Virginia Department of Transportation
U.S. Route 29 Widening Project

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Fairfax County, Virginia

PRELIMINARY NOISE ANALYSIS

Prepared For:

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I. Executive Summary

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), is studying the potential environmental consequences of the proposed Route 29 Widening Project in Fairfax County, Virginia. The project length is approximately 1.5 miles and widens existing Route 29 (Lee Highway) from four to six travel lanes, as well as providing intersection improvements and configuration of shared-use paths on both sides of the roadway. The project limits range from Union Mill Road (Route 659) in the west to approximately Buckley's Gate Drive in the eastern portion of the project corridor. For the purposes of this preliminary design noise analysis, one build alternative was analyzed and included in this document.

The Preliminary Noise Analysis in this document will focus solely on Common Noise Environments, referred to as CNEs. Noise sensitive receptors that are within approximately 500 feet of the proposed improvements were included for this evaluation. This report documents the predicted Existing (2017), No-Build (2043) and Design Year (2043) Build noise levels associated with the Route 29 Widening Project. A project field reconnaissance was performed to thoroughly review the project area. During this field view, major sources of acoustic shielding (e.g., terrain lines, building rows, etc.) adjacent to the project corridor were noted for inclusion in the noise modeling. Noise monitoring was performed at 12 locations, while noise modeling was conducted for 656 additional sites to gain a thorough understanding of the existing noise environment and to determine how the proposed improvements would change the noise levels throughout the project area. Monitored sites were used solely for noise model validation and not for the purposes of predicting Existing (2017), No-Build (2043) and or Design Year (2043) Build noise impacts.

Coordination with Fairfax County was completed in October 2018 to determine whether any undeveloped permitted land uses were present within the project corridor, including Category G. Category G represents undeveloped lands with no permits. It was determined that there were no active/approved building permit within 500 feet of the project area. This coordination will occur again in Final Design to ensure that no new permitted developments have been approved between the time of the approval of the preliminary design noise report and NEPA approval (Date of Public Knowledge).

Noise modeling was completed for Existing (2017), No-Build (2043), and predicted Design Year (2043) Build conditions. Design Year (2043) Build noise levels were predicted at each modeled receptor site. Additionally, VDOT's Environmental Traffic Data (ENTRADA) tool was used to develop preliminary traffic data in support of this project. Under Design Year (2043) Build conditions, a total of 44 receptors representing 43 residences and one trail (one grid unit) are predicted to experience noise impacts. Noise impacts are summarized in ***Table Executive Summary (E.S.) 1*** below.

Table E.S. 1 *Route 29 Widening Project* *Build Alternative Impact Summary*
Forty-Three Residences and One Trail (one grid unit)

In an effort to mitigate the predicted noise impacts, a total of 10 barrier/barrier systems were evaluated throughout the project corridor. Five of these barrier/barrier systems (Barrier B, Barrier System C, Barrier D, Barrier G, and Barrier I) were found to be feasible and reasonable at this time. A detailed discussion of the noise abatement evaluation follows in ***Section VIII*** of this report. A summary of the barriers found to be feasible and reasonable is shown below in ***Table E.S. 2.***

TABLE E.S. 2
Route 29 Widening Project
Feasible and Reasonable Barrier Summary

Barrier I.D.	Combined Noise Barrier Length (ft.)	Average Noise Barrier Height (ft.)	Square Footage (SF)	Net SF per Benefited Receptor	Barrier Cost	Feasible?	Reasonable?
Barrier B	521	14.00	7,294	810	$306,348	Yes	Yes
Barrier System C	828	15.00	12,561	739	$527,562	Yes	Yes
Barrier D	1,251	15.00	18,765	1443	$788,130	Yes	Yes
Barrier G	949	20.00	18,982	1186	$797,244	Yes	Yes
Barrier I	1,058	19.00	20,153	876	$846,426	Yes	Yes

No considerable, long-term construction related noise impacts are anticipated. Any noise impacts that do occur as a result of roadway construction measures are anticipated to be temporary in nature and would cease upon completion of the project construction phase.

The findings in this document are based on conceptual information. Therefore, noise barriers that are found to be feasible and/or reasonable during the Preliminary Noise Analysis may not be found to be feasible and/or reasonable during the Final Design Noise Analysis. Conversely, noise barriers that were not considered feasible and/or reasonable may meet the established criteria and be recommended for construction. A Final Design Noise Analysis will be performed for this project based on detailed engineering information. Thus, any conclusions derived in this report should be considered preliminary in nature and subject to change.

II. Introduction and Background

Impacts associated with noise are often a prime concern when evaluating roadway improvement projects. Roadway construction at a new location or improvements to the existing transportation network may cause impacts to the noise sensitive environment located adjacent to the project corridor. For this reason, FHWA and VDOT have established a noise analysis methodology and associated noise level criteria to assess the potential noise impacts attributed to the construction and use of transportation related projects.

This report details the steps involved in the Preliminary Noise Analysis for the Route 29 Widening Project (hereafter referred to as the Route 29 Project), including noise monitoring, noise modeling methodologies, results, and impact evaluation, and potential noise abatement. The regional study area can be seen in ***Figure 1***. Relevant information and assumptions used for this analysis are included in this report's appendices.

The proposed project length is approximately 1.5 miles and widens existing Route 29 (Lee Highway) from four to six travel lanes, as well as providing intersection improvements and configuration of shared-use paths on both sides of the roadway. The project limits range from Union Mill Road (Route 659) to Buckley's Gate Drive. The identification of a general widening concept along the length of the study corridor is consistent with FHWA's objective of analyzing transportation solutions on a broad-enough scale to provide meaningful analysis. The project area can be referenced on ***Figures 2-1 through 2-4*** in this document.

III. Noise Analysis Methodology, Terminology and Criteria

The methodologies applied to the noise analysis for the Route 29 Project are in accordance with VDOT's "*State Noise Abatement Policy"* effective July 13, 2011 and the "*Highway Traffic Noise Impact Analysis Guidance Manual*", updated February 20, 2018. VDOT guidelines are based on Title 23 of the Code of Federal Regulations, Part 772 and the Procedures for Abatement of Highway Traffic Noise and Construction Noise, (23 CFR 772).

To determine the degree of highway noise impact, Noise Abatement Criteria (NAC) has been established for a number of different land use categories that are considered to be sensitive to highway traffic noise. ***Table 1***, located at the end of this report, documents the NAC for the associated activity land use category shown in the adjacent column. The project corridor is considered partially developed with areas of residential development, interspersed with mixed commercial and undeveloped land uses. For the purposes of this analysis, all land uses are considered Activity Category B, Category C, Category D, and Category E.

Category D land uses address interior noise levels associated with hospitals, libraries, schools, medical facilities, places of worship, public or nonprofit institutions, etc. Potential interior noise level impacts in the project area were analyzed. To assess potential interior noise impacts, modeling sites are placed in close proximity to the existing structure. The standard noise

reduction for masonry construction with modern windows is 25 dB(A) when comparing the exterior versus the interior noise levels. Using this methodology, both exterior and interior noise levels are provided in ***Appendix A***.

The NAC are given in terms of an hourly, A-weighted, equivalent noise level. The A-weighted noise level frequency is used for human use areas because it is comprised of the noise level frequencies that are most easily distinguished by the human ear, out of the entire noise level spectrum. Highway traffic noise is categorized as a linear noise source, where varying noise levels occur at a fixed point during a single vehicle pass by. It is acceptable to characterize these fluctuating noise levels with a single number known as the equivalent noise level (L_{eq}). The L_{eq} is the value of a steady noise level that would represent the same acoustic energy as the actual time-varying sound evaluated over the same time period. For highway noise assessments, L_{eq} is typically evaluated over a one-hour period.

Noise abatement determination is based on VDOT's three-phased approach. The first phase (**Phase 1**) distinguishes if a sensitive receptor within a project corridor warrants highway traffic noise abatement. The following describes the **Phase 1** warranted criterion, as discussed in the VDOT policy. Receptors that satisfy either condition warrant consideration of highway traffic noise abatement.

- Predicted highway traffic noise levels (for the design year) approach or exceed the highway traffic noise abatement criteria in ***Table 1***. "Approach" has been defined by VDOT as 1 dB(A) below the noise abatement criteria.

~or~

- A substantial noise increase has been defined by VDOT as a 10 dB(A) increase above existing noise levels for all noise sensitive exterior activity categories. A 10 dB(A) increase in noise reflects the generally accepted range of a perceived doubling of the loudness.

If a traffic noise impact is identified within the project corridor, then consideration of noise abatement measures is necessary. The final decision on whether or not to provide noise abatement along a project corridor will take into account the feasibility of the design and an overall weighting of cost to benefits.

Phase 2 and **Phase 3** of VDOT's three-phased approach, which consider noise abatement feasibility and reasonableness, are discussed further in ***Section VIII*** of this report.

IV. Noise Monitoring Methodology

The identification of noise sensitive land uses using aerial imagery and local government parcel data guided the selection of noise monitoring locations along the project corridor. In order to validate the noise models, noise monitoring was conducted at 12 representative noise sensitive receptor sites. ***Figures 2-1 through 2-4*** show an overview of the project area as well as the locations of the 12 noise monitoring sites.

Monitoring was performed at each of the selected noise sensitive receptors using Rion NL-42 sound level meters. Prior to monitoring at the beginning of the day, each sound level meter was calibrated using a Rion NC-74 Calibrator. The noise meters were placed at each receptor site in a manner that would yield a typical absolute ambient environment noise reading and allowed for minimal influence from atypical background noise sources. Readings were taken on the A-weighted scale and reported in decibels (dB(A)). The noise monitoring equipment meets all requirements of the American National Standard Specifications for Sound Level Meters, ANSI S1.4-1983 (R1991), Type 2, and meets all requirements as defined by FHWA. Noise monitoring was conducted in accordance with the methodologies contained in FHWA-PD-96-046, *Measurement of Highway-Related Noise* (FHWA, May 1996).

Short-term noise monitoring was performed on October 10th, 2018 during hours of free flow traffic conditions. Data collected by the sound analyzers included time, average noise level (L_{av}), maximum noise level (L_{max}), and instantaneous peak noise level (L_{pk}) for each recorded interval. The output of the noise meters is L_{av}, which is the average noise level over the duration of the monitoring test. This data is then converted into an average, hourly noise level (L_{eq}), for assessment purposes. Additional data collected at each monitoring location included atmospheric conditions, wind speed, background noise sources, and unusual/atypical noise events. Traffic data (vehicle volume and speed) were also video-recorded on all roadways, which were visible from the monitoring sites and substantially contributed to the overall noise levels. Traffic was grouped into one of three categories: cars, medium trucks and heavy trucks, per VDOT procedures. Combined, this data is used during the noise model validation process.

Short-term noise monitoring is not a process used to determine design year noise impacts or barrier locations. Short-term noise monitoring provides a level of consistency between what is present in real-world situations and how that is represented in the computer noise model. Short-term monitoring does not need to occur within every CNE to validate the computer noise model. CNEs are groupings of receptor sites that, by location, form distinct communities within the project area. These areas are used to evaluate traffic noise impacts and potential noise mitigation options to residential developments or communities as a whole, as well as for consideration of feasibility and reasonableness of possible noise abatement measures for specific communities.

V. Undeveloped Lands and Permitted Developments

Highway traffic noise analyses are performed for developed lands as well as undeveloped lands if they are considered "permitted." Undeveloped lands are deemed to be permitted when there is a definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of at least one building permit.

In accordance with the *VDOT State Noise Policy,* an undeveloped lot is considered to be planned, designed, and programmed if a building permit has been issued by the local authorities prior to the Date of Public Knowledge for the relevant project. VDOT considers the Date of Public Knowledge as the date that the final National Environmental Policy Act (NEPA) approval is made. VDOT has no obligation to provide noise mitigation for any undeveloped land that is permitted or constructed after this date. The Route 29 Project has not yet received NEPA approval and therefore does not have a Date of Public Knowledge.

Coordination with Fairfax County was completed in October 2018 to determine whether any undeveloped permitted land uses were present within the project corridor, including Category G. Category G represents undeveloped lands with no permits. It was determined that there were no active/approved building permits within 500 feet of the project area. This coordination will occur again in Final Design to ensure that no new permitted developments have been approved between the time of the approval of the preliminary design noise report and NEPA approval (Date of Public Knowledge).

VI. Validation and Existing Conditions

Computer modeling is the accepted technique for predicting Existing (2017), and future No-Build (2043), and Design Year (2043) Build noise levels associated with traffic-induced noise. Currently, the FHWA Traffic Noise Model (TNM 2.5) is the approved highway noise prediction model. The Traffic Noise Model has been established as a reliable tool for representing noise generated by highway traffic. The information applied to the modeling effort includes the highway design files (existing and proposed conceptual design), traffic data, roadway profiles, survey TIN files, and future design TIN files. Base mapping, aerial photography, and field identification were used to identify noise sensitive land uses within the corridor and any terrain features that may shield roadway noise. The land uses identified and included in the noise analysis are residential, active sport areas, churches, a school, hotels, playgrounds, and trails. These land uses are categorized as Activity Category B, Category C, Category D, and Category E.

The modeling process begins with model validation, as per VDOT requirements. This is accomplished by comparing the monitored noise levels with noise levels generated by the computer model, using the traffic volumes, speeds, and composition that were witnessed during the monitoring effort performed in October 2018 (please note, Existing Year traffic that was used for the noise analysis is from 2017, while the monitoring effort was performed in 2018). This

comparison ensures that reported changes in noise levels between Existing (2017) and predicted Design Year (2043) Build conditions are due to changes in traffic conditions and not to discrepancies between monitoring and modeling techniques. A difference of three dB(A) or less between the monitored and modeled level is considered acceptable, since this is the limit of change detectable by the typical human ear. ***Table 2*** provides a summary of the model validation for the existing monitored conditions. Column 4 represents the difference between the modeled levels produced by the noise model (Column 3) and the monitored level (Column 2). Several of the monitoring receptors approach the 3 dB(A) threshold required for validation. This was likely due to the existing signalized intersections along the project corridor. Usually, it is easier to validate free flow traffic conditions. The presence of signalized intersections within the corridor complicated the validation process since traffic was accelerating and decelerating (non-free flow conditions) on the mainline. Regardless, all 12 analyzed receptors show a difference of less than 3 dB(A) between the monitored and modeled noise levels, and therefore the TNM is considered an accurate representation of actual existing conditions throughout the project area.

The validated noise model was the base noise model for the remainder of the noise analysis. Modeling sites were added to the validated model to thoroughly predict Existing (2017) noise levels throughout the project corridor. Additional noise modeling was then performed for existing conditions using 2017 traffic data supplied by VDOT (see ***Appendix D***). This modeling step was performed to predict Existing (2017) noise levels associated with existing traffic volumes and composition. Columns 3 and 4 of ***Table 3*** provide a summary of the Existing (2017) minimum and maximum noise levels respectively for each CNE along the project corridor.

Analysis locations were grouped into 10 CNEs. These areas are groupings of receptor sites that, by location, form distinct communities within the project area and have a common noise environment. These areas were used to evaluate traffic noise impacts and potential noise abatement options as well as to assess the feasibility and reasonableness of potential noise abatement measures for impacted communities. Where residential communities or groupings of noise sensitive land use areas exist, both noise monitoring and noise modeling-*only* sites were grouped into corresponding CNEs. A detailed discussion of each CNE and its respective, monitored and modeled noise levels is contained in ***Section VII*** of this report.

The presence of bicycle trails / sidewalks was noted within the project limits beginning near Fairfax County Parkway and continuing west along the north side of Route 29. Additional sidewalk facilities are proposed to be constructed as part of this project, running along the south side of Route 29 for the length of the project as well as some relocations to the existing sidewalk facilities on the north side of Route 29. The portion of the Willow Pond Trail that runs through the Willow Pond Park located in CNE E of this report would be eliminated by the project. This portion of the trail will be replaced by the proposed 10-feet wide shared use path. As such, this portion of the trail was not evaluated in the future build case, only the existing and Design Year No-Build cases were analyzed as part of the noise study. Correspondence from Fairfax County Park Authority (FCPA) relating to the elimination of the trail is attached in Appendix L. Further analysis revealed that the majority of the facilities within the project corridor were classified as

sidewalks and therefore were not included within the study. The location of trails within the corridor was verified through the Fairfax County Trail Buddy website. Several trails were identified outside VDOT ROW which included areas within CNEs A, C, E, and G. As such, these areas were also included in the noise analysis and where warranted, noise mitigation was evaluated for feasibility and reasonableness.

VII. Evaluation of Design Year (2043) No-Build and Build Noise Levels and Noise Impact Assessment

Following the development of the existing conditions model and the prediction of Existing (2017) noise levels, the assessment continued with the prediction of Design Year (2043) No-Build and Build noise levels. Design Year (2043) No-Build and Build noise levels were predicted by applying Design Year (2043) No-Build and Build traffic volumes and composition to the validated computer model. Design Year (2043) Build noise levels were predicted with the conceptual improvements of the Build Alternative in place and in use. Future design TIN files were provided by VDOT and were used in the noise modeling effort.

The next step in the noise analysis is to determine if design year noise levels at the noise sensitive receptors would approach or exceed the FHWA/VDOT NAC. If the criteria are approached or exceeded at any receptor, under the future design year Build condition, noise mitigation is considered warranted and would be evaluated in an attempt to reduce design year noise to acceptable levels. The minimum and maximum noise levels associated with the Design Year (2043) No-Build modeling analysis are summarized in Columns 6 and 7 of ***Table 3*** and are used for comparative purposes. The minimum and maximum noise levels associated with the Design Year (2043) Build modeling analysis are summarized in Columns 9 and 10 of ***Table 3***. Noise levels at each receptor site for the Existing (2017) and predicted Design Year (2043) No-Build and Build conditions are shown in ***Appendix A***.

Traffic Data for the Noise Analysis

VDOT's ENTRADA tool was used to develop traffic data needed for the Fairfax County Parkway Project noise analysis. Existing (2017) and Design Year (2043) No-build and (2043) Build traffic volumes, vehicle composition, and speeds were assigned to influential roadways.

Traffic data for traffic noise computations was developed by VDOT. This data was reported in hourly segments for 24 hours in ENTRADA analysis sheets. Medium and heavy truck percentages were provided separately for each roadway segment. Hourly volumes and operating speeds for each roadway segment for the Existing (2017) and Design Year (2043) No-Build and (2043) Build conditions were documented and analyzed for inclusion within the noise analysis. Per FHWA and VDOT policy, the traffic data used in the noise analysis must produce noise levels that are representative of the worst (loudest) hour of the day. The year 2043 is the defined as the Design Year for the project, therefore was used as the analysis year for the noise analysis.

Selection of Loudest Noise Hour

As required by FHWA and VDOT, the noise analysis was performed for the loudest ("worst noise") hour of the day. As part of the preliminary noise analysis, noise levels were predicted for that hour of the day when the vehicle volume, operating speed, and number of trucks (vehicles with 3 or more axles) combine to produce the loudest noise conditions. According to FHWA guidance, the "worst hourly traffic noise impact" occurs at a time when truck volumes and vehicle speeds are the greatest, typically when traffic is free flowing and at or near level of service (LOS) C conditions. In coordination with VDOT, ENTRADA was linked into VDOT's latest "Loudest Hour Spreadsheet", version 2.0 for determination and identification of the loudest hour for noise modeling purposes. This predictive tool calculates reference L_{eq}'s at 50 feet for each TNM vehicle type, utilizing interrupted operational speeds, hourly peak-hour volumes over flat ground. Due to the function of this roadway and a commuter corridor, the potential for directional loudest hours was evaluated to ensure there was not a substantive difference from the combined loudest hour. Upon reviewing the results of the methodology described above, it was determined that the combined 8:00 AM hour was the loudest hour. The Loudest Hour Determination Memorandum and additional details supporting the selection of the loudest noise hour are provided within ***Appendix E.***

In Virginia, either the posted speed or operating speed (whichever is greater) may be used to predict highway traffic noise levels on Type I federally-funded projects. In the case of Route 29 Project, operational speeds were used in the model, for all traffic segments, since those speeds were greater than the posted speeds. The traffic volumes and operating speeds that were used for this study are located in ***Appendix E***.

Flow control devices such as stop signs and traffic lights were not used in the Preliminary Noise Analysis because they were not determined to be a significant factor in sound level prediction for this analysis. This was to ensure the loudest noise environment would be modeled. However, flow control devices will be modeled, where necessary, during the final design phase when more detailed engineering plans are available.

Federal regulations (23 CFR Part 772) state that if a noise level at any given receptor approaches or exceeds the appropriate impact criterion, or if predicted traffic noise levels substantially exceed the Existing (2017) noise levels, abatement considerations are warranted. A substantial noise increase has been defined by VDOT as a 10 dB(A) increase above existing noise levels for all noise sensitive exterior activity categories. ***Table 1*** summarizes the Federal and State criteria for a variety of activity categories. Upon review of the initial TNM sound level output, no areas were predicted to experience substantial increase impacts within the project area. However, several CNEs were predicted to have sound levels below 45 dB(A). Upon further investigation it was determined that this was a result of the lack of background or ambient noise modeling within the TNM. Twenty-four-hour ambient noise monitoring was not performed for this project,

therefore the TNM only accounted for roadway traffic noise. Any sites which modeled below 45 dB(A) are marked (**) in the sound levels table shown in ***Appendix A***.

CNEs A, B, C, D, E, F, G, H, and I contained sites which experienced a decrease in noise levels between the No-Build (2043) and Design Year (2043) Build conditions. Two modeling sites (F-043 and H-001) were predicted to experience impacts under the No-Build (2043) conditions, but not under the Design Year (2043) Build conditions. In each of these instances, additional investigations were performed in to ensure the model was reporting noise levels accurately. It was determined that the widening of Route 29 and the subsequent addition of cut/fill slopes along the project corridor created additional shielding resulting in decreases in noise levels between the No-Build and Build conditions.

The following describes the locations and predicted noise levels of each CNE within the Route 29 Project area. The CNEs are shown in ***Figure 2-1 through 2-4***.

CNE A

CNE A is located north of U.S. Route 29 (Lee Highway) and west of Centreville Farms Road and encompasses noise sensitive land uses along Route 29. CNE A contains 23 modeling-*only* sites (A-001 - A-011 and A-TR01 - A-TR12) which represent ten residences, one church, and one trail (12 grid units). CNE A contains no monitoring sites. The locations of the receptor sites are shown on ***Figure 2-1***. The modeled Existing (2017) noise level within CNE A is predicted to range from 41-69 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise source within CNE A is Route 29. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 43-70 dB(A). As shown in Columns 9 and 10 of ***Table 3***, the Design Year (2043) Build noise level is predicted to range from 43-70 dB(A). Since noise levels exceed the NAC, noise abatement is warranted and will be discussed in ***Section VIII*** of this report.

CNE B

CNE B is located south of U.S. Route 29 (Lee Highway) and west of Union Mill Road and encompasses noise sensitive land uses along Quail Court, Covey Lane, and Gray Bill Court. CNE B contains 66 modeling-*only* sites (B-001 – B-066) which represent 66 residences. CNE B contains one monitoring site (M01). The locations of the receptor sites are shown on ***Figure 2-1***. The modeled Existing (2017) noise level within CNE B is predicted to range from 46-66 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise source within CNE B is Route 29. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 47-67 dB(A). As shown in Columns 9 and 10 of ***Table 3***, the Design Year (2043) Build noise level is predicted to range from 47-67 dB(A). Since noise levels exceed the NAC, noise abatement is warranted and will be discussed in ***Section VIII*** of this report.

CNE C

CNE C is located north of U.S. Route 29 (Lee Highway) and east of Centreville Farm Road and encompasses noise sensitive land uses along Matthews Vista Drive, Arrow Head Park Drive, Bent Maple Lane, Owens Wood Court, and Maple Creek Lane. CNE C contains 101 modeling-*only* sites (C-001 – C-089 and C-TR01 - C-TR12) which represent 88 residences, one playground, and a trail (12 grid units). CNE C contains two monitoring sites (M02 and M03). The locations of the receptor sites are shown on ***Figures 2-1***. The modeled Existing (2017) noise level within CNE C is predicted to range from 43-66 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise source within CNE C is Route 29. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 44-68 dB(A). As shown in Columns 9 and 10 of ***Table 3***, the Design Year (2043) Build noise level is predicted to range from 44-67 dB(A). Since noise levels exceed the NAC, noise abatement is warranted and will be discussed in ***Section VIII*** of this report.

CNE D

CNE D is located south of U.S. Route 29 (Lee Highway) and west of Clifton Road and encompasses noise sensitive land uses along Moore Road, Caballero Way, Regal Crest Drive, Regal Crest Court, and Clifton Crest Way. CNE D contains 66 modeling-*only* sites (D-001 - D-066) which represent 66 residences. CNE D contains one monitoring site (M04). The locations of the receptor sites are shown on ***Figures 2-1***. The modeled Existing (2017) noise level within CNE D is predicted to range from 42-68 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise source within CNE D is Route 29 and Clifton Road. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 43-69 dB(A). As shown in Columns 9 and 10 of ***Table 3***, the Design Year (2043) Build noise level is predicted to range from 42-69 dB(A). Since noise levels exceed the NAC, noise abatement is warranted and will be discussed in ***Section VIII*** of this report.

CNE E

CNE E is located north of U.S. Route 29 (Lee Highway) and encompasses noise sensitive land uses along Whisper Willow Drive. CNE E contains 48 modeling-*only* sites (E-001 – E-008, E-TR01 – E-TR40) which represent eight residences and two trails. CNE E contains no monitoring sites. The locations of the receptor sites are shown on ***Figures 2-2***. The modeled Existing (2017) noise level within CNE E is predicted to range from 53-70 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise source within CNE E is Route 29. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 55-71 dB(A). As shown in Columns 9 and 10 of ***Table 3***, the Design Year (2043) Build noise level is predicted to range from 55-61 dB(A). After coordination with the Fairfax County Parkway Authority (FCPA), it was determined that the sections of trail along Route 29 and within Willow Pond Park will be removed and replaced by a sidewalk as part of this project. As such, Build noise levels were not calculated for these sites (E-TR01 – E-TR24). Therefore, since noise

levels do not exceed the NAC, noise abatement is not warranted and will not be discussed further within this report.

CNE F

CNE F is located south of U.S. Route 29 (Lee Highway) east of Clifton Road and west of Hampton Forest Way and encompasses noise sensitive land uses along Route 29, Clifton Road, Blue Willow Place, Willow Forest Court, Sandy Point Lane, Feldspar Court, and Hampton Forest Way. CNE F contains 74 modeling-*only* sites (F-001 - F-074) which represent 74 residences. CNE F contains one monitoring site (M05). The locations of the receptor sites are shown on ***Figures 2-2 and 2-3***. The modeled Existing (2017) noise level within CNE F is predicted to range from 39-67 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise sources within CNE F are Route 29 and Clifton Road. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 40-68 dB(A). As shown in Columns 9 and 10 of ***Table 3***, the Design Year (2043) Build noise level is predicted to range from 40-68 dB(A). Since noise levels exceed the NAC, noise abatement is warranted and will be discussed in ***Section VIII*** of this report.

CNE G

CNE G is located north of U.S. Route 29 (Lee Highway) and encompasses noise sensitive land uses along Route 29, Meadow Estates Drive, Knight Arch Road and Willowmeade Drive. CNE G contains 68 modeling-*only* sites (G-001 – G-059, G-TR01 – G-TR09) which represent 50 residences, one shelter (The Katherine Hanley Family Shelter), one church, one school, one playground, one trail (nine grid units), and one active sport area (five grid units). CNE G contains three monitoring sites (M06, M07, and M08. The locations of the receptor sites are shown on ***Figures 2-2 and 2-3***. The modeled Existing (2017) noise level within CNE G is predicted to range from 34-66 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise source within CNE G is Route 29. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 36-67 dB(A). As shown in Columns 9 and 10 of ***Table 3***, the Design Year (2043) Build noise level is predicted to range from 36-68 dB(A). Since noise levels exceed the NAC, noise abatement is warranted and will be discussed in ***Section VIII*** of this report.

CNE H

CNE H is located south of U.S. Route 29 (Lee Highway) and encompasses noise sensitive land uses along Route 29, Tractor Lane, Summit Drive and Hazel Ferguson Drive. CNE H contains 48 modeling-*only* sites (H-001 – H-048) which represent 47 residences and one motel. CNE H contains two monitoring sites (M09 and M10). The locations of the receptor sites are shown on ***Figures 2-3 and 2-4***. The modeled Existing (2017) noise level within CNE H is predicted to range from 48-68 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise source within CNE H is Route 29. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 49-69 dB(A). As shown in Columns 9 and 10 of

Table 3, the Design Year (2043) Build noise level is predicted to range from 49-69 dB(A). Since noise levels exceed the NAC, noise abatement is warranted and will be discussed in ***Section VIII*** of this report.

CNE I

CNE I is located north of U.S. Route 29 (Lee Highway) and west of Route 286 (Fairfax County Parkway) and encompasses noise sensitive land uses along Buckleys Gate Drive, Mayde Court, Finchem Court, Heron Ridge Drive, and Royal Wolf Place. CNE I contains 155 modeling-*only* sites (I-001 – I-155) which represent 154 residences and one playground. CNE I contains two monitoring sites (M11 and M12). The locations of the receptor sites are shown on ***Figures 2-4***. The modeled Existing (2017) noise level within CNE I is predicted to range from 34-67 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise source within CNE I is Route 29. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 35-68 dB(A). As shown in Columns 9 and 10 of ***Table 3***, the Design Year (2043) Build noise level is predicted to range from 35-68 dB(A). Since noise levels exceed the NAC, noise abatement is warranted and will be discussed in ***Section VIII*** of this report.

CNE J

CNE J is located south of U.S. Route 29 (Lee Highway) and west of Route 286 (Fairfax County Parkway) and encompasses noise sensitive land uses along Route 29 and Castner Court. CNE J contains seven modeling-*only* sites (J-001 – J-007) which represent seven residences. CNE J contains no monitoring sites. The locations of the receptor sites are shown on ***Figures 2-4***. The modeled Existing (2017) noise level within CNE J is predicted to range from 45-63 dB(A) as shown in Columns 3 and 4 of ***Table 3***. The dominant noise source within CNE J is Route 29. As shown in Columns 6 and 7 of ***Table 3***, the Design Year (2043) No-Build noise level is predicted to range from 46-65 dB(A). As shown in Columns 9 and 10 of ***Table 3***, the Design Year (2043) Build noise level is predicted to range from 46-64 dB(A). Since noise levels do not exceed the NAC, noise abatement is not warranted and will not be discussed further within this report.

VIII. Noise Abatement Evaluation

Design Year (2043) Build noise levels are predicted to exceed the NAC in 8 of 10 CNEs. As per FHWA/VDOT procedures discussed in **Phase 1** of VDOT's three-phased approach, noise abatement considerations are warranted for the impacted land uses within these CNEs.

Phase 2 and **Phase 3** of VDOT's three-phased approach to considering noise abatement and determining the feasibility and reasonableness of noise barriers is discussed below in detail.

Phase 2: Feasibility Criteria for Noise Barriers

All receptors that meet the warranted criterion must progress to the "feasible" phase. **Phase 2** of the noise abatement criteria requires that both of the following acoustical and engineering conditions be considered:

- At least a 5 dB(A) highway traffic noise reduction at impacted receptors. Per 23 CFR 772, FHWA requires the highway agency to determine the number of impacted receptors required to achieve at least 5 dB(A) of reduction. VDOT requires that fifty percent (50%) or more of the impacted receptors experience 5 dB(A) or more of insertion loss to be feasible; and

- The determination that it is possible to design and construct the noise abatement measure. The factors related to the design and construction include: safety, barrier height, topography, drainage, utilities, maintenance of the abatement measure, maintenance access to adjacent properties, and general access to adjacent properties (i.e. arterial widening projects).

The noise abatement measure is said to be feasible if it meets both criteria described above.

FHWA and VDOT guidelines recommend a variety of abatement measures that should be considered in response to transportation-related noise impacts. While noise barriers and/or earth berms are generally the most effective form of noise abatement, additional abatement measures exist that have the potential to provide considerable noise reductions, under certain circumstances. A brief description of VDOT-approved noise abatement measures is provided below:

Traffic Control Measures (TCM): Traffic control measures, such as speed limit restrictions, truck traffic restrictions, and other traffic control measures that may be considered for the reduction of noise emission levels are not practical for this project. Reducing speeds will not be an effective noise mitigation measure since a substantial decrease in speed is necessary to provide adequate noise reduction. Typically, a 10 mph reduction in speed will result in only a 2 dB(A) decrease in noise level, which is not considered a sufficient level of attenuation to be considered feasible. Likewise, a 2 dB(A) change in noise is not perceptible to the human ear. Additionally, a reduction in speed is not practical for this project since the posted speed is 45 miles per hour along route 29 (Lee Highway). A significant reduction in speeds of greater than 10 mph to this roadway would create a safety hazard for motorists traveling the Route 29 corridor and would not be consistent with the project's purpose and need.

Alteration of Horizontal and Vertical Alignments: The alteration of the horizontal and vertical alignment has not been considered because typically, for a straight-line scenario, where noise is unimpeded between the noise source and the receiver, noise levels will only decrease 3 dB(A) if the distance between the noise source and the receptor is doubled (i.e. the road is shifted further away from the impacted receptor). This is not a practical alternative due to the existing location of Route 29, which is the main noise source within the project area.

Acoustical Insulation of Public-Use and Non-Profit Facilities: This noise abatement measure option applies only to public and institutional use buildings. Since no public use or institutional structures are anticipated to have interior noise levels exceeding FHWA's interior NAC, this noise abatement option will not be applied.

Acquisition of Buffering Land: The purchase of property for noise barrier construction or the creation of a "buffer zone" to reduce noise impacts is only considered for predominantly unimproved properties because the amount of property required for this option to be effective would create significant additional impacts (e.g., in terms of residential displacements), which were determined to outweigh the benefits of land acquisition.

Construction of Berms / Noise Barriers: Construction of noise barriers can be an effective way to reduce noise levels at areas of outdoor activity. Noise barriers can be wall structures, earthen berms, or a combination of the two. The effectiveness of a noise barrier depends on the distance and elevation difference between roadway and receptor and the available placement location for a barrier. Gaps between overlapping noise barriers also decrease the effectiveness of the barrier, as opposed to a single continuous barrier. The barrier's ability to attenuate noise decreases as the gap width increases.

Noise walls and earth berms are often implemented into the highway design in response to the identified noise impacts. The effectiveness of a freestanding (post and panel) noise barrier and an earth berm of equivalent height are relatively consistent; however, an earth berm is perceived as a more aesthetically pleasing option. In contrast, the use of earth berms is not always an option due to the excessive space they require adjacent to the roadway corridor. At a standard slope of 2:1, every one-foot in height would require two feet of horizontal width. This requirement becomes more complex in urban settings where residential properties often abut the proposed roadway corridor. In these situations, implementation of earth berms can require significant property acquisitions to accommodate noise mitigation, and the cost associated with the acquisition of property to construct a berm can significantly increase the total costs to implement this form of noise mitigation and make it unreasonable.

Availability of fill material to construct the berm also needs to be considered. On proposed projects where proposed grading yields excess waste material, earth berms can often be a cost-effective mitigation option. On balance or borrow projects the implementation of earth berms is often an expensive solution due to the need to identify, acquire, and transport the material to the project site. Earth berms are not currently considered a viable mitigation option throughout the project area. However, this option will be evaluated further where possible in the final design stage.

Additionally, the Code of Virginia (§33.1-223.2:21) states: "Whenever the Commonwealth Transportation Board or the Department plan for or undertake any highway construction or improvement project and such project includes or may include the requirement for the mitigation of traffic noise impacts, first consideration should be given to the use of noise reducing design and low noise pavement materials and techniques in lieu of construction of noise walls or noise

barriers. Vegetative screening, such as the planting of appropriate conifers, in such a design would be utilized to act as a visual screen if visual screening is required." Since there is a noise impact, HB 2577 requires coordination with the Project Manager and Environmental Contact to inquire about the possibility of noise reducing design, the usage of low noise pavement, and visual screening. The HB 2577 documentation and coordination for this project is included within ***Appendix G***. Detailed engineering has not been completed; therefore, methods to reduce noise through engineering will be looked at during the final design phase of the project where applicable.

In summary, due to right-of-way constraints, noise barriers were considered the only form of abatement having the potential to reduce Design Year (2043) Build noise levels.

Phase 3: Reasonableness Criteria for Noise Barriers

A determination of noise barrier reasonableness will include the consideration of the parameters listed below. The parameters used during the NEPA process are also used during the Final Design phase when making a determination of noise barrier reasonableness. All reasonableness factors must collectively be achieved in order for a noise abatement measure to be deemed reasonable.

- **Viewpoints of the benefited receptors**
  VDOT shall solicit the viewpoints of all benefited receptors through certified mailings and obtain enough responses to document a decision as to whether or not there is a desire for the proposed noise abatement measure. Fifty percent (50%) or more of the respondents shall be required to favor the noise abatement measure in determining reasonableness. Community views in and of themselves are not sufficient for a barrier to be found reasonable if one or both of the other two reasonableness criteria are not satisfied.

- **Cost-effectiveness**
  Typically, the limiting factor related to barrier reasonableness is the cost effectiveness value, where the total surface area of the barrier is divided by the number of benefited receptors receiving at least a 5 dB(A) reduction in noise level. VDOT's approved cost is based on a maximum square footage of abatement per benefited receptor, a value of 1,600 square feet per benefited receptor.

  For non-residential properties such as parks and public use facilities, a special calculation is performed in order to quantify the type of activity and compare to the cost effectiveness criterion. The determination is based on cost, severity of impact (both in terms of noise levels and the size of the impacted area and the activity it contains), and amount of noise reduction.

- **Noise Reduction Design Goals**
  The design goal is a reasonableness factor indicating a specific reduction in noise levels that VDOT uses to identify that a noise abatement measure effectively reduces noise. The design goal establishes a criterion, selected by VDOT, which noise abatement must achieve. VDOT's noise reduction design goal is defined as a 7 dB(A) insertion loss for at least one impacted receptor, meaning that at least one impacted receptor is predicted to achieve a 7 dB(A) or greater noise reduction with the proposed barrier in place. The design goal is not the same as acoustic feasibility, which defines the minimum level of effectiveness for a noise abatement measure. Acoustic feasibility indicates that the noise abatement measure can, at a minimum, achieve a discernible reduction in noise levels.

Noise reduction is measured by comparing the future Design Year Build condition pre-and post-barrier noise levels. This difference between unabated and abated noise levels is known as "insertion loss" (IL). It is important to optimize the noise barrier design to achieve the most effective noise barrier in terms of both noise reduction (insertion losses) and cost. Although at least a 5 dB(A) reduction is required to meet the feasibility criteria, the following tiered noise barrier abatement goals are used to govern barrier design and optimization.

- Reduction of future highway traffic noise by 7 dB(A) at one (1) or more of the impacted receptor sites (required criterion)

- Reduction of future highway traffic noise levels to the low-60-decibel range when practical (desirable).

- Reduction of future highway traffic noise levels to existing noise levels when practical (desirable).

The following is a discussion of the potential abatement measures for the impacted CNEs (A, B, C, D, F, G, H and I) under the Design Year (2043) Build Alternative. Noise abatement was evaluated where noise impacts were predicted to occur. However, within several CNEs (A, F, and H) noise mitigation consideration was found to be not feasible due to driveway access. Any noise barrier built for these areas would have to be terminated at each driveway access location for sight-distance requirements and to maintain access to the property. These breaks in the barrier would significantly compromise and reduce the effectiveness of the noise barrier. Due to the nature of sound waves, traffic noise stemming from Route 29 would filter around and through these breaks in the noise barrier due to the driveway access points. Consequently, a noise barrier's ability to achieve the required 5 dB(A) reductions in these areas would not be possible. These specific areas are discussed in more detail within the CNE specific barrier descriptions below.

Where a noise barrier was evaluated, the effectiveness was measured in terms of achievable insertion loss. Noise abatement measures in the project area were evaluated at heights ranging from 10 to 30 feet, at five-foot increments. However, if a barrier approached or equaled the

reasonableness factor of 1,600 square feet of barrier per benefited receptor, a more refined barrier analysis, using two-foot increments was evaluated. Elevation and terrain information beyond the roadway surfaces was determined using both existing and future TIN surfaces. Detailed noise barriers were not optimized during this abatement analysis, as a more detailed process will be performed in Final Design. ***Appendix B*** lists the Design Year (2043) Build noise levels, the abated noise levels, and the net insertion losses for the evaluated barriers and barrier systems that were determined to be feasible and reasonable.

Feasible and reasonable noise abatement was evaluated based on VDOT's noise barrier acoustical criteria. The second aspect of barrier feasibility, which deals with barrier constructability, will be evaluated in detail during the final design phase. If barriers are shown to be not feasible due to constructability concerns, all conflict(s) will be analyzed thoroughly and documented before a determination to eliminate the barrier is made.

New noise barriers were evaluated and determined to be both feasible and reasonable for CNE B (Barrier B), CNE C (Barrier System C), CNE D (Barrier D), CNE G (Barrier G) and CNE I (Barrier I). Further study is required in Final Design to refine the abatement options, and evaluate barrier constructability; no commitments on noise abatement are made until the Final Design phase of the project. ***Appendix H*** provides completed warranted, feasible, and reasonable worksheets.

CNE A

As discussed above, CNE A contains several receptors for which barriers were found to be not feasible due to access issues and therefore abatement was not evaluated for these receptors. These receptors include: A-001, A-002, and A-TR12.

Barrier A

Design year (2043) Build noise levels are predicted to exceed the NAC at three receptors representing three residences within CNE A. A preliminary noise barrier was evaluated for one of these specific impacts within CNE A (A-003). Specifically, Barrier A located along the north side of Route 29, beginning west of Centreville Farm Road and continuing for approximately 400 feet to the east and north with an average height of 30.00 feet. The location of the barrier is shown on ***Figure 2-1***. Barrier A achieves feasible (>5 dB(A)) noise reductions at the single evaluated receptor (see ***Appendix B***) representing one residence. The barrier does not meet the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The total area for the barrier is 11,991 square feet. The barrier is considered not reasonable due to not meeting the design goal IL of 7 dB(A) as well as its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 11,991, which exceeds the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for Barrier A is shown in ***Table 4***. Therefore, Barrier A is considered feasible, but not reasonable at this time.

CNE B

Barrier B

Design year (2043) Build noise levels are predicted to exceed the NAC at four receptors representing four residences within CNE B. A preliminary noise barrier was evaluated for these specific impacts within CNE B. Specifically, Barrier B located along the south side of Route 29, beginning near the intersection with Union Mill Road and continuing for approximately 521 feet to the west ending at station 302+00 to maintain access to the existing paths and Storm Water Management (SWM) facility. The barrier has an average height of 14.00 feet. The location of the barrier is shown on ***Figure 2-1***. Barrier B achieves feasible (>5 dB(A)) noise reductions at two of the impacted receptors (see ***Appendix B***) representing two residences. The barrier meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The evaluated barrier provides benefits at seven non-impacted receptors representing seven residences. The total area for the barrier system is 7,294 square feet. It is considered reasonable due to its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 810, which is below the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for this evaluated barrier is shown in ***Table 4***. Therefore, Barrier B is considered feasible and reasonable at this time and is recommended for further consideration.

Note-There is an existing community sign at the intersection of Lee Highway and Union Mills Road, and a privacy fence along Lee Highway. The sign and the privacy fence may be impacted by the proposed noise barrier and may need to be replaced or relocated. Also, the western end of the proposed barrier was terminated at the beginning of the access road so as to maintain access to the SWM facility in the vicinity. Because of this restriction, two sites (B-001 and B-002) would be impacted due to flanking noise.

CNE C

Barrier System C

Design year (2043) Build noise levels are predicted to exceed the NAC at four receptors representing four residences within CNE C. A preliminary noise barrier was evaluated for these specific impacts within CNE C. Specifically, Barrier System C is located along the north side of Route 29, beginning near the intersection with Union Mill Road and continuing for approximately 828 feet to the east with an average height of 15.00 feet. The location of the barrier is shown on ***Figure 2-1***. Barrier System C achieves feasible (>5 dB(A)) noise reductions at the all four impacted receptors (see ***Appendix B***) representing four residences. The barrier meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The evaluated barrier provides benefits at 13 non-impacted receptors representing 13 residences. The total area for the barrier system is 12,561 square feet. It is considered reasonable due to its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 739, which is below the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for this evaluated barrier is shown in ***Table 4***. Therefore, Barrier

System C is considered feasible and reasonable at this time and is recommended for further consideration.

Note-There is an existing community sign at the intersection of Lee Highway and Centerville Farms Road, and a privacy fence along Lee Highway. The sign and the privacy fence may be impacted by the proposed noise barrier and may need to be replaced or relocated. Also, there is a sidewalk connection from the adjacent homes to the existing shared use path along Route 29. In order to maintain that connection a gap with a 3:1 overlap has been introduced to the proposed barrier.

CNE D

Design year (2043) Build noise levels are predicted to exceed the NAC at 13 receptors representing 13 residences within CNE D. Further analysis showed that three impacts (D-044 – D-046) were a result of traffic noise from Clifton Road and one impact (D-047) was a result of traffic noise from Union Mill Road. As stated in Section 6.2.1 of the VDOT Highway Traffic Noise Impact Analysis Guidance Manual, impacts that are not caused by the primary proposed roadway improvements may not qualify for noise abatement. It was determined that there were no improvements along these areas of Clifton Road and Union Mill Road, therefore a barrier was not analyzed for these specific impacts.

Barrier D

A preliminary noise barrier was evaluated for impacted receptors D-001 – D-009 within CNE D. Specifically, Barrier D located along the south side of Route 29, beginning east of Moore Road and continuing for approximately 1251 feet to the east with an average height of 15.00 feet. The location of the barrier is shown on ***Figure 2-1***. Barrier D achieves feasible (>5 dB(A)) noise reductions at the all nine impacted receptors (see ***Appendix B***) representing nine residences. The barrier meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The evaluated barrier provides benefits at four non-impacted receptors representing four residences. The total area for the barrier system is 18,765 square feet. It is considered reasonable due to its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 1,443, which is below the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for this evaluated barrier is shown in ***Table 4***. Therefore, Barrier D is considered feasible and reasonable at this time and is recommended for further consideration.

Note: The site shown as D-001 currently has two access points, i.e. one at Route 29 and the other on the cul-de-sac at Regal Crest Drive. Per the information included in the preliminary design plans, access to Route 29 will be closed at this site. Consistent with the plans, the proposed Barrier D, currently closes access to Route 29 at this site.

CNE F

Design year (2043) Build noise levels are predicted to exceed the NAC at nine receptors representing nine residences within CNE F. However, due to the size of the CNE and the way the impacts are dispersed, two separate barrier analyses were investigated in an attempt to mitigate noise impacts within different sections of the CNE. The results of each scenario are described in detail below. Further analysis showed that three impacts (F-012 – F-014) were a result of traffic noise from Clifton Road. As stated in Section 6.2.1 of the VDOT Highway Traffic Noise Impact Analysis Guidance Manual, impacts that are not caused by the primary proposed roadway improvements may not qualify for noise abatement. It was determined that there were no improvements along this area of Clifton Road, therefore a barrier was not analyzed for these specific impacts.

Additionally, CNE F contains one receptor for which barriers were found to be not feasible due to access issues and therefore abatement was not evaluated for this receptor (F-011).

Barrier F1

A preliminary noise barrier was evaluated for impacted receptors F-001 and F-002 within CNE F. Specifically, Barrier F1 located along the west side of Clifton Road and the south side of Route 29, beginning approximately 200 feet south of Route 29 and continuing for approximately 450 feet to the north and east with an average height of 20.00 feet. The location of the barrier is shown on ***Figure 2-2***. Barrier F1 achieves feasible (>5 dB(A)) noise reductions at one impacted receptor (see ***Appendix B***) representing one residence. The barrier meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The total area for the barrier is 8,998 square feet. It is considered not reasonable due to its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 8,998, which exceeds the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for Barrier F1 is shown in ***Table 4***. Therefore, Barrier F1 is considered feasible, but not reasonable at this time.

Barrier System F2

A preliminary noise barrier system was evaluated for impacted receptors F-008 – F-010 within CNE F. Specifically, Barrier System F2 located along the south side of Route 29, beginning west of Sandy Point Lane and continuing for approximately 724 feet to the west with an average height of 28 feet. The location of the barrier is shown on ***Figure 2-2***. Barrier System F2 achieves feasible (>5 dB(A)) noise reductions at the three impacted receptors (see ***Appendix B***) representing three residences. The barrier meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The evaluated barrier provides benefits at seven non-impacted receptors representing seven residences. The total area for the barrier system is 19,920 square feet. The total area only accounts for the noise barrier system and excludes the berm cubic yards. It is considered feasible but not reasonable due to its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 1,992, which is above the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for this

evaluated barrier is shown in ***Table 4***. Therefore, Barrier System F2 is considered feasible, but not reasonable at this time, the barrier would be further evaluated in final design.

Note-The proposed barrier was originally evaluated as one continuous noise barrier. However, due to the presence of an underground gas transmission line and overhead electrical transmission lines east of site F-010, the barrier was divided into two barriers leaving a gap for the utilities. As noted in the last sentence of the first paragraph for Barrier System F2, this option was found to be feasible but not reasonable. A berm located in the gap between the two barriers was added to the barrier system. The berm is offset approximately 40 feet from the edge-of-pavement with length of approximately 125 feet and a height of 20 feet. With a 2:1 slope, this was the maximum allowable height the berm could achieve while staying within the right-of-way. The evaluated barrier/berm combination achieves feasible (>5 dB(A)) noise reductions at three impacted receptors (see ***Appendix B***) representing three residences. The barrier/berm combination meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor and provides benefits at seven non-impacted receptors representing seven residences. The area for the barrier system is 19,920 square feet while the area for the berm is approximately 3,707 cubic yards. The barrier/berm combination exceeds Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/CY/BR) and therefore is feasible but not reasonable. A summary of the abatement for this evaluated barrier/berm is shown in ***Table 4***.

Additionally, during the barrier analysis phase, all scenarios were explored to evaluate this barrier systems reasonableness. Specifically, the removal of the east portion of the barrier system was analyzed to evaluate if this option would improve reasonableness. The outcome of dropping any east barrier panels resulted a failure to achieve the design goal of 7 dB(A) insertion loss for at least one impacted receptor. Furthermore, the complete removal of the wall would only benefit one of the three impacted receptors resulting in not meeting the feasibility criteria.

CNE G

Barrier G

Design year (2043) Build noise levels are predicted to exceed the NAC at four receptors representing four residences within CNE G. A preliminary noise barrier was evaluated for these specific impacts within CNE G. Specifically, Barrier G located along the north side of Route 29, beginning east of Meadow Estates Drive and continuing for approximately 949 feet to the east with an average height of 20.00 feet. The location of the barrier is shown on ***Figure 2-3***. Barrier F2 achieves feasible (>5 dB(A)) noise reductions at the four impacted receptors (see ***Appendix B***) representing four residences. The barrier meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The evaluated barrier provides benefits at 12 non-impacted receptors representing 12 residences. The total area for the barrier system is 18,982 square feet. It is considered reasonable due to its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 1,186, which is below the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for this evaluated barrier is shown in

Table 4. Therefore, Barrier G is considered feasible and reasonable at this time and is recommended for further consideration.

CNE H

Design year (2043) Build noise levels are predicted to exceed the NAC at five receptors representing five residences within CNE H. However, due to the size of the CNE and the location of the impacts, two separate barrier analyses were investigated in an attempt to mitigate noise impacts within different sections of the CNE. The results of each scenario are described in detail below.

Additionally, CNE H contains one receptor for which barriers were found to be not feasible due to access issues and therefore abatement was not evaluated for this receptor (H-027).

Barrier H1

A preliminary noise barrier was evaluated for impacted receptor H-034 within CNE H. Specifically, Barrier H1 located along the south side of Route 29, beginning west of Summit Drive and continuing for approximately 500 feet to the west with an average height of 14.51 feet. The location of the barrier is shown on ***Figure 2-3***. Barrier H1 achieves feasible (>5 dB(A)) noise reductions at the impacted receptor (see ***Appendix B***) representing one residence. The barrier meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The evaluated barrier provides benefits at one non-impacted receptor representing one residence. The total area for the barrier is 7,247 square feet. It is considered not reasonable due to its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 3,624, which exceeds the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for Barrier H1 is shown in ***Table 4***. Therefore, Barrier H1 is considered feasible, but not reasonable at this time.

Barrier H2

A preliminary noise barrier was evaluated for impacted receptors H-042 – H-044 within CNE H. Specifically, Barrier H2 located along the south side of Route 29, beginning east of Summit Drive and continuing for approximately 750 feet to the east with an average height of 14.27 feet. The location of the barrier is shown on ***Figure 2-4***. Barrier H2 achieves feasible (>5 dB(A)) noise reductions at the three impacted receptors (see ***Appendix B***) representing three residences. The barrier meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The evaluated barrier provides benefits at three non-impacted receptors representing three residences. The total area for the barrier is 10,704 square feet. It is considered not reasonable due to its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 1,784, which exceeds the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for Barrier H2 is shown in ***Table 4***. Therefore, Barrier H2 is considered feasible, but not reasonable at this time.

CNE I

Barrier I

Design year (2043) Build noise levels are predicted to exceed the NAC at three receptors representing three residences within CNE I. Although closer to Route 29 than receptor site I-021, the front row receptors in the community surrounding Finchem Court are not impacted due to topography. The community sits in a slight depression causing sound levels to be slightly less than receptors I-021 and I-029, which have a direct line-of-sight to the roadway. Similarly, a comparison of I-033 and I-034 revealed that I-033 is impacted due to the placement of modeling site on a second story porch whereas I-034 is placed at ground level. A preliminary noise barrier was evaluated for these specific impacts within CNE I. Specifically, Barrier I located along the north side of Route 29, beginning east of Buckleys Gate Drive and continuing for approximately 1,058 feet to the east with an average height of 19.00 feet. The location of the barrier is shown on ***Figure 2-4***. Barrier I achieves feasible (>5 dB(A)) noise reductions at the all three impacted receptors (see ***Appendix B***) representing three residences. The barrier meets the design goal of an insertion loss (IL) of 7 dB(A) for at least one impacted receptor at the evaluated height. The evaluated barrier provides benefits at 20 non-impacted receptors representing 20 residences. The total area for the barrier is 20,153 square feet. It is considered reasonable due to its Maximum Square Footage of Abatement per Benefited Receptor (MaxSF/BR) value of 876, which is below the allowable (MaxSF/BR) value of 1,600. A summary of the abatement for this evaluated barrier is shown in ***Table 4***. Therefore, Barrier I is considered feasible and reasonable at this time and is recommended for further consideration.

Note- To maintain access to Wyndham Creek Court without impeding ingress to emergency vehicles, the barrier ends at the emergency access point at the eastern termini.

IX. Construction Noise

VDOT is also concerned with noise generated during the construction phase of the proposed project. While the degree of construction noise impact will vary, it is directly related to the types and number of equipment used and the proximity to the noise sensitive land uses within the project area. Land uses that are sensitive to traffic noise are also potentially sensitive to construction noise.

Any construction noise impacts that do occur as a result of roadway construction measures are anticipated to be temporary in nature and will cease upon completion of the project construction phase. A method of controlling construction noise is to establish the maximum level of noise that construction operations can generate.

In view of this, VDOT has developed and FHWA has approved a specification that establishes construction noise limits. This specification can be found in VDOT's 2016 *Road and Bridge Specifications, Section 107.16(b.3), "Noise"*. The contractor will be required to conform to this specification to reduce the impact of construction noise on the surrounding community.

The specifications have been reproduced below:

- The Contractor's operations shall be performed so that exterior noise levels measured during a noise sensitive activity shall not exceed 80 decibels. Such noise level measurements shall be taken at a point on the perimeter of the construction limit that is closest to the adjoining property on which a noise sensitive activity is occurring. A noise sensitive activity is any activity for which lowered noise levels are essential if the activity is to serve its intended purpose and not present an unreasonable public nuisance. Such activities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks, and recreational areas.

- VDOT may monitor construction-related noise. If construction noise levels exceed 80 decibels during noise sensitive activities, the Contractor shall take corrective action before proceeding with operations. The Contractor shall be responsible for costs associated with the abatement of construction noise and the delay of operations attributable to noncompliance with these requirements.

- VDOT may prohibit or restrict to certain portions of the project any work that produces objectionable noise between 10 PM and 6 AM. If other hours are established by local ordinance, the local ordinance shall govern.

- Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.

- When feasible, the Contractor shall establish haul routes that direct his vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.

- These requirements shall not be applicable if the noise produced by sources other than the Contractor's operation at the point of reception is greater than the noise from the Contractor's operation at the same point.

X. Public Involvement/Local Officials Coordination

FHWA and VDOT policies require that VDOT provides certain information to local officials within whose jurisdiction the highway project is located to minimize future traffic noise impacts of Type I projects on currently undeveloped lands (Type I projects involve highway improvements with noise analysis). This information must include details on noise-compatible land-use planning and noise impact zones for undeveloped lands within the project corridor. The aforementioned details are provided below and shown on ***Figures 2-1 through 2-4***. Additional information about VDOT's noise abatement program has also been included in this section.

Sections 12.1 and 12.2 of VDOT's 2011 *Highway Traffic Noise Impact Analysis Guidance Manual* outline VDOT's approach to communication with local officials and provide information and resources on highway noise and noise-compatible land-use planning. VDOT's intention is to assist local officials in planning the uses of undeveloped land adjacent to highways to minimize the potential impacts of highway traffic noise.

Entering the Quiet Zone is a brochure that provides general information and examples to elected officials, planners, developers, and the general public about the problem of traffic noise and effective responses to the noise. The following is a link to this brochure on FHWA's website: http://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/land_use/qz00.cfm.

A wide variety of administrative strategies may be used to minimize or eliminate potential highway noise impacts, thereby preventing the need or desire for costly noise abatement structures such as noise barriers in future years. There are five broad categories of such strategies:

- Zoning
- Other legal restrictions (subdivision control, building codes, health codes)
- Municipal ownership or control of the land
- Financial incentives for compatible development
- Educational and advisory services

The Audible Landscape: A Manual for Highway and Land Use is a very well-written and comprehensive guide addressing these noise-compatible land use planning strategies, with detailed information. This document is available through FHWA's website, at: http://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/audible_landscape/al00.cfm.

Also required under the revised FHWA and VDOT noise policies is information on the noise impact zones adjacent to project roadways in undeveloped lands. To determine these zones, noise levels are computed at various distances from the edge of the project roadways in each of the undeveloped areas of the project study area. The distances from the edge of the roadway to the NAC noise levels are then determined through interpolation. Distances vary in the project corridor due to changes in traffic volumes or terrain features. The distances for this project are summarized in ***Table 5.*** Any noise sensitive sites within these zones should be considered noise impacted if no barrier is present to reduce noise levels. Please note, the 66 dB(A) contour is based on predicted exterior noise levels and therefore does not reflect predicted interior noise levels at NAC D modeling sites throughout the corridor.

Noise level contours are lines of equal noise exposure that typically parallel roadway alignments. Highway traffic noise is considered a linear noise source and noise levels can drop considerably over distance. The degree that noise levels decrease can vary based on a number of different factors including objects that shield the roadway noise, terrain features and ground cover type (e.g., pavement, grass or snow). The use of noise level contours has become increasingly

popular over the last several years, as they have been implemented in planning programs for undeveloped areas with roadway noise influence. Through conscious planning efforts and noise contour generation, municipal officials can restrict future development inside the noise impact zone (i.e., the area within the 66 dB(A) noise contour). ***Figures 2-1 through 2-4*** show the approximate 66 dB(A) noise level contours when considering the improvements made to the Fairfax County Parkway Project with the Design Year (2043) Build traffic volumes, speeds and composition. ***Table 5*** shows the approximate distance of the 66 dB(A) contour line from the centerline of the 2043 Build Alternative to each CNE throughout the Project Study Area.

XI. Conclusion

Under Design Year (2043) Build conditions, a total of 44 receptors representing 43 residences, and one trail (one grid unit) are predicted to experience noise impacts. In an attempt to mitigate Design Year (2043) Build noise impacts, a total of 10 barrier/barrier systems were evaluated throughout the project corridor. Five of these barrier/barrier systems (Barrier B, Barrier System C, Barrier D, Barrier G, and Barrier I) were found to be feasible and reasonable at this time. A detailed discussion of the noise abatement evaluation can be found in ***Section VIII*** of this report. Further study will be completed in Final Design to refine the abatement options. No commitments on noise abatement are made until the Final Design phase of the project.

TABLE 1

Route 29 Widening Project

FHWA/VDOT Noise Abatement Criteria

Hourly-A-Weighted Sound Level in Decibels (dB(A)) [1]

Activity Category	Activity L_{eq} (h)[4]	Criteria[2] L10 (h)	Evaluation Location	Description of Activity Category
A	57	60	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 intended purpose.
B[3]	67	70	Exterior	Residential.
C[3]	67	70	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 non-profit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, schools, and television studios.
E[3]	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties of activities not included in A-D or F.
F	--	--	Exterior	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 Either Leq (h) or L10 (h) (but not both) may be used on a project.

2 The Leq (h) and L10 (h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measure.

3 Includes undeveloped lands permitted for this Activity Criteria.

4 VDOT utilizes the Leq(h) designation.

TABLE 2

Route 29 Widening Project

TNM Validation

1	*2*	*3*	*4*	*5*
Receptor	Monitored Level	Modeled Level	Difference	Validated
M01	55.0	55.7	0.7	Yes
M02	58.0	55.7	-2.3	Yes
M03	55.5	54.6	-0.9	Yes
M04	54.5	57.2	2.7	Yes
M05	57.7	58.0	0.3	Yes
M06	59.3	56.5	-2.8	Yes
M07	58.5	60.5	2.0	Yes
M08	58.3	58.1	-0.2	Yes
M09	53.4	54.4	1.0	Yes
M10	55.6	58.3	2.7	Yes
M11	56.7	56.2	-0.5	Yes
M12	56.6	56.6	0.0	Yes

TABLE 3

Route 29 Widening Project

Noise Impact Summary by CNE

1	2	3	4	5	6	7	8	9	10	11
CNE	Site Representation	Existing 2017 Noise Level Range (dB(A))			No-Build 2043 Noise Level Range (dB(A))			Build 2043 Noise Level Range (dB(A))		
		Min	Max	# Impacts	Min	Max	# Impacts	Min	Max	# Impacts
A	Ten Residences, One Church, and One Trail (twelve grid units)	41	69	Two Residences and One Trail (one grid unit)	43	70	Two Residences and One Trail (one grid unit)	43	70	Two Residences and One Trail (one grid unit)
B	Sixty-Six Residences	46	66	Two Residences	47	67	Four Residences	47	67	Four Residences
C	Eighty-Eight Residences, One Playground, and One Trail (twelve grid units)	43	66	One Residence	44	68	Four Residences	44	67	Four Residences
D	Sixty-Six Residences	42	68	Eight Residences	43	69	Eleven Residences	42	69	Thirteen Residences
E	Eight Residences and Two Trails (forty grid units)	53	70	One Trail (18 grid units)	55	71	One Trail (22 grid units)	55	61	No Impacts
F	Seventy-Four Residences	39	67	Five Residences	40	68	Ten Residences	40	68	Nine Residences
G	Fifty Residences, One Shelter, One Church, One School, One Playground, One Trail (nine grid units), and One Active Sport Area (five grid units)	34	66	One Residence	36	67	Four Residences	36	68	Four Residences
H	Forty-Seven Residences and One Motel	48	68	Four Residences	49	69	Five Residences	49	69	Four Residences
I	One Hundred Fifty-Four Residences and One Playground	34	67	Three Residences	35	68	Three Residences	35	68	Three Residences
J	Seven Residences	45	63	No Impacts	46	65	No Impacts	46	64	No Impacts
Totals	570 Residences, Two Churches, Five trails (73 grid units), Three Playgrounds, One School, One Active Sport Area (five grid units), One Shelter, and One Motel	33	70	Twenty-Six Residences and Two Trails (19 grid units)	35	71	Forty-Three Residences and Two Trails (23 grid units)	35	70	Forty-Three Residences and One Trail (one grid unit)

TABLE 4

Route 29 Widening Project

Noise Abatement Acoustical Feasibility and Reasonableness Evaluation Summary

Proposed and Existing Barrier Evaluations

CNE	Barrier I.D.	Number of Benefited Receptor Units	Combined Noise Barrier/Berm Length (ft.)	Average Noise Barrier/Berm Height (ft.)	Square Footage / Cubic Yard (SF) / (CY)	Net SF per Benefited Receptor	Barrier Cost	Feasible?	Reasonable?
A	Barrier A	1	400	30.00	11,991	11,991	$503,622	Yes	No
B	Barrier B*	9	521	14.00	7,294	810	$306,348	Yes	Yes
C	Barrier System C*	17	828	15.00	12,561	739	$527,562	Yes	Yes
D	Barrier D	13	1,251	15.00	18,765	1,443	$788,130	Yes	Yes
F	Barrier F1	1	450	20.00	8,998	8,998	$377,916	Yes	No
	[1]Barrier System F2/Berm*	10	724 125	28.00 20.00	19,920 3,707	1,992	$836,640	Yes	No
G	Barrier G	16	949	20.00	18,982	1,186	$797,244	Yes	Yes
H	Barrier H1*	2	500	14.51	7,247	3,624	$304,374	Yes	No
	Barrier H2*	6	750	14.27	10,704	1,784	$449,568	Yes	No
I	Barrier I*	23	1,058	19.00	20,153	876	$846,426	Yes	Yes

*** Barrier evaluated at two-foot increments**

[1] Barrier Net SF per Benefitted Receptor Calculation based on barrier square footage ONLY

TABLE 5

Route 29 Widening Project

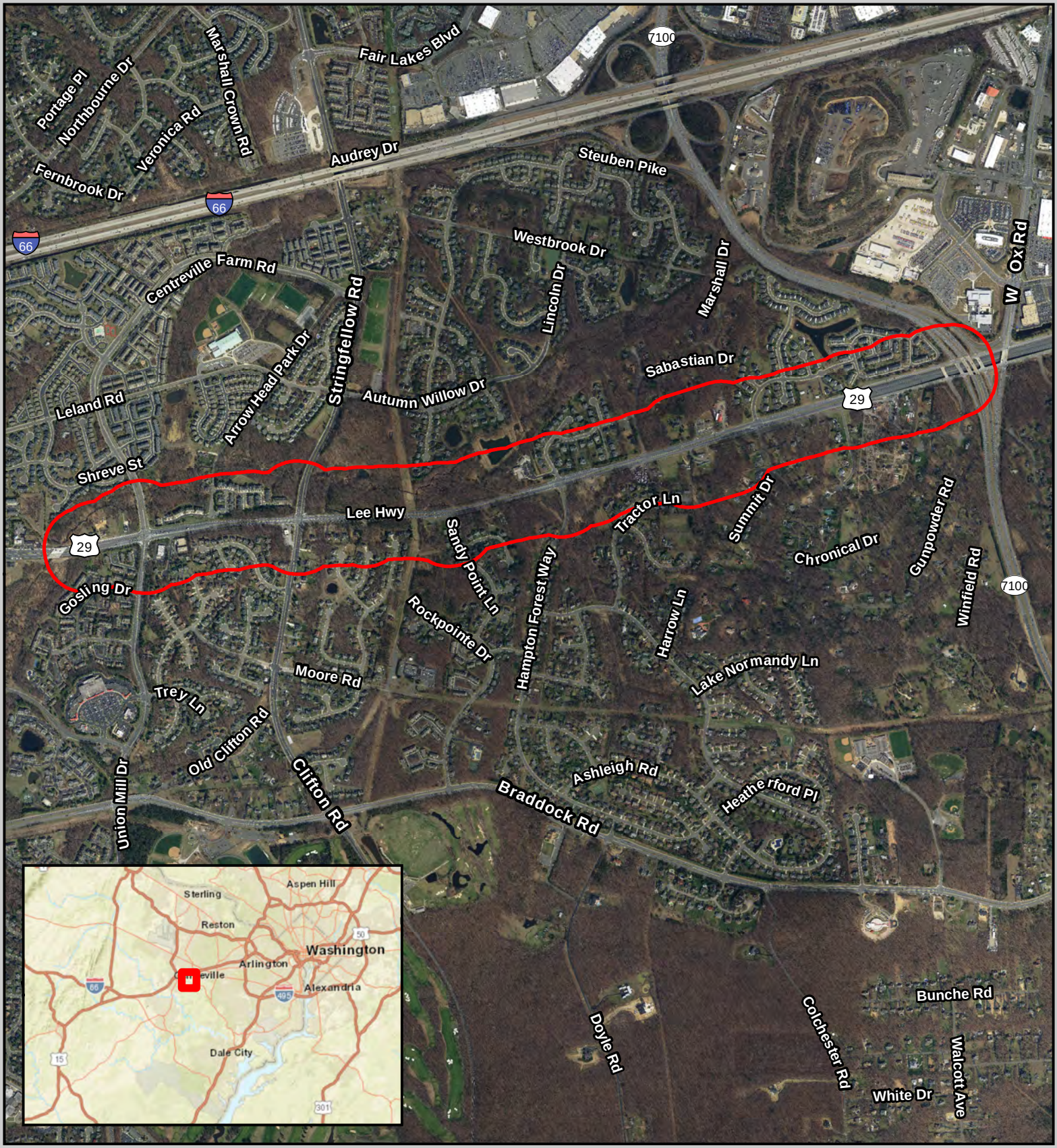
Distance from Centerline of Proposed Design

CNE Specific Noise Contours

Design Year (2043)
Noise Level Contours
66 dB(A)

CNE	Distance (feet)
A	160-240
B	115-175
C	25-90
D	182-207
E	137-177
F	80-193
G	100-147
H	90-185
I	20-120
J	50-65

FIGURES



Route 29 Widening Project

Fairfax County, Virginia
VDOT UPC: 110329
VDOT Project Number: 0029-029-350, B642, C501, P101, R201

Project Study Area

Figure 1
Regional Location Map

0 0.25 0.5
Miles

CNE A
CNE B
CNE C
CNE D
CNE E
CNE F
Barrier A
Barrier B
Barrier System C
Barrier D
Barrier F1
Centreville Farms Road
Route 29 (Lee Highway)
Moore Road
Union Mill Road
Covey Lane
Caballero Way
Regal Crest Drive
Clifton Crest Way
Clifton Road
Stringfellow Road

Modeled Receivers

- Impacted and Benefited
- Impacted not Benefited
- Benefited not Impacted
- Not Impacted not Benefited

Potential Barriers

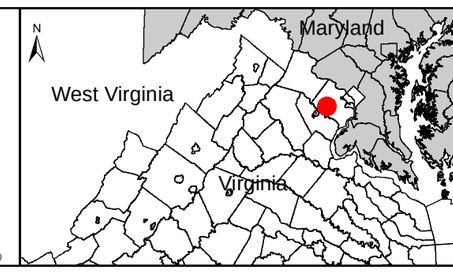
- Barrier Feasible and Reasonable
- Barrier Feasible not Reasonable
- Barrier not Feasible
- Berm

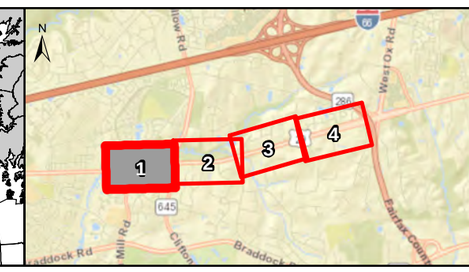
- Monitoring Site
- 66 dB(A) Contour
- Preliminary Design
- CNE Boundary
- 500' Study Area

N

0 150 300 450 Feet

Aerial imagery courtesy of ESRI & Fairfax County GIS Imagery Service (2017)





Route 29 Widening Project

VDOT UPC: 110329
VDOT Project Number: 0029-029-350, B642, C501, P101, R201

Preliminary Noise Analysis

Fairfax County, Virginia

Figure: 2 - 1

Detailed Study Area Map

Date: 5/30/2019

Modeled Receivers

- Impacted and Benefited
- Impacted not Benefited
- Benefited not Impacted
- Not Impacted not Benefited

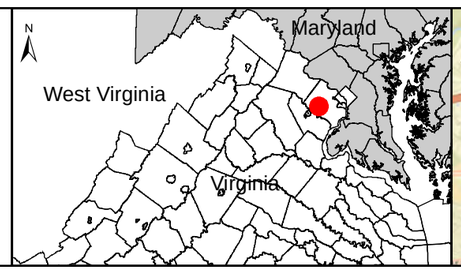
Potential Barriers

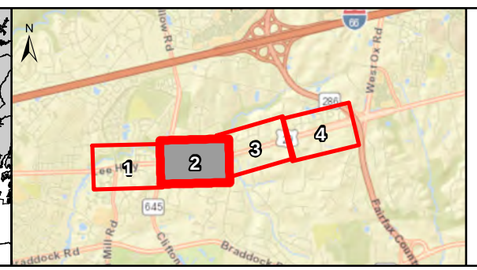
- Barrier Feasible and Reasonable
- Barrier Feasible not Reasonable
- Barrier not Feasible
- Berm

- Monitoring Site
- 66 dB(A) Contour
- Preliminary Design
- CNE Boundary
- 500' Study Area

0 150 300 450 Feet

Aerial imagery courtesy of ESRI & Fairfax County GIS Imagery Service (2017)





Route 29 Widening Project

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VDOT Project Number: 0029-029-350, B642, C501, P101, R201

Preliminary Noise Analysis

Fairfax County, Virginia

Figure: 2 - 2

Detailed Study Area Map

Date: 5/30/2019

Modeled Receivers

- Impacted and Benefited
- Impacted not Benefited
- Benefited not Impacted
- Not Impacted not Benefited

Potential Barriers

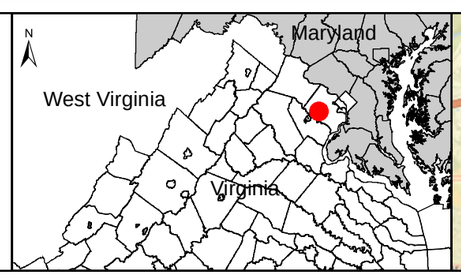
- Barrier Feasible and Reasonable
- Barrier Feasible not Reasonable
- Barrier not Feasible
- Berm

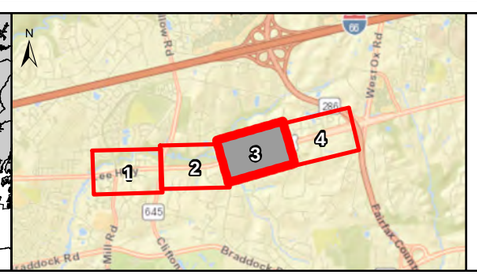
- Monitoring Site
- 66 dB(A) Contour
- Preliminary Design
- CNE Boundary
- 500' Study Area

0 150 300 450 Feet

N

Aerial imagery courtesy of ESRI & Fairfax County GIS Imagery Service (2017)





Route 29 Widening Project

VDOT UPC: 110329
VDOT Project Number: 0029-029-350, B642, C501, P101, R201

Preliminary Noise Analysis

Fairfax County, Virginia

Figure: 2 - 3

Detailed Study Area Map

Date: 5/30/2019

CNE G
CNE I
CNE H
CNE J
Buckleys Gate Drive
Finchem Court
Summit Drive
Hazel Ferguson Drive
Fairfax County Parkway
Route 29 (Lee Highway)
Barrier I
Barrier H1
Barrier H2
M-10
M-11
M-12

Modeled Receivers

- Impacted and Benefited
- Impacted not Benefited
- Benefited not Impacted
- Not Impacted not Benefited

Potential Barriers

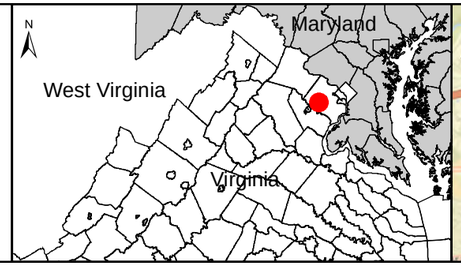
- Barrier Feasible and Reasonable
- Barrier Feasible not Reasonable
- Barrier not Feasible
- Berm

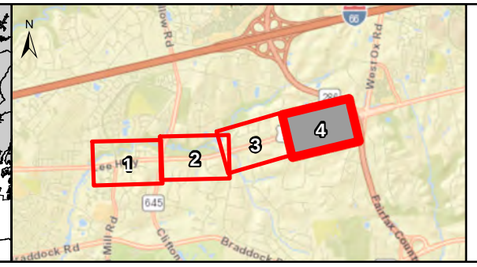
- Monitoring Site
- 66 dB(A) Contour
- Preliminary Design
- CNE Boundary
- 500' Study Area

N

0 150 300 450 Feet

Aerial imagery courtesy of ESRI & Fairfax County GIS Imagery Service (2017)





Route 29 Widening Project

VDOT UPC: 110329
VDOT Project Number: 0029-029-350, B642, C501, P101, R201

Preliminary Noise Analysis

Fairfax County, Virginia

Figure: 2 - 4

Detailed Study Area Map

Date: 5/30/2019