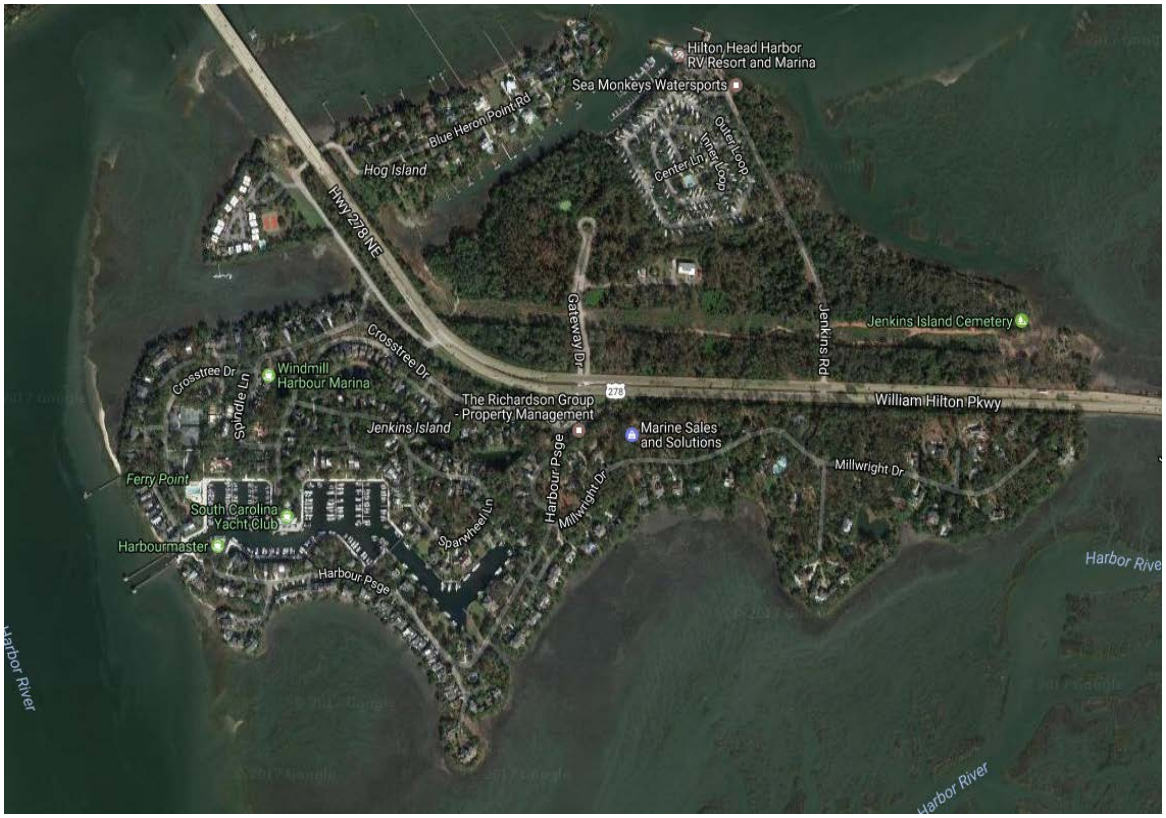
US 278 Widening and Improvement Project

Traffic Noise Analysis Report

US 278 Widening and Improvement Project
Beaufort County, South Carolina



Prepared by:

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TRAFFIC NOISE ANALYSIS SUMMARY REPORT
US 278 Widening and Improvement Project
Beaufort County, South Carolina

EXECUTIVE SUMMARY

The Code of Federal Regulations (CFR) Section 23, Part 772 contains the FHWA traffic noise standards. The SCDOT has implemented these standards in its Traffic Noise Abatement Policy. A traffic noise analysis is required for proposed Federal-aid highway projects that will construct a highway on new location or physically alter an existing highway, which will significantly change either the horizontal or vertical alignment of the road or increase the number of through-traffic lanes. Because this project is not utilizing Federal-aid or State-aid dollars, a noise analysis is not required. However, Beaufort County has requested that a noise analysis be completed in accordance with SCDOT's Traffic Noise Abatement Policy.

An analysis was performed along US 278, crossing Jenkins Island, in Beaufort County, South Carolina to determine the effect of the project on traffic noise levels in the immediate area. This investigation includes an inventory of existing noise sensitive land uses, and a field survey of background (existing) noise levels in the project study area. It also includes a comparison of the predicted noise levels and the background noise levels to determine if traffic noise impacts can be expected resulting from the proposed project. Traffic noise impacts are predicted for this project.

TNM version 2.5, a FHWA traffic noise prediction model, was used in the analysis to compare existing and future Leq(h) noise levels. Leq(h) is the average energy of a sound level over a one hour period. A-weighted decibels (dBa) are the units of measurement used in the study.

Existing noise measurements were taken in the vicinity of the project to quantify the existing acoustic environment and to provide a base for assessing the impact of noise level increases. Model inputs included existing and proposed roadway characteristics, estimated traffic volumes, and receiver locations. Table 1 lists the traffic data used to estimate Leq(h) noise levels expected to occur in the project area by the year 2040.

Table 1 - Traffic Data for Noise Analysis

Roadway Section	Speed (mph)	Two Way Design Hourly Traffic	One Way Hourly Traffic	Hourly Volume Cars (vph)	Hourly Volume Medium Trucks (vph)	Hourly Heavy Trucks (vph)
2015 Traffic Computations						
US 278	50	5470	2735	2461	174	99
2040 Traffic Computations						
US 278	50	5870	2935	2641	188	106

Source: SCDOT Traffic Division

Table 2 shows the comparison of field measurements versus modeled noise levels. The calculated noise levels for the measurement sites range from 58.8 to 64.1 dBA. The difference between field measured and calculated noise levels at all three locations is less than 3 dBA validating the results of the TNM model.

Table 2 - Existing TNM Calculated Noise Levels vs. Field Measurements

Site-Receiver	Location	Field Measurement Noise Level (dBA)	TNM Calculated Noise Level (dBA)	Difference (dBA)
1	7 Blue Heron Point Road	65.8	64.1	1.7
2	44 Crosstree Drive	64.2	62.1	2.1
3	6 Fantail Lane	56.3	58.8	-2.5

Difference = Measured Leq minus Modeled Leq

The FHWA has developed Noise Abatement Criteria (NAC) and procedures to be used in the planning and design of highways to determine whether highway noise levels are or are not compatible with various land uses (Table 3). The abatement criteria and procedures are set forth in the aforementioned Federal reference (Title 23 CFR Part 772).

Table 3 – FHWA Noise Abatement Criteria

Activity Category	Activity Criteria Leq(h)\1\	Evaluation Location	Activity Description
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its purpose.
B	67	Exterior	Residential
C	67	Exterior	Active sport areas, 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 studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E\2\	72	Exterior	Motels, hotels, offices, restaurant/bars, and other developed lands, properties or activities not included in A-D or F
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	Undeveloped lands that are not permitted

\1\ The Leq(h) Activity Criteria values are for impact determination only, and are not designed standards for noise abatement measures

\2\ Includes undeveloped lands permitted for this activity category

Traffic noise impacts occur when the predicted traffic noise levels either: (a) approach or exceed the FHWA noise abatement criteria ("approach" meaning within 1 dBA of the value listed in Table 3), or (b) substantially exceed the existing noise levels. According to the SCDOT Traffic Noise Abatement Policy, a 15 dBA increase is deemed to be a "substantial increase." Consideration for noise abatement measures must be given to receivers that fall in either category.

The results of the noise analysis indicate that traffic related noise impacts would occur to four (4) receivers under the 2040 Build Alternative. However, three (3) receivers would be impacted under the 2040 No-Build Alternative. No receivers in the project area would substantially exceed the FHWA noise abatement criteria. Table 4 summarizes the noise analysis results.

Table 4: Summary of Noise Impact Analysis

ROADWAY LOCATION	TOTAL NO. OF RECEIVERS	APPROXIMATE # OF IMPACTED RECEIVERS ACCORDING TO TITLE 23 CFR PART 772 / SCDOT POLICY				
		A	B	C	D	E
2040 Year No-Build Alternative						
US 278	63	---	3	---	---	---
2040 Year Build Alternative						
US 278	63	---	4	---	---	---

Noise Barrier Analysis Areas

Physical measures to abate anticipated traffic noise levels are often applied on fully controlled facilities using solid mass berms or walls strategically placed between the traffic sound source and the receivers to diffract, absorb, and reflect highway traffic noise emissions. To be effective, a noise barrier must be long enough and tall enough to shield the impacted receiver(s). Generally, the noise wall length must be eight times the distance from the barrier to the receiver. For example, if a receiver is 200 feet from the roadway, an effective barrier would be approximately 1,600 feet long with the receiver in the horizontal center. Due to the requisite lengths for effectiveness, noise walls are typically not economical for isolated or most low-density areas, or for most uncontrolled access facilities. On facilities where access is allowed for driveways, openings will be needed in the walls. An access opening of 40 feet in a 400-foot wall will make the wall ineffective. Based on the noise analysis four (4) residential receivers would experience noise related impacts in the 2040 build condition. Based on these impacts, two barriers were analyzed.

Barrier 1 was modeled to abate noise impacts to Receivers 49 and 53. Under the future build scenario, a total of two (2) receivers would be impacted with four (4) receivers being benefitted. The percentage of impacted receivers that would achieve at least a 5 dBA reduction is 100% which makes the barrier acoustically feasible. One (1) of the benefitted receivers would achieve at least an 8dBa reduction from the proposed barrier (25%) which does not meet the noise reduction design goal for reasonableness. The proposed barrier would be approximately 800 feet in length and 15 feet tall with total costs of $421,112 dollars. This would equate to a total cost of $105,278 dollars per benefitted receiver which does not meet the goal for cost effectiveness, and is therefore, not reasonable.

Barrier 2 was modeled to abate noise impacts to Receivers 41 and 43. Under the future build scenario, a total of two (2) receivers would be impacted with five (5) receivers being benefitted. The percentage of impacted receivers that would achieve at least a 5

dBA reduction is 100% which makes the barrier acoustically feasible. One (1) of the benefitted receivers would achieve at least an 8dBa reduction from the proposed barrier (20%) which does not meet the noise reduction design goal for reasonableness. The proposed barrier would be approximately 1200 feet in length and 15 feet tall with total costs of $633,906 dollars. This would equate to a total cost of $126,781 dollars per benefitted receiver which does not meet the goal for cost effectiveness, and is therefore, not reasonable.

The results of the noise analysis indicate that traffic related noise impacts would occur to four (4) receivers under the 2040 Build Alternative with three (3) receivers being impacted under the 2040 No-Build Alternative. No receivers in the project area would substantially exceed the FHWA noise abatement criteria. Two barriers were analyzed and were found to be not reasonable according to SCDOT traffic noise abatement criteria. Table 5 provides a summary of the barrier analysis results.

Table 5: Summary of Barrier Analysis

	Number of Impacted Receivers Achieving a 5 dBa reduction in Noise Levels[1]	Is the Proposed Abatement Measure Acoustically Feasible	Number of Benefitted Receivers Achieving an 8 dBa Reduction[2]	Cost[3]	Is the Proposed Abatement Measure Reasonable
Barrier 1	2 (100%)	Yes	1 (25%)	$105,278	No
Barrier 2	2 (100%)	Yes	1 (20%)	$126,781	No

[1]75% of impacted receivers must obtain a 5 dBa reduction in noise levels to be considered acoustically feasible.

[2]80% of benefitted receivers (receivers achieving a 5 dBa reduction in noise levels) must achieve an 8 dBa reduction in noise levels to be considered reasonable.

[3]Cost per benefitted receiver must be less than $30,000

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BEAUFORT COUNTY, SOUTH CAROLINA

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I. HIGHWAY TRAFFIC NOISE ANALYSIS

A. Introduction

The Code of Federal Regulations (CFR) Section 23, Part 772 contains the FHWA traffic noise standards. The SCDOT has implemented these standards in its Traffic Noise Abatement Policy. A traffic noise analysis is required for proposed Federal-aid highway projects that will construct a highway on new location or physically alter an existing highway, which will significantly change either the horizontal or vertical alignment of the road or increase the number of through-traffic lanes. Because this project is not utilizing Federal-aid or State-aid dollars, a noise analysis is not required. However, Beaufort County has requested that a noise analysis be completed in accordance with SCDOT's Traffic Noise Abatement Policy.

An analysis was performed along US 278, crossing Jenkins Island, in Beaufort County, South Carolina to determine the effect of the project on traffic noise levels in the immediate area. This investigation includes an inventory of existing noise sensitive land uses, and a field survey of background (existing) noise levels in the project study area. It also includes a comparison of the predicted noise levels and the background noise levels to determine if traffic noise impacts can be expected resulting from the proposed project. Traffic noise impacts are predicted for this project.

B. Project Description

Beaufort County proposes to widen US 278 from four to six travel lanes across Jenkins Island. The total distance is approximately 1.1 miles (Figure 1). The project involves adding additional travel lanes in each direction. The purpose of the project is to improve the operational efficiency of US 278 by improving the Level of Service at intersections in order to provide safe and efficient access to local communities with minimum disruption to through traffic along US 278.

C. Characteristics of Noise

Noise is basically defined as unwanted sound. It is emitted from many sources including airplanes, factories, railroads, commercial businesses, and highway vehicles. Highway traffic noise is usually a composite of noises from engine exhaust, drive train, and tire-roadway interaction. Of these sources, tire noise is typically the most offensive at unimpeded travel speeds.

The magnitude of noise is usually described by its sound pressure. Since the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, usually the decibel (dB). Sound pressures described in decibels are called sound pressure levels and are often defined in terms of frequency

\\cltsmain\GIS_DATA\GIS\G_Temp\Blair\WBeaufort County Jenkins Island\Figure 1 Project Location Map.mxd | Last Updated: 06.24.2015

Project Location Map

Figure 1

weighted scales (A, B, C, or D). The weighted-A decibel scale is used almost exclusively in vehicle noise measurements because it places the most emphasis on the frequency range to which the human ear is most sensitive (1,000-6,000 Hertz). Sound levels measured using a weighted-A decibel scale are often expressed as dBA. Throughout this report, all noise levels will be expressed in dBA's.

Most individuals are exposed to fairly high noise levels from many sources as they go about their daily activities. Sound levels experienced by individuals on a daily basis are listed in Table 1.

Table 1 – Daily Sounds

DECIBELS		
	140	Shotgun blast, jet 100' away at takeoff — PAIN
		Motor test chamber — HUMAN EAR PAIN THRESHOLD
	130	---
		Firecrackers
	120	Severe thunder, pneumatic jackhammer
		Hockey crowd
		Amplified rock music — UNCOMFORTABLY LOUD
	110	---
		Textile loom
	100	Subway train, elevated train, farm tractor
		Power lawn mower, newspaper press
		Heavy city traffic, noisy factory — LOUD
	90	---
D		Diesel truck 40 mph at 50' away
E	80	Crowded restaurant, garbage disposal
C		Average factory, vacuum cleaner
I		Passenger car 50 mph at 50' away — MODERATELY LOUD
B	70	---
E		Quiet typewriter
L	60	Singing birds, window air-conditioner
S		Quiet automobile
		Normal conversation, average office — QUIET
	50	---
		Household refrigerator
		Quiet office — VERY QUIET
	40	---
		Average home
	30	Dripping faucet
		Whisper at 5' away
	20	Light rainfall, rustle of leaves
		AVERAGE PERSON'S THRESHOLD OF HEARING
		Whisper — JUST AUDIBLE
	10	---
	0	THRESHOLD FOR ACUTE HEARING

Sources: World Book, Rand McNally Atlas of the Human Body, Encyclopedia America, "Industrial Noise and Hearing Conversation" by J. B. Olishifski and E. R. Harford (Researched by N. Jane Hunt and published in the Chicago Tribune in an illustrated graphic by Tom Heinz.)

The degree of disturbance or annoyance of unwanted sound depends essentially on three things:

1. The amount and nature of the intruding noise.
2. The relationship between the background noise and the intruding noise.
3. The type of activity occurring when the noise is heard.

In considering the first of these factors, it is important to note that individuals have different sensitivity to noise. Loud noises disturb some individuals more than others and some individuals become upset if an unwanted noise persists. The time patterns of noise also enter into an individual's judgment of whether or not a noise is offensive. For example, noises that occur during sleeping hours are usually considered to be more offensive than the same noises in the daytime.

With regard to the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). The blowing of a car horn at night when background noise levels are approximately 45 dBA would generally be more objectionable than the blowing in the afternoon when background noises might be 55 dBA.

The third factor is related to the interference of noise with activities of individuals. In a 60 dBA environment, normal conversation would be possible while sleep might be difficult. Work activities requiring high levels of concentration may be interrupted by loud noises while activities requiring manual effort may not be interrupted to the same degree.

Over time, particularly if the noises occur at predicted intervals and are expected, individuals tend to accept the noises that intrude into their lives. Attempts have been made to regulate many of these types of noises including airplane noise, factory noise, railroad noise, and highway noise. In relation to highway traffic noise, methods of analysis and control have developed rapidly over the past few years.

D. Noise Abatement Criteria

The FHWA has developed NAC and procedures to be used in the planning and design of highways to determine whether highway noise levels are or are not compatible with various land uses. The abatement criteria and procedures are set forth in the aforementioned Federal reference (Title 23 CFR Part 772). A summary of the noise abatement criteria for various land uses is presented in Table 2.

Table 2 – FHWA Noise Abatement Criteria

Activity Category	Activity Criteria Leq(h)\1\	Evaluation Location	Activity Description
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its purpose.
B	67	Exterior	Residential
C	67	Exterior	Active sport areas, 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 studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E\2\	72	Exterior	Motels, hotels, offices, restaurant/bars, and other developed lands, properties or activities not included in A-D or F
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	--	--	Undeveloped lands that are not permitted

\1\ The Leq(h) Activity Criteria values are for impact determination only, and are not designed standards for noise abatement measures

\2\ Includes undeveloped lands permitted for this activity category

Activity Category A consists of tracts of land that are locally significant for their serenity and quiet surroundings. Activity Category B consists of residential properties. Activity Category C consists of exterior locations of public outdoor areas, places of worship, cemeteries, recreational areas, etc. Activity Category D consists primarily of the same activities as Activity Category C but is for interior locations. Activity Category E

consists of hotel/motels, offices, restaurants, and other developed land with activities not included in Activity Categories A-D. Activity F consists of agricultural lands, airports, and commercial/industrial facilities. Activity G is for undeveloped lands not presently permitted. Activity Categories adjacent to the project are mostly residential category (B).

Sound pressure levels in this report are referred to as Leq(h). The hourly Leq, or equivalent sound level, is the level of constant sound in a one-hour time period that would have the same energy as a time-varying sound. In other words, the fluctuating sound levels of traffic noise are represented in terms of a steady noise level with the same energy content.

E. Existing Noise Levels

Existing noise measurements were taken in the vicinity of the project to quantify the existing acoustic environment and to provide a base for assessing the impact of noise level increases. For all locations, the measurement device was set at approximately 60 inches above the existing ground elevation. The existing Leq(h) traffic noise levels, as measured at each site, and the type of ground conditions identified at each site can be found in Table 3.

Table 3 - Existing Noise Levels [Leq(h)]

Site-Rec.	Location	Description	Noise Level (dBA)
1	7 Blue Heron Point Road	Grass	65.8
2	44 Crosstree Drive	Grass	64.2
3	6 Fantail Lane	Grass	56.3

Note: See Appendix for noise measurement data sheets.

The existing roadway and traffic conditions were used with the current traffic noise prediction model (TNM version 2.5, February 2004) to calculate existing noise levels for comparison with actual measured noise levels. Project-related traffic noise level increases are based upon the existing loudest-hour noise levels. See Table 4 for traffic counts during field measurements. All measurements were performed on January 18, 2017.

Table 4 - Field Noise Data

Site-Rec.	Time Period	Traffic Counts and Field Noise Measurements										Measured Leq
		Eastbound Lanes					*Westbound Lanes*					
		Autos	MT	HT	Bus	MC	Autos	MT	HT	Bus	MC	
1	9:40AM-9:55AM	341	30	11	0	0	365	22	9	0	0	65.8
2	10:30AM 10:45AM	370	24	22	0	0	426	11	9	0	1	64.2
3	11:00AM-11:15AM	394	21	8	1	0	393	24	15	0	0	56.3

MT = Medium Trucks; HT = Heavy Trucks; MC = Motorcycles - Data was obtained on January 18, 2017.

Table 5 shows the comparison of field measurements versus modeled noise levels. The calculated noise levels for the measurement sites range from 58.8 to 64.1 dBA. The difference between field measured and calculated noise levels at all locations is less than 3 dBA, validating the results of the TNM model.

Table 5 - Existing TNM Calculated Noise Levels vs. Field Measurements

Site-Receiver	Location	Field Measurement Noise Level (dBA)	TNM Calculated Noise Level (dBA)	Difference (dBA)
1	7 Blue Heron Point Road	65.8	64.1	1.7
2	44 Crosstree Drive	64.2	62.1	2.1
3	6 Fantail Lane	56.3	58.8	-2.5

Difference = Measured Leq minus Modeled Leq

F. Procedure for Predicting Future Noise Levels

Based on the SCDOT Traffic Noise Abatement Policy, a preliminary noise analysis is required for all build alternatives and under consideration in a project's NEPA document. The preliminary analysis models the most conservative noise environment to determine if there will be noise impacts, and if there are, the feasibility and reasonableness of noise abatement to mitigate the impacts. Once a preferred alternative has been identified, a detailed noise analysis is required for any noise abatement that was recommended for that alternative in the preliminary analysis.

Traffic noise is not constant; it varies in time depending upon the number, speed, type, and frequency of vehicles that pass by a given receiver. Furthermore, since traffic noise emissions are different for various types of vehicles, the TNM model distinguishes between the source emissions from the following vehicle types: automobiles, medium trucks, heavy trucks, buses, and motorcycles. The TNM traffic noise prediction model uses the number and type of vehicles on the planned roadway, their speeds, the physical characteristics of the road (curves, hills, depressed, elevated, etc.), receiver location and height, and, if applicable, barrier type, barrier ground elevation, and barrier top elevation.

Preliminary designs, aerial photography, and contour mapping were used to model the proposed roadway and receiver elevations and represent the topographical conditions. The noise predictions made in this report are highway-related noise predictions for the traffic conditions during the year 2040. They do not include other noises related to the excessive background noises (trains, airplanes and construction, etc.) that were measured during the existing conditions.

According to FHWA guidance, the predictions documented in this report are based upon the proposed roadway alignment design and traffic conditions for the year 2040 that result in the loudest predicted hourly-equivalent traffic noise levels for each receiver. Traffic noise level and location spreadsheets are included in the attachments and contain a list of all receivers in close proximity to the project along with aerials showing the receiver locations, and summarize the loudest hour equivalent noise levels for the Existing, No-Build, and Build conditions in the year 2040 under traffic conditions within the project site. The land uses of receivers were determined by field observations and reviewing available GIS parcel data. Table 6 lists the traffic data used in the analysis. This data is based on field observations and data obtained from SCDOT and traffic study.

Table 6 - Traffic Data for Noise Analysis

Roadway Section	Speed (mph)	Two Way Design Hourly Traffic	One Way Hourly Traffic (vph)	Hourly Volume Cars (vph)	Hourly Volume Medium Trucks (vph)	Hourly Heavy Trucks (vph)
2015 Traffic Computations						
US 278	50	5470	2735	2461	174	99
2040 Traffic Computations						
US 278	50	5870	2935	2641	188	106

- mph = miles per hour
- vph = vehicles per hour
- Design hourly traffic volumes obtained using 10% of average daily traffic provided by SCDOT and traffic study
- Truck percentages obtained by averaging counts taken during field measurements

G. Traffic Noise Impacts and Noise Thresholds

Traffic noise impacts occur when the predicted traffic noise levels either: (a) approach or exceed the FHWA noise abatement criteria ("approach" meaning within 1 dBA of the value listed in Table 2), or (b) substantially exceed the existing noise levels. According to the SCDOT Traffic Noise Abatement Policy, a 15 dBA increase is deemed to be a "substantial increase." Consideration for noise abatement measures must be given to receivers that fall in either category. The results of the noise analysis indicate that traffic related noise impacts would occur to four (4) receivers under the 2040 Build Alternative. However, three (3) receivers would be impacted under the 2040 No-Build Alternative. No receivers in the project area would substantially exceed the FHWA noise abatement criteria. Table 7 summarizes the noise analysis results.

Table 7: Summary of Noise Impacts

ROADWAY LOCATION	TOTAL NO. OF RECEIVERS	APPROXIMATE # OF IMPACTED RECEIVERS ACCORDING TO TITLE 23 CFR PART 772 / SCDOT POLICY				
		A	B	C	D	E
2040 Year No-Build Alternative						
US 278	63	---	3	---	---	---
2040 Year Build Alternative						
US 278	63	---	4	---	---	---

II. TRAFFIC NOISE ABATEMENT MEASURES

If noise impacts are predicted, noise abatement measures for reducing or eliminating the noise impacts must be considered. Consideration for noise abatement measures have been given to impacted receivers along each alternative. The following discussion addresses the applicability of these measures to the proposed project.

A. Noise Barriers

Physical measures to abate anticipated traffic noise levels are often applied on fully controlled facilities using solid mass berms or walls strategically placed between the traffic sound source and the receivers to diffract, absorb, and reflect highway traffic noise emissions. To be effective, a noise barrier must be long enough and tall enough to shield the impacted receiver(s). Generally, the noise wall length must be eight times the distance from the barrier to the receiver. For example, if a receiver is 200 feet from the roadway, an effective barrier would be approximately 1,600 feet long with the receiver in the horizontal center. Due to the requisite lengths for effectiveness, noise walls are typically not economical for isolated or most low-density areas, or for most uncontrolled access facilities. On facilities where access is allowed for driveways, openings will be needed in the walls. An access opening of 40 feet in a 400-foot wall will make the wall ineffective. Based on the noise analysis four (4) residential receivers would experience noise related impacts in the 2040 build condition. Based on these impacts, two barriers were analyzed.

According to the SCDOT's Traffic Noise Abatement Policy, a noise wall must be considered both feasible and reasonable. The feasibility of a wall is determined by constructability of the wall given the topography, presence of other dominant noise sources, and at least a 5 dBA noise reduction must be achieved for 75% of the impacted receivers. There are three mandatory factors that must be met for a noise abatement measure to be considered reasonable. All three factors must collectively be achieved for a noise abatement measure to be deemed reasonable. These three factors include; viewpoints of the property owners and residents of the benefitted receivers, cost

effectiveness (cost per benefitted receiver is less than $30,000), and a noise reduction design goal of at least 8 dBA for 80% of those receivers determined to be in the first two building rows and considered benefitted.

B. Barrier Analysis

Barrier 1 was modeled to abate noise impacts to Receivers 49 and 53. Under the future build scenario, a total of two (2) receivers would be impacted with four (4) receivers being benefitted. The percentage of impacted receivers that would achieve at least a 5 dBA reduction is 100% which makes the barrier acoustically feasible. One (1) of the benefitted receivers would achieve at least an 8dBa reduction from the proposed barrier (25%) which does not meet the noise reduction design goal for reasonableness. The proposed barrier would be approximately 800 feet in length and 15 feet tall with total costs of $421,112 dollars. This would equate to a total cost of $105,278 dollars per benefitted receiver which does not meet the goal for cost effectiveness, and is therefore, not reasonable.

Barrier 2 was modeled to abate noise impacts to Receivers 41 and 43. Under the future build scenario, a total of two (2) receivers would be impacted with five (5) receivers being benefitted. The percentage of impacted receivers that would achieve at least a 5 dBA reduction is 100% which makes the barrier acoustically feasible. One (1) of the benefitted receivers would achieve at least an 8dBa reduction from the proposed barrier (20%) which does not meet the noise reduction design goal for reasonableness. The proposed barrier would be approximately 1200 feet in length and 15 feet tall with total costs of $633,906 dollars. This would equate to a total cost of $126,781 dollars per benefitted receiver which does not meet the goal for cost effectiveness, and is therefore, not reasonable. Table 8 includes a summary of the barrier analysis.

Table 8. Summary of Barrier Analysis

	Number of Impacted Receivers Achieving a 5 dBa reduction in Noise Levels[1]	Is the Proposed Abatement Measure Acoustically Feasible	Number of Benefitted Receivers Achieving an 8 dBa Reduction[2]	Cost[3]	Is the Proposed Abatement Measure Reasonable
Barrier 1	2 (100%)	Yes	1 (25%)	$105,278	No
Barrier 2	2 (100%)	Yes	1 (20%)	$126,781	No

[1]75% of impacted receivers must obtain a 5 dBa reduction in noise levels to be acoustically feasible.

[2]80% of benefitted receivers (receivers achieving a 5 dBa reduction in noise levels) must achieve an 8 dBa reduction in noise levels to be considered reasonable.

[3]Cost per benefitted receiver must be less than $30,000

III. CONSTRUCTION NOISE

The major construction elements of this project are expected to be earth removal, hauling, grading, and paving. General construction noise impacts, such as temporary speech interference for passers-by and those individuals living or working near the project, can be expected particularly from paving operations and earth moving equipment during construction. However, considering the relatively short-term nature of construction noise, these impacts are not expected to be substantial. To minimize construction noise, the contractor would be required to comply with the *SCDOT 2007 Standard Specifications for Highway Construction*[1] which includes specifications regarding nuisance noise avoidance. Specifications suggested for nuisance noise include, but is not limited to the following:

- Construction equipment powered by an internal combustion engine shall be equipped with a properly maintained muffler
- Air powered equipment shall be fitted with pneumatic exhaust silencers
- Air compressors shall meet current USEPA noise emission exhaust standards
- stationary equipment powered by an internal combustion engine shall not be operated within 150 feet of noise sensitive areas without portable noise barriers placed between the equipment and noise sensitive sites. Noise sensitive sites include residential buildings, motels, hotels, schools, churches, hospitals, nursing homes, libraries and public recreation areas.
- Powered construction equipment shall not be operated during the traditional evening and/or sleeping hours within 150 feet of a noise sensitive site, to be decided either by local ordinances and/or agreement with the SCDOT.

In addition, the contractor would be required to comply with applicable local noise ordinances and OSHA regulations concerning noise attenuation devices on construction equipment. OSHA regulations recommend measures such as vibration isolation, vibration damping, and silencers.[2]

IV. Notification of Local Planning Officials

Local officials must be informed of future design noise levels from the edge of the nearest travel lane to encourage noise compatible land use planning. Table 9 lists the distances where noise impacts may occur based on various NAC categories.

[1] http://www.scdot.org/doing/construction_standardspec.aspx. Last accessed March 27, 2017.
[2] https://www.osha.gov/dts/osta/otm/new_noise/. Last accessed March 27, 2017.

Table 9: Approximate Sound Level Contours for Various NAC Categories from Edge of Nearest Travel Lane Centerline

NAC Land Use	Impact Criteria	Worst-Case Approximate Distances From Travel Lane Centerline
B - C	66 dBA	~232 feet
E	71 dBA	~132 feet

BEAUFORT COUNTY PLANNING DEPARTMENT

Beaufort County Planning Department
100 Ribaut Road, Room 115
Beaufort, S.C. 29901

V. PUBLIC INVOLVMENT

The public involvement process is not applicable since the analyzed feature does not meet the SCDOT noise policy criteria.

VI. SUMMARY

The results of the noise analysis indicate that traffic related noise impacts would occur to four (4) receivers under the 2040 Build Alternative with three (3) receivers being impacted under the 2040 No-Build Alternative. No receivers in the project area would substantially exceed the FHWA noise abatement criteria. Two barriers were analyzed and were found to be not reasonable according to SCDOT traffic noise abatement criteria. Table 10 provides a summary of the barrier analysis results for benefitted receivers.

Table 10. Summary of Barrier Analysis for Benefitted Receivers

Receiver No.	Decibel Levels					Cost Per Benefitted Receiver
	Existing	No-Build	Build	With Barrier	Net Reduction	
39	65	65	64	59	6	$126,781
41[1]	65	65	66	59	7	$126,781
43[1]	67	67	68	59	9	$126,781
44	60	60	61	56	5	$126,781
45	60	60	61	56	5	$126,781
49[1]	67	67	67	59	8	$105,278
52	61	62	62	55	7	$105,278
53[1]	68	68	69	58	9	$105,278
55	59	59	59	52	7	$105,278

[1]Impacted receivers (receivers that approach or exceed Federal threshold criteria for respective activity categories)

This evaluation completes the highway traffic noise requirements of Title 23 CFR Part 772.

APPENDIX

Traffic Noise Impacts and Locations

Predicted Traffic Noise Levels - US 278 - Beaufort County

RECEIVER INFORMATION					2015 EXISTING		2040 NO-BUILD ALTERNATIVE		2040 BUILD ALTERNATIVE		DIFFERENCE
Receiver ID #	LAND USE	23 CFR PART 772 NOISE ABATEMENT CRITERIA (NAC) CATEGORY	23 CFR PART 772 NOISE ABATEMENT CRITERIA (NAC) (dBA)	EQUIVALENT NO. OF RECEIVERS	ESTIMATED Leq (dBA)	NOISE IMPACT (YES/NO)	ESTIMATED Leq (dBA)	NOISE IMPACT (YES/NO)	ESTIMATED Leq (dBA)	NOISE IMPACT (YES/NO)	2035 BUILD - 2015 EXIST [Leq (dBA)]
1	Residential	B	67	1	59	No	60	No	57	No	-2
2	Residential	B	67	1	58	No	58	No	57	No	-1
3	Residential	B	67	1	58	No	58	No	58	No	0
4	Residential	B	67	1	59	No	59	No	59	No	0
5	Residential	B	67	1	61	No	62	No	61	No	0
6	Residential	B	67	1	62	No	62	No	63	No	-1
7	Substation	E	72	1	64	No	65	No	65	No	1
8	Residential	B	67	1	58	No	58	No	58	No	0
9	Residential	B	67	1	59	No	59	No	59	No	0
10	Residential	B	67	1	60	No	60	No	60	No	0
11	Residential	B	67	1	60	No	60	No	60	No	0
12	Residential	B	67	1	60	No	61	No	61	No	1
13	Residential	B	67	1	60	No	61	No	61	No	1
14	Residential	B	67	1	60	No	61	No	61	No	1
15	Residential	B	67	1	60	No	60	No	60	No	0
16	Residential	B	67	1	60	No	60	No	60	No	0
17	Residential	B	67	1	59	No	60	No	60	No	1
18	Residential	B	67	1	60	No	60	No	60	No	0
19	Residential	B	67	1	60	No	60	No	60	No	0
20	Residential	B	67	1	60	No	61	No	60	No	0
21	Residential	B	67	1	60	No	61	No	60	No	0
22	Residential	B	67	1	60	No	61	No	60	No	0
23	Residential	B	67	1	61	No	61	No	61	No	0
24	Residential	B	67	1	61	No	61	No	61	No	0
25	Residential	B	67	1	62	No	62	No	61	No	-1
26	Residential	B	67	1	62	No	62	No	62	No	-1
27	Residential	B	67	1	62	No	62	No	62	No	0
28	Residential	B	67	1	63	No	63	No	62	No	-1
29	Residential	B	67	1	64	No	64	No	64	No	0
30	Residential	B	67	1	58	No	58	No	59	No	1
31	Residential	B	67	1	59	No	59	No	60	No	1
32	Residential	B	67	1	60	No	60	No	61	No	1
33	Security Office	E	72	1	69	Yes	69	Yes	69	Yes	0
34	Sales Office	B	67	1	64	No	64	No	64	No	0
35	Residential	B	67	1	60	No	61	No	61	No	1
36	Residential	B	67	1	59	No	59	No	60	No	1
37	Residential	B	67	1	61	No	61	No	62	No	1
38	Residential	E	67	1	64	No	65	No	64	No	0
39	Residential	B	67	1	65	No	65	No	64	No	-1
40	Residential	B	67	1	63	No	63	No	64	No	1
41	Residential	B	67	1	65	No	65	No	66	Yes	1
42	Residential	B	67	1	59	No	59	No	60	No	1
43	Residential	B	67	1	67	Yes	67	Yes	68	Yes	1

Predicted Traffic Noise Levels - US 278 - Beaufort County

RECEIVER INFORMATION					2015 EXISTING		2040 NO-BUILD ALTERNATIVE		2040 BUILD ALTERNATIVE		DIFFERENCE
Receiver ID #	LAND USE	23 CFR PART 772 NOISE ABATEMENT CRITERIA (NAC) CATEGORY	23 CFR PART 772 NOISE ABATEMENT CRITERIA (NAC) (dBA)	EQUIVALENT NO. OF RECEIVERS	ESTIMATED Leq (dBA)	NOISE IMPACT (YES/NO)	ESTIMATED Leq (dBA)	NOISE IMPACT (YES/NO)	ESTIMATED Leq (dBA)	NOISE IMPACT (YES/NO)	2035 BUILD - 2015 EXIST [Leq (dBA)]
44	Residential	B	67	1	60	No	60	No	61	No	1
45	Residential	B	67	1	60	No	60	No	61	No	1
46	Industrial	E	72	1	69	No	60	No	70	No	1
47	Residential	B	67	1	61	No	61	No	63	No	2
48	Residential	B	67	1	61	No	62	No	63	No	2
49	Residential	B	67	1	67	Yes	67	Yes	67	Yes	0
50	Residential	B	67	1	62	No	62	No	63	No	1
51	Residential	E	67	1	59	No	59	No	60	No	1
52	Residential	B	67	1	61	No	62	No	62	No	1
53	Residential	B	67	1	68	Yes	68	Yes	69	Yes	1
54	Residential	B	67	1	57	No	57	No	58	No	1
55	Residential	B	67	1	59	No	59	No	59	No	0
56	Residential	B	67	1	62	No	63	No	61	No	-1
57	Residential	B	67	1	60	No	61	No	59	No	-1
58	Residential	B	67	1	59	No	59	No	58	No	-1
59	Residential	B	67	1	58	No	58	No	57	No	-1
60	Residential	B	67	1	59	No	60	No	58	No	-1
61	Residential	B	67	1	62	No	62	No	60	No	-2
62	Residential	B	67	1	64	No	65	No	62	No	-2
63	Residential	B	67	1	55	No	55	No	57	No	2

2015 Existing Noise Levels

JENKINS ISLAND NOISE STUDY

2015 EXISTING CONDITION

SHEET 1 OF 2

1"=200'

IMPACTED

NOT IMPACTED

JENKINS ISLAND NOISE STUDY

2015 EXISTING CONDITION

SHEET 2 OF 2

1"=200'

IMPACTED

NOT IMPACTED

2040 No-Build Noise Levels

JENKINS ISLAND NOISE STUDY

2040 NO BUILD CONDITION

SHEET 1 OF 2

1"=200'

IMPACTED

NOT IMPACTED

JENKINS ISLAND NOISE STUDY

2040 NO BUILD CONDITION

SHEET 2 OF 2

1"=200'

IMPACTED

NOT IMPACTED

2040 Build Noise Levels

JENKINS ISLAND NOISE STUDY

2040 BUILD CONDITION

SHEET 1 OF 2

1"=200'

IMPACTED

NOT IMPACTED

JENKINS ISLAND NOISE STUDY

2040 BUILD CONDITION

SHEET 2 OF 2

1"=200'

IMPACTED

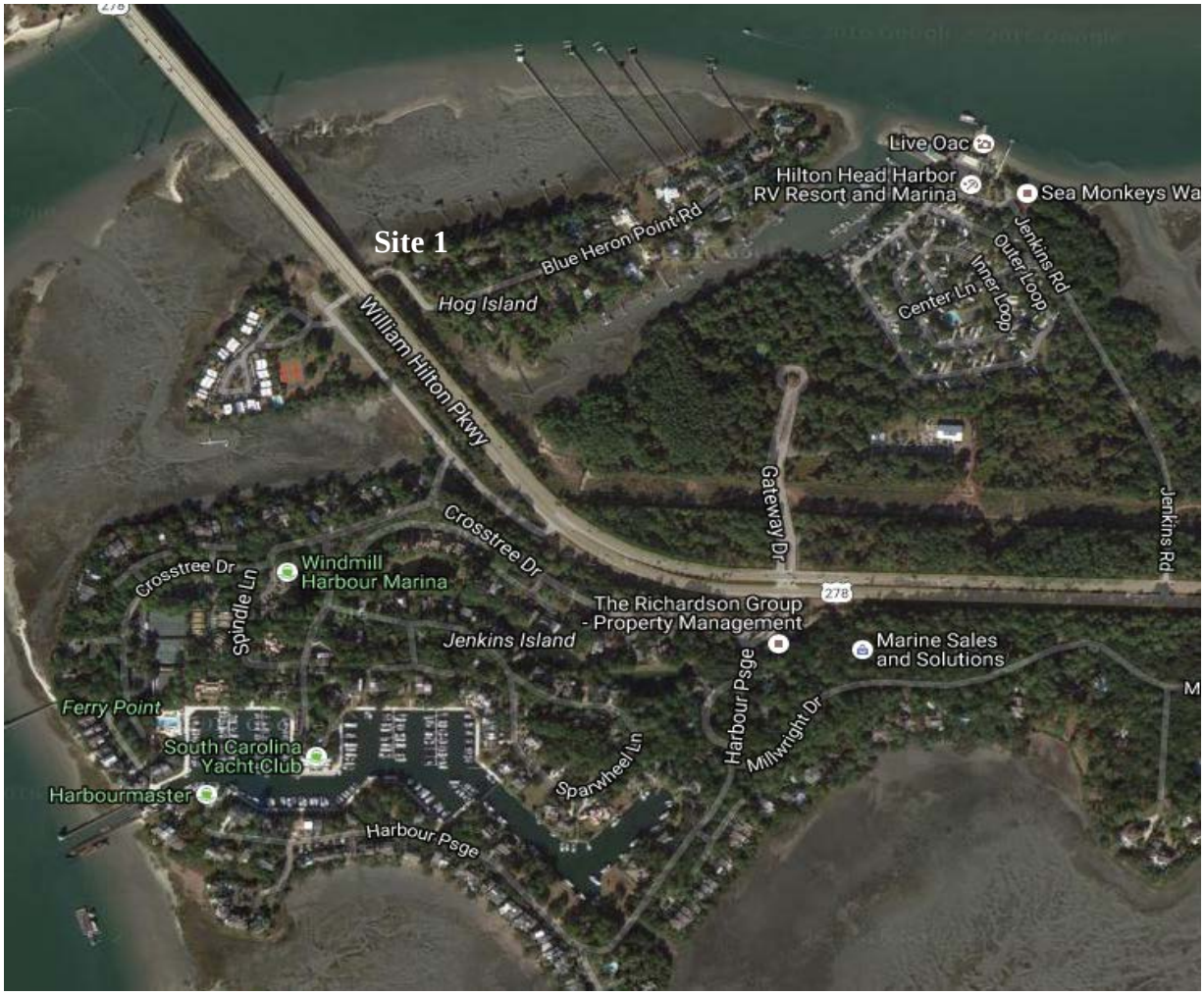
NOT IMPACTED

Noise Measurement Data Sheets

TRAFFIC NOISE FIELD MEASUREMENT WORKSHEET

Project Name: **US 278 Widening**		Site #: 1	Date: 1/18/2017
Site Description: Residential		Site Location: 7 Blue Heron Point Road	
Start Time: 9:40	9:55	Duration: 15 minutes	L_{eq}: 65.8

Site Sketch: (Plan View)

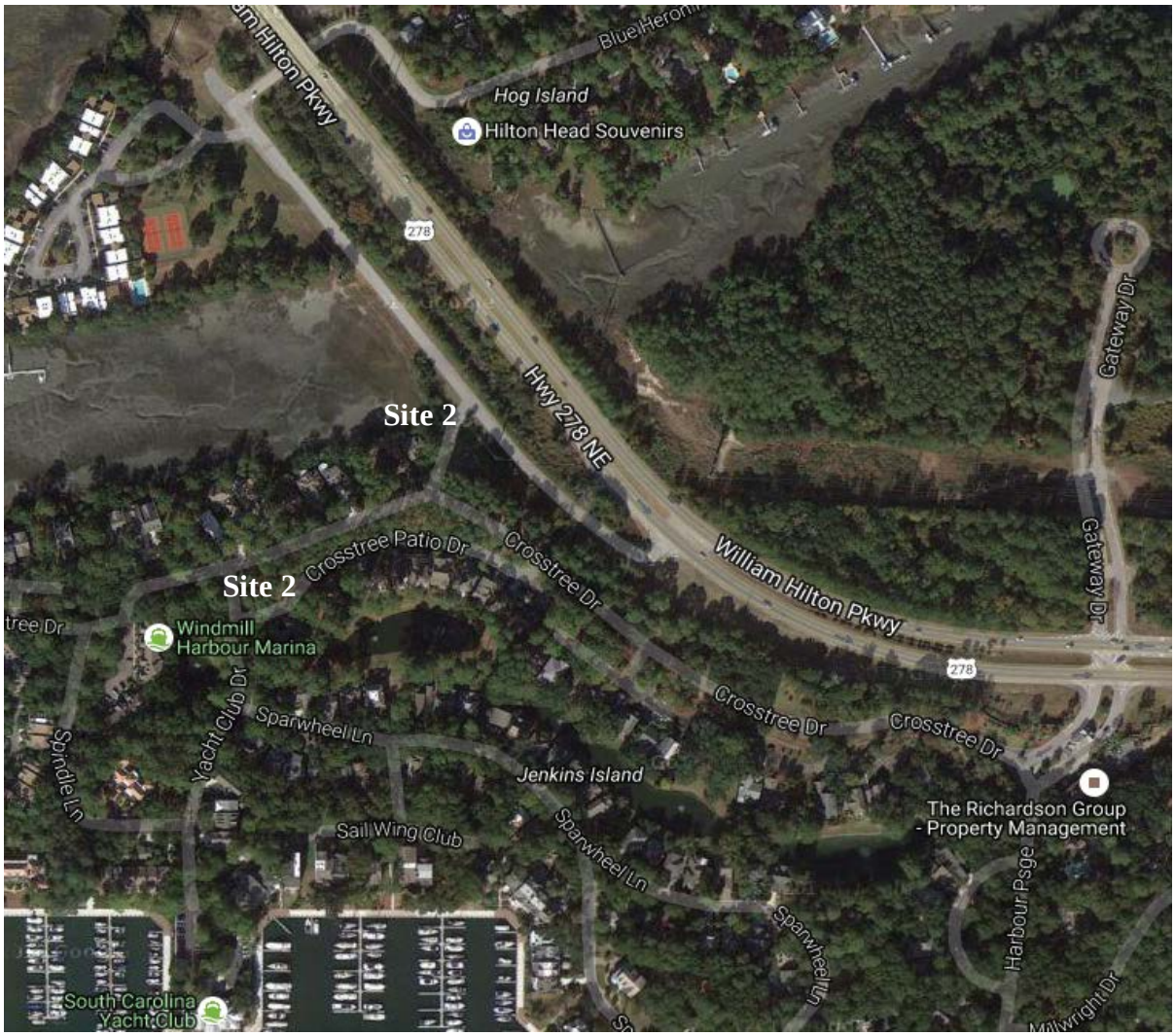


Notes:	
Traffic Counts	**US 278**
Autos:	East Bound – 365, West Bound – 341
Medium Trucks:	East Bound – 22, West Bound – 30
Heavy Trucks:	East Bound – 9, West Bound – 11
Buses:	East Bound – 0, West Bound – 0
Motorcycles:	East Bound – 0, West Bound – 0

TRAFFIC NOISE FIELD MEASUREMENT WORKSHEET

Project Name: **US 278 Widening**		Site #: 2	Date: 1/18/2017
Site Description: Residential		Site Location: 44 Crosstree Drive	
Start Time: 10:30	10:45	Duration: 15 minutes	L_{eq}: 64.2

Site Sketch: (Plan View)



Notes:

Traffic Counts	**US 278**
Autos:	East Bound – 426, West Bound –370
Medium Trucks:	East Bound – 11, West Bound – 24
Heavy Trucks:	East Bound – 9, West Bound – 22
Buses:	East Bound – 0, West Bound – 0
Motorcycles:	East Bound – 1, West Bound – 0

TRAFFIC NOISE FIELD MEASUREMENT WORKSHEET

Project Name: **US 278 Widening**		Site #: 3	Date: 1/18/2017
Site Description: Residential		Site Location: 5 Fantail Drive	
Start Time: 11:00	11:15	Duration: 15 minutes	L_{eq}: 56.3

Site Sketch: (Plan View)

Notes:

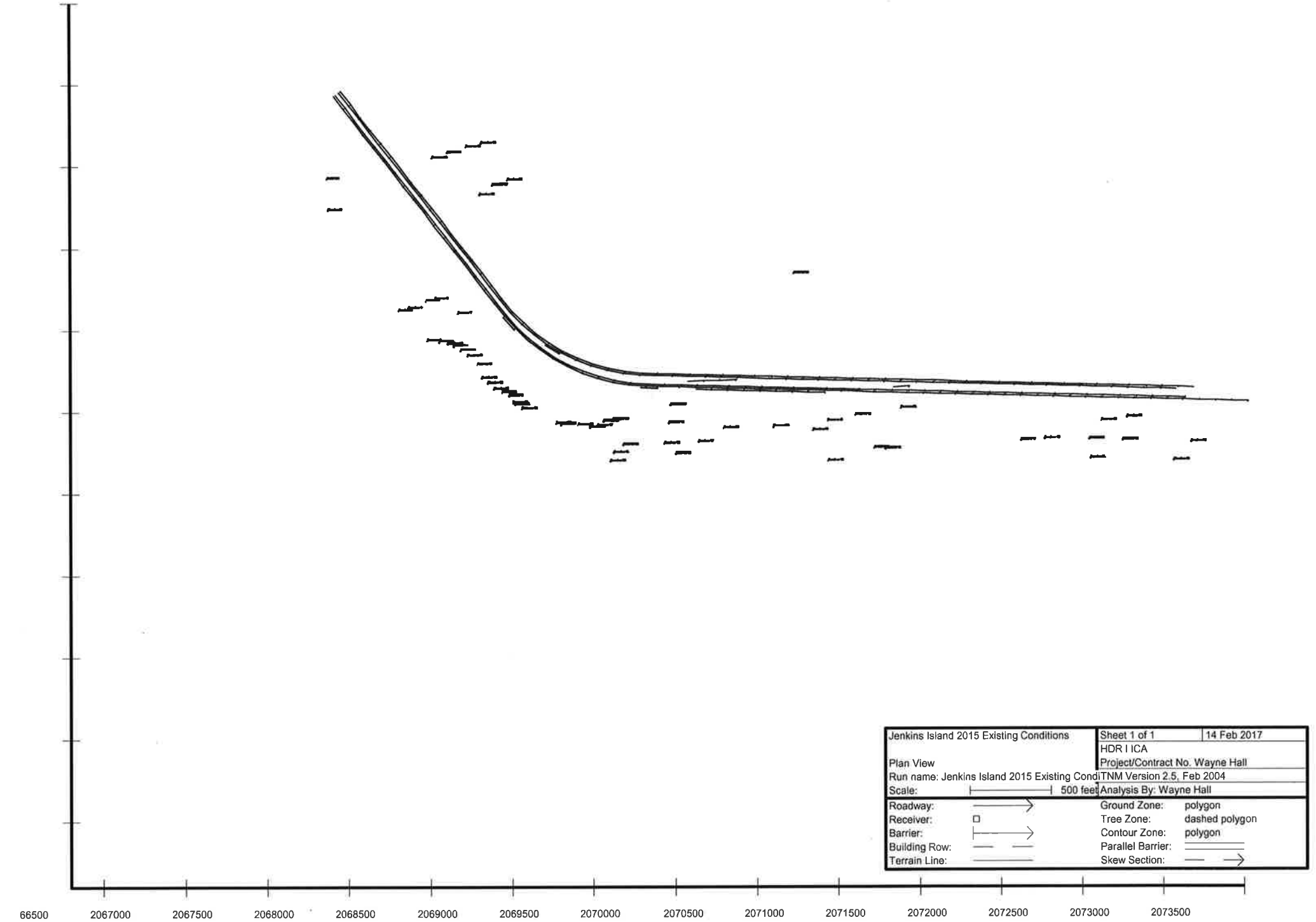
Traffic Counts	**US 278**
Autos:	East Bound – 393, West Bound – 394
Medium Trucks:	East Bound – 24, West Bound – 21
Heavy Trucks:	East Bound – 15, West Bound – 8
Buses:	East Bound – 0, West Bound – 0
Motorcycles:	East Bound – 0, West Bound – 0

Traffic Data

Traffic Data for Noise Analysis

Roadway Section	Speed (mph)	Two Way Design Hourly Traffic	One Way Hourly Traffic (vph)	Hourly Volume Cars (vph)	Hourly Volume Medium Trucks (vph)	Hourly Heavy Trucks (vph)
2015 Traffic Computations						
US 278	50	5470	2735	2461	175	99
2035 Traffic Computations						
US 278	50	5870	2935	2641	188	106

2015 Existing Noise Levels


Jenkins Island 2015 Existing Conditions
Sheet 1 of 1
14 Feb 2017
HDR I ICA
Plan View
Project/Contract No. Wayne Hall
Run name: Jenkins Island 2015 Existing Condi
TNM Version 2.5, Feb 2004
Scale:
500 feet
Analysis By: Wayne Hall
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
66500
2067000
2067500
2068000
2068500
2069000
2069500
2070000
2070500
2071000
2071500
2072000
2072500
2073000
2073500

HDR I ICA
Wayne Hall

21 February 2017
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Wayne Hall
RUN: Jenkins Island 2015 Existing Conditions
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

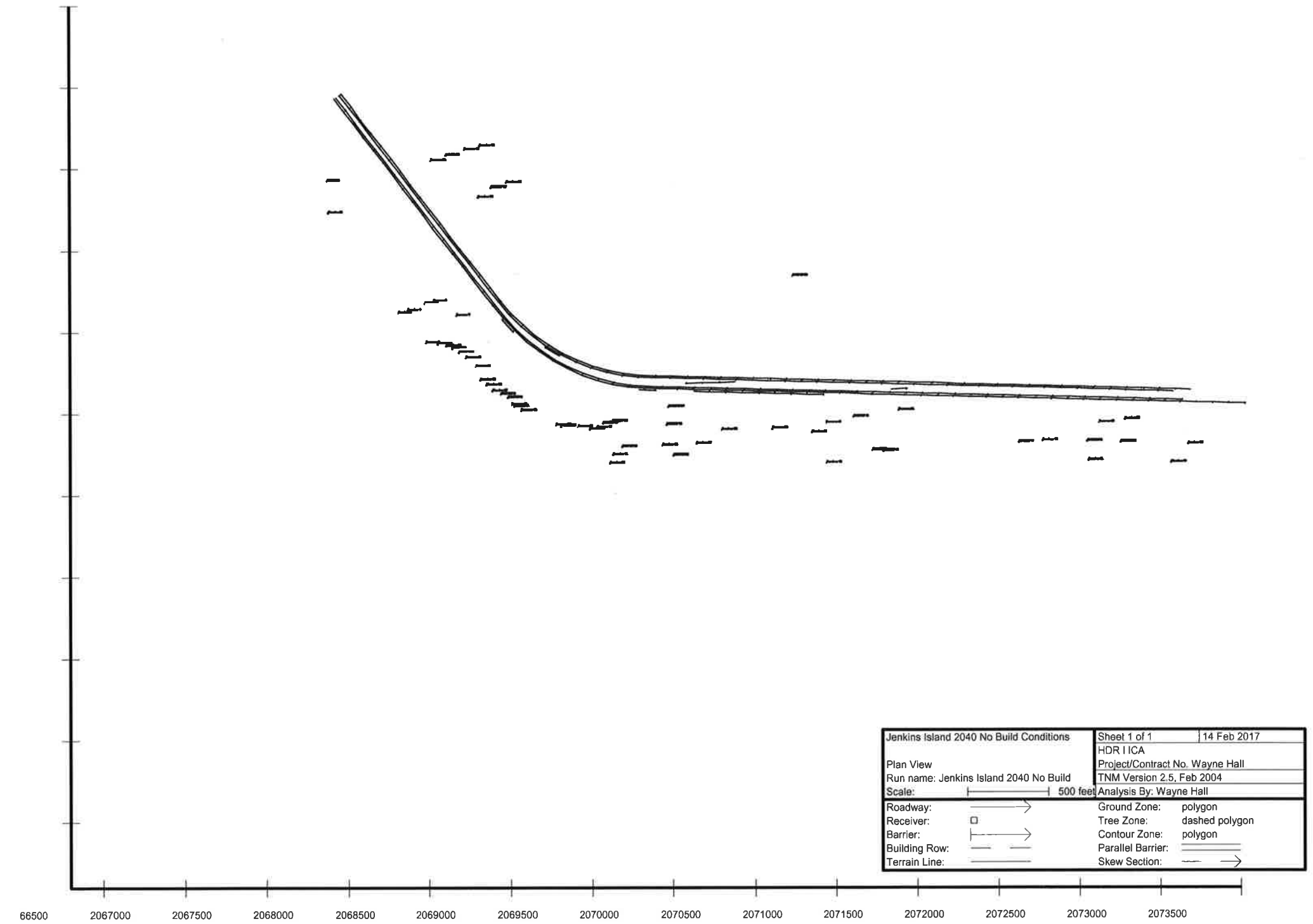
Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h		Increase over existing		Type Impact	With Barrier Calculated LAeq1h	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver1	1	1	0.0	59.3	66	59.3	15	----	59.3	0.0	8	-8.0
Receiver2	2	1	0.0	58.0	66	58.0	15	----	58.0	0.0	8	-8.0
Receiver3	3	1	0.0	58.0	66	58.0	15	----	58.0	0.0	8	-8.0
Receiver4	4	1	0.0	59.0	66	59.0	15	----	59.0	0.0	8	-8.0
Receiver5	5	1	0.0	61.3	66	61.3	15	----	61.3	0.0	8	-8.0
Receiver6	6	1	0.0	62.1	66	62.1	15	----	62.1	0.0	8	-8.0
Receiver7	7	1	0.0	64.4	66	64.4	15	----	64.4	0.0	8	-8.0
Receiver8	8	1	0.0	58.1	66	58.1	15	----	58.1	0.0	8	-8.0
Receiver9	9	1	0.0	59.1	66	59.1	15	----	59.1	0.0	8	-8.0
Receiver10	10	1	0.0	59.6	66	59.6	15	----	59.6	0.0	8	-8.0
Receiver11	11	1	0.0	60.1	66	60.1	15	----	60.1	0.0	8	-8.0
Receiver12	12	1	0.0	60.2	66	60.2	15	----	60.2	0.0	8	-8.0
Receiver13	13	1	0.0	60.5	66	60.5	15	----	60.5	0.0	8	-8.0
Receiver14	14	1	0.0	60.4	66	60.4	15	----	60.4	0.0	8	-8.0
Receiver15	15	1	0.0	59.6	66	59.6	15	----	59.6	0.0	8	-8.0
Receiver16	16	1	0.0	59.7	66	59.7	15	----	59.7	0.0	8	-8.0
Receiver17	17	1	0.0	59.5	66	59.5	15	----	59.5	0.0	8	-8.0
Receiver18	18	1	0.0	59.7	66	59.7	15	----	59.7	0.0	8	-8.0
Receiver19	19	1	0.0	59.8	66	59.8	15	----	59.8	0.0	8	-8.0
Receiver20	20	1	0.0	60.4	66	60.4	15	----	60.4	0.0	8	-8.0
Receiver21	21	1	0.0	60.4	66	60.4	15	----	60.4	0.0	8	-8.0
Receiver22	22	1	0.0	60.2	66	60.2	15	----	60.2	0.0	8	-8.0
Receiver23	23	1	0.0	60.7	66	60.7	15	----	60.7	0.0	8	-8.0
Receiver24	24	1	0.0	60.9	66	60.9	15	----	60.9	0.0	8	-8.0
Receiver25	25	1	0.0	61.5	66	61.5	15	----	61.5	0.0	8	-8.0
Receiver26	26	1	0.0	61.7	66	61.7	15	----	61.7	0.0	8	-8.0
Receiver27	27	1	0.0	62.1	66	62.1	15	----	62.1	0.0	8	-8.0
Receiver28	28	1	0.0	63.0	66	63.0	15	----	63.0	0.0	8	-8.0
Receiver29	29	1	0.0	63.8	66	63.8	15	----	63.8	0.0	8	-8.0
Receiver30	30	1	0.0	58.0	66	58.0	15	----	58.0	0.0	8	-8.0
Receiver31	31	1	0.0	58.8	66	58.8	15	----	58.8	0.0	8	-8.0
Receiver32	32	1	0.0	59.9	66	59.9	15	----	59.9	0.0	8	-8.0
Receiver33	33	1	0.0	68.8	71	68.8	15	----	68.8	0.0	8	-8.0

Receiver34	34	1	0.0	64.0	66	64.0	15	----	64.0	0.0	8	-8.0
Receiver35	35	1	0.0	60.3	66	60.3	15	----	60.3	0.0	8	-8.0
Receiver36	36	1	0.0	59.2	66	59.2	15	----	59.2	0.0	8	-8.0
Receiver37	37	1	0.0	60.9	66	60.9	15	----	60.9	0.0	8	-8.0
Receiver38	38	1	0.0	64.3	66	64.3	15	----	64.3	0.0	8	-8.0
Receiver39	39	1	0.0	64.6	66	64.6	15	----	64.6	0.0	8	-8.0
Receiver40	40	1	0.0	63.1	66	63.1	15	----	63.1	0.0	8	-8.0
Receiver41	41	1	0.0	65.0	66	65.0	15	----	65.0	0.0	8	-8.0
Receiver42	42	1	0.0	58.5	66	58.5	15	----	58.5	0.0	8	-8.0
Receiver43	43	1	0.0	66.5	66	66.5	15	Snd Lvl	66.5	0.0	8	-8.0
Receiver44	44	1	0.0	59.7	66	59.7	15	----	59.7	0.0	8	-8.0
Receiver45	45	1	0.0	59.5	66	59.5	15	----	59.5	0.0	8	-8.0
Receiver46	46	1	0.0	69.2	66	69.2	15	Snd Lvl	69.2	0.0	8	-8.0
Receiver47	47	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
Receiver48	48	1	0.0	61.4	66	61.4	15	----	61.4	0.0	8	-8.0
Receiver49	49	1	0.0	66.6	66	66.6	15	Snd Lvl	66.6	0.0	8	-8.0
Receiver50	50	1	0.0	61.5	66	61.5	15	----	61.5	0.0	8	-8.0
Receiver51	51	1	0.0	58.6	66	58.6	15	----	58.6	0.0	8	-8.0
Receiver52	52	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
Receiver53	53	1	0.0	67.6	66	67.6	15	Snd Lvl	67.6	0.0	8	-8.0
Receiver54	54	1	0.0	56.9	66	56.9	15	----	56.9	0.0	8	-8.0
Receiver55	55	1	0.0	59.1	66	59.1	15	----	59.1	0.0	8	-8.0
Receiver56	56	1	0.0	62.2	66	62.2	15	----	62.2	0.0	8	-8.0
Receiver57	57	1	0.0	60.3	66	60.3	15	----	60.3	0.0	8	-8.0
Receiver58	58	1	0.0	59.0	66	59.0	15	----	59.0	0.0	8	-8.0
Receiver59	59	1	0.0	57.9	66	57.9	15	----	57.9	0.0	8	-8.0
Receiver60	60	1	0.0	59.4	66	59.4	15	----	59.4	0.0	8	-8.0
Receiver61	61	1	0.0	61.7	66	61.7	15	----	61.7	0.0	8	-8.0
Receiver62	62	1	0.0	64.3	66	64.3	15	----	64.3	0.0	8	-8.0
Receiver63	64	1	0.0	55.2	66	55.2	15	----	55.2	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	63	0.0	0.0	0.0
All Impacted	4	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

2040 No-Build Noise Levels


Jenkins Island 2040 No Build Conditions
Plan View
Run name: Jenkins Island 2040 No Build
Scale: 500 feet
Sheet 1 of 1
14 Feb 2017
HDR I ICA
Project/Contract No. Wayne Hall
TNM Version 2.5, Feb 2004
Analysis By: Wayne Hall
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
66500
2067000
2067500
2068000
2068500
2069000
2069500
2070000
2070500
2071000
2071500
2072000
2072500
2073000
2073500

HDR I ICA
Wayne Hall

21 February 2017
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Wayne Hall
RUN: Jenkins Island 2040 No Build Conditions
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

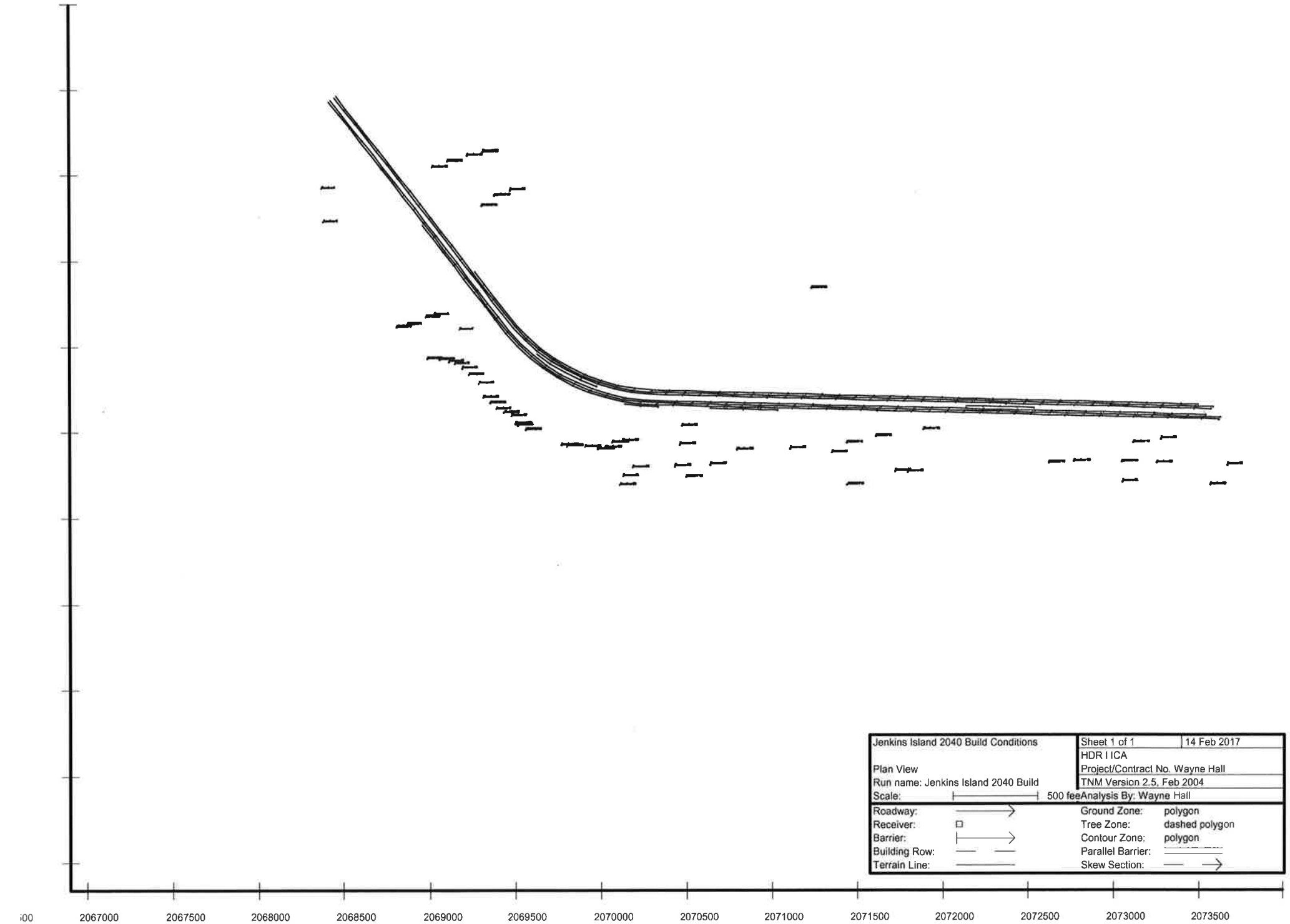
Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier					With Barrier			
				LAeq1h		Increase over existing		Type Impact	Calculated LAeq1h	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver1	1	1	0.0	59.5	66	59.5	15	----	59.5	0.0	8	-8.0
Receiver2	2	1	0.0	58.3	66	58.3	15	----	58.3	0.0	8	-8.0
Receiver3	3	1	0.0	58.3	66	58.3	15	----	58.3	0.0	8	-8.0
Receiver4	4	1	0.0	59.3	66	59.3	15	----	59.3	0.0	8	-8.0
Receiver5	5	1	0.0	61.6	66	61.6	15	----	61.6	0.0	8	-8.0
Receiver6	6	1	0.0	62.4	66	62.4	15	----	62.4	0.0	8	-8.0
Receiver7	7	1	0.0	64.6	66	64.6	15	----	64.6	0.0	8	-8.0
Receiver8	8	1	0.0	58.4	66	58.4	15	----	58.4	0.0	8	-8.0
Receiver9	9	1	0.0	59.4	66	59.4	15	----	59.4	0.0	8	-8.0
Receiver10	10	1	0.0	59.9	66	59.9	15	----	59.9	0.0	8	-8.0
Receiver11	11	1	0.0	60.3	66	60.3	15	----	60.3	0.0	8	-8.0
Receiver12	12	1	0.0	60.5	66	60.5	15	----	60.5	0.0	8	-8.0
Receiver13	13	1	0.0	60.8	66	60.8	15	----	60.8	0.0	8	-8.0
Receiver14	14	1	0.0	60.7	66	60.7	15	----	60.7	0.0	8	-8.0
Receiver15	15	1	0.0	59.9	66	59.9	15	----	59.9	0.0	8	-8.0
Receiver16	16	1	0.0	60.0	66	60.0	15	----	60.0	0.0	8	-8.0
Receiver17	17	1	0.0	59.7	66	59.7	15	----	59.7	0.0	8	-8.0
Receiver18	18	1	0.0	60.0	66	60.0	15	----	60.0	0.0	8	-8.0
Receiver19	19	1	0.0	60.0	66	60.0	15	----	60.0	0.0	8	-8.0
Receiver20	20	1	0.0	60.7	66	60.7	15	----	60.7	0.0	8	-8.0
Receiver21	21	1	0.0	60.7	66	60.7	15	----	60.7	0.0	8	-8.0
Receiver22	22	1	0.0	60.5	66	60.5	15	----	60.5	0.0	8	-8.0
Receiver23	23	1	0.0	61.0	66	61.0	15	----	61.0	0.0	8	-8.0
Receiver24	24	1	0.0	61.1	66	61.1	15	----	61.1	0.0	8	-8.0
Receiver25	25	1	0.0	61.8	66	61.8	15	----	61.8	0.0	8	-8.0
Receiver26	26	1	0.0	62.0	66	62.0	15	----	62.0	0.0	8	-8.0
Receiver27	27	1	0.0	62.4	66	62.4	15	----	62.4	0.0	8	-8.0
Receiver28	28	1	0.0	63.3	66	63.3	15	----	63.3	0.0	8	-8.0
Receiver29	29	1	0.0	64.1	66	64.1	15	----	64.1	0.0	8	-8.0
Receiver30	30	1	0.0	58.3	66	58.3	15	----	58.3	0.0	8	-8.0
Receiver31	31	1	0.0	59.1	66	59.1	15	----	59.1	0.0	8	-8.0
Receiver32	32	1	0.0	60.2	66	60.2	15	----	60.2	0.0	8	-8.0
Receiver33	33	1	0.0	69.1	71	69.1	15	----	69.1	0.0	8	-8.0

Receiver34	34	1	0.0	64.3	66	64.3	15	----	64.3	0.0	8	-8.0
Receiver35	35	1	0.0	60.6	66	60.6	15	----	60.6	0.0	8	-8.0
Receiver36	36	1	0.0	59.4	66	59.4	15	----	59.4	0.0	8	-8.0
Receiver37	37	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
Receiver38	38	1	0.0	64.6	66	64.6	15	----	64.6	0.0	8	-8.0
Receiver39	39	1	0.0	64.8	66	64.8	15	----	64.8	0.0	8	-8.0
Receiver40	40	1	0.0	63.3	66	63.3	15	----	63.3	0.0	8	-8.0
Receiver41	41	1	0.0	65.2	66	65.2	15	----	65.2	0.0	8	-8.0
Receiver42	42	1	0.0	58.8	66	58.8	15	----	58.8	0.0	8	-8.0
Receiver43	43	1	0.0	66.8	66	66.8	15	Snd Lvl	66.8	0.0	8	-8.0
Receiver44	44	1	0.0	60.0	66	60.0	15	----	60.0	0.0	8	-8.0
Receiver45	45	1	0.0	59.8	66	59.8	15	----	59.8	0.0	8	-8.0
Receiver46	46	1	0.0	69.5	66	69.5	15	Snd Lvl	69.5	0.0	8	-8.0
Receiver47	47	1	0.0	61.4	66	61.4	15	----	61.4	0.0	8	-8.0
Receiver48	48	1	0.0	61.7	66	61.7	15	----	61.7	0.0	8	-8.0
Receiver49	49	1	0.0	66.9	66	66.9	15	Snd Lvl	66.9	0.0	8	-8.0
Receiver50	50	1	0.0	61.8	66	61.8	15	----	61.8	0.0	8	-8.0
Receiver51	51	1	0.0	58.8	66	58.8	15	----	58.8	0.0	8	-8.0
Receiver52	52	1	0.0	61.5	66	61.5	15	----	61.5	0.0	8	-8.0
Receiver53	53	1	0.0	67.9	66	67.9	15	Snd Lvl	67.9	0.0	8	-8.0
Receiver54	54	1	0.0	57.2	66	57.2	15	----	57.2	0.0	8	-8.0
Receiver55	55	1	0.0	59.4	66	59.4	15	----	59.4	0.0	8	-8.0
Receiver56	56	1	0.0	62.5	66	62.5	15	----	62.5	0.0	8	-8.0
Receiver57	57	1	0.0	60.6	66	60.6	15	----	60.6	0.0	8	-8.0
Receiver58	58	1	0.0	59.2	66	59.2	15	----	59.2	0.0	8	-8.0
Receiver59	59	1	0.0	58.2	66	58.2	15	----	58.2	0.0	8	-8.0
Receiver60	60	1	0.0	59.6	66	59.6	15	----	59.6	0.0	8	-8.0
Receiver61	61	1	0.0	61.9	66	61.9	15	----	61.9	0.0	8	-8.0
Receiver62	62	1	0.0	64.6	66	64.6	15	----	64.6	0.0	8	-8.0
Receiver63	64	1	0.0	55.4	66	55.4	15	----	55.4	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	63	0.0	0.0	0.0
All Impacted	4	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

2040 Build Noise Levels


Jenkins Island 2040 Build Conditions
Sheet 1 of 1
14 Feb 2017
HDR I ICA
Plan View
Project/Contract No. Wayne Hall
Run name: Jenkins Island 2040 Build
TNM Version 2.5, Feb 2004
Scale:
500 fee
Analysis By: Wayne Hall
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
2067000
2067500
2068000
2068500
2069000
2069500
2070000
2070500
2071000
2071500
2072000
2072500
2073000
2073500

HDR I ICA
Wayne Hall

21 February 2017
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Wayne Hall
RUN: Jenkins Island 2040 Build Conditions
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

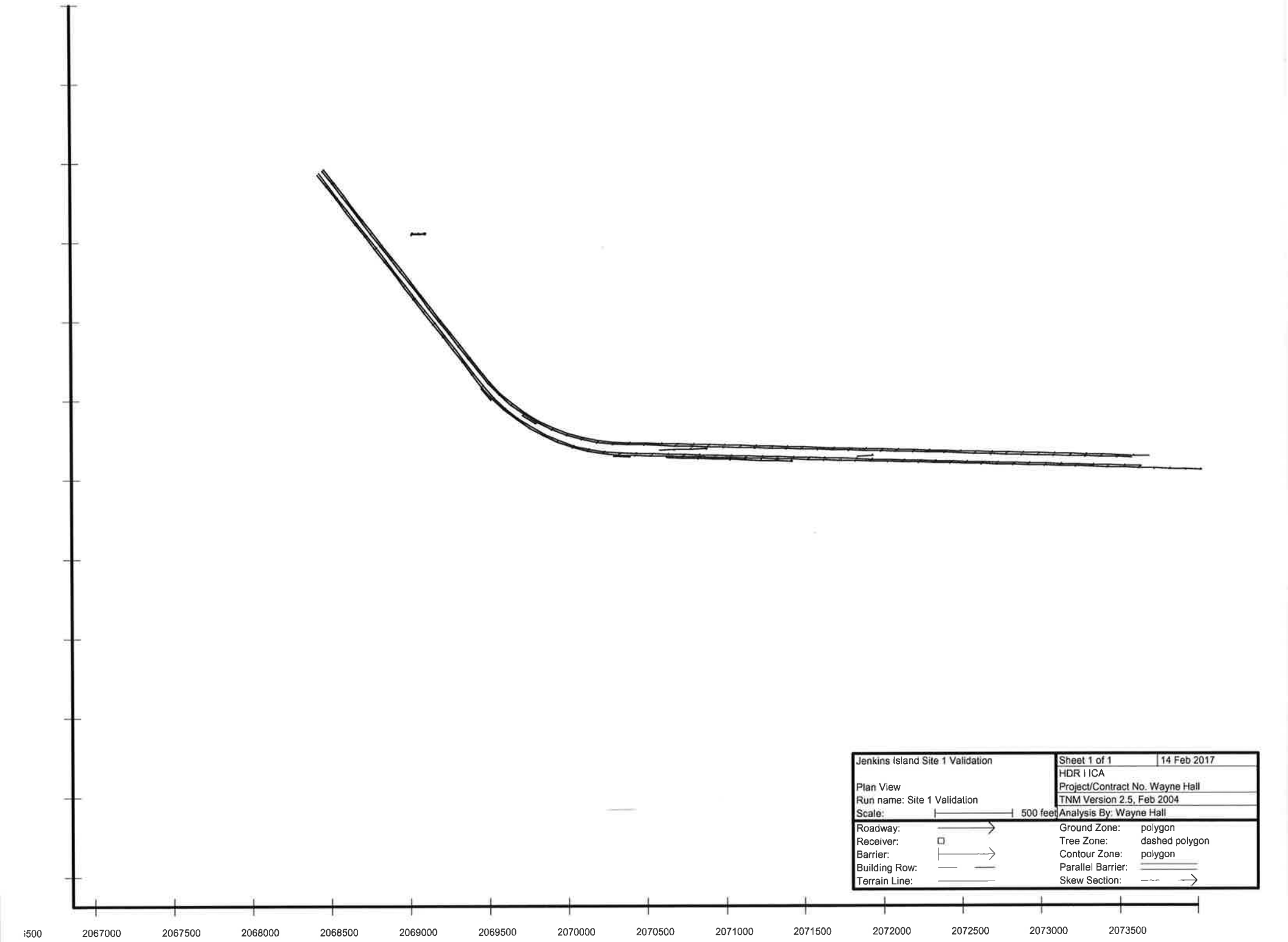
Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver1	1	1	0.0	57.5	66	57.5	15	----	57.5	0.0	8	-8.0
Receiver2	2	1	0.0	56.6	66	56.6	15	----	56.6	0.0	8	-8.0
Receiver3	3	1	0.0	57.6	66	57.6	15	----	57.6	0.0	8	-8.0
Receiver4	4	1	0.0	58.8	66	58.8	15	----	58.8	0.0	8	-8.0
Receiver5	5	1	0.0	61.3	66	61.3	15	----	61.3	0.0	8	-8.0
Receiver6	6	1	0.0	62.5	66	62.5	15	----	62.5	0.0	8	-8.0
Receiver7	7	1	0.0	65.0	66	65.0	15	----	65.0	0.0	8	-8.0
Receiver8	8	1	0.0	58.3	66	58.3	15	----	58.3	0.0	8	-8.0
Receiver9	9	1	0.0	59.3	66	59.3	15	----	59.3	0.0	8	-8.0
Receiver10	10	1	0.0	59.9	66	59.9	15	----	59.9	0.0	8	-8.0
Receiver11	11	1	0.0	60.1	66	60.1	15	----	60.1	0.0	8	-8.0
Receiver12	12	1	0.0	60.5	66	60.5	15	----	60.5	0.0	8	-8.0
Receiver13	13	1	0.0	60.5	66	60.5	15	----	60.5	0.0	8	-8.0
Receiver14	14	1	0.0	60.5	66	60.5	15	----	60.5	0.0	8	-8.0
Receiver15	15	1	0.0	59.7	66	59.7	15	----	59.7	0.0	8	-8.0
Receiver16	16	1	0.0	59.7	66	59.7	15	----	59.7	0.0	8	-8.0
Receiver17	17	1	0.0	59.7	66	59.7	15	----	59.7	0.0	8	-8.0
Receiver18	18	1	0.0	59.9	66	59.9	15	----	59.9	0.0	8	-8.0
Receiver19	19	1	0.0	60.1	66	60.1	15	----	60.1	0.0	8	-8.0
Receiver20	20	1	0.0	60.0	66	60.0	15	----	60.0	0.0	8	-8.0
Receiver21	21	1	0.0	60.4	66	60.4	15	----	60.4	0.0	8	-8.0
Receiver22	22	1	0.0	60.3	66	60.3	15	----	60.3	0.0	8	-8.0
Receiver23	23	1	0.0	60.6	66	60.6	15	----	60.6	0.0	8	-8.0
Receiver24	24	1	0.0	60.7	66	60.7	15	----	60.7	0.0	8	-8.0
Receiver25	25	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
Receiver26	26	1	0.0	61.8	66	61.8	15	----	61.8	0.0	8	-8.0
Receiver27	27	1	0.0	62.3	66	62.3	15	----	62.3	0.0	8	-8.0
Receiver28	28	1	0.0	62.2	66	62.2	15	----	62.2	0.0	8	-8.0
Receiver29	29	1	0.0	63.9	66	63.9	15	----	63.9	0.0	8	-8.0
Receiver30	30	1	0.0	58.8	66	58.8	15	----	58.8	0.0	8	-8.0
Receiver31	31	1	0.0	59.6	66	59.6	15	----	59.6	0.0	8	-8.0
Receiver32	32	1	0.0	60.7	66	60.7	15	----	60.7	0.0	8	-8.0
Receiver33	33	1	0.0	69.4	71	69.4	15	----	69.4	0.0	8	-8.0

Receiver34	34	1	0.0	64.3	66	64.3	15	----	64.3	0.0	8	-8.0
Receiver35	35	1	0.0	61.2	66	61.2	15	----	61.2	0.0	8	-8.0
Receiver36	36	1	0.0	60.1	66	60.1	15	----	60.1	0.0	8	-8.0
Receiver37	37	1	0.0	61.7	66	61.7	15	----	61.7	0.0	8	-8.0
Receiver38	38	1	0.0	64.2	66	64.2	15	----	64.2	0.0	8	-8.0
Receiver39	39	1	0.0	64.3	66	64.3	15	----	64.3	0.0	8	-8.0
Receiver40	40	1	0.0	63.6	66	63.6	15	----	63.6	0.0	8	-8.0
Receiver41	41	1	0.0	65.5	66	65.5	15	----	65.5	0.0	8	-8.0
Receiver42	42	1	0.0	59.9	66	59.9	15	----	59.9	0.0	8	-8.0
Receiver43	43	1	0.0	67.6	66	67.6	15	Snd Lvl	67.6	0.0	8	-8.0
Receiver44	44	1	0.0	61.4	66	61.4	15	----	61.4	0.0	8	-8.0
Receiver45	45	1	0.0	61.4	66	61.4	15	----	61.4	0.0	8	-8.0
Receiver46	46	1	0.0	70.4	66	70.4	15	Snd Lvl	70.4	0.0	8	-8.0
Receiver47	47	1	0.0	62.8	66	62.8	15	----	62.8	0.0	8	-8.0
Receiver48	48	1	0.0	63.0	66	63.0	15	----	63.0	0.0	8	-8.0
Receiver49	49	1	0.0	67.3	66	67.3	15	Snd Lvl	67.3	0.0	8	-8.0
Receiver50	50	1	0.0	62.7	66	62.7	15	----	62.7	0.0	8	-8.0
Receiver51	51	1	0.0	60.1	66	60.1	15	----	60.1	0.0	8	-8.0
Receiver52	52	1	0.0	62.4	66	62.4	15	----	62.4	0.0	8	-8.0
Receiver53	53	1	0.0	68.5	66	68.5	15	Snd Lvl	68.5	0.0	8	-8.0
Receiver54	54	1	0.0	57.6	66	57.6	15	----	57.6	0.0	8	-8.0
Receiver55	55	1	0.0	58.8	66	58.8	15	----	58.8	0.0	8	-8.0
Receiver56	56	1	0.0	61.0	66	61.0	15	----	61.0	0.0	8	-8.0
Receiver57	57	1	0.0	59.3	66	59.3	15	----	59.3	0.0	8	-8.0
Receiver58	58	1	0.0	58.0	66	58.0	15	----	58.0	0.0	8	-8.0
Receiver59	59	1	0.0	57.0	66	57.0	15	----	57.0	0.0	8	-8.0
Receiver60	60	1	0.0	58.1	66	58.1	15	----	58.1	0.0	8	-8.0
Receiver61	61	1	0.0	60.0	66	60.0	15	----	60.0	0.0	8	-8.0
Receiver62	62	1	0.0	62.4	66	62.4	15	----	62.4	0.0	8	-8.0
Receiver63	64	1	0.0	57.0	66	57.0	15	----	57.0	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	63	0.0	0.0	0.0
All Impacted	4	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

TNM Validations


Jenkins Island Site 1 Validation
Plan View
Run name: Site 1 Validation
Scale: 500 feet
Sheet 1 of 1
14 Feb 2017
HDR | ICA
Project/Contract No. Wayne Hall
TNM Version 2.5, Feb 2004
Analysis By: Wayne Hall
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
500
2067000
2067500
2068000
2068500
2069000
2069500
2070000
2070500
2071000
2071500
2072000
2072500
2073000
2073500

HDR I ICA
Wayne Hall

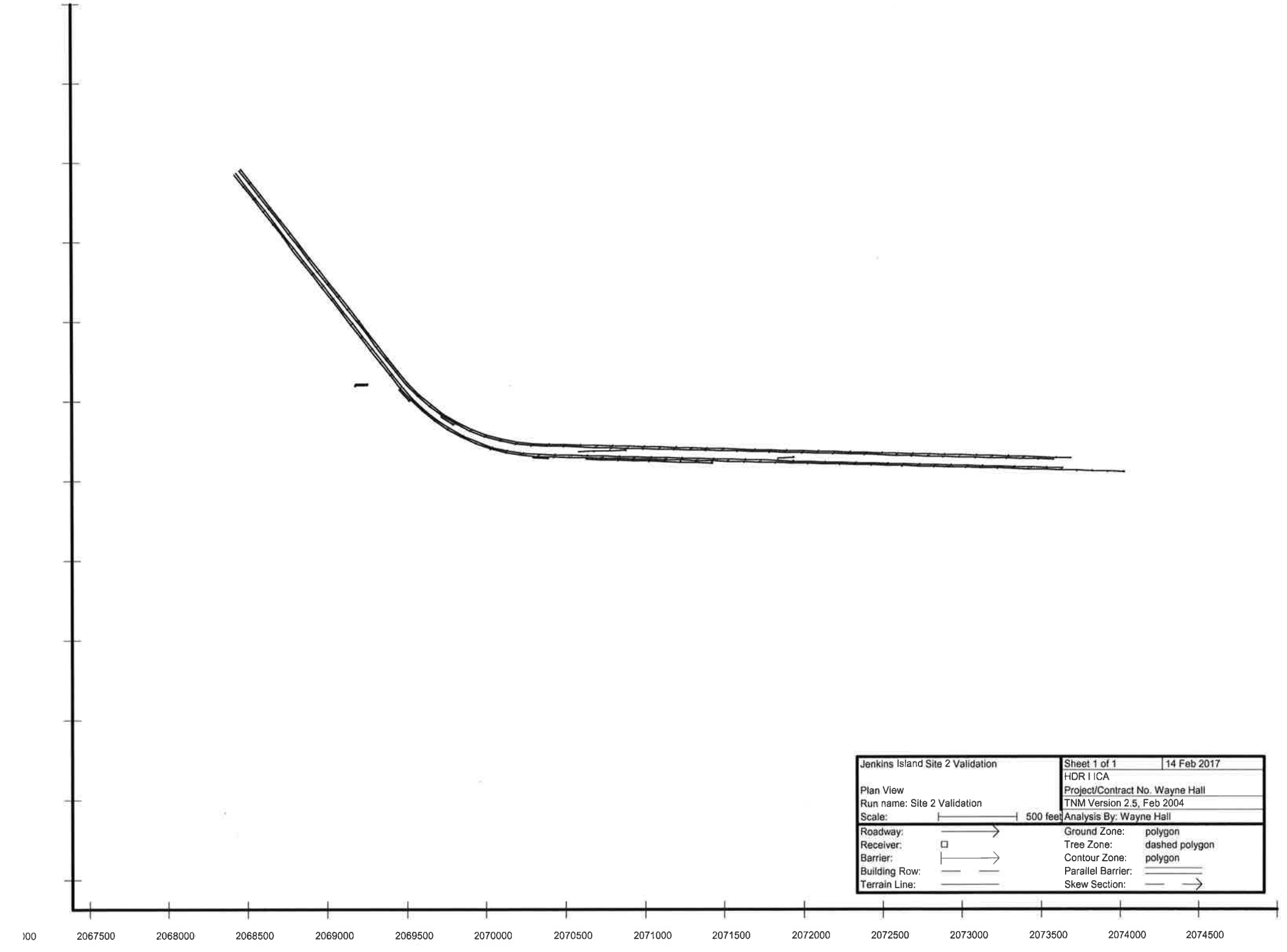
14 February 2017
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Wayne Hall
RUN: Jenkins Island Site 1 Validation
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver62	62	1	0.0	64.1	66	64.1	15	----	64.1	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	1	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0


Jenkins Island Site 2 Validation
Plan View
Run name: Site 2 Validation
Scale: 500 feet
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Sheet 1 of 1
14 Feb 2017
HDR I ICA
Project/Contract No. Wayne Hall
TNM Version 2.5, Feb 2004
Analysis By: Wayne Hall
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
)00
2067500
2068000
2068500
2069000
2069500
2070000
2070500
2071000
2071500
2072000
2072500
2073000
2073500
2074000
2074500

HDR I ICA
Wayne Hall

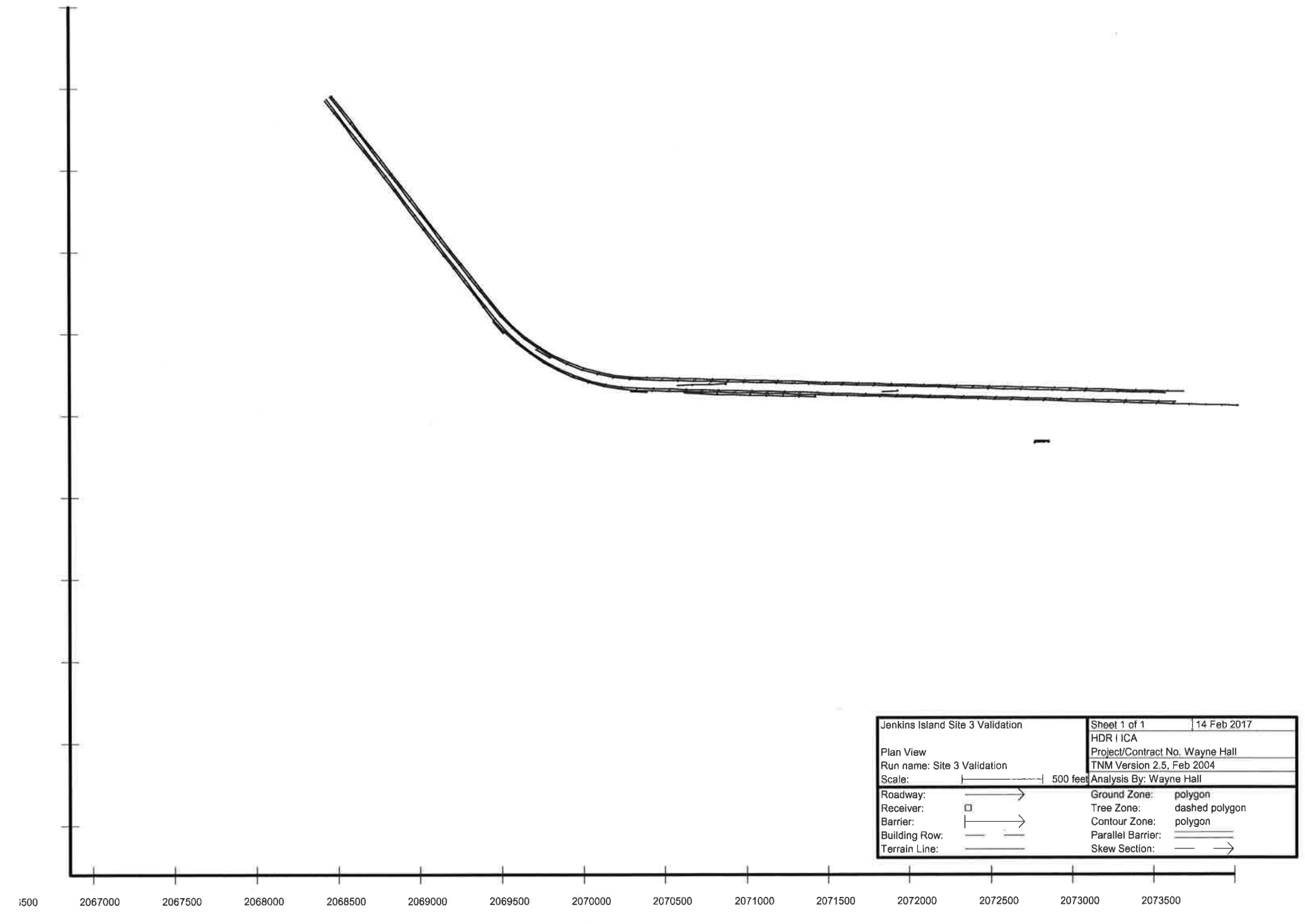
14 February 2017
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Wayne Hall
RUN: Jenkins Island Site 2 Validation
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver7	7	1	0.0	62.1	66	62.1	15	----	62.1	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	1	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0


Jenkins Island Site 3 Validation
Plan View
Run name: Site 3 Validation
Scale: 500 feet
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Sheet 1 of 1
14 Feb 2017
HDR | ICA
Project/Contract No. Wayne Hall
TNM Version 2.5, Feb 2004
Analysis By: Wayne Hall
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
2067000
2067500
2068000
2068500
2069000
2069500
2070000
2070500
2071000
2071500
2072000
2072500
2073000
2073500

HDR I ICA
Wayne Hall

14 February 2017
TNM 2.5
Calculated with TNM 2.5

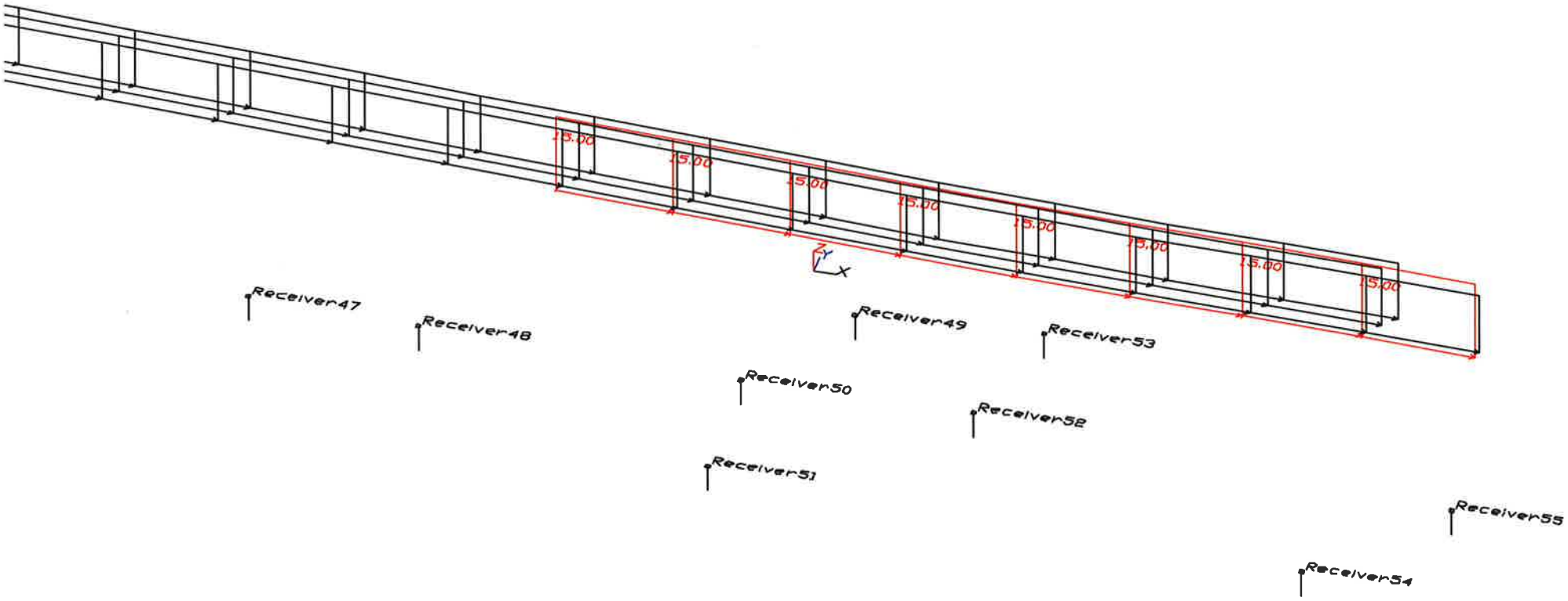
RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Wayne Hall
RUN: Jenkins Island Site 3 Validation
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver48	48	1	0.0	58.8	66	58.8	15	----	58.8	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	1	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Barrier Analysis



Jenkins Island 2035 Barrier 1		Sheet 1 of 1	16 Feb 2017
		HDR I ICA	
Barrier View-unsaved		Project/Contract No. Wayne Hall	
Run name: Barrier 1		TNM Version 2.5, Feb 2004	
Scale: <DNA - due to perspective>		Analysis By: Wayne Hall	
Roadway:	→	Ground Zone:	polygon
Receiver:	□	Tree Zone:	dashed polygon
Barrier:	⊢→	Contour Zone:	polygon
Building Row:	— —	Parallel Barrier:	═══
Terrain Line:	———	Skew Section:	—→

HDR I ICA
16 February 2017
Wayne Hall
TNM 2.5
Calculated with TNM 2.5
RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Wayne Hall
RUN: Jenkins Island 2035 Barrier 1
BARRIER DESIGN: Barrier 1
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Increase over existing Crit'n Sub'l Inc	With Barrier Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Noise Reduction Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver47	47	1	62.3	62.7	66	0.4	15	----	62.0	0.7	8	-7.3
Receiver48	48	1	62.4	62.9	66	0.5	15	----	61.2	1.7	8	-6.3
Receiver49	49	1	66.4	67.0	66	0.6	15	Snd Lvl	59.4	7.6	8	-0.4
Receiver50	50	1	62.0	62.5	66	0.5	15	----	57.8	4.7	8	-3.3
Receiver51	51	1	59.3	59.8	66	0.5	15	----	56.3	3.5	8	-4.5
Receiver52	52	1	61.4	61.9	66	0.5	15	----	55.9	6.0	8	-2.0
Receiver53	53	1	67.5	68.0	66	0.5	15	Snd Lvl	58.6	9.4	8	1.4
Receiver54	54	1	56.4	56.8	66	0.4	15	----	52.0	4.8	8	-3.2
Receiver55	55	1	57.6	58.0	66	0.4	15	----	52.4	5.6	8	-2.4

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	9	0.7	4.9	9.4
All Impacted	2	7.6	8.5	9.4
All that meet NR Goal	1	9.4	9.4	9.4

HDR I ICA
Wayne Hall

16-Feb-17
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: US 278
RUN: Jenkins Island 2040 Barrier 1
BARRIER DESIGN: Barrier 1

ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Increase over existing Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	With Barrier Noise Reduction Calculated	With Barrier Noise Reduction Goal	With Barrier Noise Reduction Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver47	47	1	62.3	62.7	66	0.4	15	----	62	0.7	8	-7.3
Receiver48	48	1	62.4	62.9	66	0.5	15	----	61.2	1.7	8	-6.3
Receiver49	49	1	66.4	67	66	0.6	15	Snd Lvl	59.4	7.6	8	-0.4
Receiver50	50	1	62	62.5	66	0.5	15	----	57.8	4.7	8	-3.3
Receiver51	51	1	59.3	59.8	66	0.5	15	----	56.3	3.5	8	-4.5
Receiver52	52	1	61.4	61.9	66	0.5	15	----	55.9	6	8	-2
Receiver53	53	1	67.5	68	66	0.5	15	Snd Lvl	58.6	9.4	8	1.4
Receiver54	54	1	56.4	56.8	66	0.4	15	----	52	4.8	8	-3.2
Receiver55	55	1	57.6	58	66	0.4	15	----	52.4	5.6	8	-2.4

Dwelling Units	# DUs	Noise Reduction Min dB	Noise Reduction Avg dB	Noise Reduction Max dB
All Selected	9	0.7	4.9	9.4
All Impacted	2	7.6	8.5	9.4
All that meet NR Goal	1	9.4	9.4	9.4

Feasible to reduce noise levels at 75% of impacted receptors by at least 5dBA

HDR I ICA
Wayne Hall

16-Feb-17
TNM 2.5

RESULTS: BARRIER DESC
PROJECT/CONTRACT: Wayne Hall
RUN: Jenkins Island 2035 Barrier 1
BARRIER DESIGN: Barrier 1

Barriers Name	Type	Heights along Barrier Min	Heights along Barrier Avg	Heights along Barrier Max	Length	If Wall Area	If Berm Volume	Top Width	Run:Rise	Cost
		ft	ft	ft	ft	sq ft	cu yd	ft	ft:ft	$
Barrier1	W	15	15	15	802	12032				$421,112
									Total Cost:	$421,112

SCDOT Feasibility and Reasonableness Worksheet

Date: 2/13/2017

Project Name US 278 Improvements

Highway Traffic Noise Abatement Measure Barrier 1

Feasibility

Number of Impacted Receivers: 2

Number of Benefited Receivers: 4

Percentage of Impacted Receivers that would achieve a 5 dBA reduction from the proposed noise abatement measure: 100%

Is the proposed noise abatement measure acoustically feasible?
NOTE:SCDOT Policy indicates that 75% of the impacted receivers must achieve at least a 5 dBA reduction for it to be acoustically feasible.

☒ Yes ☐ No

Would any of the following issues limit the ability of the abatement measure to achieve the noise reduction goal?

Topography	☐ Yes	☐ No
Safety	☐ Yes	☐ No
Drainage	☐ Yes	☐ No
Utilities	☐ Yes	☐ No
Maintenance	☐ Yes	☐ No
Access	☐ Yes	☐ No
Exposed Height of Wall	☐ Yes	☐ No

If "Yes" was marked for any of the questions above, please explain below.

Reasonableness

According to 23 CFR 772.13(d)(2)(iv) the abatement measure must collectively achieve each of these criteria to be reasonable. Therefore if any of the three mandatory reasonable factors are not achieved, then the abatement measure is determined NOT to be reasonable. When completing the form it is not necessary to detail each of the criteria if one was determined not to be reasonable.

#1: Noise Reduction Design Goal

Number of Benefited Receivers: 4

Number of Benefited Receivers that achieve at least an 8 dBA reduction: 1

Percentage of Benefited Receivers that would achieve at least a 8 dBA reduction from the proposed noise abatement measure. NOTE: SCDOT Policy indicates that 80% of the benefited receivers must achieve at least a 8 dBA reduction for it to be reasonable.: 0

Is the proposed noise abatement measure acoustically feasible? ☐ Yes ☒ No

If "Yes" is marked, continue to #2. If "No" is marked, then abatement is determined NOT to be reasonable.

#2: Cost Effectiveness

Estimated cost per square foot for noise abatement measure: $35.00

Estimated construction cost for noise abatement measure: $421,112

Estimated cost per Benefited Receiver: $105,278

Based on the SCDOT policy of $30,000 per Benefited Receiver, would the abatement measure be reasonable? NOTE: SCDOT Policy states that the preliminary noise analysis is based on $35.00 per square foot and a more project-specific construction cost should be applied at a cost per square foot basis during the detailed noise abatement evaluation. ☐ Yes ☒ No

If "Yes" is marked, continue to #3. If "No" is marked, then abatement is determined NOT to be reasonable.

#3: Viewpoints of the property owners and residents of the benefitted receivers

Number of Benefited Receivers (same as above):

Number of Benefited Receivers in **support** of noise abatement measure:

Percentage of Benefited Receivers in **support** of noise abatement measure:

Number of Benefited Receivers **opposed** to noise abatement measure:

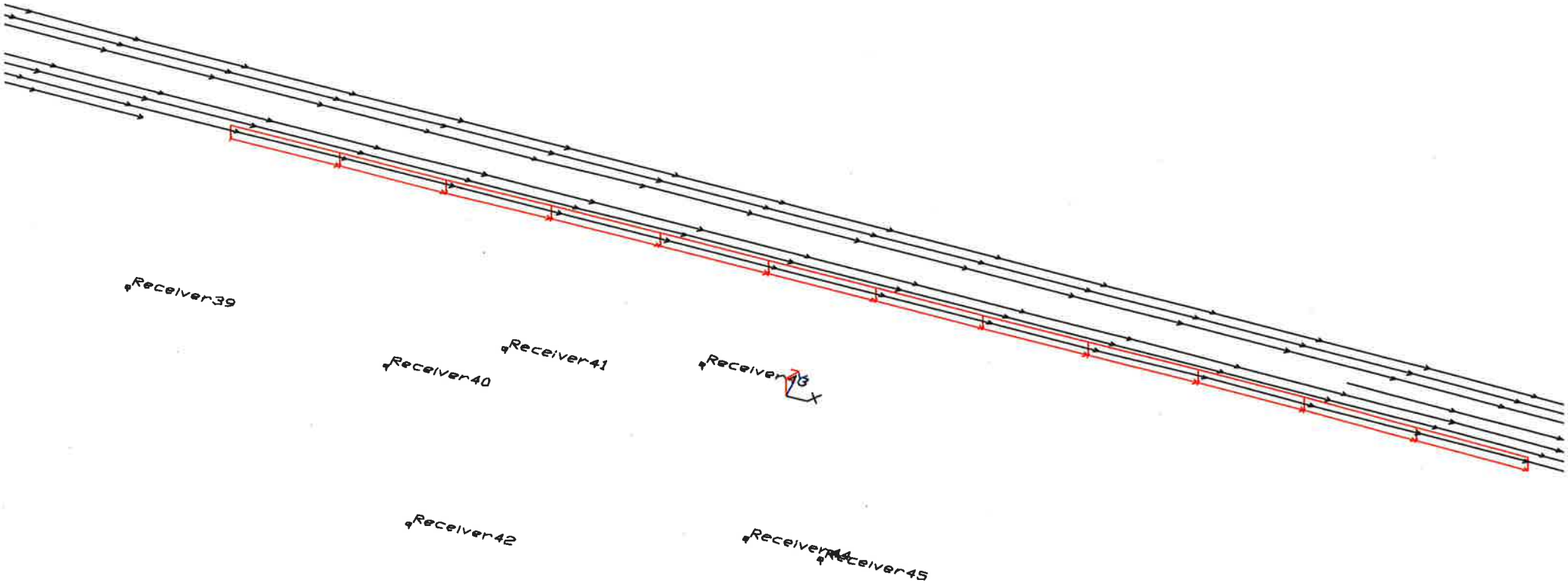
Percentage of Benefited Receivers **opposed** to noise abatement measure:

Number of Benefited Receivers **that did not respond** to solicitation on noise abatement measure:

Percentage of Benefited Receivers **that did not respond** to solicitation on noise abatement measure:

Based on the viewpoints of the property owners and residents of the Benefited Receivers, would the abatement measure be reasonable? NOTE: SCDOT Policy indicates that the noise abatement shall be constructed unless greater than 50% of the benefited receptors are opposed to noise abatement. ☐ Yes ☐ No

Noise Abatement is not reasonable for reducing or eliminating noise impacts for this project.



Barrier 2		Sheet 1 of 1	29 Mar 2017
		HDR I ICA	
Perspective View		Project/Contract No. Wayne Hall	
Run name: Barrier 2		TNM Version 2.5, Feb 2004	
Scale: <DNA - due to perspective>		Analysis By: Wayne Hall	
Roadway:		Ground Zone:	polygon
Receiver:		Tree Zone:	dashed polygon
Barrier:		Contour Zone:	polygon
Building Row:		Parallel Barrier:	
Terrain Line:		Skew Section:	

HDR I ICA
Wayne Hall

29 March 2017
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Wayne Hall
RUN: Barrier 2
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver40	40	1	0.0	63.6	66	63.6	15	----	58.9	4.7	8	-3.3
Receiver41	41	1	0.0	65.6	66	65.6	15	----	59.1	6.5	8	-1.5
Receiver42	42	1	0.0	59.9	66	59.9	15	----	55.7	4.2	8	-3.8
Receiver43	43	1	0.0	67.7	66	67.7	15	Snd Lvl	59.0	8.7	8	0.7
Receiver44	44	1	0.0	61.4	66	61.4	15	----	56.0	5.4	8	-2.6
Receiver45	45	1	0.0	61.5	66	61.5	15	----	55.9	5.6	8	-2.4
Receiver39	66	1	0.0	64.4	66	64.4	15	----	62.3	2.1	8	-5.9

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	7	2.1	5.3	8.7
All Impacted	1	8.7	8.7	8.7
All that meet NR Goal	1	8.7	8.7	8.7

HDR I ICA
Wayne Hall

15-Feb-17
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: US 278
RUN: Jenkins Island Barrier 2
BARRIER DESIGN: Barr.2 15'x1207'

ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

633,906

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
R39	39	1	65	64.4	66	0.6	15		58.9	5.5	8	-2.5
R40	40	1	63.1	63.6	66	0.5	15		58.9	4.7	8	-3.3
R41	41	1	65	65.6	66	0.6	15	Snd Lvl	59.1	6.5	8	-1.5
R42	42	1	58.5	59.9	66	1.4	15		55.7	4.2	8	-3.8
R43	43	1	66.5	67.7	66	1.2	15	Snd Lvl	59	8.7	8	0.7
R44	44	1	59.7	61.4	66	1.7	15		56	5.4	8	-2.6
R45	45	1	59.5	61.5	66	2	15		55.9	5.6	8	-2.4

Dwelling Units	# DUs	Noise Reduction Min dB	Avg dB	Max dB
All Selected	7	2.1	5.3	8.7
All Impacted	2	6.5	7.6	8.7
All that meet NR Goal	1	8.7	8.7	8.7

Feasible to reduce noise levels at 75% of impacted receivers by 5dBA

HDR I ICA
Wayne Hall

27-Mar-17
TNM 2.5

RESULTS: BARRIER DESCRIP
PROJECT/CONTRACT: US 278
RUN: Jenkins Island Barrier 2
BARRIER DESIGN: Barr.2 15'x1207'

Barriers Name	Type	Heights along Barrier Min	Avg	Max	Length	If Wall Area	If Berm Volume	Top Width	Run:Rise	Cost
		ft	ft	ft	ft	sq ft	cu yd	ft	ft:ft	$
Barr.F	W	15	15	15	1207	18112				$633,906.00
									Total Cost	$633,906.00

SCDOT Feasibility and Reasonableness Worksheet

Date: 3/27/2017

Project Name US 278 Improvements

Highway Traffic Noise Abatement Measure Barrier 2

Feasibility

Number of Impacted Receivers: 2

Number of Benefited Receivers: 5

Percentage of Impacted Receivers that would achieve a 5 dBA reduction from the proposed noise abatement measure: 100%

Is the proposed noise abatement measure acoustically feasible?
NOTE:SCDOT Policy indicates that 75% of the impacted receivers must achieve at least a 5 dBA reduction for it to be acoustically feasible.

☒ Yes ☐ No

Would any of the following issues limit the ability of the abatement measure to achieve the noise reduction goal?

Topography	☐ Yes	☐ No
Safety	☐ Yes	☐ No
Drainage	☐ Yes	☐ No
Utilities	☐ Yes	☐ No
Maintenance	☐ Yes	☐ No
Access	☐ Yes	☐ No
Exposed Height of Wall	☐ Yes	☐ No

If "Yes" was marked for any of the questions above, please explain below.

Reasonableness

According to 23 CFR 772.13(d)(2)(iv) the abatement measure must collectively achieve each of these criteria to be reasonable. Therefore if any of the three mandatory reasonable factors are not achieved, then the abatement measure is determined NOT to be reasonable. When completing the form it is not necessary to detail each of the criteria if one was determined not to be reasonable.

#1: Noise Reduction Design Goal

Number of Benefited Receivers: 5

Number of Benefited Receivers that achieve at least an 8 dBA reduction: 1

Percentage of Benefited Receivers that would achieve at least a 8 dBA reduction from the proposed noise abatement measure. NOTE: SCDOT Policy indicates that 80% of the benefited receivers must achieve at least a 8 dBA reduction for it to be reasonable.: 20%

Is the proposed noise abatement measure acoustically feasible? ☐ Yes ☒ No

If "Yes" is marked, continue to #2. If "No" is marked, then abatement is determined NOT to be reasonable.

#2: Cost Effectiveness

Estimated cost per square foot for noise abatement measure: $35.00

Estimated construction cost for noise abatement measure: $633,906

Estimated cost per Benefited Receiver: $126,781

Based on the SCDOT policy of $30,000 per Benefited Receiver, would the abatement measure be reasonable? NOTE: SCDOT Policy states that the preliminary noise analysis is based on $35.00 per square foot and a more project-specific construction cost should be applied at a cost per square foot basis during the detailed noise abatement evaluation. ☐ Yes ☒ No

If "Yes" is marked, continue to #3. If "No" is marked, then abatement is determined NOT to be reasonable.

#3: Viewpoints of the property owners and residents of the benefitted receivers

Number of Benefited Receivers (same as above):

Number of Benefited Receivers in **support** of noise abatement measure:

Percentage of Benefited Receivers in **support** of noise abatement measure:

Number of Benefited Receivers **opposed** to noise abatement measure:

Percentage of Benefited Receivers **opposed** to noise abatement measure:

Number of Benefited Receivers **that did not respond** to solicitation on noise abatement measure:

Percentage of Benefited Receivers **that did not respond** to solicitation on noise abatement measure:

Based on the viewpoints of the property owners and residents of the Benefited Receivers, would the abatement measure be reasonable? NOTE: SCDOT Policy indicates that the noise abatement shall be constructed unless greater than 50% of the benefited receptors are opposed to noise abatement. ☐ Yes ☐ No

Noise Abatement is not reasonable for reducing or eliminating noise impacts for this project.