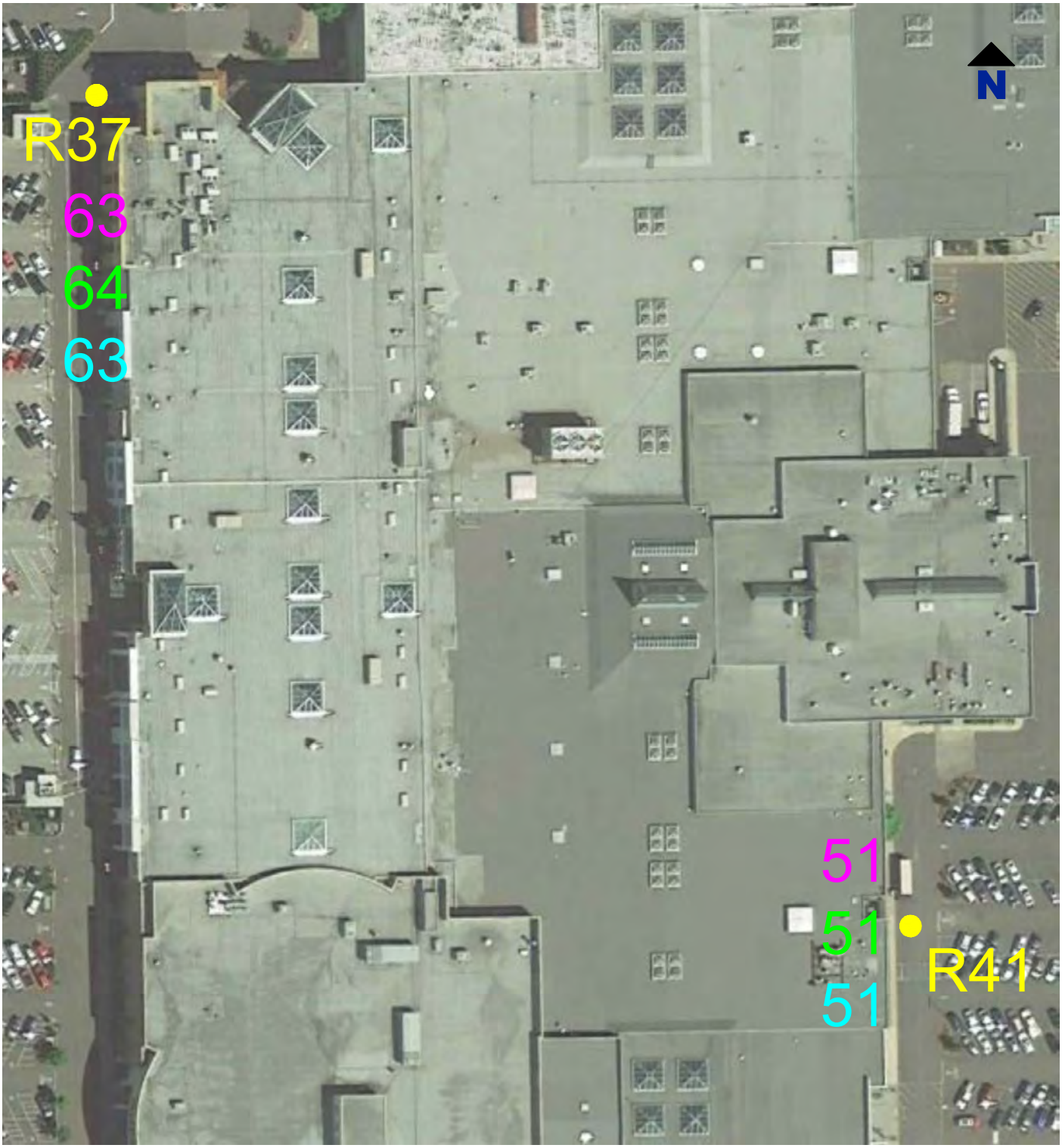
Drawing

Receiver Locations - Noise Levels

Date	September 20, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. B - 1

SLR



0 100 200 300 feet

Receiver Location

Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

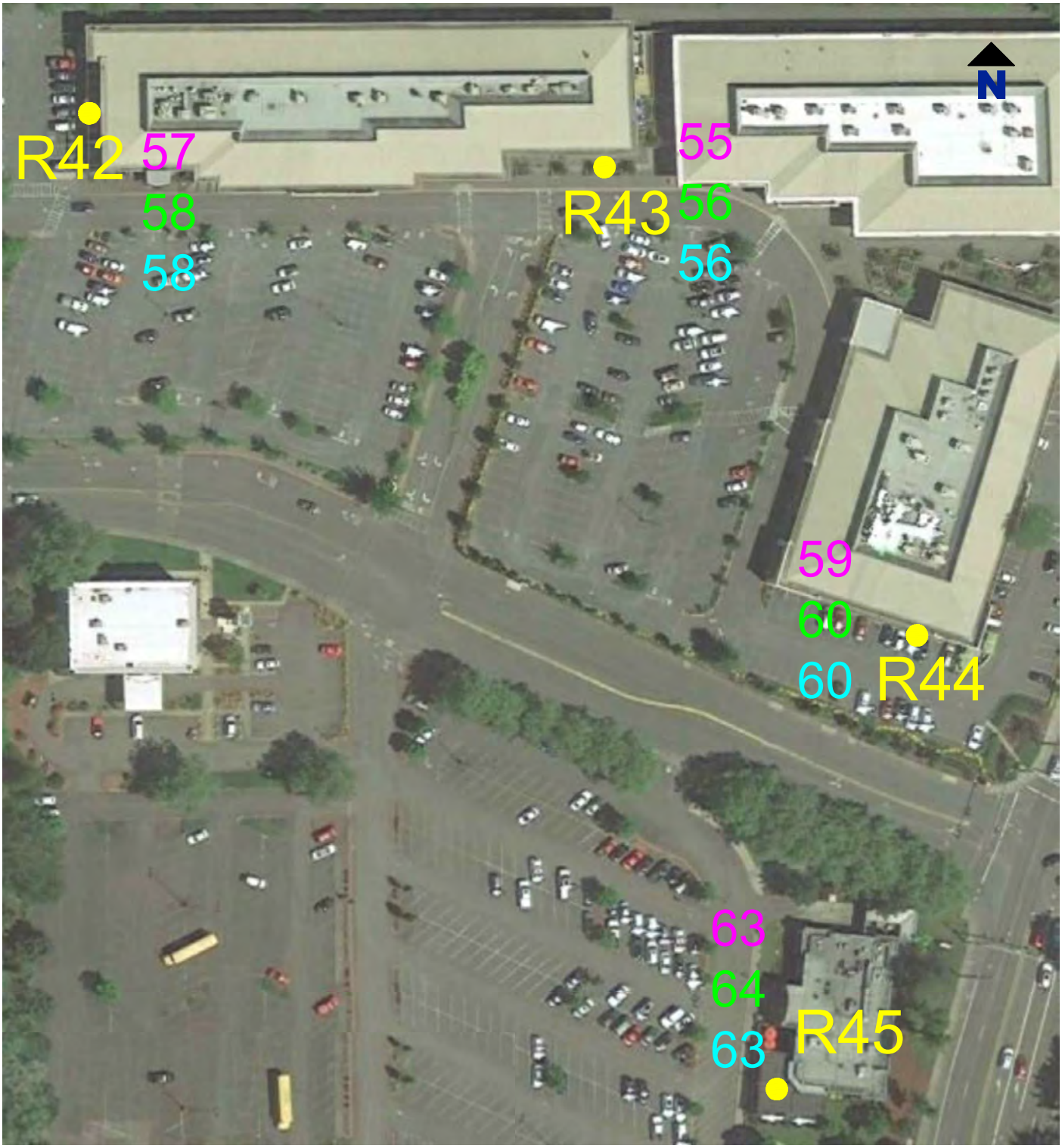
SLR

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (A)

Date	August 27, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. B - 2



0 100 200 300 feet

Receiver Location

Sound Level Key

- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

SLR

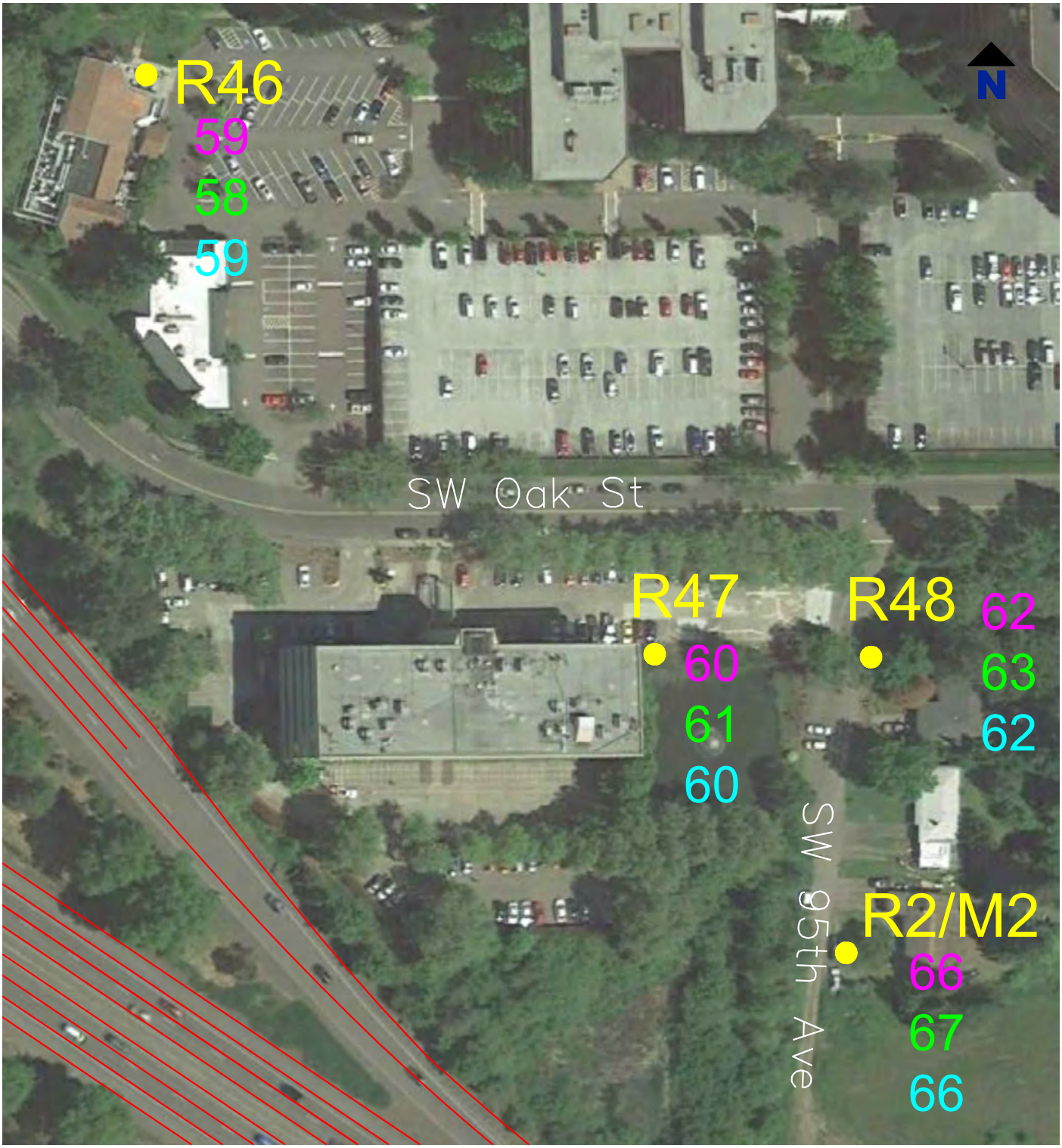
Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

Receiver Locations - Noise Levels (B)

Date	August 25, 2018	Scale	AS SHOWN	Fig. No. B - 3
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	



0 100 200 300 feet

Proposed Build Alternative Lane Lines
Receiver Location

Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

SLR

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (C)

Date	August 27, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. B - 4

0 100 200 300 feet

Receiver Location

Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (D)

Date	August 27, 2018	Scale	AS SHOWN	Fig. No. B - 5
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	

0 100 200 300 feet

Receiver Location

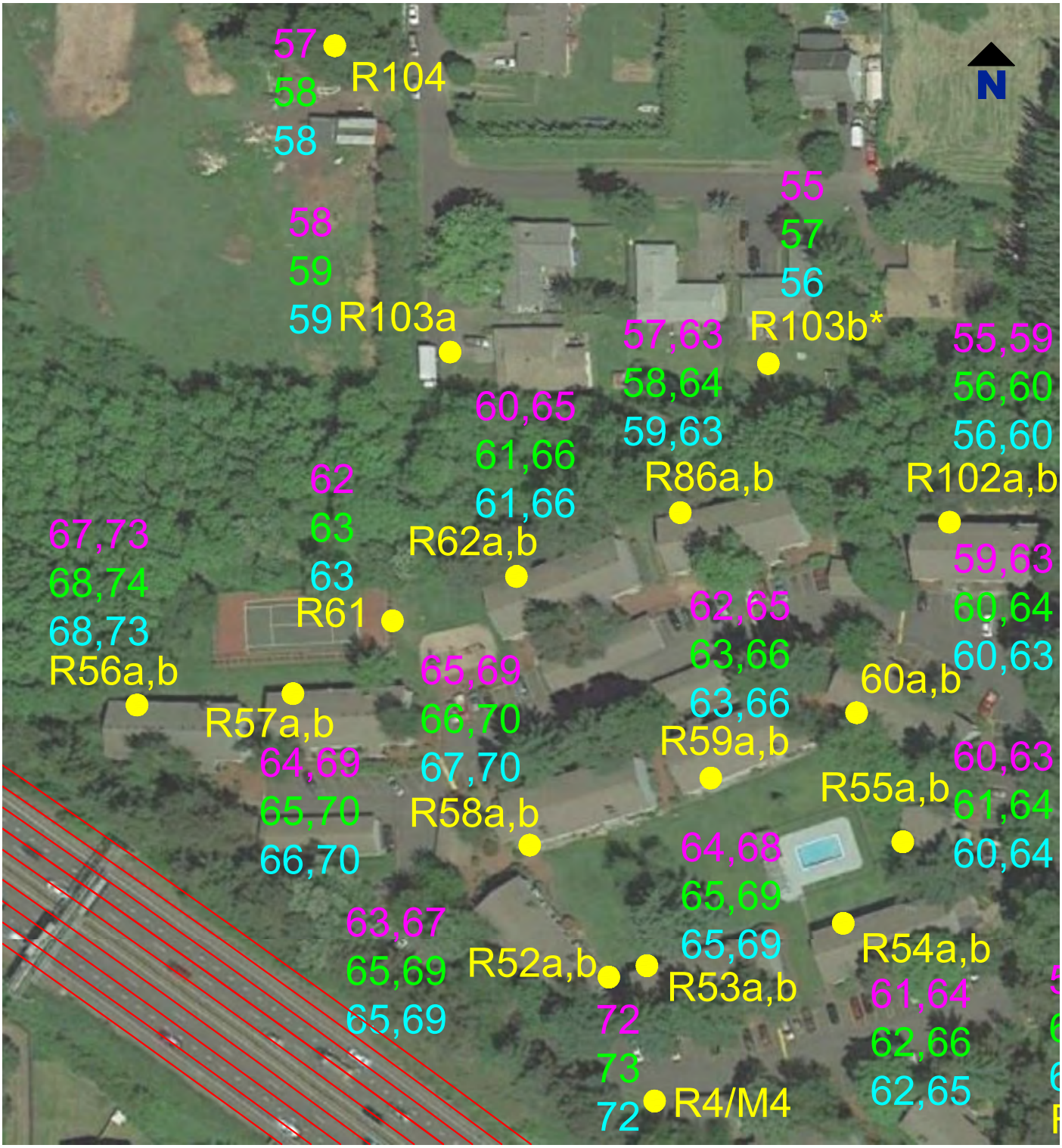
Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

SLR

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (E)

Date	August 27, 2018	Scale	AS SHOWN	Fig. No. B- 6
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	



0 100 200 300 feet

Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

SLR

- Receiver Location
- * Receiver Site is at 5 feet Above Ground Level

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (F)

Date	August 27, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. B - 7

0 100 200 300 feet

Proposed Build Alternative Lane Lines
Receiver Location

Sound Level Key
Existing Sound Levels
No Build Alternative Sound Levels
Build Alternative Sound Levels

SLR

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (G)

Date	August 27, 2018	Scale	AS SHOWN	Fig. No.
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	B - 8

0 100 200 300 feet

Receiver Location

Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

SLR

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (H)

Date	October 25, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. B - 9

0 100 200 300 feet

Receiver Location

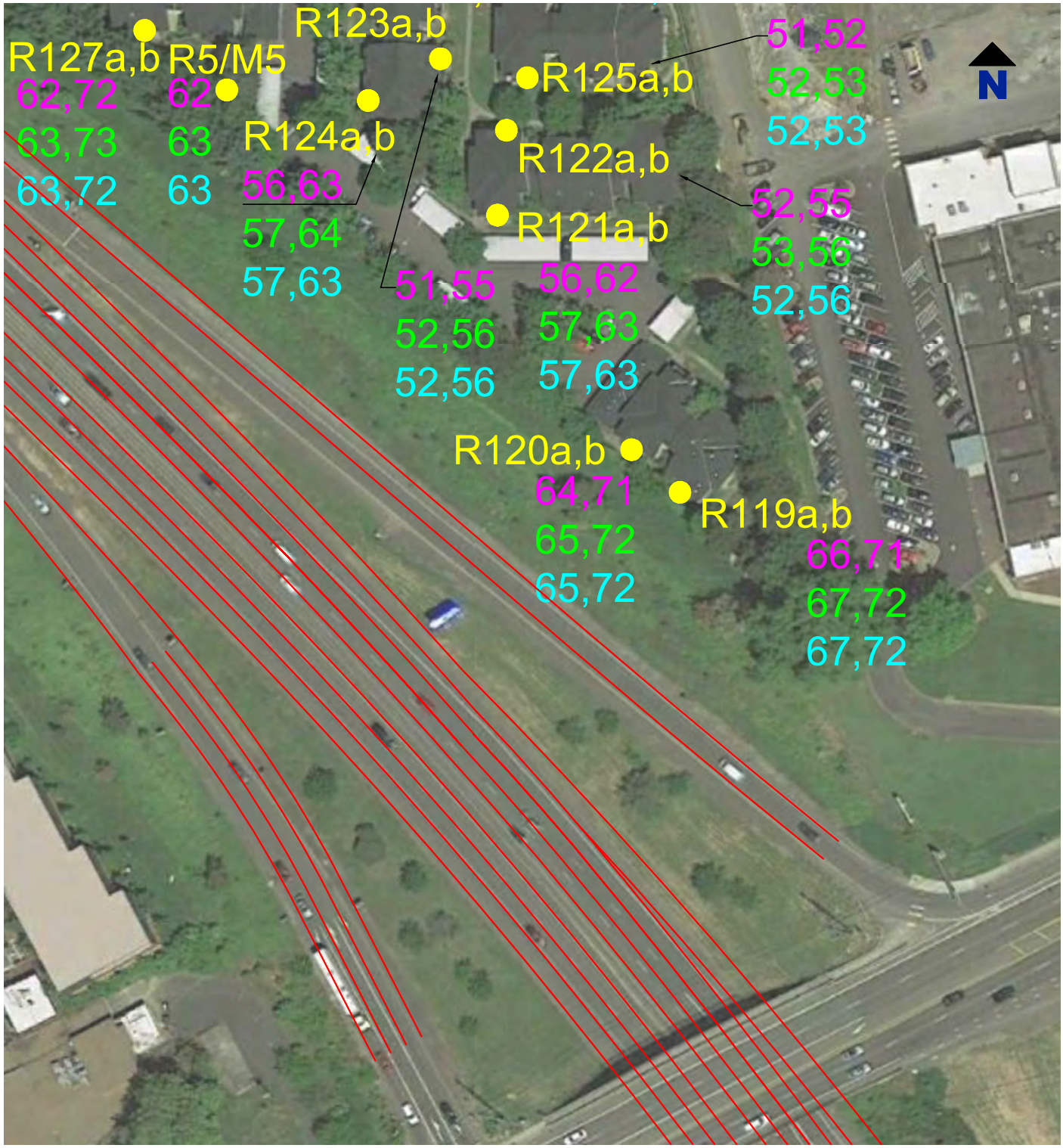
Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

SLR

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (I)

Date August 27, 2018	Scale AS SHOWN	Fig. No. B - 10
File Name 217 NB Working File - FINAL	Project No. 108.00494.00012	



0 100 200 300 feet

Proposed Build Alternative Lane Lines
Receiver Location

Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

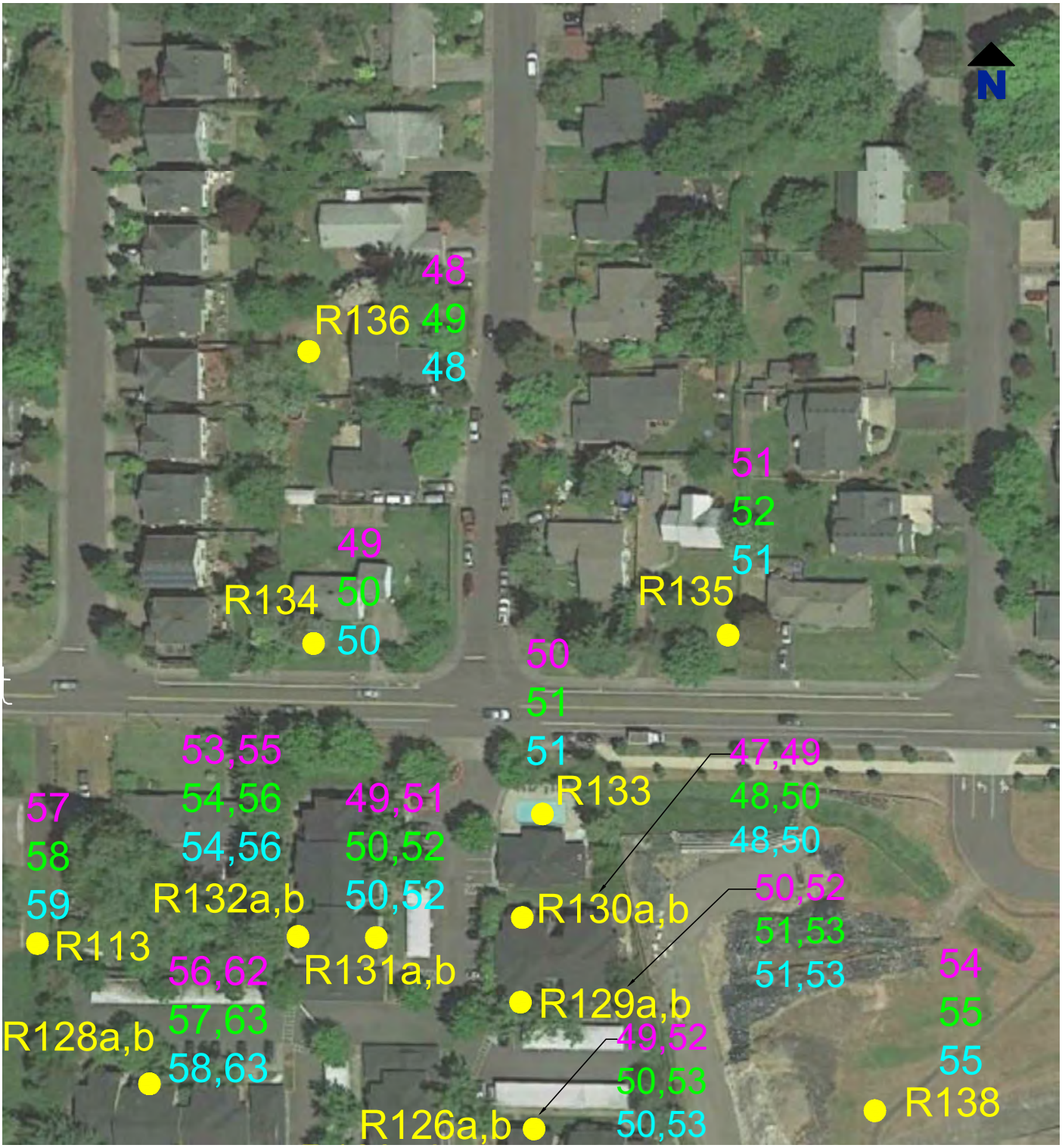
SLR

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (J)

Date	August 27, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. B - 11



0 100 200 300 feet

Receiver Location

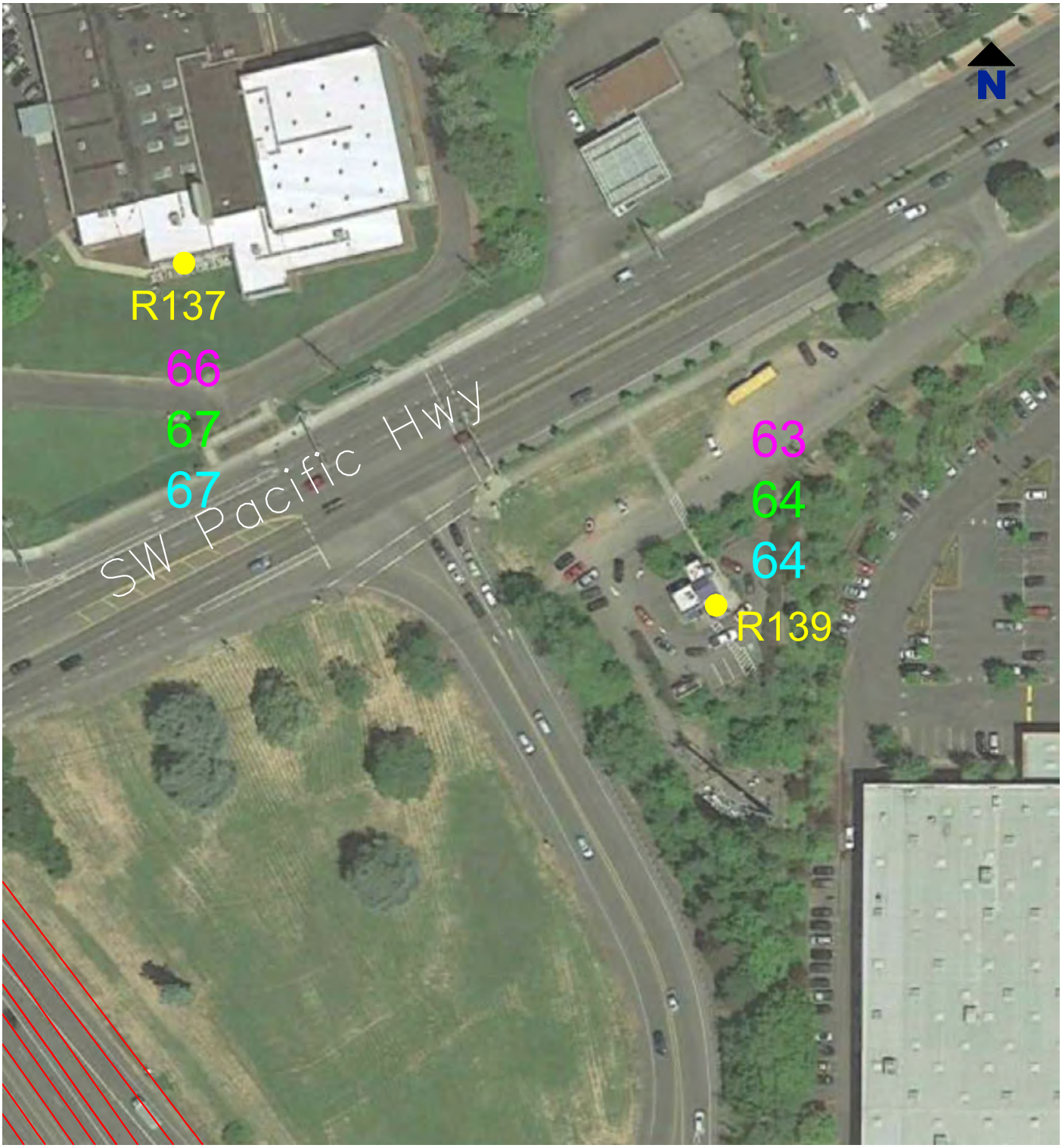
Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

SLR

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (K)

Date August 27, 2018	Scale AS SHOWN	Fig. No. B - 12
File Name 217 NB Working File - FINAL	Project No. 108.00494.00012	



0 100 200 300 feet

Receiver Location

Sound Level Key

- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

SLR

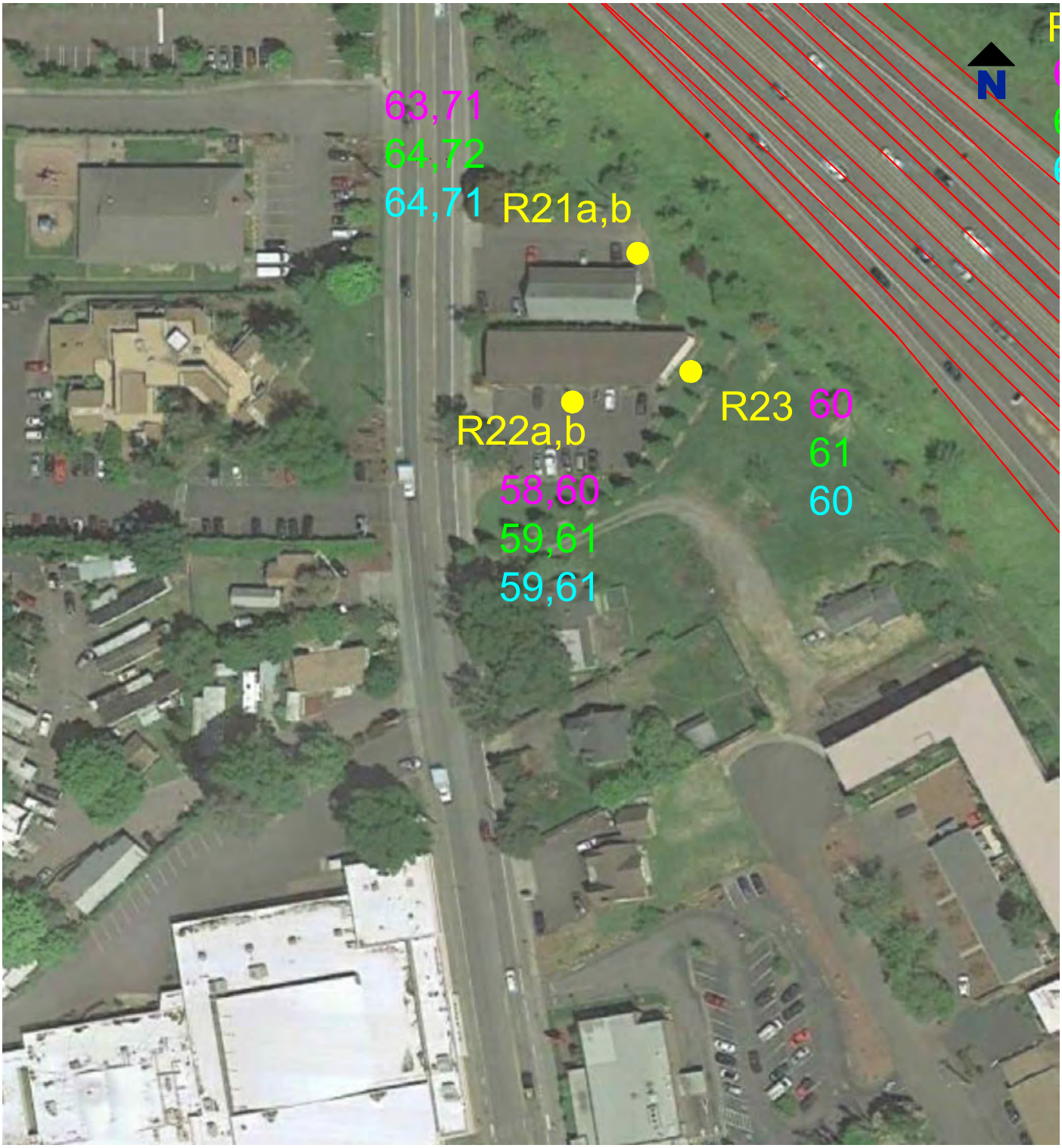
Report

OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing

Receiver Locations - Noise Levels (L)

Date	August 25, 2018	Scale	AS SHOWN	Fig. No. B - 13
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012	



0 100 200 300 feet

Receiver Location

Sound Level Key
- Existing Sound Levels
- No Build Alternative Sound Levels
- Build Alternative Sound Levels

SLR

Report
OR 217 Southbound and Northbound Auxiliary Lanes: Beaverton-Hillsdale Highway to OR 99W

Drawing
Receiver Locations - Noise Levels (M)

Date	August 27, 2018	Scale	AS SHOWN
File Name	217 NB Working File - FINAL	Project No.	108.00494.00012

Fig. No. B - 14

APPENDIX C

NORTHBOUND BARRIER ANALYSIS RESULTS

Noise Technical Report

Oregon Department of Transportation
123 NW Flanders Street
Portland, OR 97209

November 2018

Receiver	Receiver Description	Activity Category	Oregon NAAC	Number of Receptors	Existing (2017) TNM Noise Level (dBA)	Build Alternative (2040) TNM Noise Level (dBA)	12 FT Barrier TNM Noise Level (dBA)	12 FT Barrier Insertion Loss (dBA)	12 FT Barrier Receptors with IL ≥ 7 dBA	12 FT Barrier Benefitted Receptors (≥ 5 dBA)	12 FT Barrier Impacted Receptors Receiving 5 dBA IL	12 FT Barrier Impacted Receptors Not Benefitted	14 FT Barrier TNM Noise Level (dBA)	14 FT Barrier Insertion Loss (dBA)	14 FT Barrier Receptors with IL ≥ 7 dBA	14 FT Barrier Benefitted Receptors (≥ 5 dBA)	14 FT Barrier Impacted Receptors Receiving 5 dBA IL	14 FT Barrier Impacted Receptors Not Benefitted	16 FT Barrier TNM Noise Level (dBA)	16 FT Barrier Insertion Loss (dBA)	16 FT Barrier Receptors with IL ≥ 7 dBA	16 FT Barrier Benefitted Receptors (≥ 5 dBA)	16 FT Barrier Impacted Receptors Receiving 5 dBA IL	16 FT Barrier Impacted Receptors Not Benefitted
R105a	8th Row Apartment Complex on SW Oak St. Back of Building 1st Floor Balcony	B	65	5	54	55	54	1					54	1					54	1				
R105b	8th Row Apartment Complex on SW Oak St. Back of Building 2nd Floor Balcony	B	65	5	58	58	58	0					58	0					57	1				
R105c	8th Row Apartment Complex on SW Oak St. Back of Building 3rd Floor Balcony	B	65	5	60	60	59	1					59	1					59	1				
R105d	8th Row Apartment Complex on SW Oak St. Back of Building 4th Floor Balcony	B	65	5	61	61	61	0					60	1					60	1				
R105e	8th Row Apartment Complex on SW Oak St. Back of Building 5th Floor Balcony	B	65	5	62	62	61	1					61	1					61	1				
R49	2nd Row House on SW 95th Ave. South of SW Oak St.	B	65	3	59	60	58	2					58	2					58	2				
R47	1st Row College on SW Oak St West of SW 95th Ave.	C	65	1	60	60	58	2					57	3					57	3				
R48	2nd Row House on SW 95th Ave South of SW Oak St.	B	65	1	62	62	59	3					59	3					58	4				
M2/R2	1st Row House on SW 95th Ave South of SW Oak St.	B	65	2	66	66	61	5		2	2	0	60	6		2	2	0	60	6		2	2	
									0	2	2	0			0	2	2	0			0	2	2	0

	12 FT Barrier	14 FT Barrier	16 FT Barrier
Wall Height (ft):	12	14	16
Length of Wall (ft):	804	804	804
Wall Area (sq. ft):	9,648	11,256	12,864
Wall Cost ($/sq. ft):	$20	$20	$20
Total Cost of Selected Wall ($):	$192,960	$225,120	$257,280
Cost Effectiveness ($/Benefitted Residence):	$96,480	$112,560	$128,640
Cost Reasonableness Criteria ($/Benefitted Residence):	$25,000	$25,000	$25,000
Cost Effectiveness < Cost Reasonableness? (yes/no):	No	No	No
Calculation of Feasible Abatement (a simple majority of impacted receptors receive a minimum of 5 dBA IL):	100 percent	100 percent	100 percent
Feasible (>50%)?	Yes	Yes	Yes
Design Goal (>7 dBA)?	No	No	No

Legend	
(green)	Impacted receiver
(purple)	Benefitted receiver (5 dBA or more)
(blue)	Design goal achieved (7 dBA or more)

BARRIER IS NOT RECOMMENDED

					Existing (2017)	Build Alternative (2040)	12 FT Barrier						14 FT Barrier						16 FT Barrier					
Receiver	Receiver Description	Activity Category	Oregon NAAC	Number of Receptors	TNM Noise Level (dBA)	TNM Noise Level (dBA)	TNM Noise Level (dBA)	Insertion Loss (dBA)	Receptors with IL ≥ 7 dBA	Benefitted Receptors (≥ 5 dBA)	Impacted Receptors Receiving 5 dBA IL	Impacted Receptors Not Benefitted	TNM Noise Level (dBA)	Insertion Loss (dBA)	Receptors with IL ≥ 7 dBA	Benefitted Receptors (≥ 5 dBA)	Impacted Receptors Receiving 5 dBA IL	Impacted Receptors Not Benefitted	TNM Noise Level (dBA)	Insertion Loss (dBA)	Receptors with IL ≥ 7 dBA	Benefitted Receptors (≥ 5 dBA)	Impacted Receptors Receiving 5 dBA IL	Impacted Receptors Not Benefitted
M4/R4	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St.	B	65	Info	72	72	63	9	Info	Info	Info	0	62	10	Info	Info	Info	0	61	11	Info	Info	Info	0
R50a	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	73	73	63	10	4	4	4	0	62	11	4	4	4	0	61	12	4	4	4	0
R50b	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	75	76	67	9	4	4	4	0	65	11	4	4	4	0	64	12	4	4	4	0
R51a	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	63	64	59	5		4	4	0	59	5		4		0	58	6		4		0
R51b	1st Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	68	69	62	7	4	4	4	0	61	8	4	4	4	0	60	9	4	4	4	0
R52a	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	63	65	60	5		4	4	0	59	6		4	4	0	59	6		4	4	0
R52b	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	67	69	63	6		4	4	0	62	7	4	4	4	0	61	8	4	4	4	0
R53a	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	64	65	61	4				4	61	4			0	4	60	5		4	4	
R53b	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	68	69	64	5		4	4	0	63	6		4	4	0	62	7	4	4	4	0
R54a	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	3	61	62	59	3					59	3					58	4				
R54b	2nd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	64	65	61	4				4	61	4			0	4	60	5		4	4	0
R55a	3rd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	2	60	60	58	2				2	57	3					57	3			0	
R55b	3rd Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	2	63	64	60	4				2	60	4					60	4			0	
R56a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	67	68	64	4				4	64	4			0	4	63	5		4	4	0
R56b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	73	73	68	5		4	4	0	67	6		4	4	0	66	7	4	4	4	0
R57a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	64	66	63	3				4	63	3				4	62	4			0	4
R57b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	69	70	66	4				4	65	5		4	4		65	5		4	4	0
R58a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	65	67	62	5		4	4	0	61	6		4	4		61	6		4	4	0
R58b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	69	70	64	6		4	4	0	63	7	4	4	4		62	8	4	4	4	0
R59a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	62	63	59	4					59	4					58	5		4		
R59b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	65	66	62	4				4	61	5		4	4	0	61	5		4	4	0
R60a	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	59	60	58	2					57	3					57	3			0	
R60b	4th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	63	63	61	2					60	3					60	3			0	
R61	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. Playground and Pool	B	65	1	62	63	61	2					61	2					61	2			0	
R62a	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St.1st Floor Balcony	B	65	4	60	61	60	1					59	2					59	2			0	
R62b	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	65	66	63	3				4	62	4			0	4	62	4			0	4
R86a	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	57	59	57	2					57	2					57	2			0	
R86b	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	63	63	61	2					60	3					60	3			0	
R102a	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 1st Floor Balcony	B	65	4	55	56	56	0					56	0					56	0			0	
R102b	5th Row Apartment Complex on SW Hall Blvd. South of SW Thorn St. 2nd Floor Balcony	B	65	4	59	60	59	1					59	1					59	1			0	
R103a	6th Row House on SW 89th Ave. South of SW Thorn St.	B	65	2	58	59	58	1					58	1					57	2			0	
R103b	6th Row House on SW 89th Ave. South of SW Thorn St.	B	65	3	55	56	56	0					55	1					55	1			0	
R104	7th Row House on SW 89th Ave. North of SW Thorn St.	B	65	2	57	58	58	0					58	0					58	0			0	
R106	1st Row House on SW Hall Blvd. North of SW Pfaffle St.	B	65	1	64	66	62	4				1	62	4			0	1	61	5		1	1	0
R107	2nd Row House on SW Hall Blvd. North of SW Pfaffle St.	B	65	2	61	62	60	2					60	2					60	2			0	

St James Barrier Analysis

Receiver	Receiver Description	Activity Category	Oregon NAAC	Number of Receptors	Existing (2017) TNM Noise Level (dBA)	Build Alternative (2040) TNM Noise Level (dBA)	12 FT Barrier TNM Noise Level (dBA)	12 FT Barrier Insertion Loss (dBA)	12 FT Barrier Receptors with IL ≥ 7 dBA	12 FT Barrier Benefitted Receptors (≥ 5 dBA)	12 FT Barrier Impacted Receptors Receiving 5 dBA IL	12 FT Barrier Impacted Receptors Not Benefitted	14 FT Barrier TNM Noise Level (dBA)	14 FT Barrier Insertion Loss (dBA)	14 FT Barrier Receptors with IL ≥ 7 dBA	14 FT Barrier Benefitted Receptors (≥ 5 dBA)	14 FT Barrier Impacted Receptors Receiving 5 dBA IL	14 FT Barrier Impacted Receptors Not Benefitted	16 FT Barrier TNM Noise Level (dBA)	16 FT Barrier Insertion Loss (dBA)	16 FT Barrier Receptors with IL ≥ 7 dBA	16 FT Barrier Benefitted Receptors (≥ 5 dBA)	16 FT Barrier Impacted Receptors Receiving 5 dBA IL	16 FT Barrier Impacted Receptors Not Benefitted
R108b	3rd Row Apartment Complex on SW Hall Blvd.	B	65	8	59	60	57	3					57	3					57	3			0	
R109	3rd Row Apartment Complex on SW Hall Blvd.	B	65	1	57	58	56	2					56	2					56	2			0	
R110b	4th Row Apartment Complex on SW Hall Blvd.	B	65	10	59	60	57	3					57	3					57	3			0	
R111b	4th Row Apartment Complex on SW Hall Blvd.	B	65	8	60	61	59	2					59	2					59	2			0	
R112	5th Row House on SW Hall Blvd. South of SW Lucille Ct.	B	65	2	57	58	57	1					57	1					57	1			0	
R114	3rd Row House on SW Pfaffle St. West of SW 84th Ave.	B	65	5	57	57	57	0					57	0					57	0			0	
R115a	3rd Row Apartment Complex on SW SW Pfaffle St. Back of Building 1st Floor Patio	B	65	3	61	62	62	0					62	0					62	0			0	
R115b	3rd Row Apartment Complex on SW Pfaffle St. Back of Building 2nd Floor Balcony	B	65	4	64	64	63	1					63	1					63	1			0	
R116	4th Row House on SW 84th Ave. Back of Building	B	65	7	53	54	53	1					53	1					53	1			0	
R117a	4th Row Apartment Complex on SW SW Pfaffle St. Back of Building 1st Floor Patio	B	65	3	61	62	61	1					61	1					61	1			0	
R117b	4th Row Apartment Complex on SW SW Pfaffle St. Back of Building 2nd Floor Balcony	B	65	3	63	64	63	1					63	1					62	2			0	
R118	5th Row House on SW Hall Blvd. North of SW Pfaffle St.	B	65	2	64	66	65	1				2	65	1			0	2	65	1			0	2
									12	40	40	35			20	48	44	23			28	65	57	10

	12 FT Barrier	14 FT Barrier	16 FT Barrier
Wall Height (ft):	12	14	16
Length of Wall (ft):	1,320	1,320	1,320
Wall Area (sq. ft):	15,840	18,480	21,120
Wall Cost ($/sq. ft):	$20	$20	$20
Total Cost of Selected Wall ($):	$316,800	$369,600	$422,400
Cost Effectiveness ($/Benefitted Residence):	$7,920	$7,700	$6,498
Cost Reasonableness Criteria ($/Benefitted Residence):	$25,000	$25,000	$25,000
Cost Effectiveness < Cost Reasonableness? (yes/no):	Yes	Yes	Yes
Calculation of Feasible Abatement (a simple majority of impacted receptors receive a minimum of 5 dBA IL):	53 percent	66 percent	85 percent
Feasible (>50%)?	Yes	Yes	Yes
Design Goal (>7 dBA)?	Yes	Yes	Yes

Legend:
- Impacted receiver
- Benefitted receiver (5 dBA or more)
- Design goal achieved (7 dBA or more)

BARRIER IS RECOMMENDED - 16 feet

Noise Technical Report
OR 217 Northbound Auxiliary Lane
Carriage House Barrier Analysis

Receiver	Receiver Description	Activity Category	Oregon NAAC	Number of Receptors	Existing (2017) TNM Noise Level (dBA)	Build Alternative (2040) TNM Noise Level (dBA)	Build Alternative (2040) Increase over Existing	12 FT Barrier TNM Noise Level (dBA)	12 FT Insertion Loss (dBA)	12 FT Receptors with IL ≥ 7 dBA	12 FT Benefitted Receptors (≥ 5 dBA)	12 FT Impacted Receptors Receiving 5 dBA IL	12 FT Impacted Receptors Not Benefitted	14 FT Barrier TNM Noise Level (dBA)	14 FT Insertion Loss (dBA)	14 FT Receptors with IL ≥ 7 dBA	14 FT Benefitted Receptors (≥ 5 dBA)	14 FT Impacted Receptors Receiving 5 dBA IL	14 FT Impacted Receptors Not Benefitted	16 FT Barrier TNM Noise Level (dBA)	16 FT Insertion Loss (dBA)	16 FT Receptors with IL ≥ 7 dBA	16 FT Benefitted Receptors (≥ 5 dBA)	16 FT Impacted Receptors Receiving 5 dBA IL	16 FT Impacted Receptors Not Benefitted
M5/R5	1st Row Apartment Complex on SW Pfaffle St.	B	65	1	62	63	1	58	5		1			57	6		1			57	6		1		
R113	2nd Row House on SW Pfaffle St. East of SW Hall Blvd.	B	65	3	57	59	2	57	2					57	2					57	2				
R114	3rd Row House on SW Pfaffle St. West of SW 84th Ave.	B	65	5	57	57	0	57	0					57	0					57	0				
R115a	3rd Row Apartment Complex on SW SW Pfaffle St. Back of Building 1st Floor Patio	B	65	3	61	62	1	62	0					62	0					62	0				
R115b	3rd Row Apartment Complex on SW Pfaffle St. Back of Building 2nd Floor Balcony	B	65	4	64	64	0	64	0					64	0					64	0				
R119a	1st Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	66	67	1	59	8	2	2	2		59	8	2	2	2	0	58	9	2	2	2	0
R119b	1st Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	71	72	1	64	8	2	2	2	0	62	10	2	2	2	0	61	11	2	2	2	0
R120a	1st Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	64	65	1	59	6		2	2	0	58	7	2	2	2	0	58	7	2	2	2	0
R120b	1st Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	71	72	1	63	9	2	2	2	0	61	11	2	2	2	0	60	12	2	2	2	0
R121a	2nd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	56	57	1	56	1					56	1					56	1				
R121b	2nd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	62	63	1	58	5		4			58	5		4			57	6		4		
R122a	2nd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	52	52	0	51	1					51	1					51	1				
R122b	2nd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	55	56	1	53	3					52	4					52	4				
R123a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	51	52	1	51	1					51	1					50	2				
R123b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	55	56	1	53	3					52	4					52	4				
R124a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	4	56	57	1	55	2					55	2					55	2				
R124b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	4	63	63	0	57	6		4			56	7	4	4			56	7	4	4		
R125a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	51	52	1	50	2					50	2					50	2				
R125b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	52	53	1	52	1					52	1					51	2				
R126a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	49	50	1	49	1					49	1					49	1				
R126b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	52	53	1	52	1					52	1					52	1				
R127a	1st Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	62	63	1	58	5		2			57	6		2			56	7	2	2		
R127b	1st Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	72	72	0	60	12	2	2	2	0	59	13	2	2	2	0	58	14	2	2	2	0
R128a	3rd Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	56	58	2	56	2					55	3					55	3				
R128b	3rd Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	62	63	1	58	5		2			58	5		2			57	6		2		
R129a	4th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	50	51	1	50	1					50	1					50	1				
R129b	4th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	52	53	1	52	1					52	1					52	1				
R130a	4th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	2	47	48	1	48	0					47	1					47	1				
R130b	4th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	2	49	50	1	49	1					49	1					49	1				
R131a	5th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	49	50	1	49	1					49	1					49	1				
R131b	5th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	51	52	1	51	1					51	1					51	1				
R132a	5th Row Apartment Complex on SW Pfaffle St. 1st Floor Balcony	B	65	3	53	54	1	53	1					53	1					53	1				
R132b	5th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	3	55	56	1	55	1					55	1					55	1				
R133	5th Row Apartment Complex on SW Pfaffle St. 2nd Floor Balcony	B	65	1	50	51	1	51	0					50	1					50	1				
R134	6th Row House on SW Pfaffle St. West of SW 83rd Ave.	B	65	6	49	50	1	50	0					49	1					49	1				
R135	6th Row House on SW Pfaffle St. East of SW 83rd Ave.	B	65	6	51	51	0	50	1					50	1					50	1				
R136	7th Row House on SW Pfaffle St. West of SW 83rd Ave.	B	65	8	48	48	0	48	0					48	0					48	0				
R137	1st Row School on SW Pfaffle St.	C	65	1	66	67	1	66	1			0	1	66	1			0	1	65	2			0	1
R138	3rd Row School on SW Pfaffle St. Playground	C	65	1	54	55	1	54	1					54	1					54	1				
R139	1st Row Coffee Shop on SW Pacific Hwy.	E	70	1	63	64	1	64	0					64	0					64	0				
										8	23	10	1			14	23	10	1			16	23	10	1

Legend:
- Impacted receiver (green)
- Benefitted receiver (5 dBA or more) (purple)
- Design goal achieved (7 dBA or more) (blue)

BARRIER IS RECOMMENDED - 16 feet

	12 FT Barrier	14 FT Barrier	16 FT Barrier
Wall Height (ft):	12	14	16
Length of Wall (ft):	1,400	1,400	1,400
Wall Area (sq. ft):	16,800	19,600	22,400
Wall Cost ($/sq. ft):	$20	$20	$20
Total Cost of Selected Wall ($):	$336,000	$392,000	$448,000
Cost Effectiveness ($/Benefitted Residence):	$14,609	$17,043	$19,478
Cost Reasonableness Criteria ($/Benefitted Residence):	$25,000	$25,000	$25,000
Cost Effectiveness < Cost Reasonableness? (yes/no):	Yes	Yes	Yes
Calculation of Feasible Abatement (a simple majority of impacted receptors receive a minimum of 5 dBA IL):	91 percent	91 percent	91 percent
Feasible (>50%)?	Yes	Yes	Yes
Design Goal (>7 dBA)?	Yes	Yes	Yes

								12 FT Barrier						14 FT Barrier						16 FT Barrier					
Receiver	Receiver Description	Activity Category	Oregon NAAC	Number of Receptors	Existing (2017) TNM Noise Level (dBA)	Build Alternative (2040) TNM Noise Level (dBA)	12 FT Barrier TNM Noise Level (dBA)	TNM Noise Level (dBA)	Insertion Loss (dBA)	Receptors with IL ≥ 7 dBA	Benefitted Receptors (≥ 5 dBA)	Impacted Receptors Receiving 5 dBA IL	Impacted Receptors Not Benefitted	TNM Noise Level (dBA)	Insertion Loss (dBA)	Receptors with IL ≥ 7 dBA	Benefitted Receptors (≥ 5 dBA)	Impacted Receptors Receiving 5 dBA IL	Impacted Receptors Not Benefitted	TNM Noise Level (dBA)	Insertion Loss (dBA)	Receptors with IL ≥ 7 dBA	Benefitted Receptors (≥ 5 dBA)	Impacted Receptors Receiving 5 dBA IL	Impacted Receptors Not Benefitted
R21a	1st Row Apartment Complex on SW Hall Blvd. 1st Floor Patio	B	65	2	63	64	61.4	61	3					61	3					61	3				
R21b	1st Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	2	71	71	63.3	63	8	2	2	2	0	63	8	63	2	2		63	8	63	2	2	
R22a	1st Row Apartment Complex on SW Hall Blvd. 1st Floor Patio	B	65	5	58	59	58.2	58	1					58	1					58	1				
R22b	1st Row Apartment Complex on SW Hall Blvd. 2nd Floor Balcony	B	65	5	60	61	59.9	60	1					60	1					60	1				
R23	1st Row Apartment Complex on SW Hall Blvd.	B	65	1	60	60	58.1	58	2					58	2					58	2				
										2	2	2	0			63	2	2	0			63	2	2	0

Impacted receiver
Benefitted receiver (5 dBA or more)
Design goal achieved (7 dBA or more)

BARRIER IS NOT RECOMMENDED

12 FT Barrier

Wall Height (ft):	12	Calculation of Feasible Abatement (a simple majority of impacted receptors receive a minimum of 5 dBA IL):	100 percent
Length of Wall (ft):	400		
Wall Area (sq. ft):	4,800		
Wall Cost ($/sq. ft):	$20		
Total Cost of Selected Wall ($):	$96,000		
Residence):	$48,000		
Cost Reasonableness Criteria ($/Benefitted Residence):	$25,000	Feasible (>50%)?	**Yes**
Cost Effectiveness < Cost Reasonableness? (yes/no):	**No**	Design Goal (>7 dBA)?	**Yes**

14 FT Barrier

Wall Height (ft):	14	Calculation of Feasible Abatement (a simple majority of impacted receptors receive a minimum of 5 dBA IL):	100 percent
Length of Wall (ft):	400		
Wall Area (sq. ft):	5,600		
Wall Cost ($/sq. ft):	$20		
Total Cost of Selected Wall ($):	$112,000		
Residence):	$56,000		
Cost Reasonableness Criteria ($/Benefitted Residence):	$25,000	Feasible (>50%)?	**Yes**
Cost Effectiveness < Cost Reasonableness? (yes/no):	**No**	Design Goal (>7 dBA)?	**Yes**

16 FT Barrier

Wall Height (ft):	16	Calculation of Feasible Abatement (a simple majority of impacted receptors receive a minimum of 5 dBA IL):	100 percent
Length of Wall (ft):	400		
Wall Area (sq. ft):	6,400		
Wall Cost ($/sq. ft):	$20		
Total Cost of Selected Wall ($):	$128,000		
Residence):	$64,000		
Cost Reasonableness Criteria ($/Benefitted Residence):	$25,000	Feasible (>50%)?	**Yes**
Cost Effectiveness < Cost Reasonableness? (yes/no):	**No**	Design Goal (>7 dBA)?	**Yes**