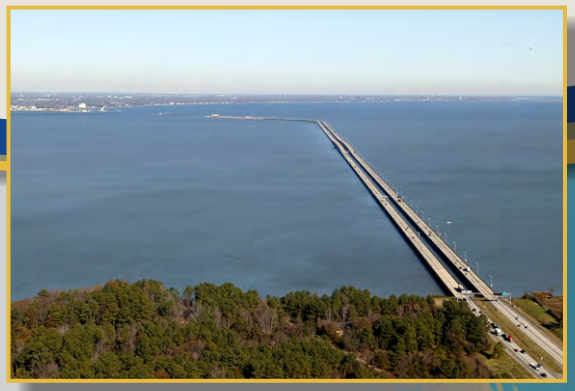
HRCS SEIS
Hampton Roads Crossing Study SEIS

# Noise Technical Report

## Prepared in Support of the Supplemental Environmental Impact Statement






VDOT
Virginia Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

July 2016

# NOISE ANALYSIS TECHNICAL REPORT

HRCS SEIS

Hampton Roads Crossing Study SEIS

Prepared in support of the Supplemental Environmental Impact Statement

VDOT Project #: 0064-965-081, P101

UPC#: 106724

**July 2016**

## EXECUTIVE SUMMARY

This report for the Hampton Roads Crossing Study documents the noise analysis conducted for the existing (2015) and future (2040) noise conditions in the HRCS Study Area Corridors to support the Supplemental Draft Environmental Impact Statement. The project study area includes sections of I-64, I-664, I-564, VA 164, and new-location roadways under consideration in the cities of Hampton, Newport News, Norfolk, Portsmouth, Suffolk and Chesapeake. All analysis was performed in accordance with current Federal Highway Administration (FHWA) regulations contained in 23 CFR 772 and Virginia Department of Transportation Noise Abatement Policy.

The study involved monitoring of existing noise conditions and modeling of existing (2015) and future design-year (2040) noise conditions in the study area with the FHWA-approved computerized Traffic Noise Model. The modeling accounts for the existing terrain and buildings, and for existing and proposed roadways with projected loudest-hour traffic. Noise impact is assessed for all project alternatives and summarized by major project corridor, by alternative and by FHWA land use activity category in the table below. AM and PM peak hour, rather than hourly traffic volume and speed data were developed for the project, therefore the loudest hour traffic data used for the noise analysis was the louder of the two peak hours. The AM peak hour was consistently the louder hour over the entire study area, for all alternatives. Traffic projections are preliminary and would be reevaluated during the final design noise analysis, accounting for final lane configuration and managed lanes that may be part of the design. In addition, hourly traffic data will be developed for the final design noise analysis, and the loudest hour will be determined from those data.

**Noise Impact Summary by Corridor and Land Use Activity Category**

| Corridor | Alternative | Number of Receptors Impacted by Activity Category | | | | |
|---|---|---|---|---|---|---|
| | | Residential Category B | Recreational/ Parks Category C | Institutional Interior Category D | Commercial Category E | Total |
| I-64 | 2015 Existing | 653 | 125 | 0 | 0 | 778 |
| | 2040 No-build | 826 | 176 | 0 | 0 | 1002 |
| | 2040 Alternative A | 780 | 173 | 0 | 0 | 953 |
| | 2040 Alternative B | 780 | 173 | 0 | 0 | 953 |
| | 2040 Alternative D | 705 | 159 | 0 | 0 | 864 |
| I-564 | 2015 Existing | 1 | 17 | 0 | 0 | 18 |
| | 2040 No-build | 7 | 0 | 0 | 0 | 7 |
| | 2040 Alternative B | 10 | 8 | 0 | 0 | 18 |
| | 2040 Alternative C | 14 | 8 | 0 | 0 | 22 |
| | 2040 Alternative D | 14 | 8 | 0 | 0 | 22 |
| VA 164 | 2015 Existing | 26 | 0 | 0 | 0 | 26 |
| | 2040 No-build | 51 | 0 | 0 | 0 | 51 |
| | 2040 Alternative B | 901 | 6 | 3 | 0 | 910 |
| | 2040 Alternative C | 1 | 0 | 0 | 0 | 1 |

| Corridor | Alternative | Number of Receptors Impacted by Activity Category | | | | |
|---|---|---|---|---|---|---|
| | | Residential Category B | Recreational/ Parks Category C | Institutional Interior Category D | Commercial Category E | Total |
| | 2040 Alternative D | 751 | 6 | 3 | 0 | 760 |
| I-664 Southside | 2015 Existing | 243 | 11 | 0 | 0 | 254 |
| | 2040 No-build | 315 | 14 | 0 | 0 | 329 |
| | 2040 Alternative B | 104 | 2 | 0 | 0 | 106 |
| | 2040 Alternative C | 386 | 14 | 0 | 0 | 400 |
| | 2040 Alternative D | 397 | 16 | 0 | 0 | 413 |
| I-664 Peninsula | 2015 Existing | 124 | 30 | 0 | 1 | 155 |
| | 2040 No-build | 263 | 45 | 0 | 1 | 309 |
| | 2040 Alternative C | 520 | 70 | 0 | 1 | 591 |
| | 2040 Alternative D | 422 | 66 | 0 | 1 | 489 |
| Alternative A Totals | 2015 Existing A | 653 | 125 | 0 | 0 | 778 |
| | 2040 No-build A | 826 | 176 | 0 | 0 | 1002 |
| | 2040 Build A | 780 | 173 | 0 | 0 | 953 |
| Alternative B Totals | 2015 Existing B | 722 | 143 | 0 | 0 | 865 |
| | 2040 No-build B | 930 | 178 | 0 | 0 | 1108 |
| | 2040 Build B | 1795 | 189 | 3 | 0 | 1987 |
| Alternative C Totals | 2015 Existing C | 368 | 58 | 0 | 1 | 427 |
| | 2040 No-build C | 585 | 59 | 0 | 1 | 645 |
| | 2040 Build C | 921 | 92 | 0 | 1 | 1014 |
| Alternative D Totals | 2015 Existing D | 1047 | 183 | 0 | 1 | 1231 |
| | 2040 No-build D | 1462 | 235 | 0 | 1 | 1698 |
| | 2040 Build D | 2289 | 255 | 3 | 1 | 2548 |

Noise abatement must be considered where noise impact is predicted. Noise abatement is evaluated to determine if it is warranted, feasible and reasonable. The following tables summarize the total length, estimated cost and benefits that would be provided by the potential and replacement barriers evaluated that are found to be warranted, feasible and reasonable. The first table summarizes the barriers by alternative, the second table summarizes by corridor and city. Since the different Build Alternatives in each corridor are identical or nearly the same physically, and projected to carry very similar traffic in 2040, the barriers and their benefits are the same for each alternative.

**Summary of Feasible and Reasonable Noise Barriers by Alternative**

| Alternatives | Length (mi.) | Estimated Cost ($31/square feet) | Number of Benefited Receptors | | |
|---|---|---|---|---|---|
| | | | Impacted | Not impacted | Total |
| A | 9 | 29,062,497 | 748 | 957 | 1705 |
| B | 13.3 | 42,822,157 | 1307 | 2202 | 3509 |
| C | 13.4 | 46,437,628 | 904 | 1895 | 2799 |
| D | 25.4 | 86,159,630 | 2185 | 4002 | 6187 |

**Summary of Feasible and Reasonable Noise Barriers by Corridor and City**

| Corridor and City | Alterna-tives | Length (mi.) | Estimated Cost ($31/square feet) | Number of Benefited Receptors | | |
|---|---|---|---|---|---|---|
| | | | | Impacted | Not impacted | Total |
| I-64 Hampton | A, B, D | 3.7 | 9,902,609 | 174 | 239 | 413 |
| I-64 Norfolk | A, B, D | 5.3 | 19,159,888 | 574 | 718 | 1,292 |
| I-564 Norfolk | B, D | 1.2 | 2,759,496 | 14 | 93 | 107 |
| I-564 Norfolk | C | 1.3 | 3,100,155 | 22 | 94 | 116 |
| VA 164 Portsmouth | B, D | 3.1 | 11,000,164 | 545 | 1,152 | 1,697 |
| I-664 Chesapeake | C, D | 3.8 | 12,950,746 | 243 | 349 | 592 |
| I-664 Suffolk | C, D | 1.9 | 7,653,094 | 145 | 284 | 429 |
| I-664 Newport News | C, D | 3.5 | 14,018,665 | 281 | 782 | 1,063 |
| I-664 Hampton | C, D | 2.9 | 8,714,968 | 213 | 386 | 599 |

The noise analysis conducted was preliminary, and a more detailed review will be completed during final design on the Preferred Alternative. As such, noise barriers that are found to be feasible and reasonable during the preliminary noise analysis may also not be found to be feasible and reasonable during the final design noise analysis. Conversely, noise barriers that were not considered feasible and reasonable may meet the established criteria and be recommended for construction. If a noise barrier is determined to be feasible and reasonable in final design, the affected public will be given an opportunity to decide whether they are in favor of construction of the noise barrier.

In addition to the traffic data and noise barrier analysis described above, the following elements of the study will also be reevaluated during the detailed noise study to be performed during the final design of this project:

- Additional coordination with the cities' planning and building departments to confirm and update permitted land uses,
- The significance of noise contributions from aircraft operations from Norfolk Naval Air Station and from various railroad operations along rail lines in the study corridor,
- Monitoring sites where the predicted model validation sound levels were not within 3 decibels of the monitored levels will be monitored again and re-validated,

- The use of adjustment factors will be considered for predicted sound levels in portions of the study area where quieter THMACO pavement is present,
- The need for an analysis of sound reflected from potential noise barriers and the potential use of sound absorbing materials, and
- The feasibility of implementing abatement measures other than noise walls, such as berms, noise reducing design, and low noise pavement materials.

Construction activity may cause intermittent fluctuations in noise levels. During the construction phase of the project, all reasonable measures will be taken to minimize noise impact from these activities.

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# 1. INTRODUCTION

This report documents the noise analysis conducted for the existing (2015) and future (2040) noise conditions in the HRCS Study Area Corridors to support the Supplemental Draft Environmental Impact Statement. The project study area includes sections of I-64, I-664, I-564, VA 164, and new-location roadways under consideration in the cities of Hampton, Newport News, Norfolk, Portsmouth, Suffolk and Chesapeake.

## 1.1 NOISE STUDY OVERVIEW

The Federal Highway Administration (FHWA) regulations for assessment and mitigation of highway traffic noise in the planning and design of federally aided highway projects are contained in Title 23 of the United States Code of Federal Regulations Part 772 (23 CFR 772). These regulations state that a "Type I" traffic noise impact analysis is required where through travel lanes or interchange ramps are added. This report details the noise impact analysis conducted for the HRCS Study Area Corridors. This noise analysis was conducted in accordance with FHWA and VDOT noise assessment regulations and guidelines.

This report presents a summary of the roadway improvements under study, description of noise terminology, the applicable standards and criteria, an evaluation of the existing noise conditions, a description of the computations of existing and future noise levels, a prediction of future noise impact, an evaluation of potential noise abatement measures, construction noise considerations, and information for local government officials. **Appendix A** presents the list of preparers, **Appendix B** tabulates the traffic data used in the noise modeling, **Appendix C** presents predicted noise levels, **Appendix D** presents all noise measurement data, **Appendix E** provides a response from the Virginia Department of Transportation (VDOT) project management on alternative noise abatement measures, and **Appendix F** presents VDOT's Warranted, Feasible and Reasonable barrier worksheets.

## 1.2 PROJECT DESCRIPTION

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA) as the lead federal agency, is preparing a Supplemental Environmental Impact Statement (SEIS) for the Hampton Roads Crossing Study (HRCS). The Study is located in the cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk, Virginia. The SEIS re-evaluates the findings of the 2001 HRCS Final Environmental Impact Statement (FEIS) and Record of Decision (ROD). The three alternatives retained for analysis in the 2001 FEIS, as well as input received from the public during initial scoping for the SEIS, were used to establish the Study Area Corridors shown in **Figure 1-1**. The purpose and need of the SEIS is summarized below.

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, FHWA is preparing an SEIS because of the time that has lapsed since the 2001 FEIS and new information indicating significant environmental impacts not previously considered. The SEIS, prepared in accordance with the implementing regulations of NEPA (23 CFR §771.130), is intended to aid in ensuring sound decision-making moving forward by providing a comparative understanding of the potential effects of the various options.

**Figure 1-1: HRCS Study Area Corridors**

### 1.2.1 Purpose and Need

The purpose of the HRCS is to relieve congestion at the I-64 Hampton Roads Bridge-Tunnel (HRBT) in a manner that improves accessibility, transit, emergency evacuation, and military and goods movement along the primary transportation corridors in the Hampton Roads region, including the I-64, I-664, I-564, and VA 164 corridors. The HRCS addresses the following needs (in the order of presentation in Chapter 1 of the Draft SEIS):

- Accommodate travel demand – capacity is inadequate on the Study Area Corridors, contributing to congestion at the HRBT;
- Improve transit access – the lack of transit access across the Hampton Roads waterway;
- Increase regional accessibility – limited number of water crossings and inadequate highway capacity and severe congestion decrease accessibility;
- Address geometric deficiencies – insufficient vertical and horizontal clearance at the HRBT contribute to congestion;
- Enhance emergency evacuation capability – increase capacity for emergency evacuation, particularly at the HRBT;
- Improve strategic military connectivity – congestion impedes military movement missions; and
- Increase access to port facilities – inadequate access to interstate highway travel in the Study Area Corridors impacts regional commerce.

### 1.2.2 Alternatives

Five alternatives, including the No-Build Alternative, are under consideration for the Draft SEIS and are assessed in this technical report. The proposed limits of the four Build Alternatives are shown on **Figure 1-2**. Each Technical Report and Memorandum prepared in support of the Draft SEIS will assess existing conditions and environmental impacts along the Study Area Corridors (as shown on **Figure 1-1**) for each alternative. Each alternative is comprised of various roadway alignments, used to describe the alternatives and proposed improvements, shown on **Figure 1-3**.

<u>The No-Build Alternative</u>

This alternative includes continued routine maintenance and repairs of existing transportation infrastructure within the Study Area Corridors, but there would be no major improvements.

<u>Alternative A</u>

Alternative A begins at the I-64/I-664 interchange in Hampton and creates a consistent six-lane facility by widening I-64 to the I-564 interchange in Norfolk. A parallel bridge-tunnel would be constructed west of the existing I-64 HRBT. During the public review of the HRBT DEIS, there was a clear lack of public or political support for the level of impacts associated with any of the build alternatives. Specifically, potential impacts to the historic district at Hampton University, Hampton National Cemetery, and the high number of displacements were key issues identified by the public, elected officials, and University and Veterans Affairs officials. Given this public opposition, a Preferred Alternative was not identified and the study did not advance. On August 20, 2015, FHWA rescinded its Notice of Intent to prepare the HRBT DEIS, citing public and agency comments and concerns over the magnitude of potential environmental impacts to a variety of resources, such as impacts to historic resources as well as communities and neighborhoods. Consequently, VDOT and FHWA have committed that improvements proposed in the HRCS SEIS to the I-64 corridor would be largely confined to existing right-of-way. To

**Figure 1-2: Build Alternatives**

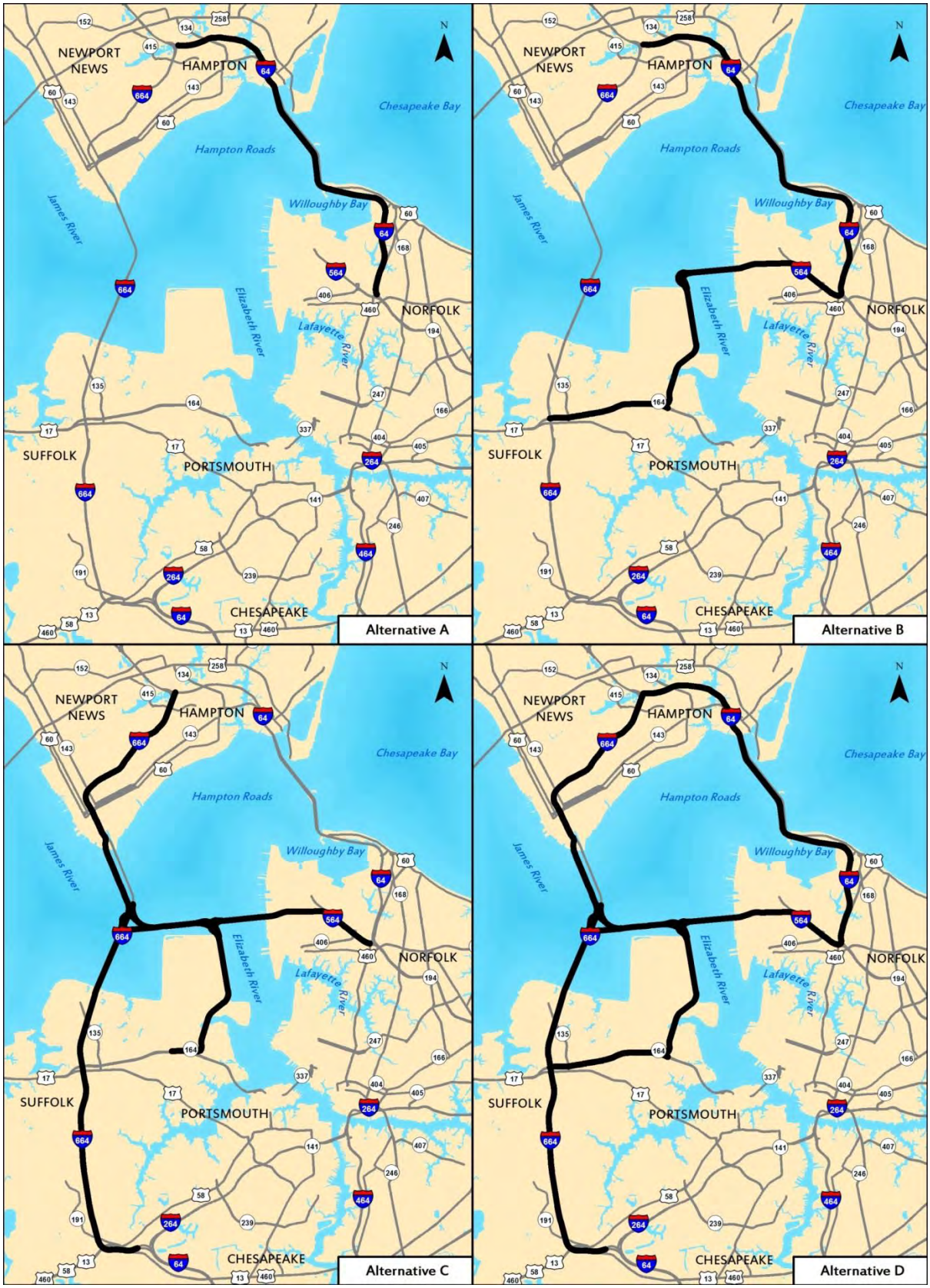
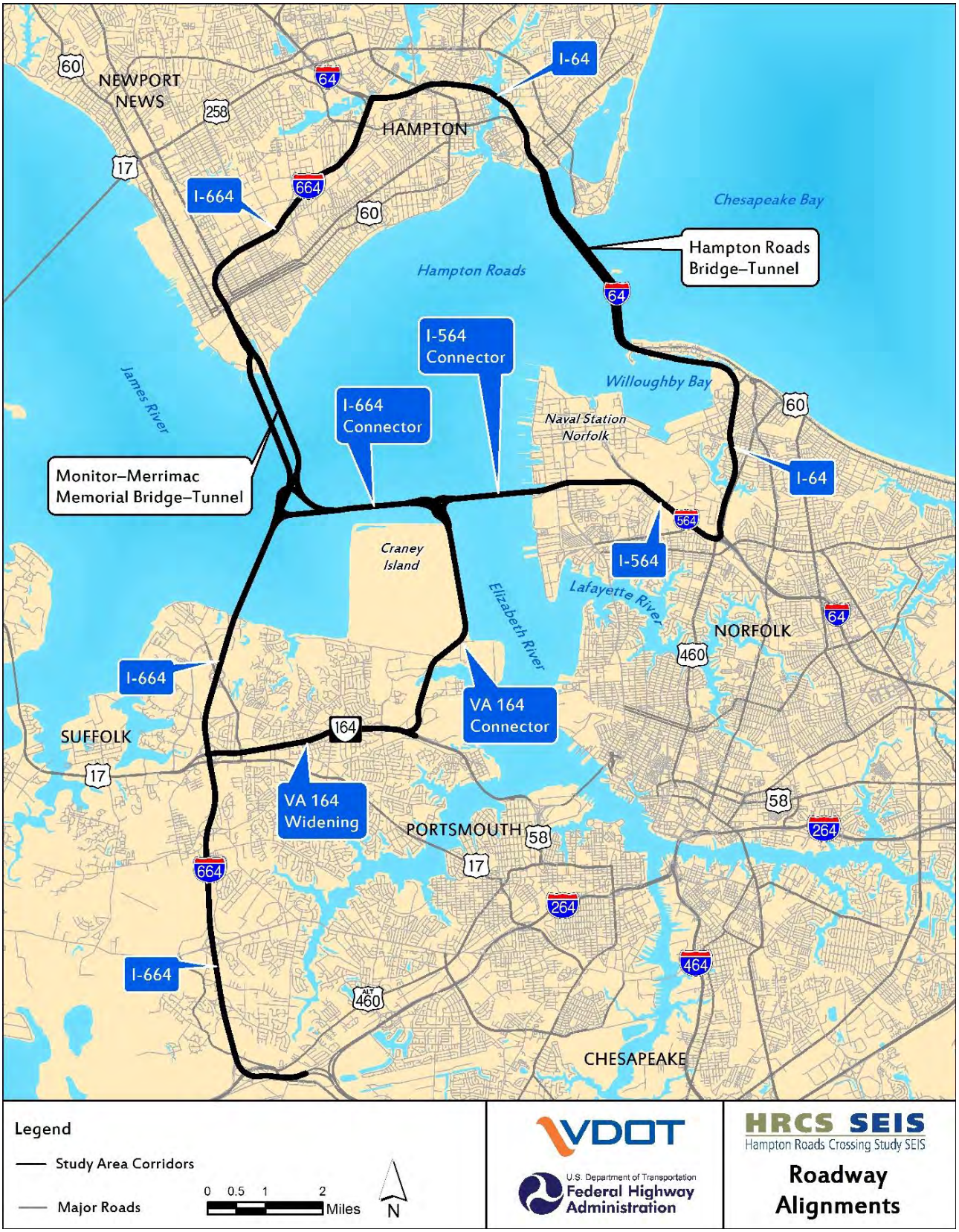


**Figure 1-3: Roadway Alignments**



meet this commitment, Alternative A considers a six-lane facility. Alternative A lane configurations are summarized in **Table 1-1.**

**Table 1-1: Alternative A Lane Configurations**

| Roadway Alignments | Existing Lanes | Proposed Lanes |
|---|---|---|
| I-64 (Hampton) | 4-6 | 6 |
| I-64 (HRBT and Norfolk) | 4 | 6 |

Alternative B

Alternative B includes all of the improvements included under Alternative A, and the existing I-564 corridor that extends from its intersection with I-64 west towards the Elizabeth River. I-564 would be extended to connect to a new bridge-tunnel across the Elizabeth River (I-564 Connector). A new roadway (VA 164 Connector) would extend south from the I-564 Connector, along the east side of the Craney Island Dredged Material Management Area (CIDMMA), and connect to existing VA 164. VA 164 would be widened from this intersection west to I-664. Alternative B lane configurations are summarized in **Table 1-2**.

**Table 1-2: Alternative B Lane Configurations**

| Roadway Alignments | Existing Lanes | Proposed Lanes |
|---|---|---|
| I-64 (Hampton) | 4-6 | 6 |
| I-64 (HRBT and Norfolk) | 4 | 6 |
| I-564 | 6 | 6 |
| I-564 Connector | none | 4 |
| VA 164 Connector | none | 4 |
| VA 164 | 4 | 6 |

*Note: The I-564 Intermodal Connector (IC) project is a separate project from HRCS that lies between the I-564 Connector and I-564. It would be constructed regardless of whether the HRCS improvements are made and therefore is included under the No-Build Alternative and is not listed with other proposed improvements.*

Alternative C

Alternative C includes the same improvements along I-564, the I-564 Connector, and the VA 164 Connector that are considered with Alternative B. This alternative would not propose improvements to I-64 or VA 164 beyond the VA 164 Connector. Alternative C includes dedicated transit facilities in specific locations. The Virginia Department of Rail and Public Transportation (DRPT) completed a study in November 2015 that recommended high frequency bus rapid transit (BRT) service in a fixed guideway or in a shared high occupancy vehicle (HOV) or high occupancy toll (HOT) lanes (DRPT, 2015). Based on that recommendation, for the purposes of this Draft SEIS, transit assumes Bus Rapid Transit (BRT). In the Final SEIS, transit could be redefined or these lanes may be used as managed lanes. Alternative C converts one existing HOV lane in each direction on I-564 in Norfolk to transit only. The I-564 Connector and the I-664 Connector would be constructed with transit only lanes. This alternative also includes widening along I-664 beginning at I-664/I-64 in Hampton and continuing south to the I-264 interchange in Chesapeake. One new transit lane is included along I-664 between I-664/I-64 in Hampton and the new interchange with the I-664 Connector. Alternative C lane configurations are summarized in **Table 1-3**.

**Table 1-3: Alternative C Lane Configurations**

| Roadway Alignments | Existing Lanes | Proposed Lanes |
|---|---|---|
| I-664 (from I-64 to the proposed I-664 Connector) | 4-6 | 8 + 2 Transit Only |
| I-664 (from the proposed I-664 Connector to VA 164) | 4 | 8 |
| I-664 (from VA 164 to I-264) | 4 | 6 |
| I-564 | 6 | 4 + 2 Transit Only |
| I-564 Connector | none | 4 + 2 Transit Only |
| VA 164 Connector | none | 4 |
| I-664 Connector | none | 4 + 2 Transit Only |

*Note: The I-564 IC project is a separate project from HRCS that lies between the I-564 Connector and I-564. It would be constructed regardless of whether the HRCS improvements are made and therefore is included under the No-Build Alternative and is not listed with other proposed improvements.*

Alternative D

Alternative D is a combination of the sections that comprise Alternatives B and C. Alternative D lane configurations are summarized in **Table 1-4**.

**Table 1-4: Alternative D Lane Configurations**

| Roadway Alignments | Existing Lanes | Proposed Lanes |
|---|---|---|
| I-64 (Hampton) | 4-6 | 6 |
| I-64 (HRBT and Norfolk) | 4 | 6 |
| I-664 (from I-64 to VA 164) | 4-6 | 8 |
| I-664 (from VA 164 to I-264) | 4 | 6 |
| I-664 Connector | None | 4 |
| I-564 | 6 | 6 |
| I-564 Connector | none | 4 |
| VA 164 Connector | none | 4 |
| VA 164 | 4 | 6 |

*Note: The I-564 IC project is a separate project from HRCS that lies between the I-564 Connector and I-564. It would be constructed regardless of whether the HRCS improvements are made and therefore is included under the No-Build Alternative and is not listed with other proposed improvements.*

### 1.2.1 Operationally Independent Sections

Given the magnitude and scope of the alternatives, it is expected that a Preferred Alternative would be constructed in stages or operationally independent sections (OIS). An OIS is a portion of an alternative that could be built and function as a viable transportation facility even if other portions of the alternative are not advanced. The OIS are comprised of various roadway alignments and were developed by identifying sections of roadway improvements that if constructed, could function independently. Noise impacts from OIS would be evaluated for the FEIS if a new hybrid alternative is determined to be the preferred alternative. In addition, during design, more detailed analysis would be completed for each individual section. Regardless of this, an additional, detailed noise reevaluation will occur during the final detailed design of the project.

## 1.3 NOISE ANALYSIS STUDY AREA BOUNDARIES

For the purposes of this noise analysis, the Study Area Corridors for detailed evaluation are generally defined as approximately 500 feet on either side of the edge of pavement of the roadways where improvements are proposed for the particular Build Alternative. The black lines on the Alternatives maps in **Figure 1-2** indicate the sections of each alternative that have been evaluated in detail under each alternative. It should be noted that there are a few roadway sections where improvements are not being proposed under any of the alternatives, but which are being evaluated because they are considered part of the project and the roadways leading to them are being improved. These sections include 1) I-64 in Hampton between the I-664 interchange and Route 60, which are applicable to Alternatives A, B and D, 2) the I-664 / I-64 interchange in Hampton, which is applicable to all alternatives, and a section of I-564 between the Intermodal Connector tie-in and I-64, which is applicable to Alternatives B, C and D.

## 1.4 STUDY PARTICIPANTS

Rummel Klepper & Kahl, LLP (RK&K) was retained by VDOT to evaluate the projected environmental impacts associated with the proposed improvements to the project roadways in the HRCS Study Area Corridors. HMMH was retained by RK&K to perform the noise analysis for this study, and RK&K staff supported HMMH for portions of the noise analysis. **Appendix A** provides a list of preparers.

# 2. NOISE TERMINOLOGY AND CRITERIA

## 2.1 REGULATIONS AND GUIDELINES

The noise impact of the existing and future HRCS roadways in the Study Area Corridors was assessed in accordance with FHWA and VDOT noise assessment regulations and guidelines. The FHWA regulations are set forth in 23 CFR Part 772 (FHWA, 2010). On July 13, 2010, FHWA published revised noise regulations which became effective on July 13, 2011. FHWA has also published a guidance document to support the new regulations (FHWA, 2011). VDOT prepared revisions to its noise policy in accordance with FHWA's requirements and revised policy. VDOT's revised policy has received approval from FHWA, and was updated on July 14, 2015 (Virginia DOT, 2015).

## 2.2 NOISE ABATEMENT CRITERIA

To assess the degree of impact of highway traffic and noise on human activity, the FHWA established Noise Abatement Criteria (NAC) for different categories of land use activity (see **Table 2-1**). The NAC are given in terms of the hourly, A-weighted, equivalent sound level in decibels (dBA). The A-weighted sound level is commonly used when measuring environmental noise to provide a single number descriptor that correlates with human subjective response to noise because the sensitivity of human hearing varies with frequency. The A-weighted sound level is widely accepted by acousticians as a proper unit for describing environmental noise. Most environmental noise (and the A-weighted sound level) fluctuates from moment to moment, and it is common practice to characterize the fluctuating level by a single number called the equivalent sound level ($L_{eq}$). The $L_{eq}$ is the value or level of a steady, non-fluctuating sound that represents the same sound energy as the actual time-varying sound evaluated over the same time period. For traffic noise assessment, $L_{eq}$ is typically evaluated over a one-hour period, and may be denoted as $L_{eq}(h)$.

In this study, residential (Category B), recreational (Category C), indoor institutional (Category D) and commercial (Category E) land uses are evaluated for noise impact. For Categories B and C, noise impact is assumed to occur when predicted exterior noise levels approach or exceed 67 dBA in terms of $L_{eq}(h)$ during the loudest hour of the day. For Category D (noise-sensitive institutional) land uses such as schools and church buildings, impact is projected where predicted interior sound levels due to the Project would approach or exceed 52 dBA, $L_{eq}(h)$. For Category E land uses, examples of which are outdoor eating areas adjacent to restaurants or offices and motel swimming pools, noise impact is assumed to occur when predicted exterior noise levels due to the Project approach or exceed 72 dBA in terms of $L_{eq}(h)$ during the loudest hour of the day. VDOT defines the word "approach" in "approach or exceed" as within 1 decibel. Therefore, the threshold for noise impact is where exterior noise levels are within 1 decibel of 67 dBA $L_{eq}(h)$, or 66 dBA for Categories B and C, and within one decibel of 72 dBA $L_{eq}(h)$, or 71 dBA for Category E. For Category D, the threshold for noise impact is where interior noise levels are within 1 decibel of 52 dBA $L_{eq}(h)$, or 51 dBA. Noise impact also would occur wherever Project noise causes a substantial increase over existing noise levels. VDOT defines a substantial increase as an increase of 10 decibels or more above existing noise levels.

When the predicted design-year Build scenario noise levels approach or exceed the NAC during the loudest hour of the day or cause a substantial increase in existing noise, consideration of traffic noise reduction measures is warranted. If it is found that such mitigation measures will cause adverse social, economic or environmental effects that outweigh the benefits received, they may be dismissed from

**Table 2-1: FHWA Noise Abatement Criteria**

| Activity Category | $L_{eq}(h)$[1] | Description of Activity Category |
|---|---|---|
| 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 intended purpose |
| B[2] | 67 (Exterior) | Residential |
| C[2] | 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 | 72 (Exterior) | Hotels, motels, offices, restaurants/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[2] | – | Undeveloped lands that are not permitted (without building permits) |

[1] *Hourly Equivalent A-weighted Sound Level (dBA)*
[2] *Includes undeveloped lands permitted for this activity category*
*Source: 23 CFR Part 772.*

consideration. For this study, noise levels throughout the study area are analyzed for Existing (2015) conditions and for the design-year (2040) No-Build and Build Alternatives.

All noise-sensitive land uses potentially affected by the project are near roads for which traffic data were developed as part of the environmental study. Because this is a preliminary noise study and due the magnitude of the study area, hourly traffic data were not developed for the noise analysis. Instead, all noise levels are predicted from the louder of the two peak hours for which traffic data were

developed. Hourly traffic data would be developed during the noise study for the final design of the project, from which loudest-hour traffic will be derived. The prediction methods and predicted noise levels appear in **Section 4**.

## 2.3 UNDEVELOPED LANDS AND PERMITTED DEVELOPMENTS

Highway traffic noise analyses are (and will be) 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 Traffic 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 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 building, planning and/or development departments in the cities of Hampton, Newport News, Norfolk, Chesapeake, Portsmouth and Suffolk were contacted in December 2015 to request current permitted but undeveloped noise-sensitive land uses in the project corridor. Other than in Newport News, little noise-sensitive development activity in the project corridor was identified by the cities' building and planning departments. Mr. Mike Nall and Mr. Marc A. Rodgers in the Newport News Department of Development provided detailed information on two areas with developing residential units in that city near I 664. One area with significant recent and ongoing residential development is along the West side of Jefferson Avenue, adjacent to I-664. Ninety apartment units are permitted or recently constructed in several different buildings between 22$^{nd}$ Street and 28$^{th}$ Street. The other open land in this corridor between 14$^{th}$ and 33$^{rd}$ Streets is zoned for future commercial and industrial development. A four-story apartment building in Newport News called Brennan Pointe was permitted on 12/21/2015 and would have 44 units and be located on the east side of Warwick Ave north of 30$^{th}$ Street. Additional coordination with the cities' planning and building departments will be conducted to confirm and update permitted land uses during the detailed noise study conducted during the final design phase of the project.

# 3. EXISTING NOISE CONDITIONS

A noise monitoring program was conducted along the HRCS Project corridor, consistent with FHWA and VDOT recommended procedures, to document existing ambient noise levels in noise-sensitive locations in the study corridor, and to provide a means for validation of the FHWA Traffic Noise Model (TNM) implementation for the project.

## 3.1 MONITORING OF EXISTING NOISE LEVELS

Noise monitoring was conducted in different sections of the HRCS study area at different times. In the I-64 corridor in Hampton and Norfolk, monitoring was conducted during the Hampton Roads Bridge-Tunnel (HRBT) project noise study, in October and November of 2011. These monitoring data are considered sufficiently current to be appropriate for the HRCS noise analysis. Along the I-564 corridor in Norfolk, noise monitoring was conducted for the I-564 Intermodal Connector Project noise study in August of 2014. Noise monitoring along the I-664 and VA 164 corridors was conducted as part of the HRCS noise study in November of 2015.

Short-term noise monitoring is not a process 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 Common Noise Environment to validate the computer noise model.

The noise monitoring at the 30 sites along I-64 was nominally 20 minutes in duration and was conducted over the course of 4 days – October 18, 25 and November 8 - 9, 2011. Unattended monitoring was conducted for 24 hours at two of the sites. The monitoring locations in the study corridor are shown in **Figures 3-1 to 3-3**. **Appendix D** in the HRBT Noise Analysis Technical Report (Menge, 2012) provides details of the data acquired during the noise measurement program along I-64, including noise monitor output, site sketches, photographs, noise level data with site summary results, and traffic counts.

Monitoring in the I-64 corridor during the HRBT study was conducted with RK&K-owned Rion NL06, Metrosonics dB 3080 and dB 308 Type 2 sound level meters. For all noise monitoring being reported, the noise measurement instrumentation was field calibrated regularly during the measurement program, and all instruments had current laboratory calibrations traceable to the National Institute of Standards and Technology.

Monitoring in 2014 along I-564 for the Intermodal Connector project was also conducted for 20 minutes' duration at each of three sites, using an ANSI Type 1 Bruel & Kjaer 2236 sound level meter, calibrated before and after each measurement using a Bruel & Kjaer 4231 calibrator. Appendices B and C in the I-564 Intermodal Connector Project Noise Technical Report (Jacobs, 2015) provide the details and data sheets from the noise measurement program along I-564.

Monitoring for the HRCS project in 2015 along the I-664 and VA 164 corridors was conducted for 30 minutes in duration at nearly all of the 36 sites. Measurements were conducted with HMMH-owned ANSI Type I Larson-Davis sound level meters, model 820 or 870, which were field calibrated before and after each measurement with a Quest QC-20 or Bruel & Kjaer 4231 calibrator, respectively. All instruments had current laboratory calibrations traceable to the National Institute of Standards and Technology. Monitoring was conducted between November 3 and 20, 2015.

**Appendix D** provides details of the data acquired during the I-664 and VA 164 noise measurement program, including noise monitor output, site sketches, photographs, noise level data with site summary results, and traffic counts.

The data collection procedure involved measurements of individual one-minute $L_{eq}$s so that the minutes including noise events unrelated to traffic noise (such as aircraft operations) could later be separated or excluded, and the total measurement period $L_{eq}$ is determined both with and without the minutes that included these events. By comparing the two totals, the significance of non-traffic events to the overall noise level can be determined for the measurement period. Simultaneous traffic classification counts were performed during the noise monitoring, to provide a basis for the model validation effort.

The measured short-term noise levels appear in **Table 3-1** as equivalent sound levels (Leq), along with site address and measurement date, start time and duration. The measured "Total" Leqs range from a low of 52 dBA at the Churchland High School baseball field in Portsmouth (Site M54) to a high of 74 dBA at 9279 Coleman Ave. in Norfolk (Site M25). These measurement results also show that the measured Total Leqs and the "Traffic-only" Leqs are the same at most sites, which is an indication that traffic is the dominant source of noise at most locations in spite of the presence of occasional aircraft. Monitoring at sites M1 through M31 was conducted during 2011 for the HRBT study, sites M32 through M69 were measured in 2015 for the HRCS SEIS project, and monitoring for sites MR1 through MR3 was carried out in 2014 for the I-564 Intermodal study.

In the I-64 corridor in Norfolk, aircraft from Chambers Field at the Norfolk Naval Air Station occasionally dominate the noise level on a momentary basis, but due to the intermittent nature of aircraft operations, aircraft noise does not necessarily affect traffic noise levels in any given hour of the day. The Navy has prepared an "AICUZ" study report on compatible land uses around the facility (US Navy, 2009), and annual average day-night aircraft operations noise levels are reported. However, as a result of the highly intermittent nature of the aircraft noise in the study area, aircraft noise levels are not added to the predicted highway traffic noise levels in this study. This is consistent with the analysis approach taken for the HRBT noise study in 2012. The significance of aircraft noise will be reevaluated during the detailed noise study conducted during the project's final design, and will be included in that analysis if deemed appropriate.

**Table 3-1: Noise Measurement Results**

| Site | Address | Date | Time Start | Duration (min.) | Total Leq, dBA | Traffic Only Leq, dBA |
|---|---|---|---|---|---|---|
| M1 | 48 Red Robin Turn, Hampton | 10/18/2011 | 15:25 | 20 | 55 | 55 |
| M2 | Swing Set @ Horizon Plaza Apts, Hampton | 10/18/2011 | 15:25 | 20 | 60 | 60 |
| M4 | 1303 Patrick Court, Hampton | 10/18/2011 | 17:10 | 20 | 62 | 62 |
| M5 | 1105 Thomas Street, Hampton | 10/18/2011 | 17:10 | 20 | 69 | 69 |
| M6 | 808 Langley Avenue, Hampton | 10/18/2011 | 17:10 | 11 | 66 | 66 |
| M7 | 931 Mason Street, Hampton | 10/18/2011 | 17:10 | 20 | 69 | 66 |
| M8 | 100 Spanish Trail (Pool Deck), Hampton | 10/25/2011 | 11:50 | 20 | 61 | 61 |
| M9[1] | 15 Colbert Avenue, Hampton | 10/25-26/2011 | 10:15 | 24 hrs | 67[1] | N/A |
| M10 | 326 Poplar Avenue, Hampton | 10/25/2011 | 11:50 | 20 | 67 | 67 |
| M11 | 101 Brough Lane, Hampton | 10/25/2011 | 11:50 | 20 | 67 | 67 |

| Site | Address | Date | Time Start | Duration (min.) | Total Leq, dBA | Traffic Only Leq, dBA |
|---|---|---|---|---|---|---|
| M12 | 72 S Boxwood Street, Hampton | 10/25/2011 | 11:50 | 20 | 62 | 62 |
| M13 | Hampton University Baseball Stadium, Hampton | 10/25/2011 | 14:50 | 20 | 62 | 62 |
| M14 | 114 Cameron Street, Hampton | 10/25/2011 | 14:50 | 20 | 63 | 63 |
| M15 | 9 Home Place, Hampton | 10/25/2011 | 14:50 | 20 | 63 | 63 |
| M16 | Small Beach East Side of I-64, Hampton | 10/25/2011 | 14:50 | 20 | 63 | 63 |
| M17 | 1560 Chela Avenue, Norfolk | 11/8/2011 | 10:05 | 20 | 63 | 63 |
| M18 | 1353 Bayville Court, Norfolk | 11/8/2011 | 10:05 | 20 | 66 | 65 |
| M19 | Int. of 14th View and Little Bay Avenue, Norfolk | 11/8/2011 | 10:05 | 20 | 65 | 65 |
| M20 | Pier/Beach Willoughby Boat Club, Norfolk | 11/8/2011 | 13:45 | 20 | 61 | 61 |
| M21 | Captain's Quarters Waterfront Park, Norfolk | 11/8/2011 | 13:45 | 20 | 59 | 59 |
| M22 | 9605 6th View Street, Norfolk | 11/8/2011 | 13:45 | 20 | 61 | 58 |
| M23 | 8667 O'Conner Crescent, Norfolk | 11/8/2011 | 15:25 | 20 | 69 | 64 |
| M24 | 381 Cherry Street, Norfolk | 11/8/2011 | 15:25 | 20 | 65 | 62 |
| M25 | 9279 Coleman Avenue, Norfolk | 11/8/2011 | 15:25 | 20 | 74 | 73 |
| M26 | 9246 Hickory Street, Norfolk | 11/8/2011 | 15:25 | 20 | 66 | 61 |
| M27[1] | 235 Burgoyne Road, Norfolk | 11/08-09/2011 | 12:00 | 24 hrs | 68[1] | NA |
| M28 | 15 Burrage Road, Norfolk | 11/9/2011 | 10:00 | 20 | 59 | 59 |
| M29 | 145 Burrage Road, Norfolk | 11/9/2011 | 11:00 | 20 | 69 | NA[2] |
| M30 | 8587 Granby Street, Norfolk | 11/9/2011 | 11:00 | 20 | 64 | 64 |
| M31 | Executive Manor Apartments Norfolk | 11/9/2011 | 10:00 | 20 | 69 | 69 |
| M32 | 340 Bradford Ave, Norfolk | 11/11/2015 | 13:12 | 30 | 63 | 63 |
| M35 | North End of Summerset, Chesapeake | 11/4/2015 | 15:15 | 30 | 68 | 68 |
| M36 | Side Yard of 1432 Branchview Way, Chesapeake | 11/4/2015 | 16:20 | 30 | 66 | 66 |
| M37 | 4355 Topsail Landing, Chesapeake | 11/12/2015 | 14:13 | 30 | 69 | 69 |
| M38 | 1509 James Landing, Chesapeake | 11/12/2015 | 15:09 | 30 | 62 | 62 |
| M39 | 4401 Old Woodland Dr, Chesapeake | 11/13/2015 | 8:24 | 30 | 67 | 66 |

| Site | Address | Date | Time Start | Duration (min.) | Total Leq, dBA | Traffic Only Leq, dBA |
|---|---|---|---|---|---|---|
| M40 | 4441 Woodland Dr, Chesapeake | 11/12/2015 | 16:02 | 30 | 64 | 64 |
| M41 | 4512 Winnie Dr, Chesapeake | 11/13/2015 | 9:24 | 30 | 63 | 63 |
| M42 | 2914 Old Stone Way, Chesapeake | 11/13/2015 | 10:10 | 30 | 66 | 64 |
| M43 | 4956 Old Pughsville Rd, Chesapeake | 11/13/2015 | 11:00 | 30 | 60 | 60 |
| M44 | 4903 Clifton St, Chesapeake | 11/18/2015 | 15:02 | 30 | 69 | 69 |
| M45 | 3670 Mardean Dr, Chesapeake | 11/18/2015 | 14:08 | 30 | 65 | 65 |
| M46 | 4733 Camelia Dr, Suffolk | 11/12/2015 | 12:00 | 30 | 68 | 68 |
| M47 | 7020 Kenny Ln, Portsmouth | 11/12/2015 | 11:02 | 30 | 60 | 60 |
| M48 | 3909 Old Farm Rd, Portsmouth | 11/12/2015 | 9:54 | 30 | 59 | 59 |
| M49 | 3105 Polk St, Portsmouth | 11/12/2015 | 9:02 | 30 | 52 | 52 |
| M50 | 6229 Hightower Rd, Portsmouth | 11/11/2015 | 16:36 | 30 | 57 | 56 |
| M51 | 5229 Crabtree Pl., Portsmouth | 11/11/2015 | 15:39 | 30 | 55 | 55 |
| M52 | 5416 Lilac Crescent, Portsmouth | 11/11/2015 | 14:48 | 30 | 57 | 56 |
| M53 | 5010 Huntersville Pl, Suffolk | 11/18/2015 | 11:00 | 30 | 60 | 60 |
| M54 | Churchland HS Baseball Field - Cedar Ln, Portsmouth | 11/12/2015 | 17:00 | 22 | 52 | 52 |
| M55 | 535 13th St, Newport News | 11/20/2015 | 8:25 | 30 | 62 | 62 |
| M56 | 523 22nd St, Newport News | 11/20/2015 | 9:10 | 30 | 60 | 60 |
| M57 | Madison Ave, North of 36th St, Newport News | 11/5/2015 | 13:55 | 30 | 62 | 62 |
| M58 | Corner of 40th and Madison, Newport News | 11/5/2015 | 13:12 | 30 | 61 | 61 |
| M59 | Between Marshall Ave and Orcutt Ave, Newport News | 11/5/2015 | 14:56 | 30 | 65 | 65 |
| M60 | 1118 41st St, Newport News | 11/20/2015 | 10:01 | 30 | 59 | 56 |
| M61 | 1124 39th St, Newport News | 11/20/2015 | 10:46 | 30 | 72 | 72 |
| M62 | 2604 W Pembroke Ave, Newport News | 11/4/2015 | 12:55 | 30 | 66 | 66 |
| M63 | 730 Birch Ave, Hampton | 11/20/2015 | 11:50 | 30 | 73 | 73 |
| M64 | 309 Ward Drive, Hampton | 11/3/2015 | 14:55 | 30 | 60 | 60 |
| M65 | 228 Prince James Drive, Hampton | 11/3/2015 | 16:15 | 30 | 60 | 59 |
| M66 | Back yard of #5 Dundee Road, Hampton | 11/3/2015 | 11:35 | 30 | 66 | 66 |
| M67 | Hampton High School Batting Cages, Hampton | 11/3/2015 | 13:15 | 30 | 61 | 61 |

| Site | Address | Date | Time Start | Duration (min.) | Total Leq, dBA | Traffic Only Leq, dBA |
|---|---|---|---|---|---|---|
| M68 | West End of Braemar Drive, Hampton | 11/3/2015 | 10:25 | 30 | 66 | 66 |
| M69 | 52 Allison Sutton Drive, Hampton | 11/3/2015 | 8:55 | 30 | 67 | 66 |
| MR1 | Fleet Recreation Park Pools, Norfolk | 8/13/2014 | 12:39 | 20 | 63 | NA |
| MR2 | Breezy Point Apartments, Norfolk | 8/13/2014 | 10:19 | 20 | 60 | NA |
| MR3 | Ingersol Ave. Apt. Complex, Rec. Areas, Golf Course, Norfolk | 8/13/2014 | 11:46 | 25 | 62 | NA |

*Note: Site locations shown on map in **Figures 3-1 to 3-3**. Detailed data are provided in **Appendix D** of this report and in the HRBT and I-564 Intermodal Connector Noise Technical Reports.*
*[1] 24-hour long-term measurement site. Loudest-hour Leq is reported.*
*[2] Duration too short for meaningful measurement.*
*Sources: HMMH, 2012 and 2016, and Jacobs, 2015.*

## 3.2 PREDICTED EXISTING NOISE LEVELS

For calculation of loudest-hour noise levels throughout the study area in the TNM noise-prediction computer model, many additional receiver locations were added to the measurement sites to provide a comprehensive basis of comparison for the analysis of noise impacts from the existing and future project conditions. Using the appropriate loudest-hour traffic data, existing and future traffic noise levels were predicted for the measurement sites and the additional receiver locations. The computation methods and predicted noise levels are presented in the next section of this report.

## 3.3 EXISTING NOISE BARRIERS

There are several existing noise barriers along I-64, I-664 and VA 164 within the study area. The study team conducted field surveys and reviews of the locations so that locations and heights of all of these barriers could be included in the noise modeling of both the existing and future conditions. **Figures 3-1 to 3-3** show the locations of all existing barriers within the study area.

**Figure 3-1: Noise Monitoring Sites and Existing Noise Barriers Map – Peninsula**

**Figure 3-2: Noise Monitoring Sites and Existing Noise Barriers Map – Norfolk**

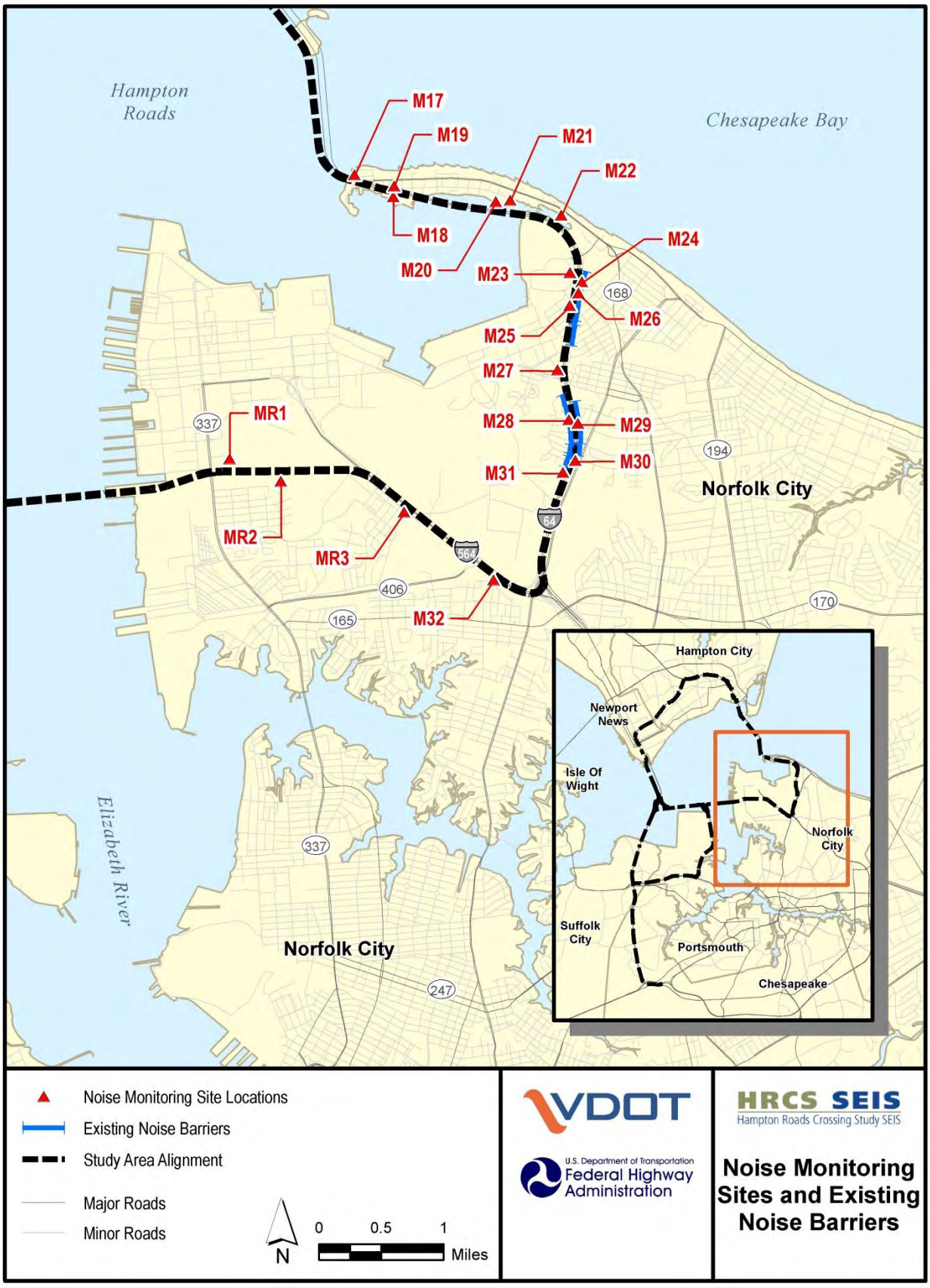
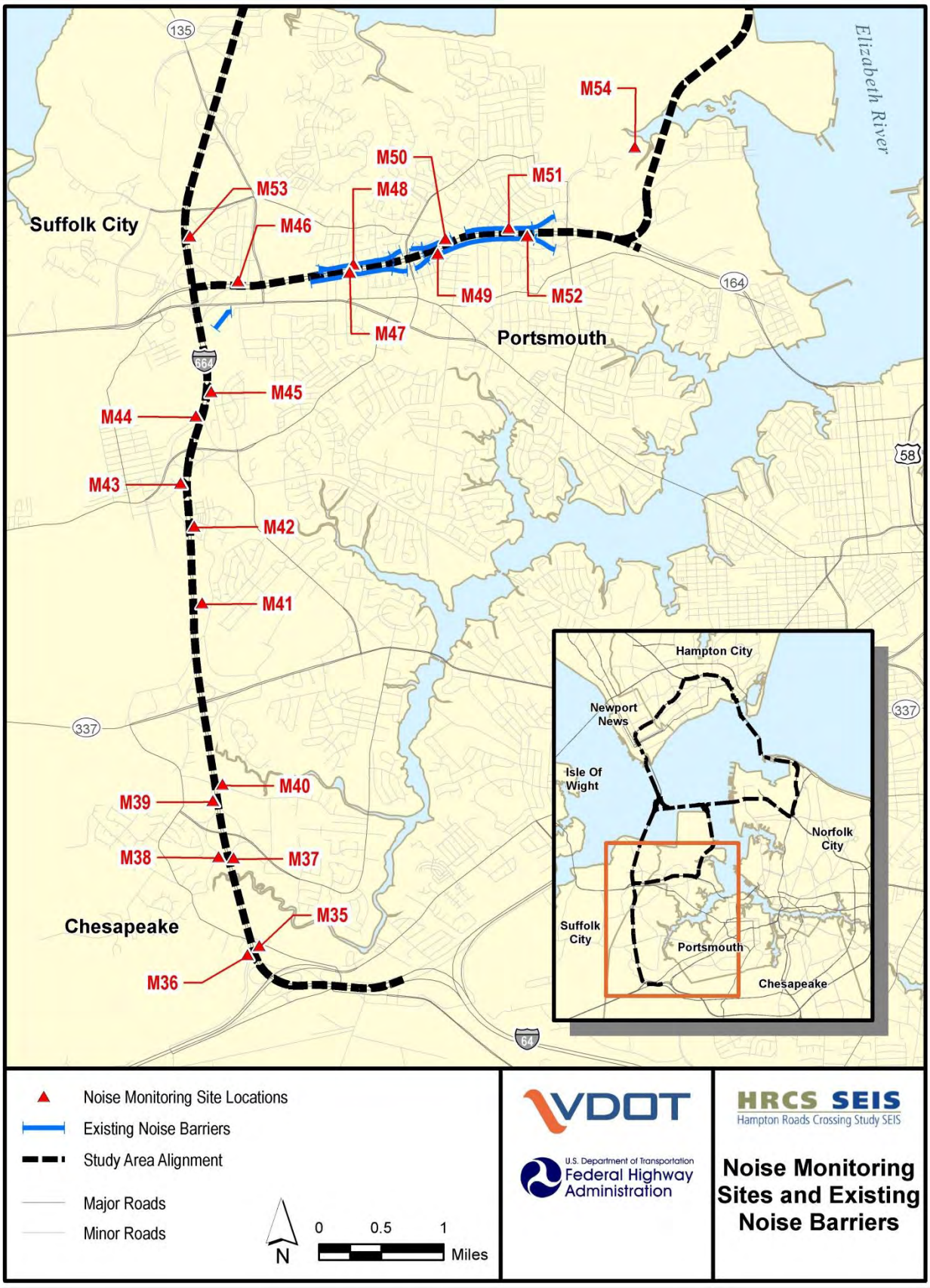


**Figure 3-3: Noise Monitoring Sites and Existing Noise Barriers Map – Southside**



# 4. PREDICTED NOISE LEVELS

## 4.1 NOISE PREDICTION MODEL

All traffic noise computations for this study were conducted using the latest version of the FHWA TNM version 2.5. TNM incorporates state-of-the-art sound emissions and sound propagation algorithms, based on well-established theory or on accepted international standards (FHWA, 1998). The acoustical algorithms contained within the FHWA TNM have been validated with respect to carefully conducted noise measurement programs, and show excellent agreement in most cases for sites with and without noise barriers (US DOT, 2004).

Available project engineering plans, aerial photography, topographic contours and building information are used to create a three-dimensional model in the TNM of the geometry of the existing and future design roadway configurations and the surrounding terrain and buildings. The noise modeling also accounts for such factors as propagation over different types of ground (acoustically soft and hard ground), elevated roadway sections, significant shielding effects from local terrain and structures, distance from the road, traffic speed, and hourly traffic volumes including percentage of medium and heavy trucks. To fully characterize existing and future noise levels at all noise-sensitive land uses in the study area, over 6600 noise prediction receivers (also called “receptors” and “sites”) were added to the measurement sites in the modeling. TNM runs are available upon request.

There are a number of freight rail lines that operate in or near the project roadway corridors in the study area. These include a Commonwealth Railway line along VA 164 and I-664, a Norfolk Southern (NS) line along I-564, and CSX lines in three areas near I-664. For each location, the frequency of rail traffic was determined by contacting the rail companies. Since rail traffic is no more than four trains per day on the CSX and Commonwealth Railway lines, rail traffic is not modeled as a noise source on these lines. The significance of rail noise in these corridors will be reevaluated during the detailed noise study conducted during the project’s final design, and will be included in that analysis if deemed appropriate. However, traffic on the NS line had been included in the I-564 Intermodal Connector Project TNM runs, so this is included in the HRCS noise analysis.

## 4.2 NOISE MODEL VALIDATION

A validation of the noise modeling assumptions was conducted using the traffic counted on nearby roadways simultaneous with the noise measurement at most monitoring sites, as input to the noise prediction model. The same implementations of the TNM were used to model I-64 in this study as in the HRBT study. Therefore, since the TNM for I-64 had been validated for the HRBT study, it did not need to be validated again for this project. Similarly for the I-564 corridor, the TNM runs for the Intermodal Connector project were used for this project, and were validated during the Intermodal Connector study. The validation exercise for the I-664 and VA 164 corridors was carried out for this project.

The traffic counts at the I-664 and VA 164 monitoring sites are provided in **Appendix D**. Computed noise levels with TNM based on the counted traffic were compared to the measured noise levels to confirm the assumptions about aspects of the modeling, such as the acoustical shielding provided by intervening terrain and existing noise barriers. The modeling assumptions were refined, as necessary, to obtain appropriate agreement between the computed and measured values. The validated modeling assumptions at the measurement sites and for the existing geometry were then extended to the design-year alternative and applied at prediction locations where no measurements were made.

In two areas along I-664, the computed sound levels deviated from the measured sound levels by more than the usual and expected amounts, and trends were apparent. Along I-664 in Suffolk and Chesapeake, measured sound levels are consistently lower than the predicted sound levels, at sites M35 through M45 and M53. HMMH suspected that VDOT may have placed an open-graded pavement in that section of the highway, which could explain reduced sound levels. Kevin McGhee of the Virginia Center for Transportation Innovation and Research, who leads the agency's research on quieter pavement, confirmed that a pavement called thin hot-mix asphalt concrete overlay (THMACO, or trade name NovaChip), was placed on both directions (i.e. northbound and southbound) of I-664 in Suffolk and Chesapeake in 2013. Mr. McGhee confirmed that this pavement is usually quieter than most pavements in Virginia, and considerably quieter than the concrete pavement surface previously on I-664. HMMH estimates that traffic on the 2013 THMACO pavement generates noise levels approximately 3 decibels lower than those from an average pavement. With such a 3-decibel adjustment, the sound levels at all of the 12 measurement sites in this area deviate from the TNM prediction by less than 3 decibels. However, FHWA requires the use of "Average" pavement in TNM for federally-funded highway noise studies. Therefore, no adjustments were made to the modeling to account for the quieter pavement along I-664 under existing conditions. Since the noise emissions from pavements change with time and also pavements must be replaced periodically, there can be no certainty that future noise levels would be lower than average in this section of I-664.

In the area along I-664 in Hampton between Power Point Parkway and W. Queen Street, the measured sound levels from I-664 traffic at sites M66, M67 and M68 are consistently higher than the TNM-predicted sound levels. There are two reflective noise barriers parallel to and opposite each other along both sides of I-664 in this section. HMMH conducted a parallel-barrier analysis with TNM, and confirmed that multiple reflections of sound between the 16-ft high barriers are likely degrading their noise-reduction performance by 3 to 5 decibels at the three sites. The presence of multiple reflections of sound between parallel noise barriers effectively "lowers" the heights of the noise barriers. Therefore, the reduced noise reduction due to the parallel barrier reflections is very closely approximated in TNM's main module by modeling the noise barriers in that section at heights of 9 feet instead of 16 feet. Therefore, in the Existing and No-build alternatives, the barriers were modeled at 9 feet high where they are on both sides of I-664. In the Alt. C and Alt. D Build cases, the widened roadway necessitates removal and replacement of the existing barriers. Those would be replaced with absorptive barriers to eliminate multiple reflections, so the barriers in the build case TNM runs are modeled at their proposed true heights.

Predicted noise levels at each of the 35 measurement sites where validation was conducted using the counted traffic as input to the model are on average slightly higher by 1.3 decibels when compared to the measured noise levels, with a standard deviation of the differences of 2.7 decibels. When the sites adjacent to the quieter THMACO pavement are not included in the average, the difference is reduced to 0.3 decibels. The model validation for three sites (M59, M61, and M64) yielded results that are outside the normally acceptable range of +/- 3.0 dBA. Various factors present in the environment at the time of the measurements are likely to have contributed to the validation results at these sites, and are discussed separately.

Measured sound levels at Site M59 are 5.2 dBA higher than predicted. There is an existing barrier along an elevated portion of I-664 in this area, and some wind blowing from the highway may have contributed to the higher than expected measured levels. Also, the pavement in this section of the highway is fairly rough, which also could have contributed to higher measured sound levels. Measured levels at Site M61, near M59 are also higher than predicted, by 3.1 dBA. Wind blowing from the roadway

to the receiver and louder than average pavement are likely contributors, as at Site M59. At site M64, measured sound levels are 4.7 decibels lower than predicted. There is a thick band of trees between the highway and this site, and by adding a tree zone to the model, the predicted sound level is higher than measured by 3.0 dBA, so trees are thought to be a significant contributor to the reduced sound levels at M64.

The difference between measured and computed levels is two or more decibels at many of the sites, which, in addition to the factors already discussed may be due to a combination of the relatively complex geometry of the different roadways in some sections, structure-radiated noise in areas where I-664 is on elevated structure (such as near M59), terrain and intervening structures in the area, and variations in speed that may have occurred on the roadways.

Monitoring sites where the predicted sound levels are not within 3.0 decibels of the measured values would be monitored again and re-validated during the detailed noise study during the project's final design. Further, the use of "adjustment factors" associated with predicted sound levels will be evaluated during the final design noise study for the areas where THMACO pavement is present. The comparison of measured versus computed sound levels at each of the measurement sites is shown in **Table 4-1**.

**Table 4-1: Computed vs. Measured Sound Levels at Measurement Sites**

| Site No. | Address | Land Use | Measured Leq (dBA) (Traffic-only) | Computed Leq (dBA) | Difference |
|---|---|---|---|---|---|
| M32 | 4433 S Military Rd, Chesapeake | Residential | 62.9 | 64.0 | 1.1 |
| M35 | North End of Summerset, Chesapeake | Residential | 67.6* | 69.0 | 1.4* |
| M36 | Side Yard of 1432 Branchview Way, Chesapeake | Residential | 65.6* | 66.9 | 1.3* |
| M37 | 4355 Topsail Landing, Chesapeake | Residential | 69.2* | 72.1 | 2.9* |
| M38 | 1509 James Landing, Chesapeake | Residential | 62.0* | 64.4 | 2.4* |
| M39 | 4401 Old Woodland Dr, Chesapeake | Residential | 66.2* | 71.5 | 5.3* |
| M40 | 4441 Woodland Dr, Chesapeake | Residential | 63.7* | 68.6 | 4.9* |
| M41 | 4512 Winnie Dr, Chesapeake | Residential | 63.0* | 65.4 | 2.4* |
| M42 | 2914 Old Stone Way, Chesapeake | Residential | 64.4* | 68.7 | 4.3* |
| M43 | 4956 Old Pughsville Rd, Chesapeake | Residential | 59.7* | 64.5 | 4.8* |
| M44 | 4903 Clifton St, Chesapeake | Residential | 69.3* | 71.5 | 2.2* |
| M45 | 3670 Mardean Dr, Chesapeake | Residential | 64.7* | 66.8 | 2.1* |
| M46 | 4733 Camelia Dr, Suffolk | Residential | 68.1 | 70.9 | 2.8 |
| M47 | 7020 Kenny Ln, Portsmouth | Residential | 60.0 | 59.6 | -0.4 |
| M48 | 3909 Old Farm Rd, Portsmouth | Residential | 59.4 | 57.8 | -1.6 |
| M49 | 3105 Polk St, Portsmouth | Residential | 51.8 | 53.8 | 2.0 |
| M50 | 6229 Hightower Rd, Portsmouth | Residential | 56.0 | 59.0 | 3.0 |

| Site No. | Address | Land Use | Measured Leq (dBA) (Traffic-only) | Computed Leq (dBA) | Difference |
|---|---|---|---|---|---|
| M51 | 5229 Crabtree Pl., Portsmouth | Residential | 55.1 | 57.3 | 2.2 |
| M52 | 5416 Lilac Crescent, Portsmouth | Residential | 55.6 | 56.3 | 0.7 |
| M53 | 5010 Huntersville Pl, Suffolk | Residential | 62.7* | 68.5 | 5.8* |
| M55 | 535 13th St, Newport News | Residential | 61.6 | 64.1 | 2.5 |
| M56 | 523 22nd St, Newport News | Residential | 60.4 | 61.2 | 0.8 |
| M57 | Madison Ave, North of 36th St, Newport News | Residential | 61.5 | 63.8 | 2.3 |
| M58 | Corner of 40th and Madison, Newport News | Residential | 61.3 | 63.4 | 2.1 |
| M59 | Between Marshall Ave and Orcutt Ave, Newport News | Residential | 65.0 | 59.8 | -5.2 |
| M60 | 1118 41st St, Newport News | Residential | 56.3 | 59.0 | 2.7 |
| M61 | 1124 39th St, Newport News | Residential | 71.7 | 68.6 | -3.1 |
| M62 | 2604 W Pembroke Ave, Newport News | Residential | 65.7 | 63.7 | -2.0 |
| M63 | 730 Birch Ave, Hampton | Residential | 73.2 | 70.9 | -2.3 |
| M64 | 309 Ward Drive, Hampton | Residential | 60.0 | 64.7 | 4.7 |
| M65 | 228 Prince James Drive, Hampton | Residential | 59.1 | 57.7 | -1.4 |
| M66 | Backyard of #5 Dundee Road, Hampton | Residential | 66.0 | 63.2 | -2.8 |
| M67 | Hampton High School (Batting Cages), Hampton | Recreational | 61.2 | 62.1 | 0.9 |
| M68 | West End of Braemar Drive, Hampton | Residential | 65.5 | 62.8 | -2.7 |
| M69 | 52 Allison Sutton Drive, Hampton | Residential | 66.3 | 66.1 | -0.2 |
| **Average Difference** | | | | | **1.3** |

** Sites along I-664 with quieter THMACO pavement.*
*Source: HMMH, 2016*

### 4.3 TRAFFIC DATA FOR NOISE PREDICTION

Traffic data for traffic noise computations were developed for the project and are detailed in the Traffic Technical Report. For the noise analysis, the data included are the 2013 Existing and 2040 Future cases as hourly volume, vehicle classification and speed data for all of the project interstate highways, all intersecting roadways and the associated ramps. The traffic data developed for the noise analysis were AM peak hour and PM peak hour volumes and truck percentages for all roadway segments in each alternative. The speeds used are free-flow speeds in most cases, and posted speeds in some cases, where free-flow speeds are not available. The use of peak-hour volumes with free-flow speeds is conservative, and may result in slight over-estimates of noise levels in cases where actual running

speeds may be slower due to high volume relative to capacity. In addition, similar traffic was provided for major arterials in the study area. As required by FHWA and VDOT, the noise analysis was performed for the loudest period of the day.

The loudest period of the day for each project alternative was determined by using TNM to compute the overall traffic noise level at a reference distance on each side of each project Interstate mainline roadway, for each project segment between interchanges, for both AM and PM peak hour traffic. The AM peak hour was found to be louder than the PM peak hour for nearly every segment of every mainline interstate roadway for every study alternative, including the 2015 Existing and 2040 No-build, and Build Alternatives A, B, C and D. Along I-64 segments, the AM peak hour averaged about 0.5 decibels louder than the PM peak hour. However, along I-664, the AM peak hour averaged 1 to 1.5 dB louder than the PM peak hour. Increased truck percentages rather than overall volume in the AM peak hour is the primary reason for the increased noise levels during the AM peak hour. Traffic data for the AM peak hour was used in the final TNM analysis for adjacent intersecting roads, crossing arterials and ramps as well as for the mainline roadways. The traffic data used for the roadways in TNM is summarized in **Appendix B**.

## 4.4 PRESENTATION OF RESULTS

The study area includes mostly residential land use and development, as well as some recreational, institutional and exterior commercial land use.

To fully characterize existing and future noise levels at all noise-sensitive land uses in the study area, more than 6600 additional noise prediction receptors (also called “receivers” and “sites”) were incorporated into the TNM analysis of the study area. Each of these receptors represented exterior noise-sensitive land use or the interiors of institutional land uses such as schools, places of worship and assisted living facilities.

All noise levels predicted are the A-weighted equivalent sound level, or Leq, in dBA. Loudest-hour noise levels are predicted for the Existing 2015 and the design-year 2040 No-Build and Build Alternatives. Sound levels at all study area receivers are computed explicitly from the provided traffic data for Build Alternatives B, C and D. It was determined during the loudest-period assessment that the traffic for I-64 in Alternative A is very similar to that for Alternative B, such that the noise levels along I-64 are different by an average of less than 0.2 decibels. The study team agreed that this made the two alternatives effectively equivalent along I-64. Therefore, only Alternative B is evaluated in detail, and all of the conclusions about noise along I-64 for Alternative B are applicable to Alternative A as well.

**Tables 4-2 through 4-6** present ranges of the predicted sound levels at the receptors in each Common Noise Environment area (CNE) for each alternative. CNE boundaries are shown in **Figure 4-1** for areas with noise-sensitive land use, and descriptions of the land use and location of each CNE are provided in **Tables 4-2 through 4-6**. Areas that do not have noise-sensitive land uses are not identified with CNE boundaries; such land use is Activity Category E, F, or G, that is commercial with no exterior activity areas, industrial, or undeveloped, respectively. **Tables 4-2 through 4-6** also indicate the NAC Activity Categories for noise-sensitive land use that is present in each CNE. Predicted interior sound levels are shown for Category D institutional land use. Since all of the noise-sensitive facilities identified in the study area have air conditioning and masonry construction, an outside-to-inside noise reduction value of 25 decibels is used to determine the interior sound levels from the exterior sound levels predicted by TNM. **Appendix C** provides a table that lists the predicted sound levels at all of the receptors for each

alternative. Each receptor, or prediction site, is given an identifier with the two-letter CNE ID followed by a number. These IDs are also displayed in **Figure 4-1**.

**Table 4-2** provides results for I-64 in Hampton and Norfolk. The results in this table shown for Alternative B are computed for Alternative B but they are also applicable to Alternative A.

**Figure 4-1** shows the location and predicted noise impact status as well as noise abatement benefit status for all receptors in the project study area, for the loudest Build Alternative with the most impact in each section of the project. Alternative B impact status is shown along I-64 and VA 164, because it is

**Table 4-2: Ranges of Predicted Loudest-Hour Sound Levels by CNE – I-64 in Hampton and Norfolk**

| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | |
|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alts. B & A | Alt. D |
| **HAMPTON** | | | | | | |
| Hampton Coliseum (Concert Venue) and multi-family development North of I64 off of Coliseum Dr/Freeman Dr | AC | B, D | 44 - 70 | 45 - 71 | 45 - 72 | 45 - 71 |
| Single-family residences South of I-64 and West of I-664 on Red Robin Turn | AD | B | 60 - 67 | 61 - 67 | 62 - 68 | 61 - 68 |
| Our Lady of Vietnam Catholic Church and Horizon Plaza multi-family residences and recreation areas, South of I-64 Off LaSalle Ave/Michigan Dr | AE | B, C | 59 - 67 | 60 - 68 | 61 - 68 | 60 - 68 |
| Hampton Family YMCA, VA Baseball Academy, Perfecting Saints Church, and single-family residences, LaSalle/Armistead | AF | B, D | 40 - 69 | 41 - 70 | 41 - 70 | 41 - 70 |
| Single-family residences, South of I-64 and east of Armistead Ave | AG | B | 63 - 74 | 64 - 75 | 64 - 75 | 64 - 75 |
| Single-family residences North of I-64 and Northeast of Armistead Ave | AH | B | 58 - 67 | 59 - 68 | 59 - 68 | 59 - 68 |
| Community center baseball field and park, single-family residences, and multi-family apartments, North of I-64 and East of LaSalle Ave | AI | B, C, E | 45 - 72 | 46 - 73 | 47 - 73 | 46 - 73 |
| Single-family residences, South of I-64 and north of E Pembroke Ave | AJ | B | 58 - 68 | 59 - 69 | 59 - 69 | 59 - 69 |
| Single-family residences and multi-family apartments, North of I-64 on River St, Cooper St, and Creek Ave | AK | B | 57 - 65 | 58 - 66 | 58 - 67 | 58 - 66 |
| River Street Park, South of I-64 and underneath bridge, off of River St | AL | C | 54 - 69 | 55 - 70 | 56 - 70 | 55 - 70 |
| Single-family residences, multi-family apartment complex and marina, South of I-64 on Brough Ln | AM | B, C | 57 - 69 | 58 - 70 | 57 - 70 | 57 - 69 |
| Single-family residences, North of I-64 on S Boxwood St and Magnolia Pl | AN | B | 62 - 68 | 62 - 69 | 62 - 69 | 62 - 69 |
| Woodlands Golf Course and Hampton Tennis Center, Northeast of I-64 off Woodland Rd | AO | C | 60 - 68 | 61 - 69 | 61 - 69 | 61 - 69 |
| Hampton University Mall, West of I-64 and North of Marshall Ave | AP | C | 57 - 57 | 58 - 58 | 58 - 58 | 58 - 58 |
| Hampton University Baseball Stadium/Field, West of I-64 on Emancipation Dr | AQ | B, C | 61 - 70 | 62 - 71 | 62 - 70 | 61 - 70 |

| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | |
|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alts. B & A | Alt. D |
| Single-family residences, West of I-64 on Emancipation Dr | AR | B | 70 - 74 | 71 - 75 | 71 - 75 | 71 - 75 |
| Hampton Veterans Affairs Medical Center, Domicilliary Section D, Building 148, benches | AS | C | 60 - 60 | 61 - 61 | 61 - 61 | 61 - 61 |
| Hampton national Cemetery Phoebus Addition, East of I-64, on W County St and Bainbridge Ave | AT | C | 59 - 75 | 60 - 76 | 60 - 76 | 59 - 76 |
| Single-family residences, East of I-64 on Cameron St | AU | B | 56 - 65 | 57 - 66 | 57 - 67 | 57 - 66 |
| McDonald's outdoor seating, East of I-64 on S Mallory St | AV | E | 62 - 62 | 63 - 63 | 63 - 63 | 62 - 62 |
| Single-family residences, East of I-64 on S Mallory St and Downes St | AW | B | 52 - 67 | 53 - 68 | 53 - 68 | 53 - 68 |
| Fort Monroe Park and Old Point Comfort Marina, East of I-64 Bridge/Tunnel, on McNair Dr | AX | C | 55 - 58 | 56 - 59 | 57 - 59 | 56 - 59 |
| Fort Wool, East of I-64 Bridge/Tunnel on Rip Raps Island | AY | C | 56 - 56 | 57 - 57 | 57 - 57 | 57 - 57 |
| **NORFOLK** | | | | | | |
| Willoughby Harbor Marina | AZ | C | 58 - 68 | 59 - 69 | 59 - 69 | 59 - 69 |
| Residences on Willoughby Spit south of I-64 | BA | B, C | 60 - 73 | 62 - 74 | 62 - 74 | 62 - 73 |
| Beach area at west end of Willoughby Spit, north of I-64 | BB | C | 66 - 71 | 67 - 71 | 66 - 71 | 65 - 70 |
| Residences west of 15th View Street, north of I-64 | BC | B | 59 - 70 | 60 - 71 | 60 - 72 | 59 - 71 |
| Residences between 15th View Street and 13th View Street, north of I-64 | BD | B | 58 - 75 | 59 - 77 | 60 - 77 | 59 - 77 |
| Residences between 13th View Street and the end of Little Bay Avenue, north of I-64 | BE | B | 57 - 72 | 58 - 74 | 59 - 74 | 58 - 73 |
| Captain's Quarters Nature Center and Park | BF | B, C | 64 - 69 | 66 - 71 | 65 - 70 | 64 - 70 |
| Residences between the end of Little Bay Avenue and 4th View Street, north of I-64 | BG | B | 57 - 66 | 58 - 67 | 57 - 68 | 56 - 67 |
| Outdoor land use at Norfolk Visitor's Center | BH | C | 63 - 63 | 64 - 64 | 64 - 64 | 63 - 64 |
| Residences at Willoughby Bay military housing complex | BI | B | 59 - 66 | 60 - 67 | 60 - 67 | 60 - 67 |
| Residences from Orange Avenue to Ridgewell Avenue, west of I-64 | BJ | B | 60 - 73 | 61 - 74 | 61 - 75 | 61 - 74 |
| Residences between 1st View Street and W Bay Avenue, west of I-64 | BK | B | 41 - 69 | 42 - 70 | 42 - 70 | 42 - 69 |
| Willoughby Elementary School | BL | D | 36 - 36 | 37 - 37 | 38 - 38 | 38 - 38 |
| Baseball field at Ocean View Elementary School | BM | C | 53 - 59 | 54 - 60 | 55 - 60 | 54 - 60 |
| Residences between W Government Avenue and Mace Arch, east of I-64 | BN | B | 53 - 70 | 54 - 71 | 55 - 71 | 54 - 70 |
| Residences from Mace Arch to along W Bay Avenue, east of I-64 | BO | B | 54 - 71 | 55 - 72 | 55 - 71 | 55 - 71 |
| Residences along W Bay Avenue EB, west of I-64 | BP | B | 50 - 63 | 51 - 64 | 52 - 64 | 51 - 63 |

| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | |
|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alts. B & A | Alt. D |
| Residences from Commodore Drive to W Bayview Boulevard, west of I-64 | BQ | B | 53 - 67 | 54 - 68 | 54 - 69 | 54 - 69 |
| Residences from W Bayview Boulevard to the south end of Executive Drive, west of I-64 | BR | B | 57 - 71 | 58 - 72 | 57 - 69 | 56 - 68 |
| Military baseball fields along Patrol Road near on-ramp to I-64 EB, west of I-64 | BS | C | 60 - 66 | 60 - 67 | 60 - 67 | 60 - 67 |
| Military baseball field along Patrol Road near I- 564 interchange, west of I-64 | BT | C | 61 - 67 | 61 - 67 | 62 - 67 | 62 - 67 |
| Residences from W Chester Street to E Bayview Boulevard, east of I-64 | BU | B, D | 41 - 68 | 41 - 69 | 40 - 68 | 39 - 68 |
| Residences from E Bayview Boulevard to the I-64 WB on-ramp from Granby Street, east of I-64 | BV | B | 60 - 70 | 61 - 70 | 61 - 70 | 60 - 70 |
| Forest Lawn Cemetery, Girl Scouts Camp | BW | C | 61 - 69 | 62 - 69 | 62 - 69 | 62 - 69 |

**Table 4-3: Ranges of Predicted Loudest-Hour Sound Levels by CNE – I-564 Corridor in Norfolk**

| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | | |
|---|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. B | Alt. C | Alt. D |
| Residences southwest of I-564/I-64 Interchange near Bradford St. | BZ | B, C | 51 - 66 | 51 - 66 | 52 - 67 | 52 - 68 | 52 - 68 |
| Residences and Golf Course southwest of I-564 and Ingersol Ave. | CA | C | 55 - 68 | 51 - 63 | 52 - 69 | 52 - 69 | 52 - 71 |
| Residences south of Intermodal Connector and east of Hampton Blvd. | CB | B, C | 50 - 52 | 50 - 53 | 54 - 58 | 55 - 59 | 55 - 59 |
| Pool north of Intermodal Connector and east of Hampton Blvd. | CC | B, C | 55 - 56 | 58 - 59 | 60 - 61 | 60 - 61 | 60 - 61 |

**Table 4-4: Ranges of Predicted Loudest-Hour Sound Levels by CNE – VA 164 Corridor in Portsmouth**

| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | | |
|---|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. B | Alt. C | Alt. D |
| Residences on Magnolia Dr. north of VA 164, Old Dominion University | CY | B, D | 36 - 57 | 37 - 58 | 39 - 59 | NA | 38 - 59 |
| Single-family residences, Pepperwood Townhomes, The Village Church of Portsmouth, north of VA 164, west of Towne Point Rd | CZ | B, C, D | 32 - 58 | 33 - 59 | 34 - 75 | NA | 33 - 74 |
| Single-family residences, apartments, Sleep Inn & Suites, south of VA 164, west of Towne Point Rd | DB | B,E | 38 - 61 | 39 - 62 | 41 - 78 | NA | 40 - 77 |

| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | | |
|---|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. B | Alt. C | Alt. D |
| Single-family residences, apartments, Churchland North Baptist Church, north of VA 164, east of Towne Point Rd | DC | B, D | 28 - 68 | 29 - 69 | 31 - 76 | 44 - 62 | 30 - 75 |
| Residences, churches, Ebony Heights Park, cemetery, south of VA 164, east of Towne Point Rd | DD | B, C, D | 23 - 60 | 24 - 61 | 34 - 75 | 41 - 59 | 33 - 74 |
| Residences, Churchland House Assisted Living, south of VA 164, east of Cedar Ln | DE | B, D | 29 - 62 | 30 - 63 | 30 - 58 | 30 - 58 | 30 - 58 |
| Residences, First Baptist Church, south of VA 164, east of Cedar Ln | DF | B, D | 31 - 67 | 32 - 68 | 32 - 67 | 32 - 67 | 32 - 67 |
| Churchland High School baseball diamond | DG | C | 52 - 52 | 52 - 52 | 51 - 59 | 50 - 58 | 50 - 58 |
| US Coast Guard patio | DH | C | 52 - 52 | 52 - 52 | 51 - 51 | 49 - 49 | 49 – 49 |

**Table 4-5: Ranges of Predicted Loudest-Hour Sound Levels by CNE – I-664 Corridor, Southside**

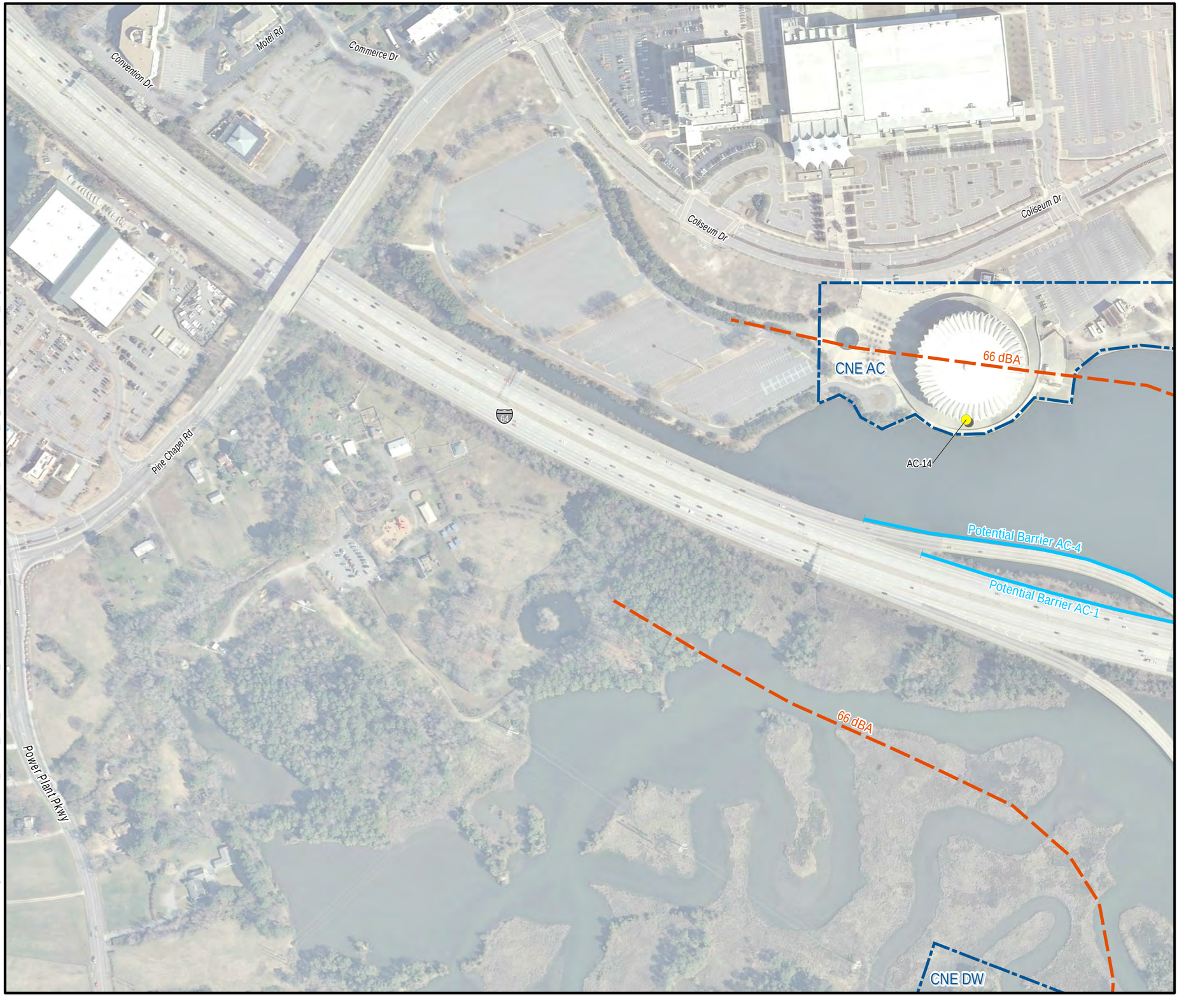
| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | | |
|---|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. B | Alt. C | Alt. D |
| **CHESAPEAKE** | | | | | | | |
| America's Best Value Inn, single-family residences, South of I-664 off S Military Hwy | CE | B, E | 59 - 70 | 59 - 70 | NA | 60 - 72 | 60 - 72 |
| Single-family residences, mobile homes, North of I-664 off Airline Blvd and Ridgeway Ave | CG | B | 60 - 73 | 60 - 73 | NA | 56 - 69 | 61 - 69 |
| Jolliff Middle School and associated track/field, single family residences, North/East of I-664 off of Jolliff Rd and Airline Blvd | CH | B, C, D | 34 - 72 | 34 - 73 | NA | 34 - 73 | 34 - 73 |
| Single-family residences West of I-664, on Jolliff Rd and Branchview Way | CI | B | 59 - 70 | 60 - 71 | NA | 62 - 71 | 62 - 71 |
| Single-family residences East of I-664 on Dock Landing Rd and Clark's Circle | CJ | B | 56 - 68 | 57 - 69 | NA | 59 - 76 | 58 - 76 |
| Single-family residences West of I-664, South of Dock Landing Rd, on Jolliff Rd, Swan Lake Crescent, Old Dock Landing Rd | CK | B | 51 - 63 | 52 - 64 | NA | 52 - 67 | 52 - 67 |
| Alexander Baptist Church, single-family residences, East of I-664, North of Dock Landing Rd, off Woodland Dr | CL | B, C | 52 - 73 | 53 - 74 | NA | 53 - 74 | 53 - 74 |
| Union Bethel Baptist Church, single-family residences, West of I-664, off Jolliff Rd, Woodland Dr, Quivers Keep | CM | B, C | 52 - 72 | 53 - 73 | NA | 56 - 75 | 55 - 75 |
| Sunstone Apartments multi-family, single-family residences, East of I-664 on Peek Trail, River Peral Way, and Waterstone Way | CN | B, C | 52 - 71 | 53 - 71 | NA | 54 - 73 | 54 - 72 |
| Single-family residences West of I-664 on Jolliff Rd | CO | B | 53 - 71 | 54 - 72 | NA | 55 - 72 | 55 - 71 |

| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | | |
|---|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. B | Alt. C | Alt. D |
| Holiday Inn Express, Horizon Community Church, single-family residences, East of I-664 off Gum Rd and Portsmouth Blvd | CP | B, D, E | 33 - 63 | 35 - 64 | NA | 35 - 64 | 35 - 64 |
| Living Waters Christian Fellowship, Chesapeake Public Trail, Hunters Cove Park, | CQ | B, C, D | 42 - 75 | 43 - 76 | NA | 45 - 73 | 45 - 73 |
| Single-family residences, West of I-664, South of Pughsville Road | CR | B | 56 - 64 | 57 - 65 | NA | 58 - 65 | 58 - 65 |
| Single-family residences, West of I-664, North of Pughsville Road | CS | B | 52 - 71 | 53 - 72 | NA | 54 - 75 | 54 - 74 |
| Residences, New Hope Baptist Church cemetery, East of I-664, South of Pughsville Road | CT | B, C | 59 - 66 | 60 - 67 | NA | 60 - 67 | 60 - 67 |
| Single-family residences, East of I-664, North of Pughsville Road | CU | B | 52 - 70 | 53 - 71 | NA | 54 - 73 | 53 - 73 |
| **SUFFOLK** | | | | | | | |
| Belleville Harbour Apartments multi-family units, West of I-664 Off of Townpoint Rd and Belleharbour Cir | CV | B | 49 - 65 | 50 - 66 | 50 - 65 | 50 - 66 | 51 - 66 |
| Meridian Harbourview multi-family apartments, West of I-664 and VA164, on Harbour Towne Pkwy | CW | B | 49 - 68 | 50 - 69 | 46 - 69 | 50 - 70 | 50 - 72 |
| Single-family residences, West of I-664 and South of VA164 | CWA | C | 64 - 66 | 65 - 67 | 65 - 67 | 65 - 67 | 66 - 68 |
| Little Grove Baptist Church, Children's Corner Daycare, and single-family residences, West of I-664, North of VA164, and East of College Dr | CX | B, C | 53 - 74 | 55 - 76 | 55 - 75 | 54 - 75 | 54 - 75 |
| Lakeview Medical Center, East of I-664 and South of VA164, on Western Branch Blvd | DA | D | 36 - 36 | 37 - 37 | 38 - 38 | 36 - 36 | 37 - 37 |
| Bon Secours Maryview Nursing, East of I-664 off of Bridge Rd | DAA | B, C | 57 - 58 | 58 - 59 | 58 - 59 | 58 - 59 | 58 - 59 |

**Table 4-6: Ranges of Predicted Loudest-Hour Sound Levels by CNE – I-664 Corridor, Peninsula**

| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | |
|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. C | Alt. D |
| **NEWPORT NEWS** | | | | | | |
| King Lincoln Park, East of I-664 on Jefferson Ave | DI | C | 58 - 65 | 59 - 66 | 59 - 66 | 59 - 65 |
| Agape Hands Cathedral Trustees, single-family residences on East of I-664 Jefferson Ave, 13th & 14th St | DJ | B, D | 38 - 67 | 39 - 68 | 38 - 67 | 39 - 68 |
| Multi-family residences and ballfield, East of I-664 on Jefferson Ave in between 22nd and 28th St | DK | B, C | 55 - 73 | 56 - 74 | 57 - 76 | 57 - 76 |
| Navy Field, Brennan Pointe multi-family residences, and Juvenile Center, west of I-664 on Warwick Blvd in between 30th and 32nd St | DL | B, C, D | 33 - 67 | 34 - 68 | 36 - 68 | 35 - 68 |

| Area Land Use and Description | CNE ID | Cate-gory | Range of Predicted Exterior & Interior Leq Sound Levels, dBA | | | |
|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. C | Alt. D |
| Multi-family and single-family residences, Southeast of I-664, between 32nd and 36th St/Jefferson Ave and Marshall Ave | DM | B | 51 - 65 | 52 - 66 | 52 - 67 | 52 - 68 |
| Friendship Baptist Church & Playground, Gethsemane Baptist Academy Playground, Alpha & Omega Christian Worship, House of Judah Deliverance Church, single-family, and multi-family residences, South of I-664 between Marshall Ave and Roanoke Ave | DN | B, C, D | 39 - 69 | 40 - 70 | 40 - 71 | 40 - 70 |
| Apprentice Builders Stadium, single-family residences, Northwest of I-664, between Jefferson Ave and Marshall Ave | DO | B, C | 57 - 70 | 58 - 71 | 58 - 71 | 58 - 72 |
| Newsome Park Elementary School, New Grafton Baptist Church, Full Gospel Deliverance Church, Bethlehem Judah, Family Light Baptist Church, Kingdom Hall Jehovah's Witness, single-family, and multi-family residences, North of I-664 between Marshall Ave and Chestnut Ave | DP | B, C, D | 28 - 66 | 29 - 67 | 32 - 70 | 31 - 70 |
| Booker T Washington Middle School & Baseball Field, Greenlawn Memorial Park, and single-family residences Southeast of I-664, between 35th and 39th, East of Chestnut Ave | DQ | B, C, D | 38 - 65 | 39 - 66 | 39 - 66 | 39 - 66 |
| **HAMPTON** | | | | | | |
| Hampton Coliseum (Concert Venue) and multi-family development North of I64 off of Coliseum Dr/Freeman Dr | AC | B, D | 44 - 70 | 45 - 71 | 45 - 71 | 45 - 71 |
| Single-family residences South of I-64 and West of I-664 on Red Robin Turn | AD | B | 60 - 67 | 61 - 67 | 61 - 67 | 61 - 68 |
| Single-family residences, apartments, Greenlawn Cemetery, East of I-664, South of Aberdeen Rd | DQ | B, C, D | 34 - 67 | 35 - 68 | 35 - 69 | 35 - 68 |
| Single-family residences, playground, church, picnic table, East of I-664, North of Aberdeen Rd | DR | B, C, D, E | 30 - 74 | 31 - 75 | 33 - 74 | 32 - 73 |
| Single-family residences, Briar Queen Pool, West of I-664, South of Powhatan Pkwy | DS | B, C | 54 - 73 | 54 - 74 | 55 - 74 | 55 - 74 |
| Single-family residences, West of I-664, North of Powhatan Pkwy | DT | B | 55 - 68 | 56 - 69 | 58 - 76 | 58 - 76 |
| Hampton High School, building and athletic fields, West of I-664, South of W Queen St | DU | C, D | 38 - 68 | 39 - 69 | 44 - 76 | 44 - 76 |
| Single-family residences, East of I-664, South of W Queen St | DV | B | 54 - 67 | 55 - 68 | 60 - 78 | 60 - 78 |
| Single-family residences, townhomes, assisted living facility, West of I-664, North of W Queen St | DW | B | 53 - 72 | 54 - 73 | 55 - 75 | 55 - 75 |
| Single-family residences, West Cemetery, East of I-664, North of W Queen St | DX | B, C | 58 - 67 | 59 - 68 | 60 - 69 | 60 – 69 |

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VDOT Virginia Department of Transportation

# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

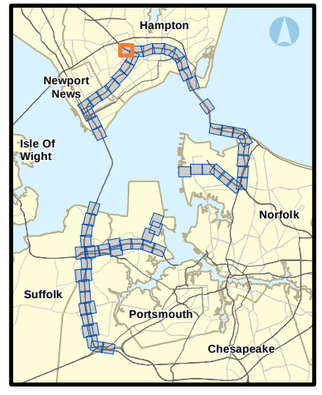
Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 1 of 64

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HRCS SEIS Hampton Roads Crossing Study SEIS

U.S. Department of Transportation Federal Highway Administration

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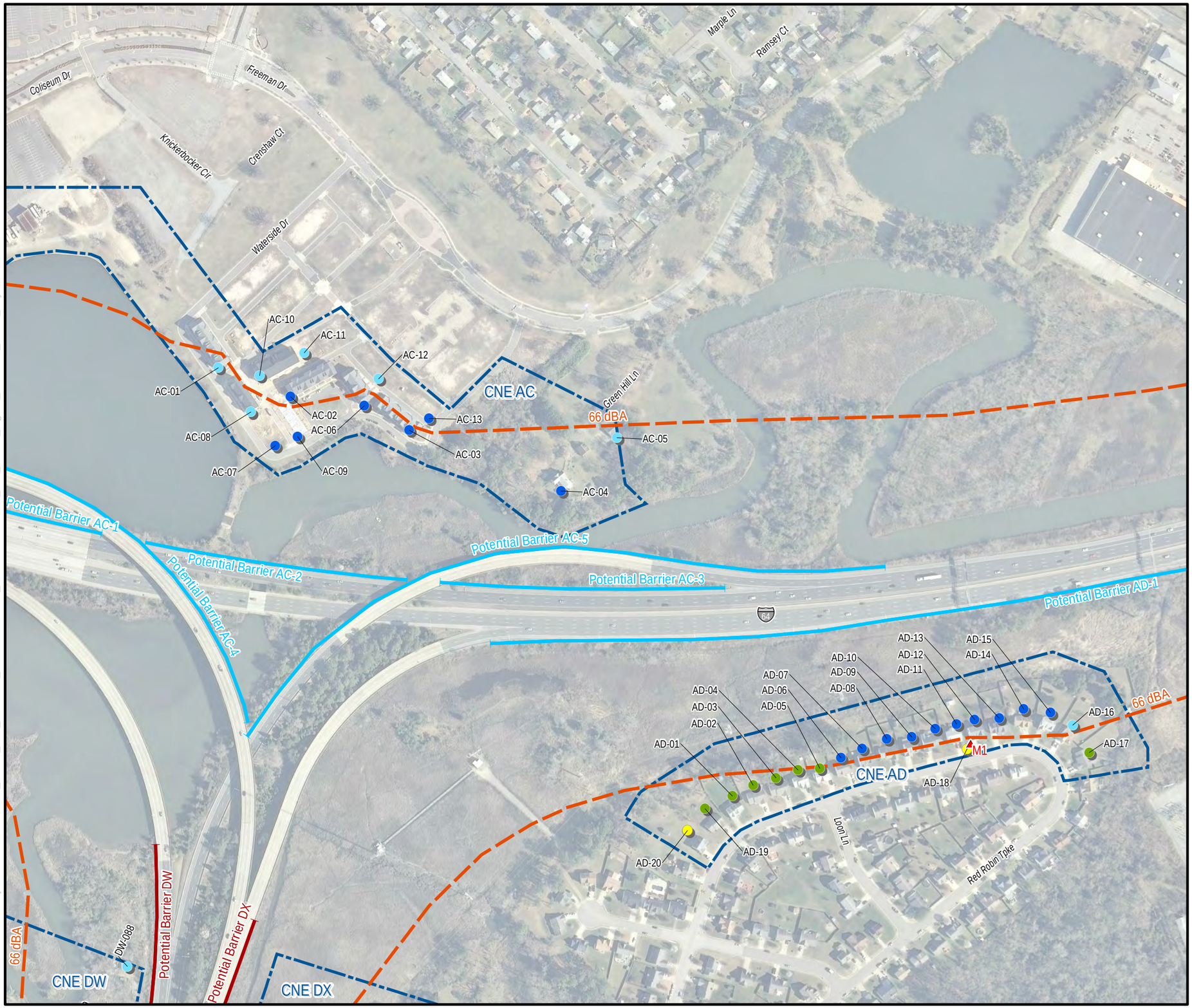


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined

Top Floor Noise Prediction Result

Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

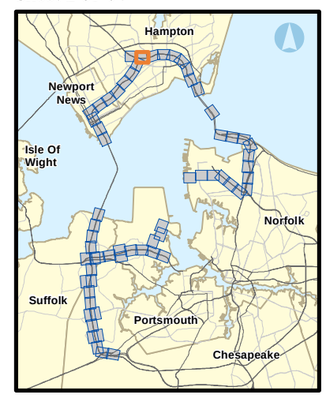
M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

CNE Boundary

66 dBA Noise Contour

Sheet 2 of 64

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HRCS SEIS
Hampton Roads Crossing Study SEIS

U.S. Department of Transportation
Federal Highway Administration

RK&K

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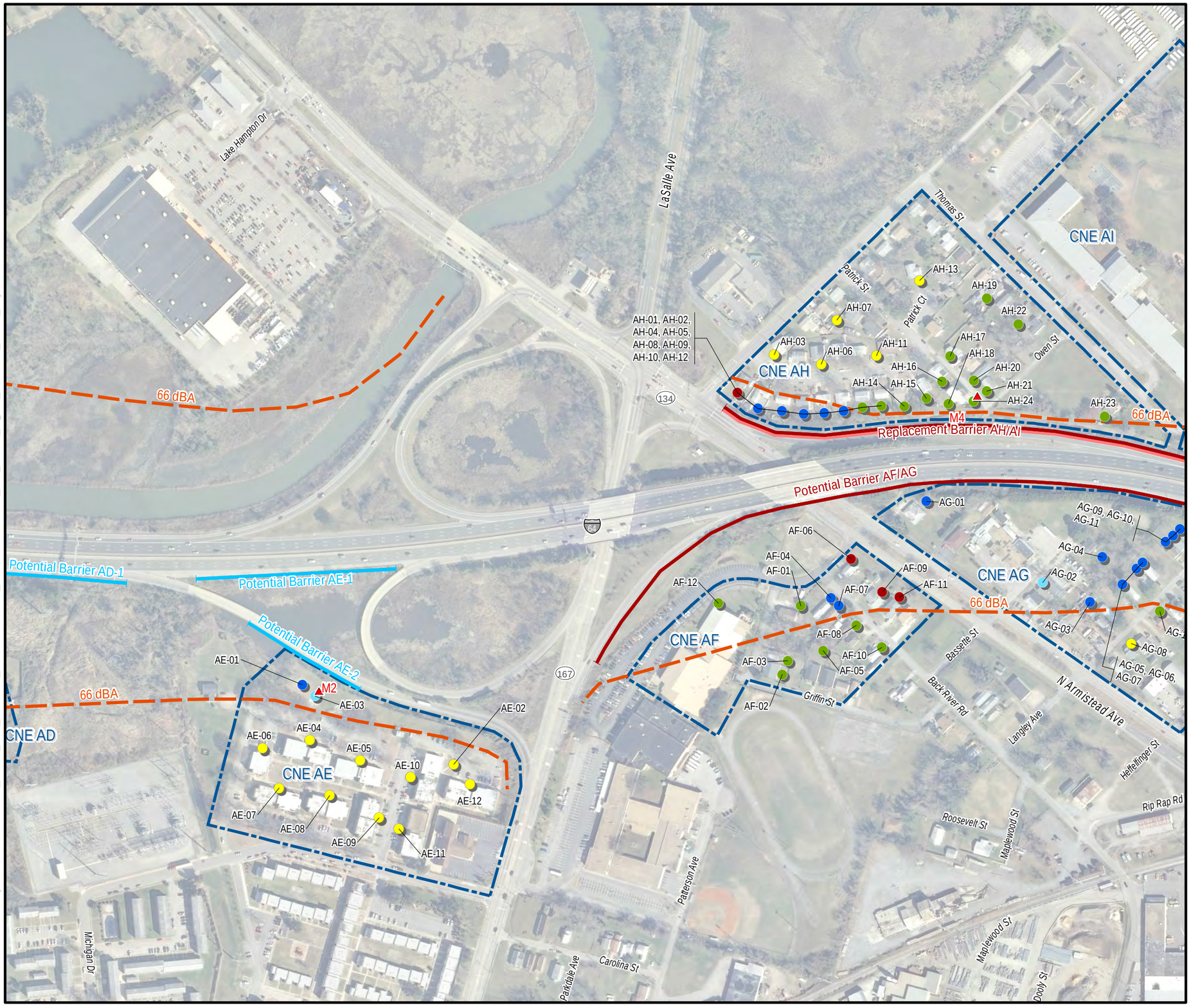


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number

- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

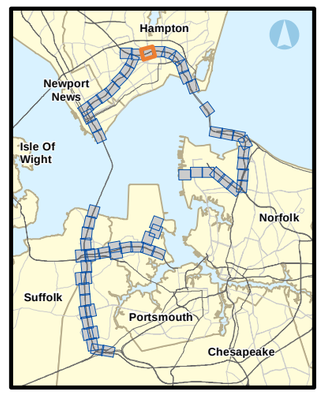
- M# Measurement Site

Noise Barriers

- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 3 of 64

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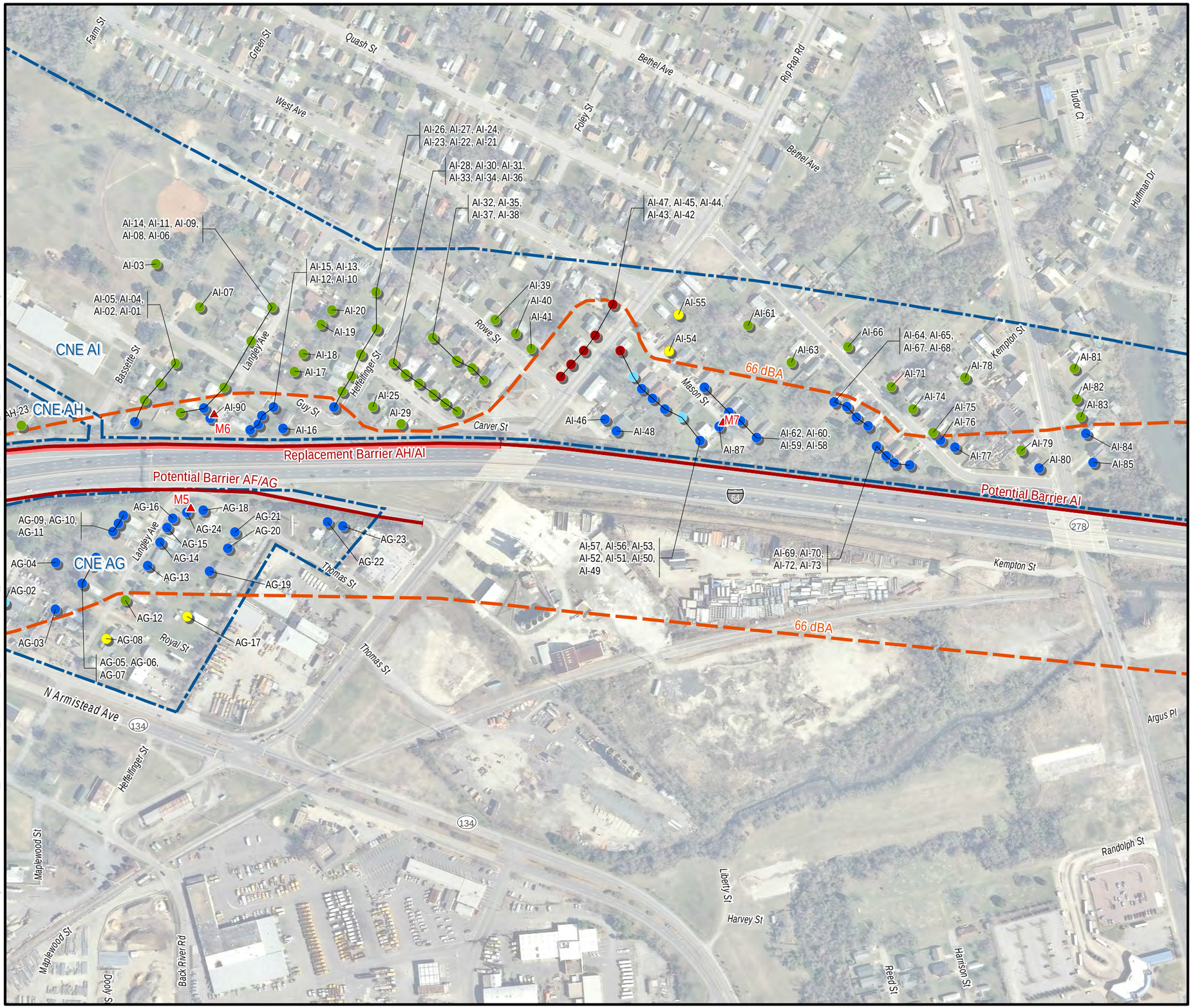


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

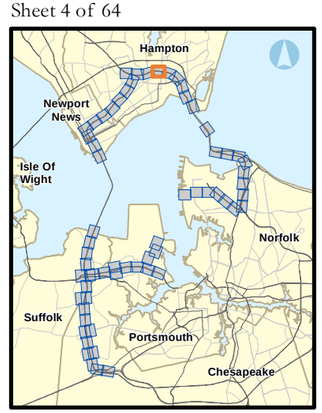
Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 4 of 64

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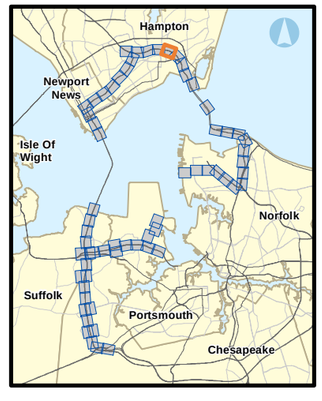
Sheet 5 of 64

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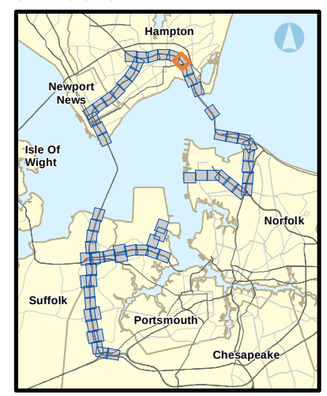


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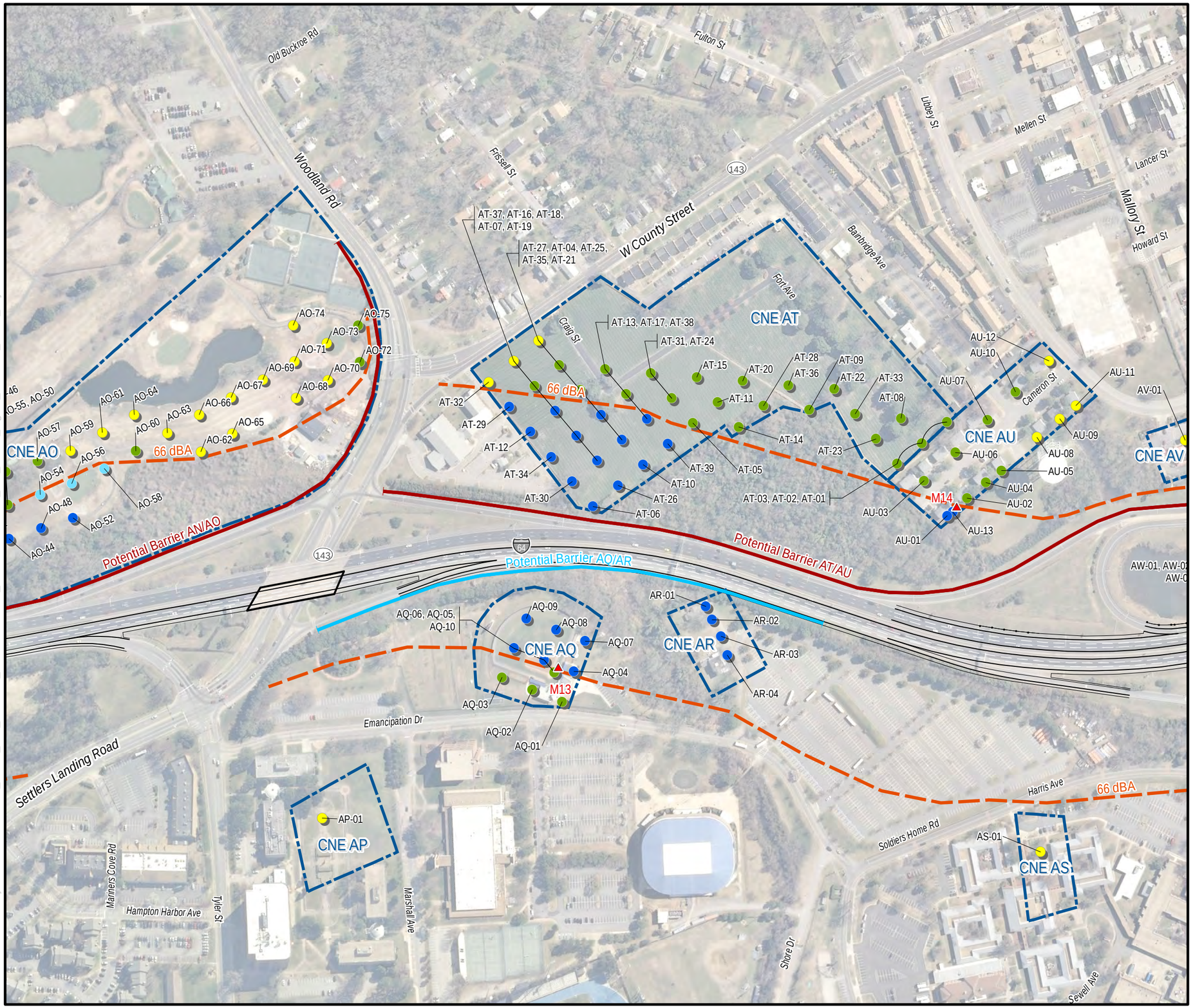


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# Figure 4-1
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## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

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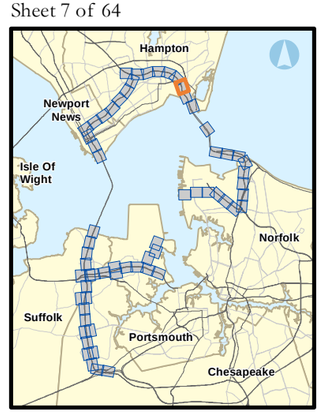


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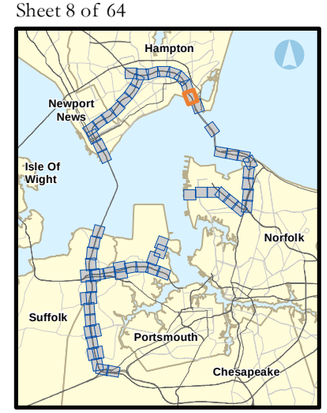


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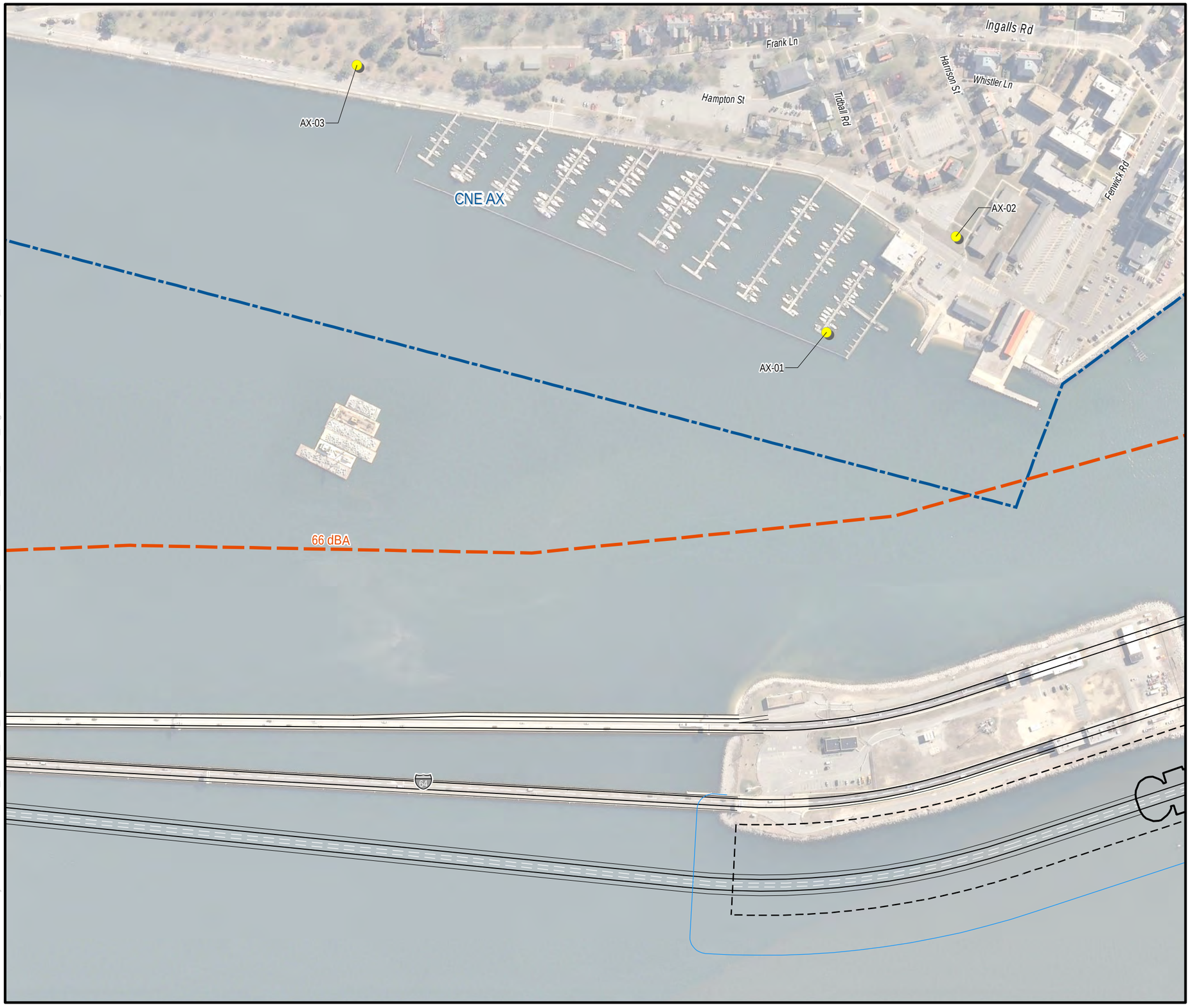


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- 66 dBA Noise Contour

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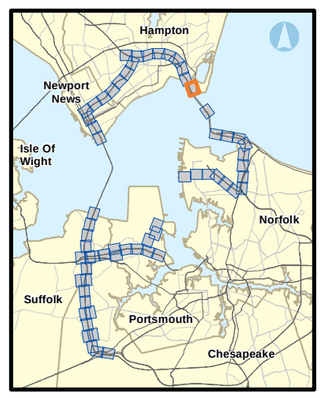


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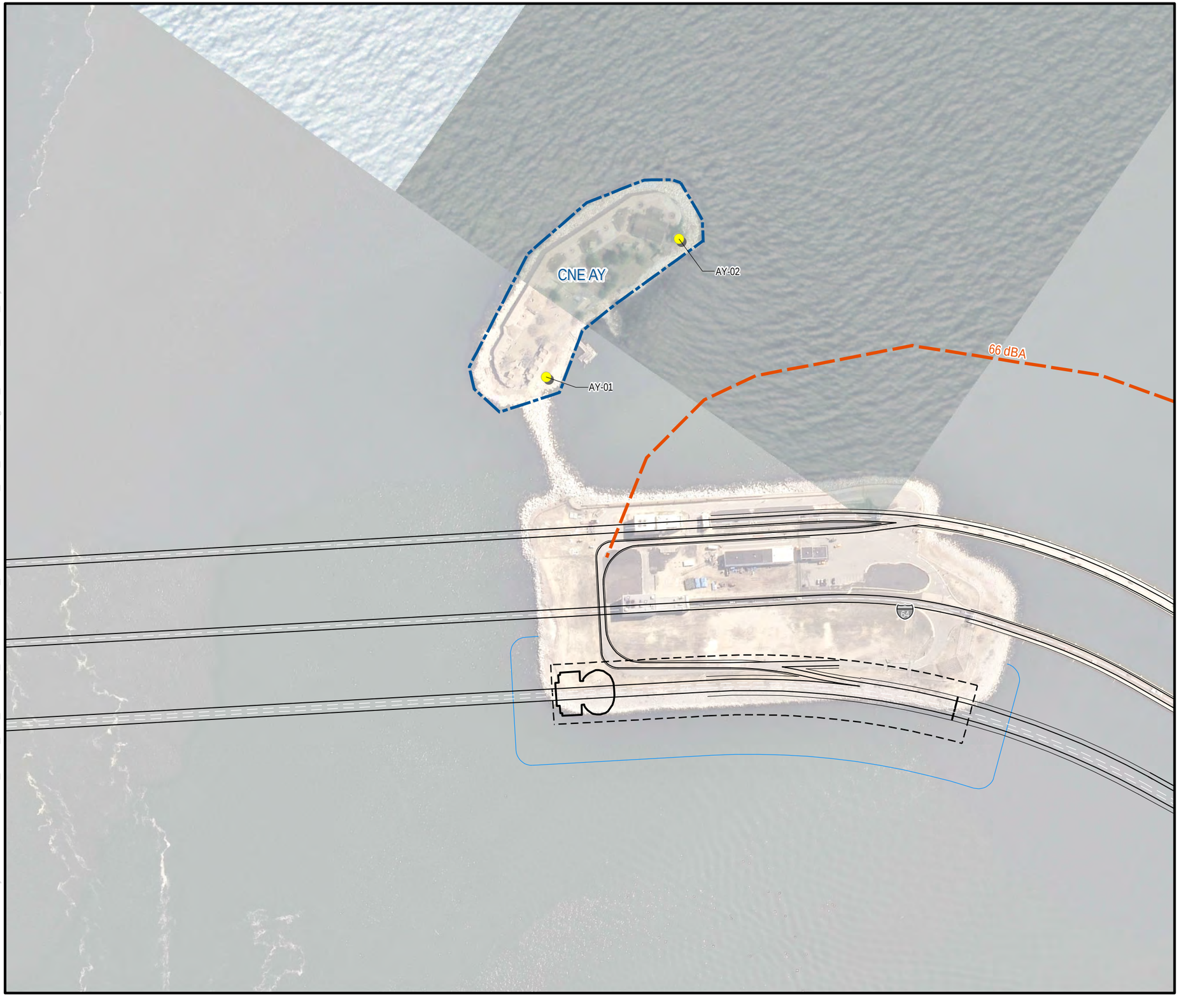


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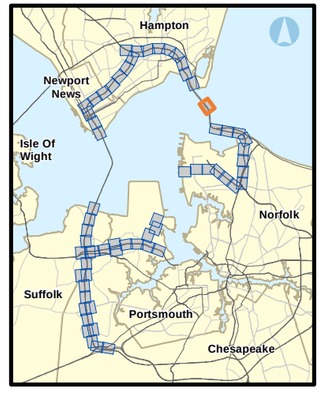
Sheet 10 of 64

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# Figure 4-1
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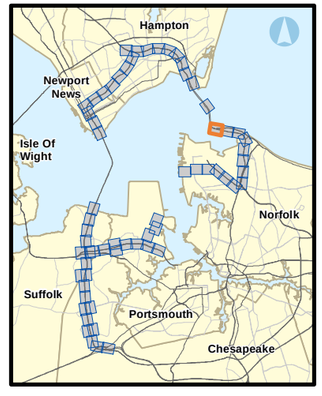
- CNE Boundary
- 66 dBA Noise Contour

Sheet 11 of 64

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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

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VDOT Project No. 0064-965-081, P101; UPC No. 106724

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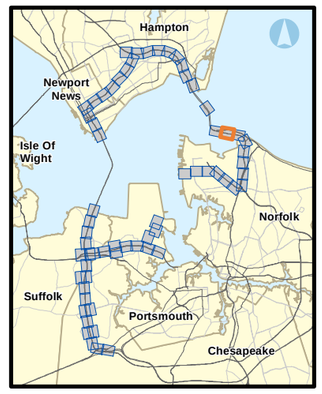
Sheet 12 of 64

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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

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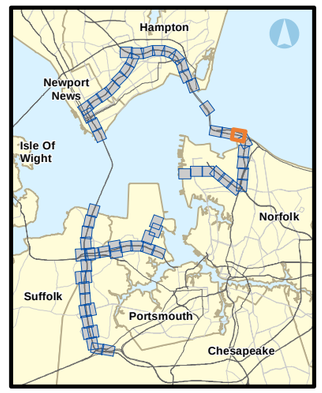


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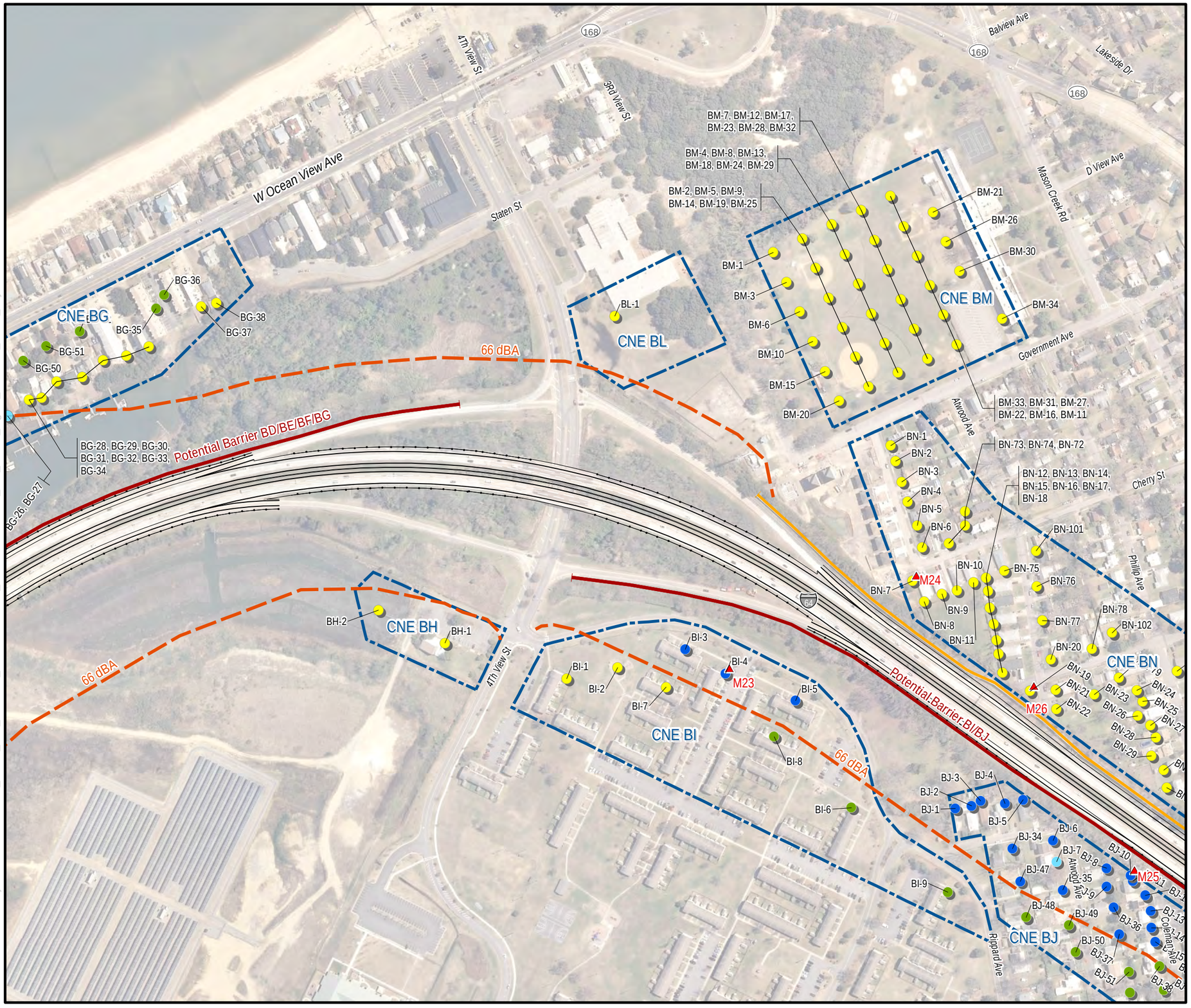


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VDOT Virginia Department of Transportation

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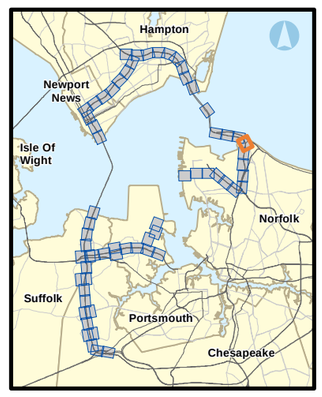


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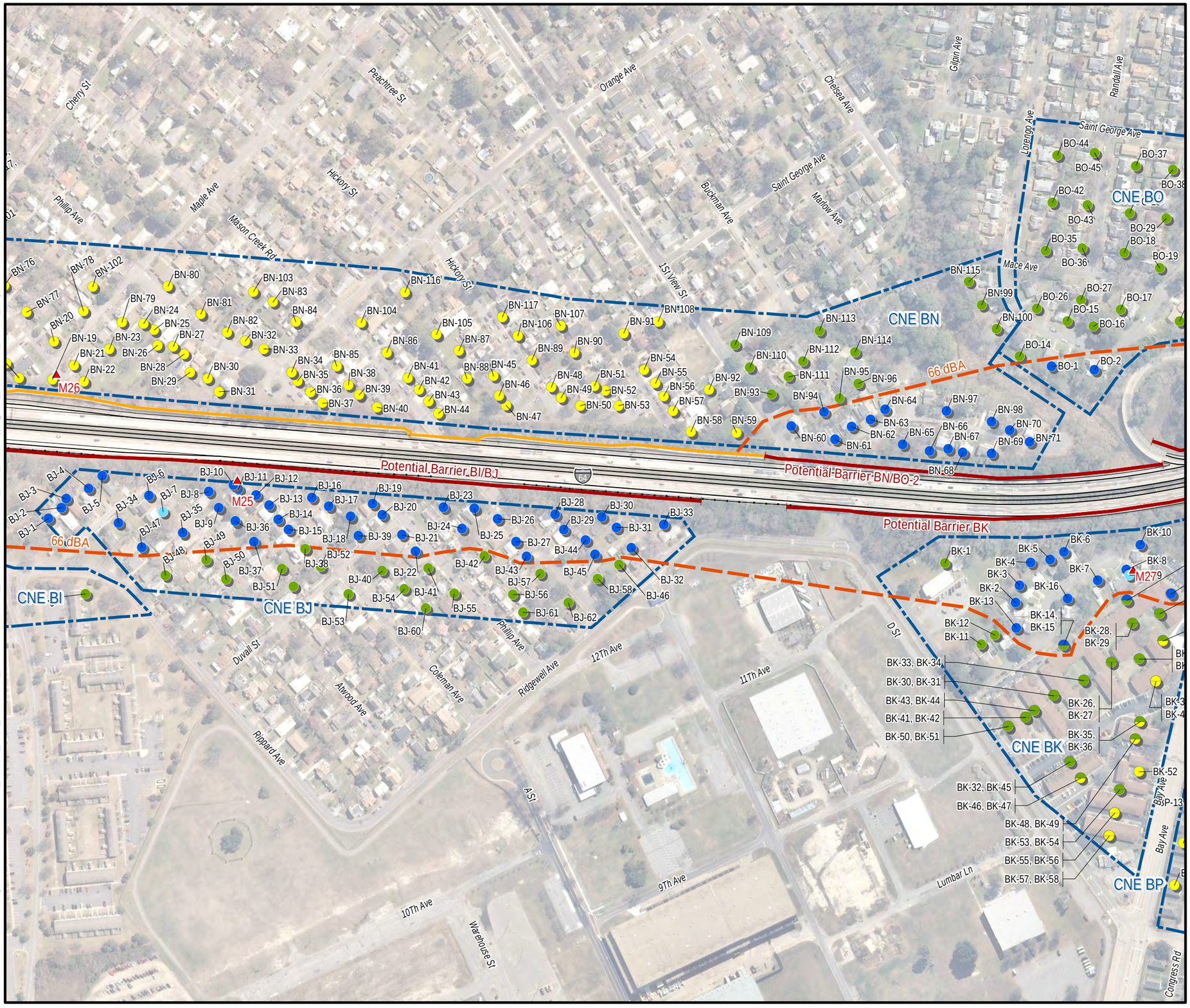


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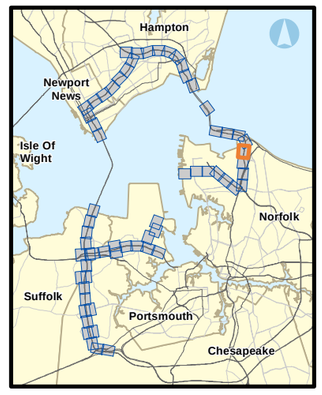


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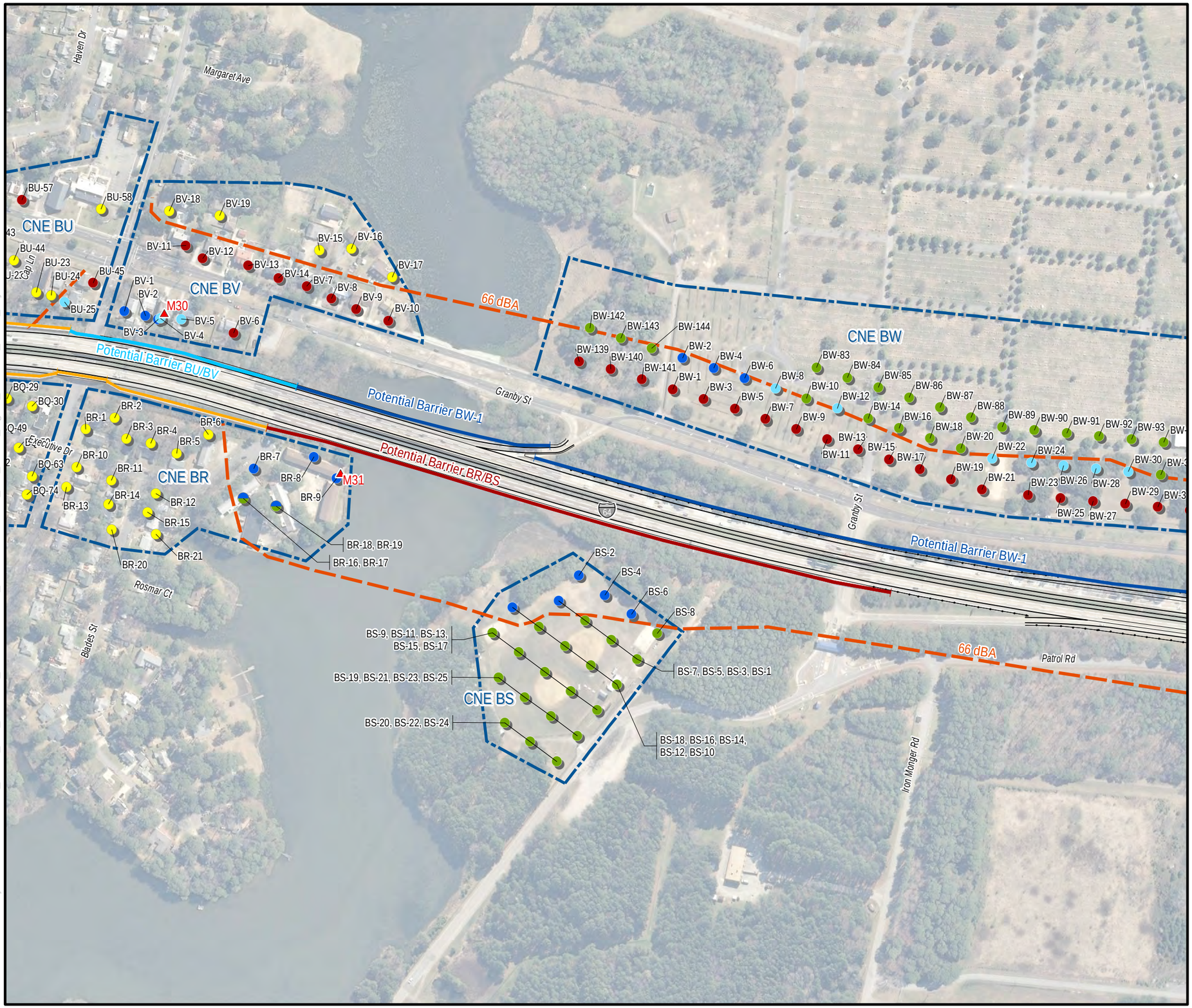


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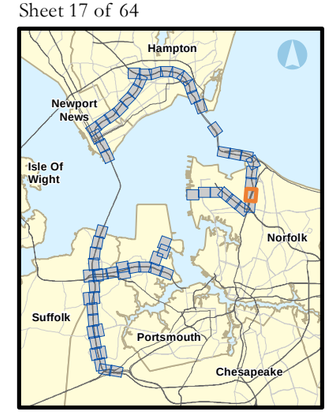


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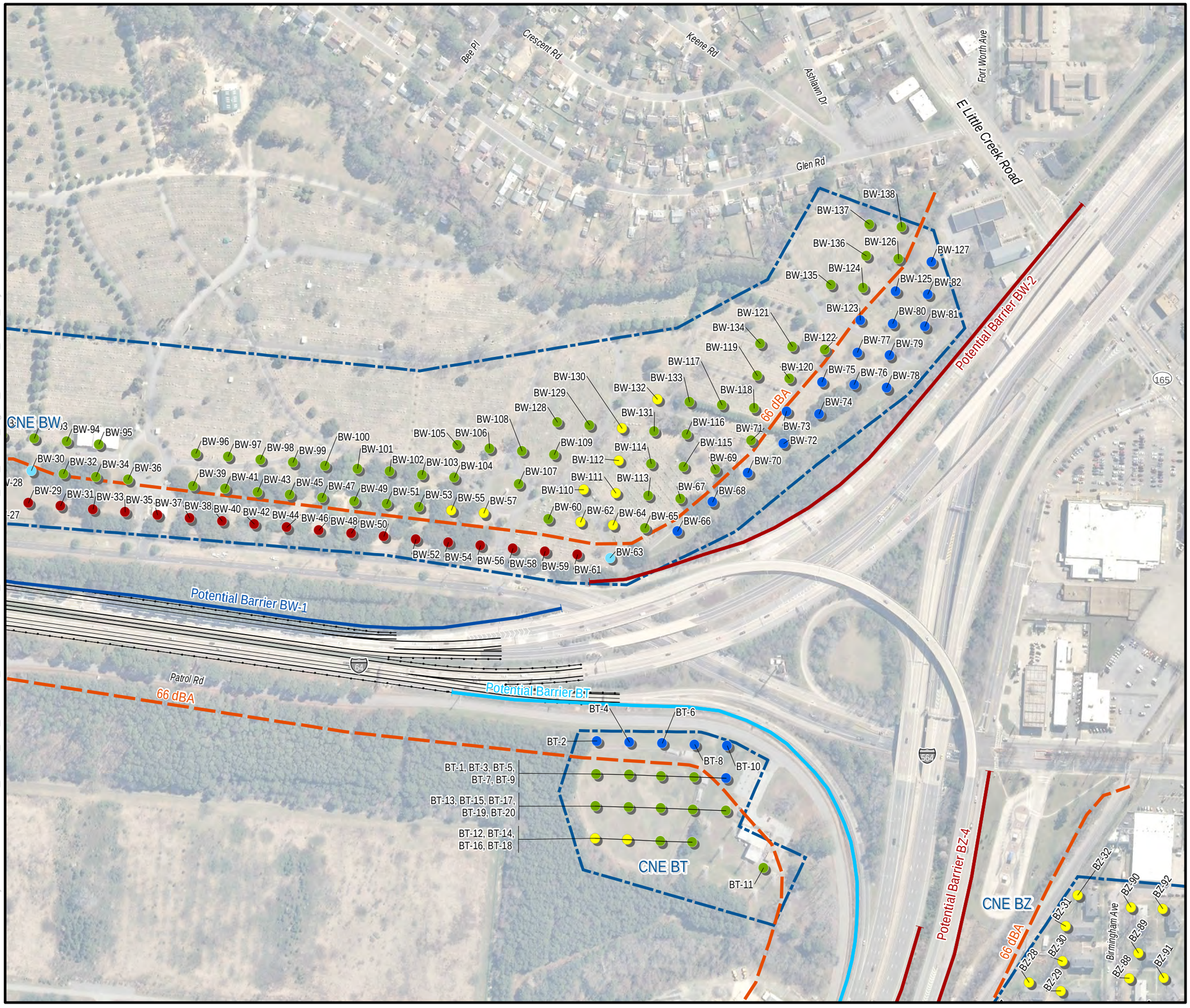


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VDOT
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- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined

Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

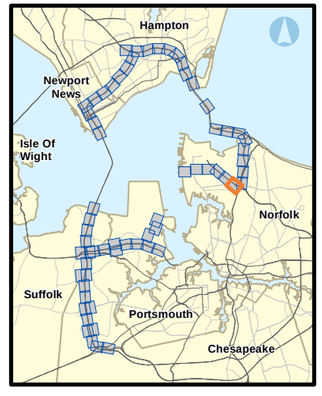
Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

CNE Boundary
66 dBA Noise Contour

Sheet 19 of 64

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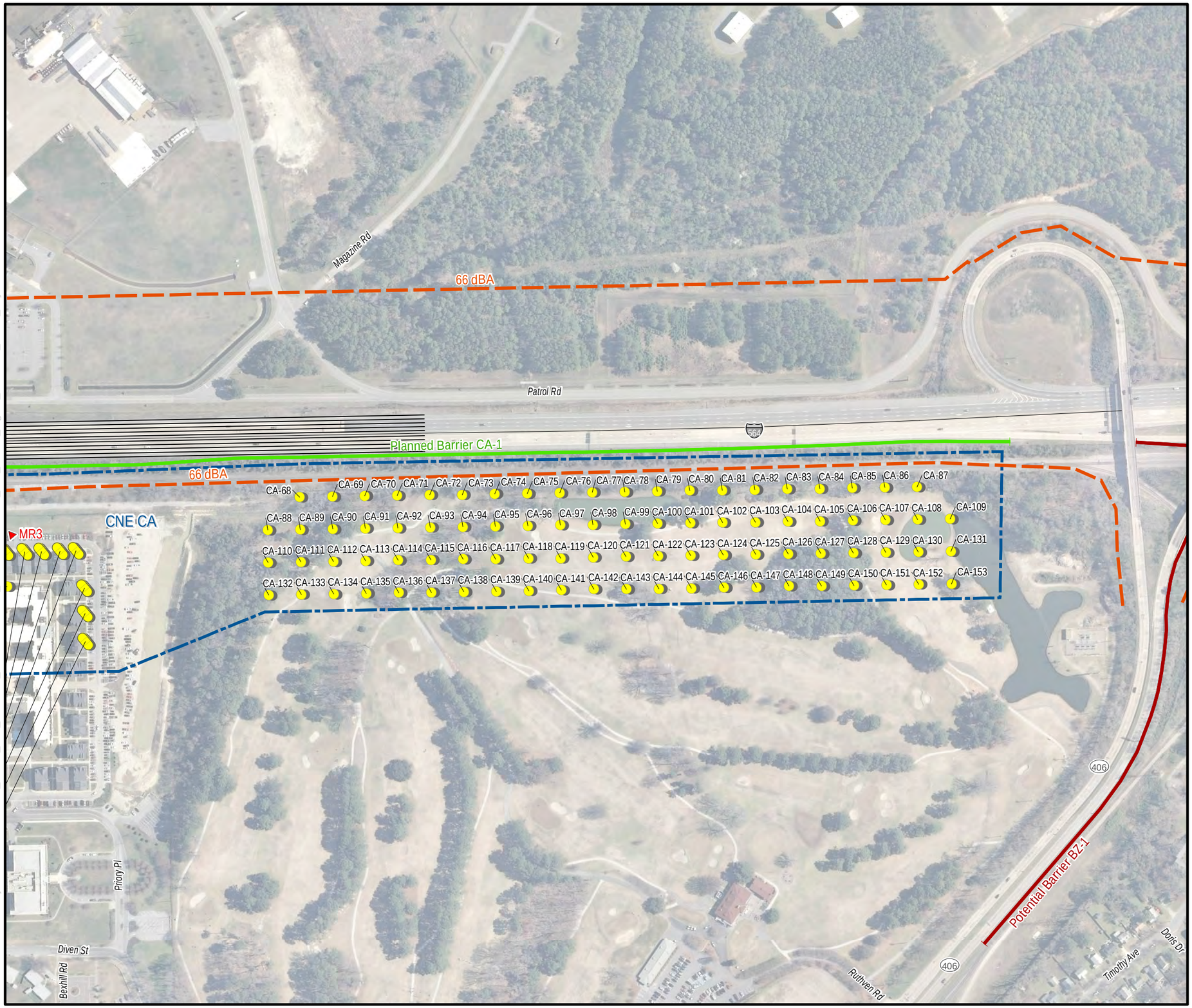




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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
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- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined

Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

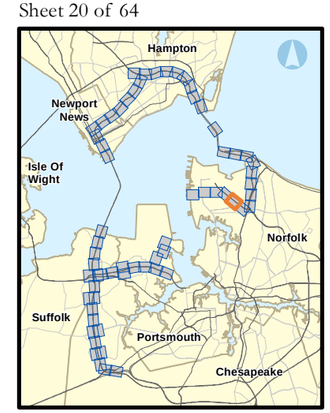
Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 20 of 64

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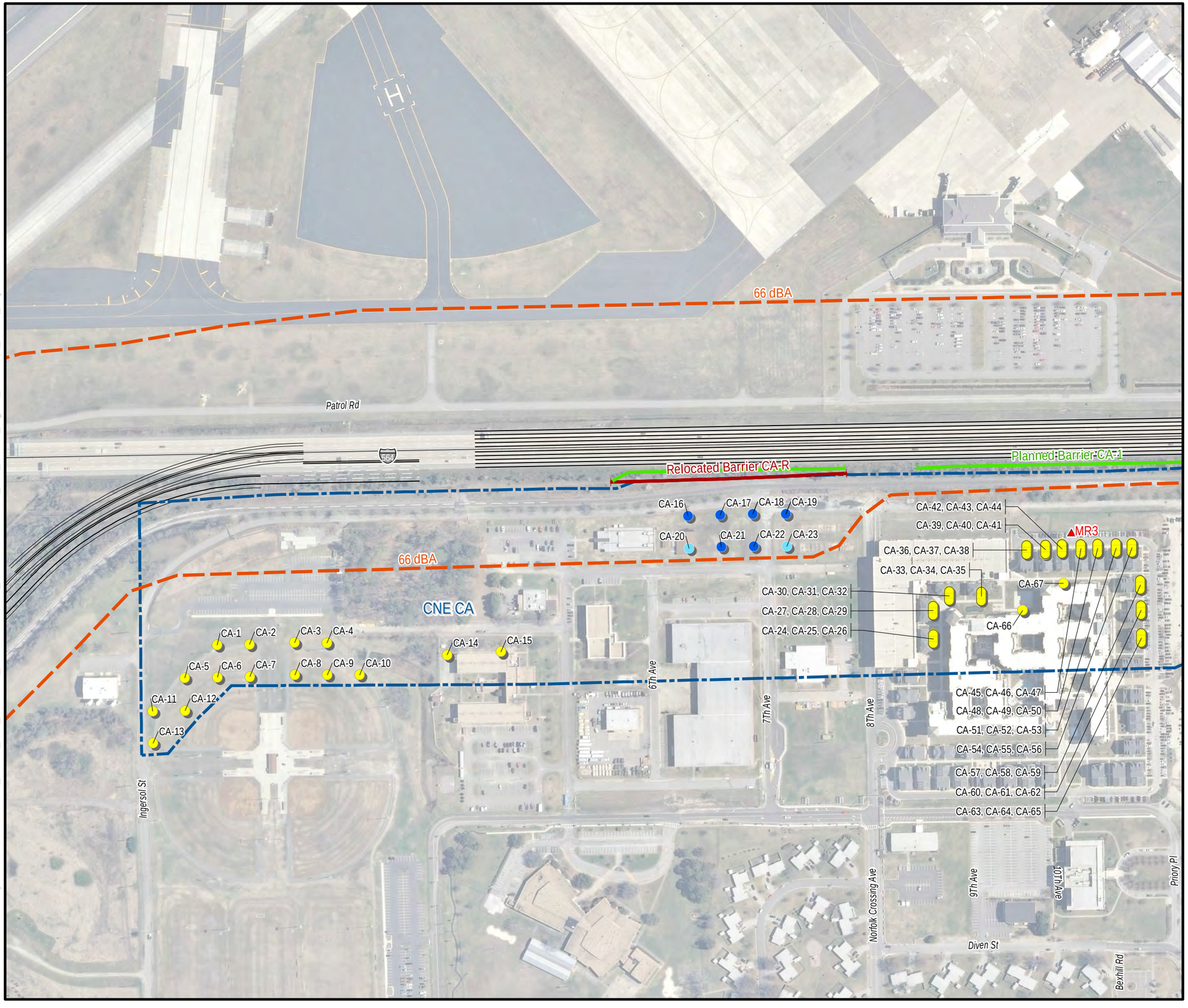


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

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- Bottom Floor Noise Prediction Result

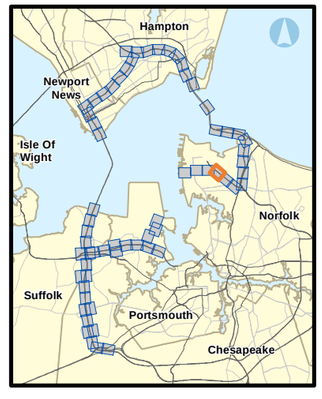
Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 21 of 64

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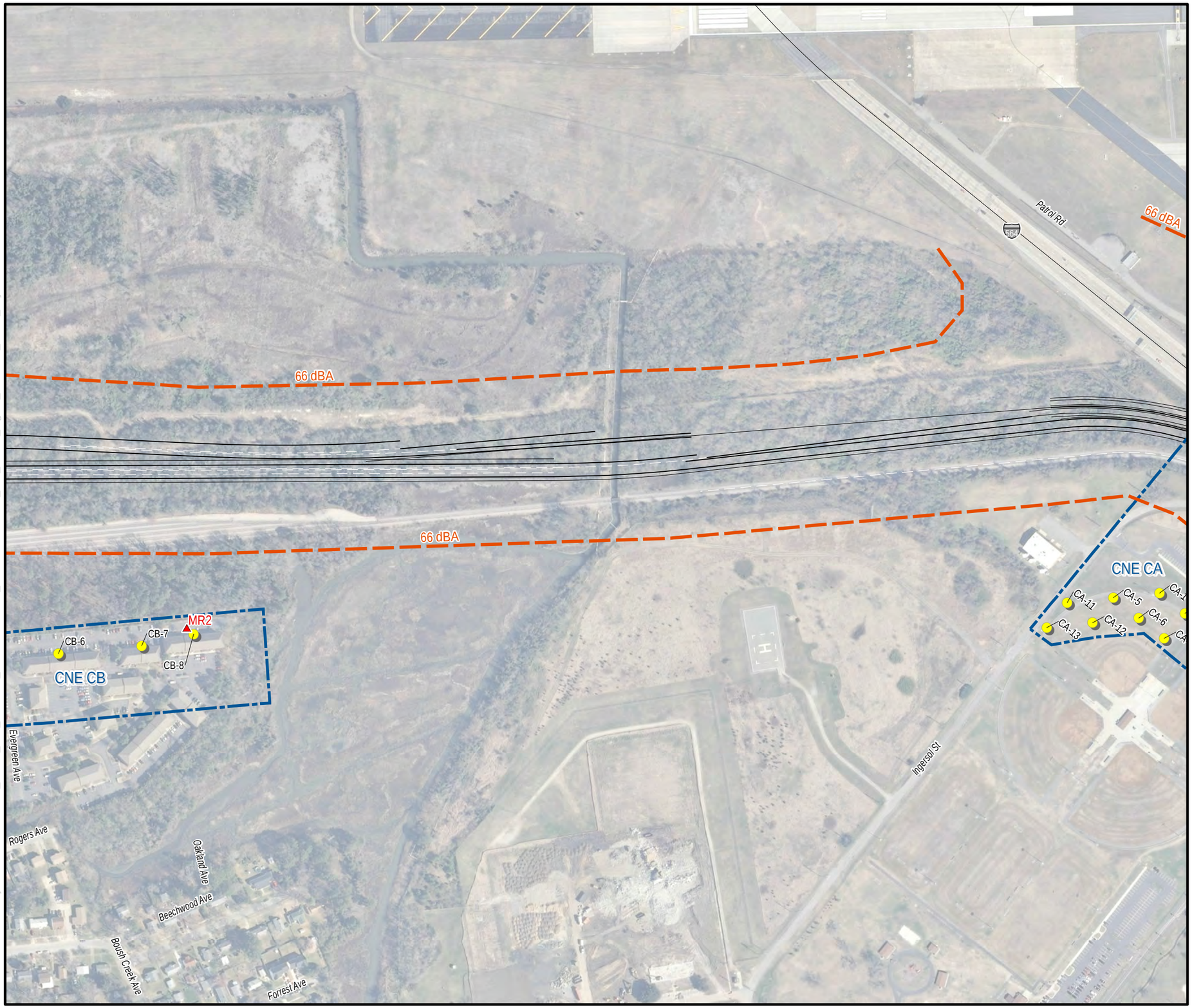


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

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- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

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- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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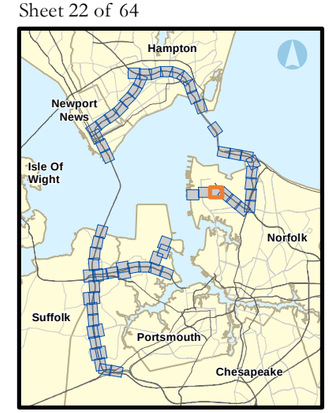


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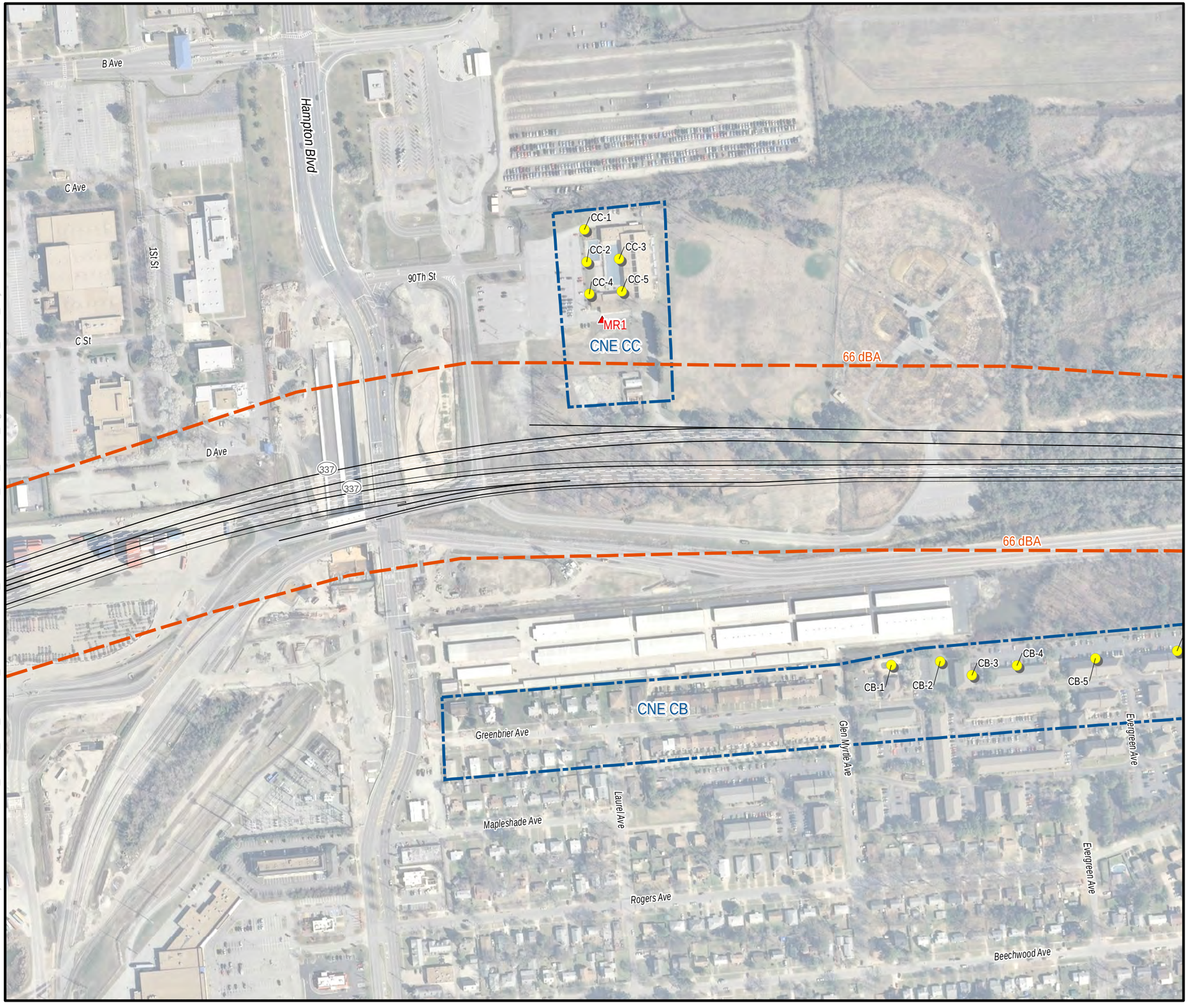


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

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- Bottom Floor Noise Prediction Result

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- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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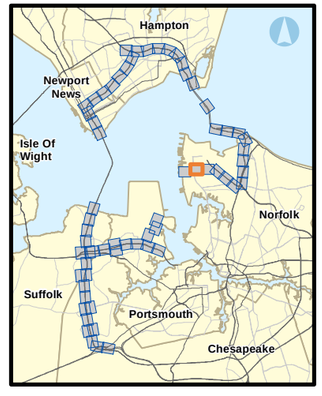


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

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- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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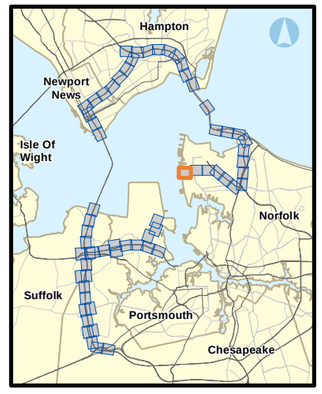


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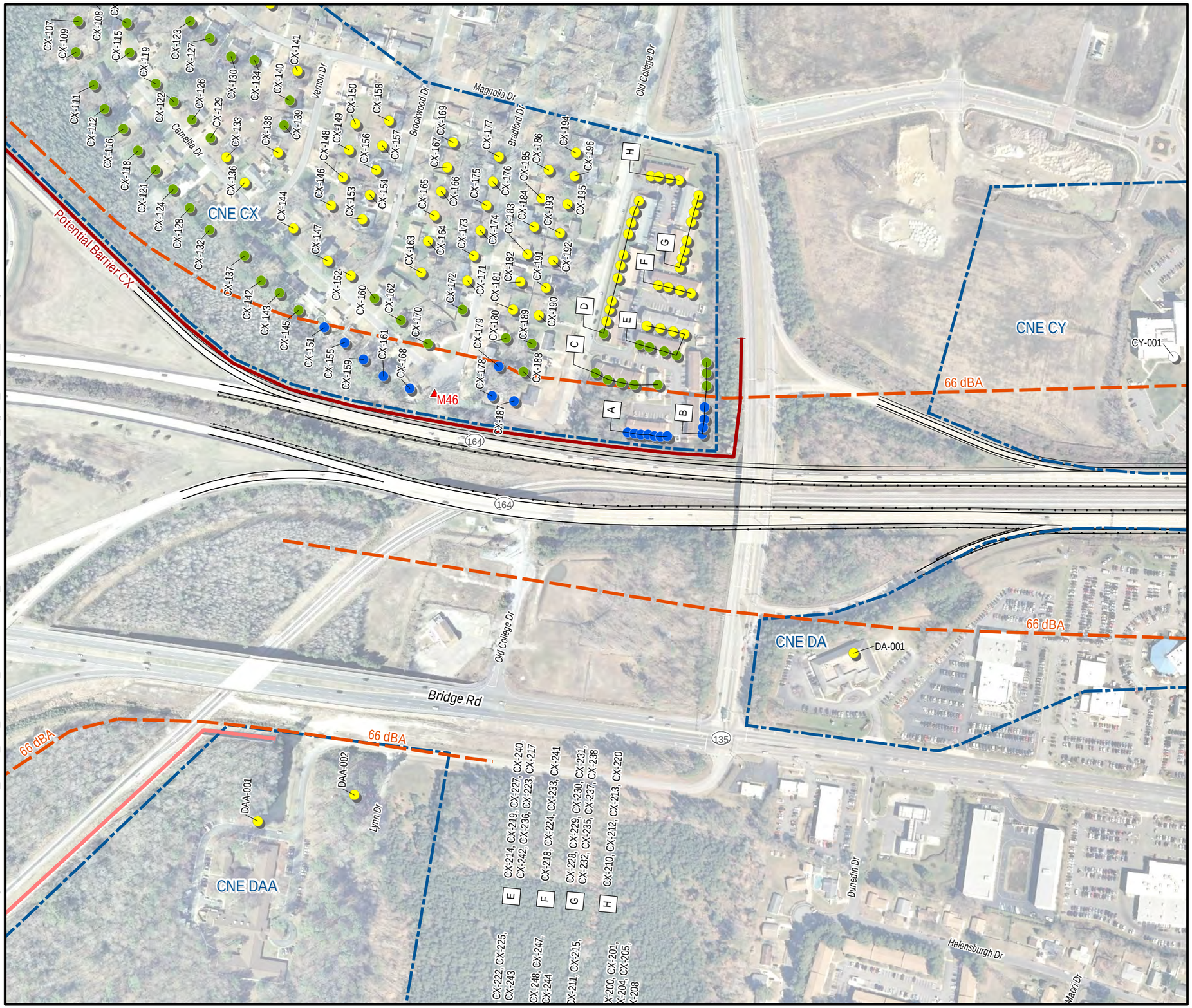


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined

Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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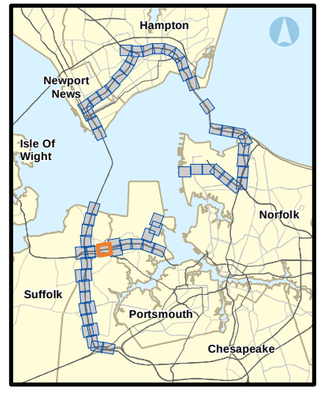


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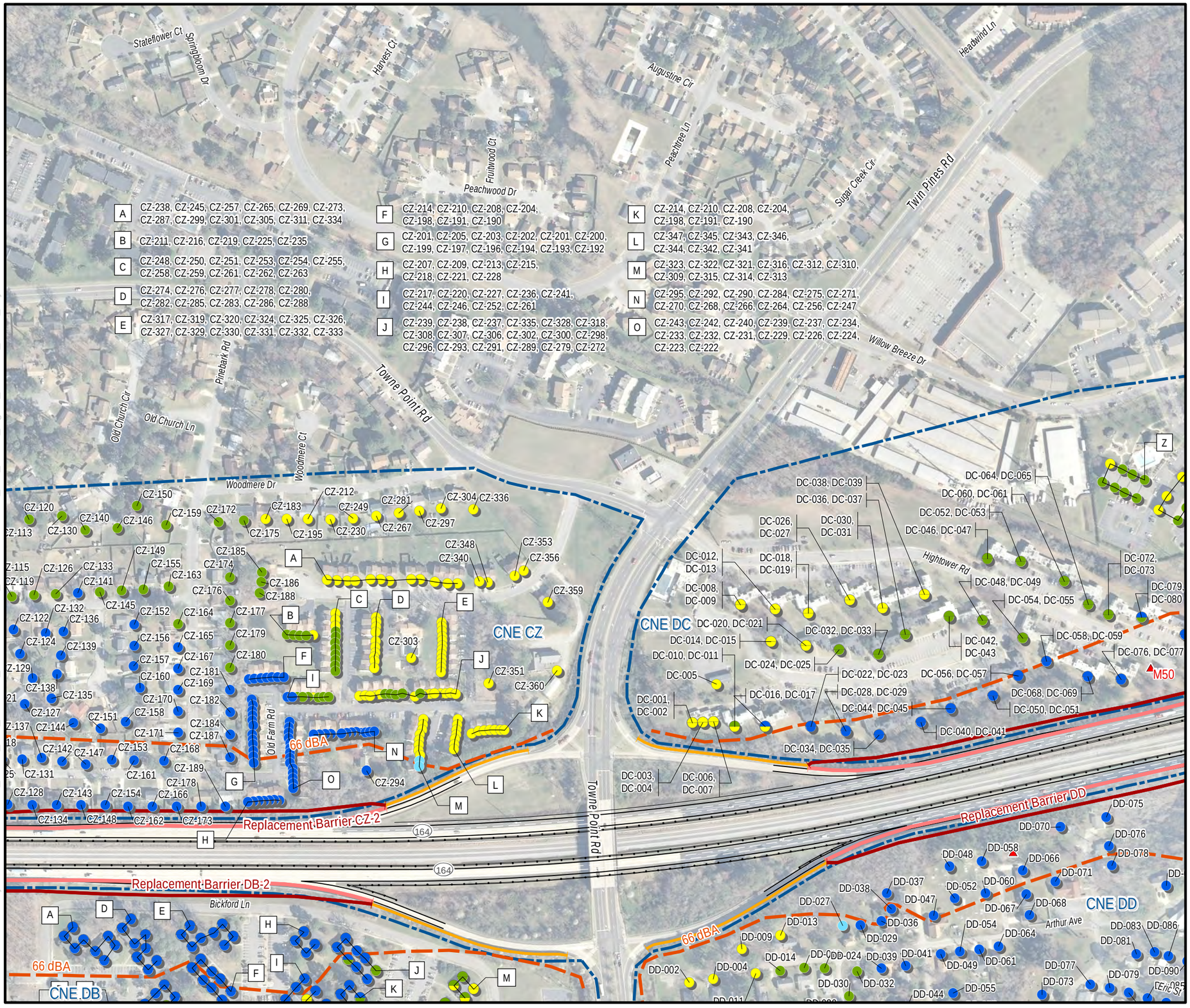


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
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- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

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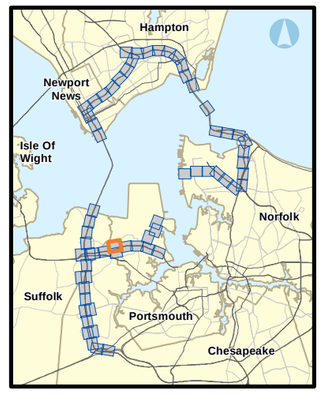
Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 27 of 64

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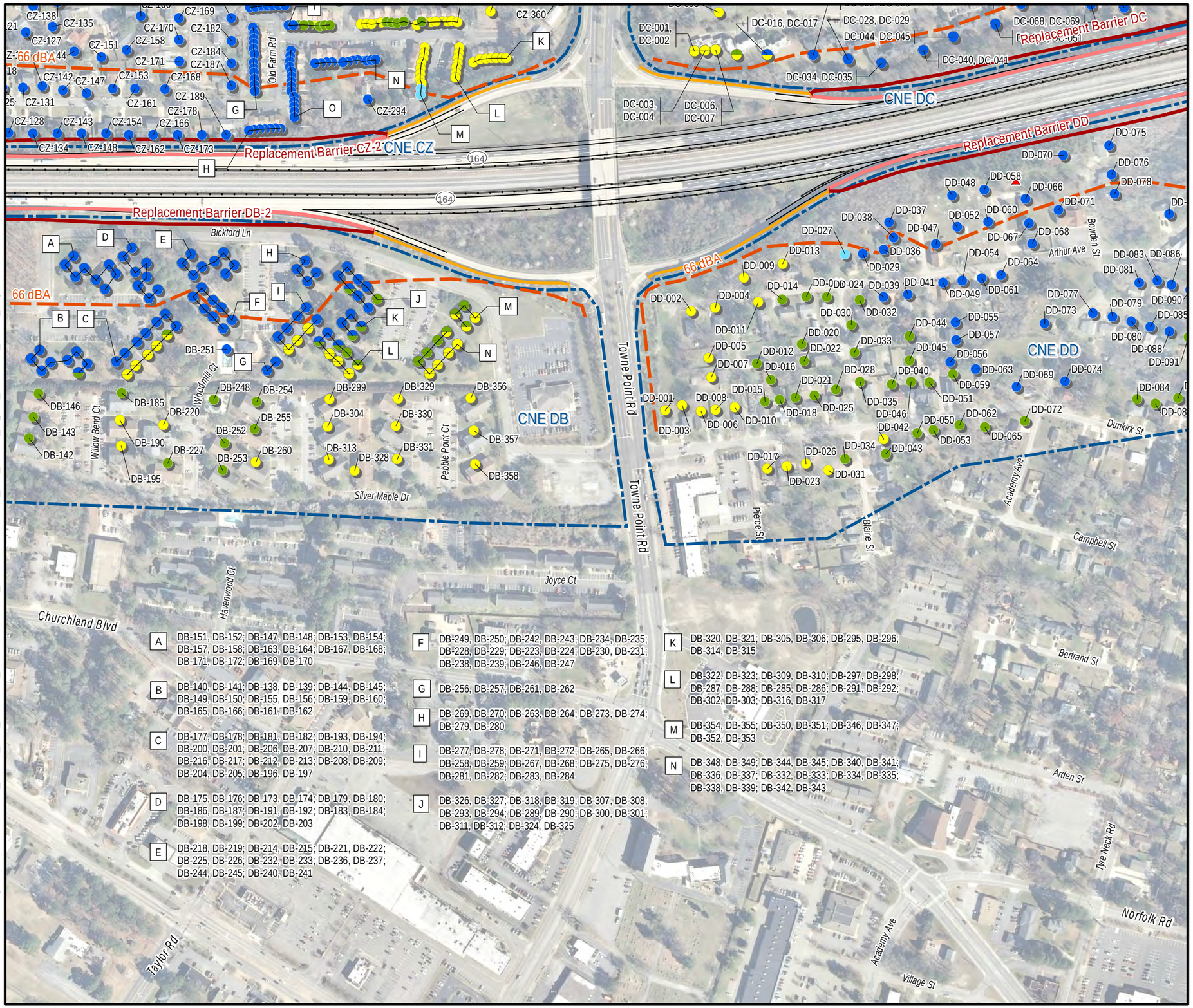


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

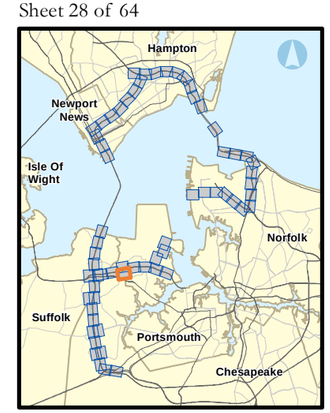
Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 28 of 64

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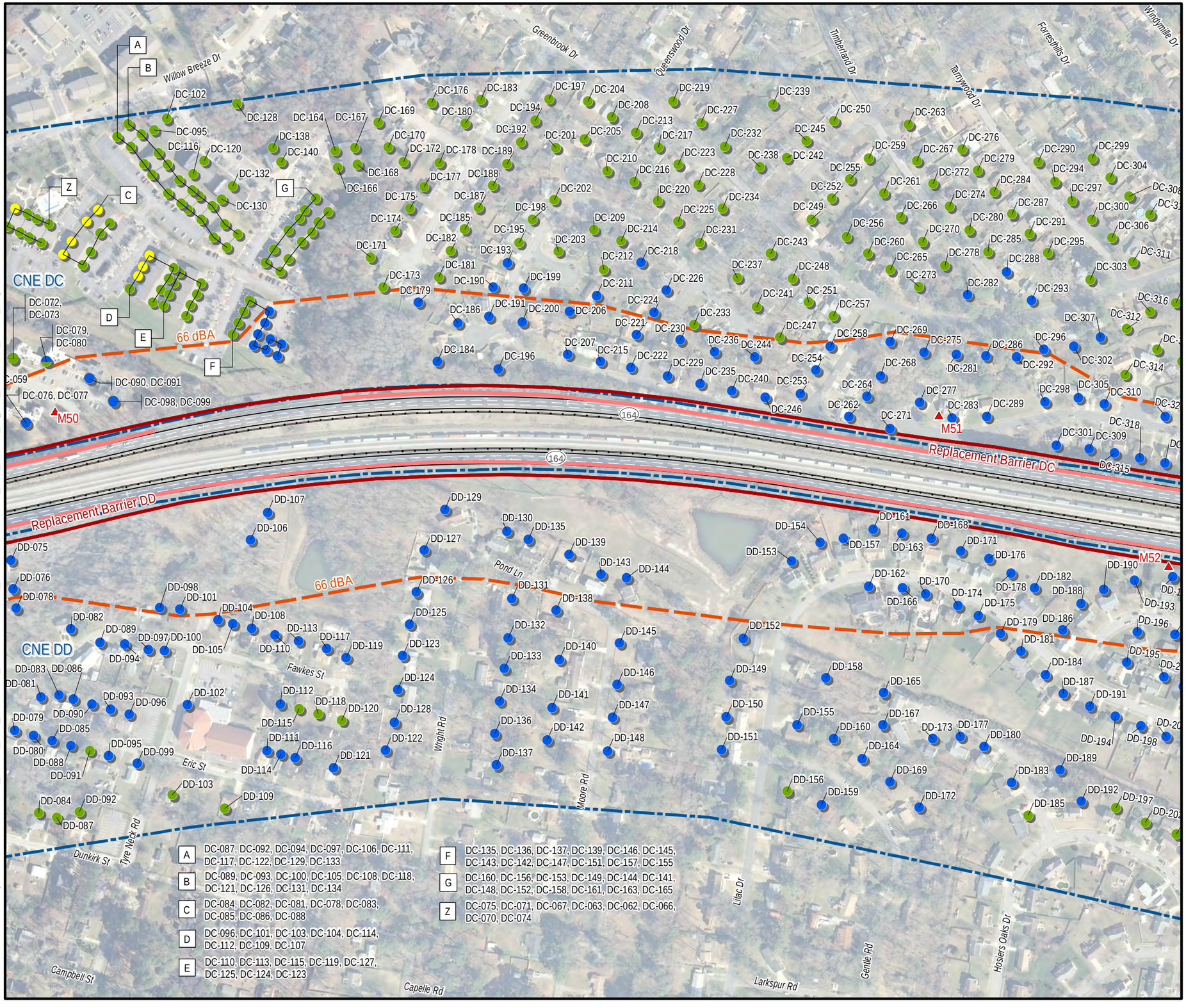


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

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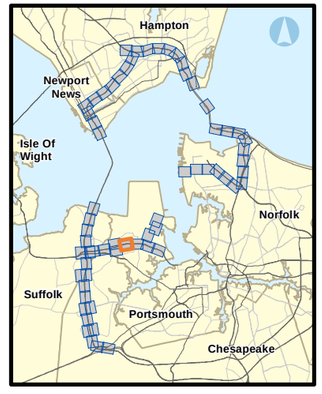
Sheet 29 of 64

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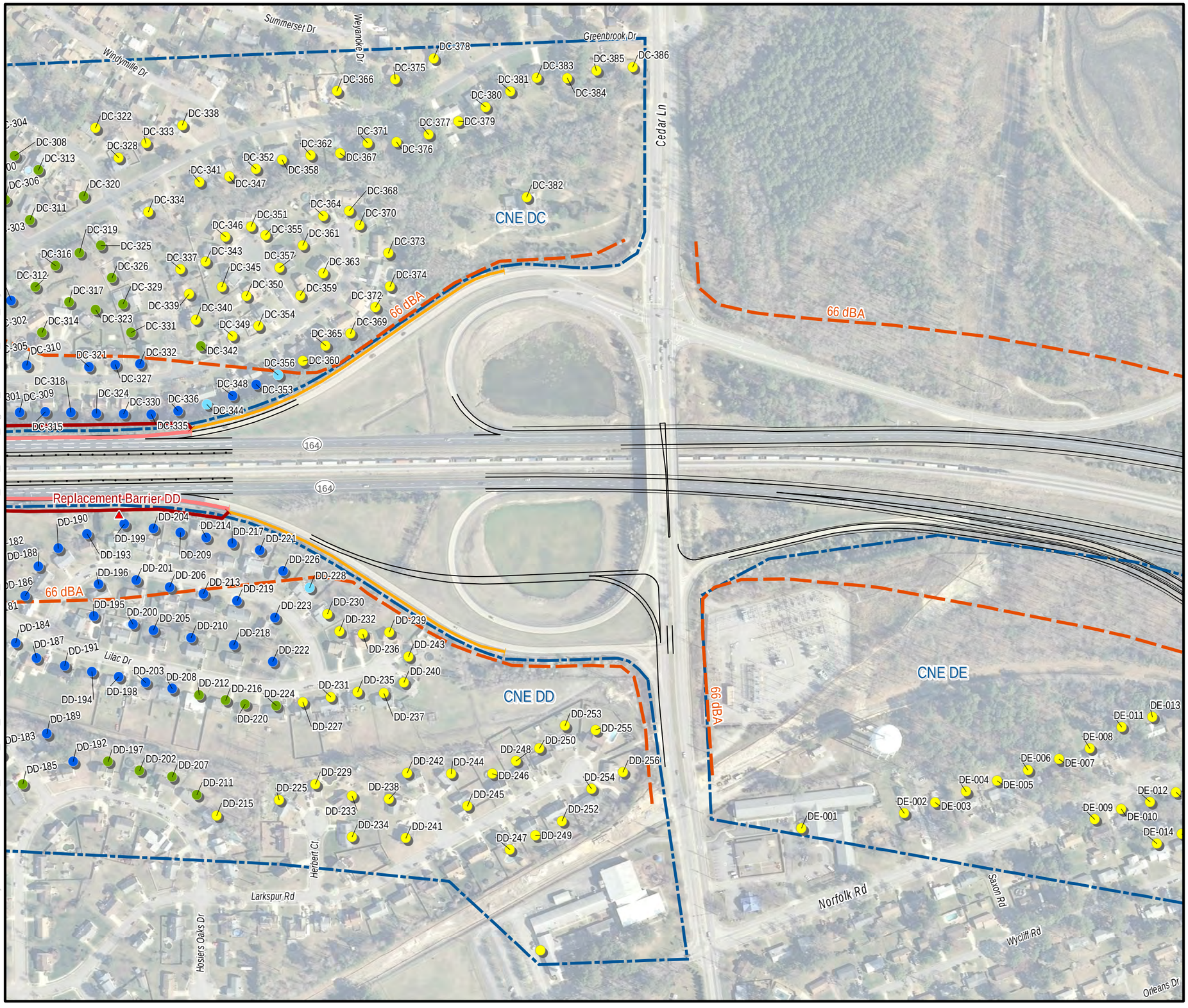


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

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- CNE Boundary
- 66 dBA Noise Contour

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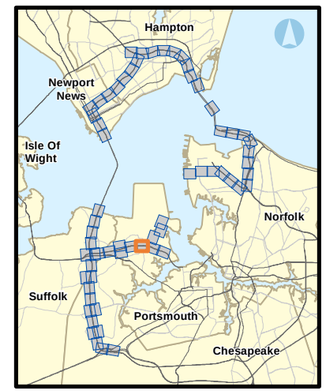


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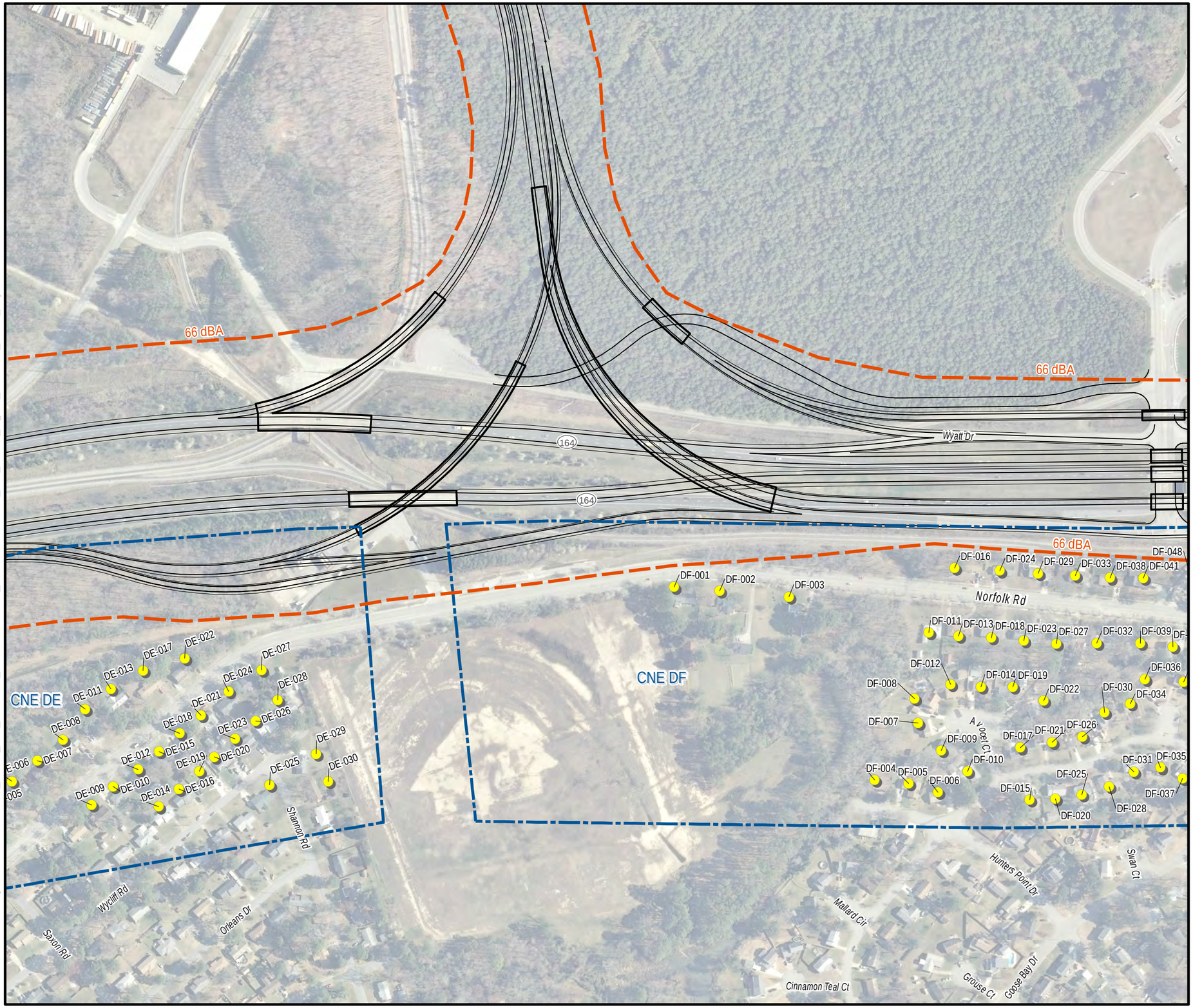


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

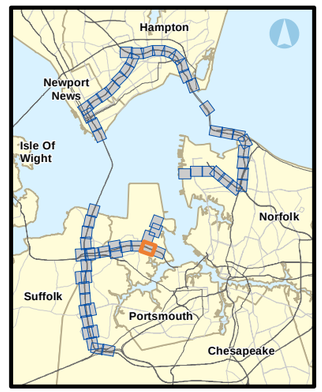
Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 31 of 64

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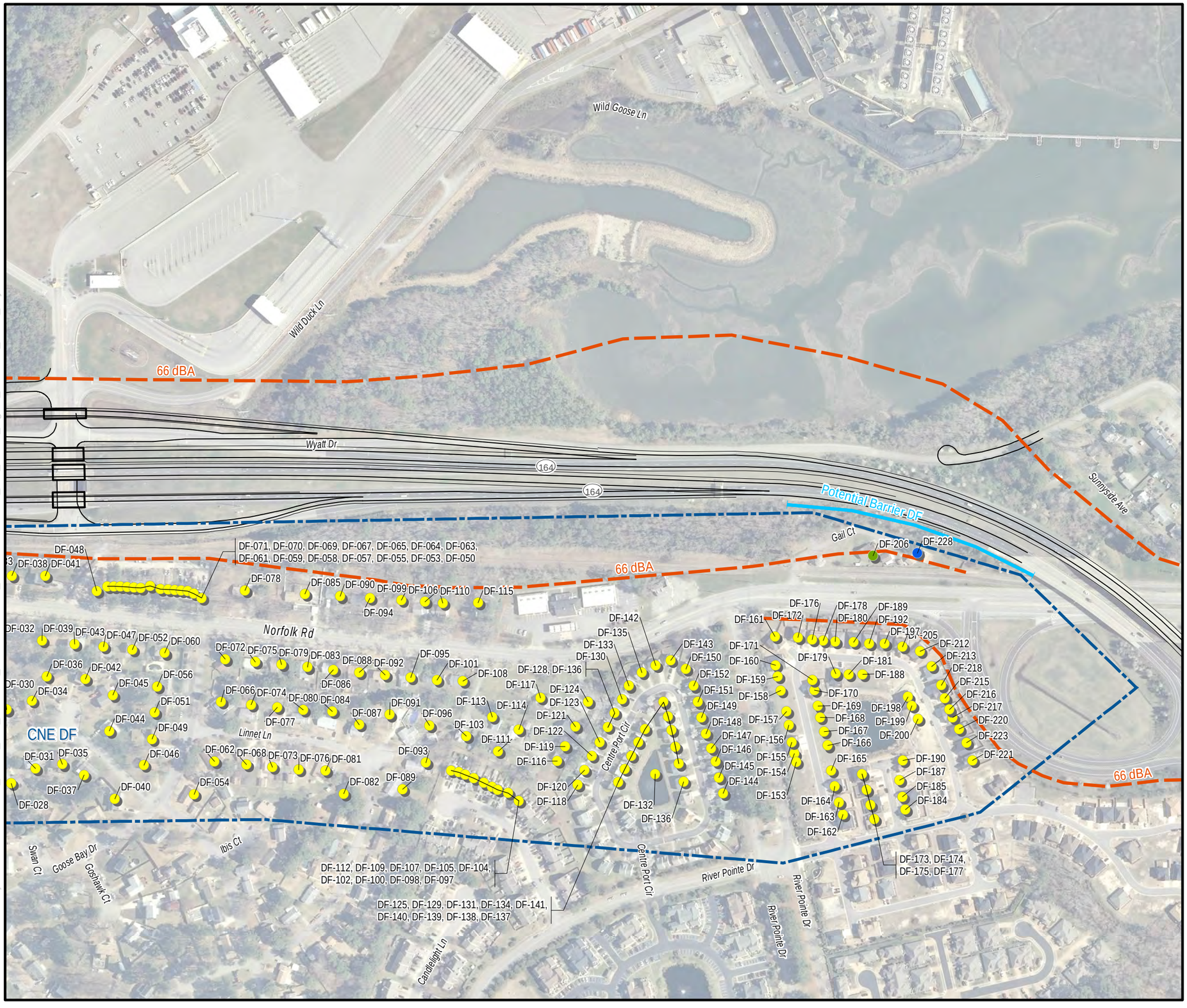


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Bottom Floor Noise Prediction Result

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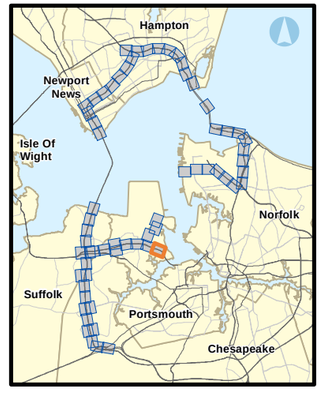
- CNE Boundary
- 66 dBA Noise Contour

Sheet 32 of 64

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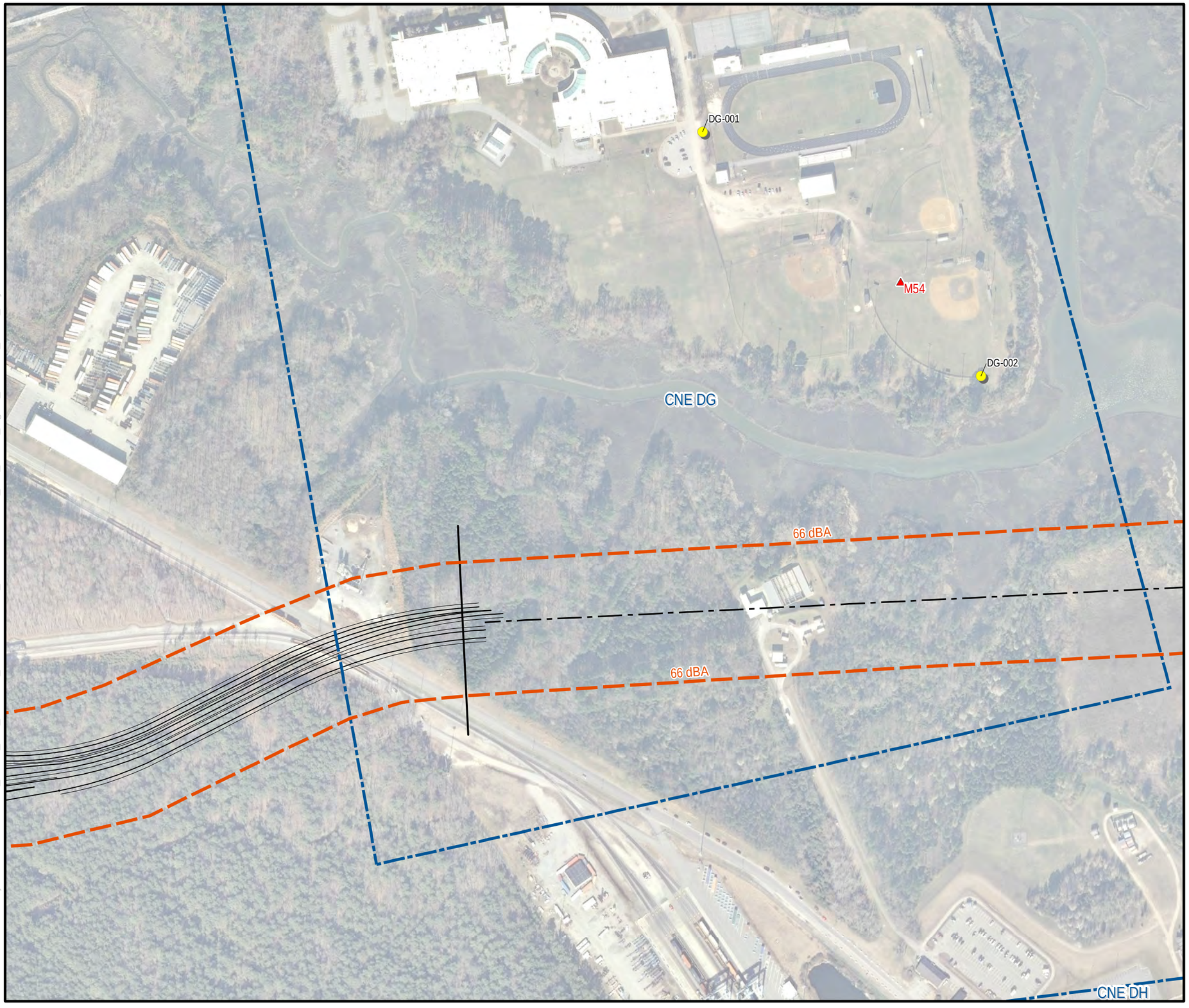


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## Hampton Roads Crossing Study Supplemental EIS Alternative B (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

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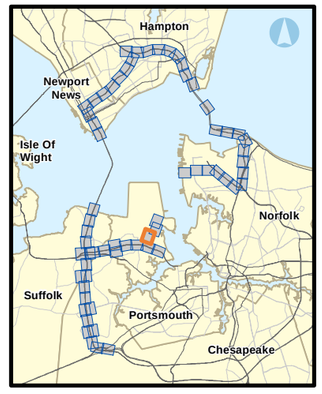


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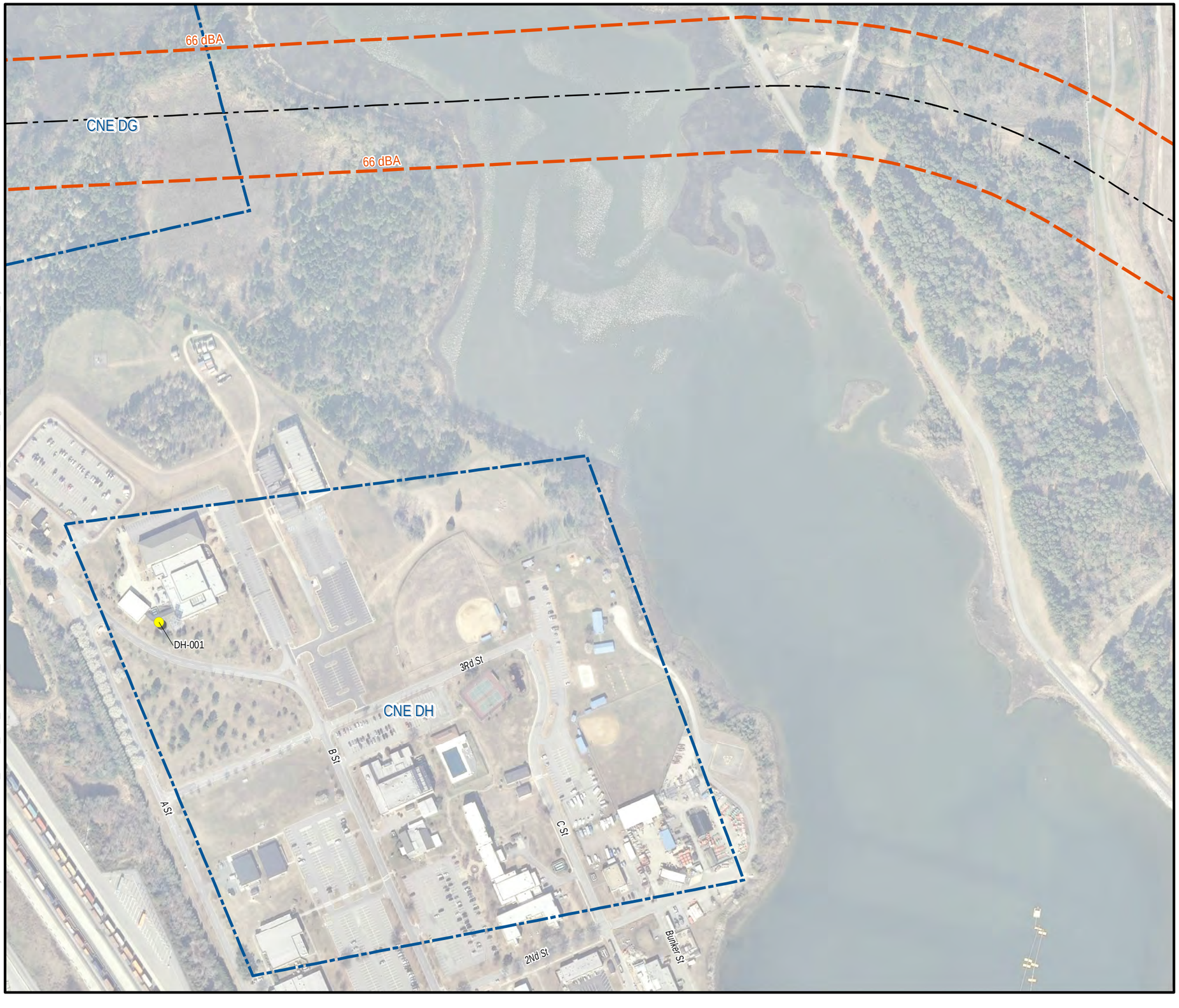




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# Figure 4-1
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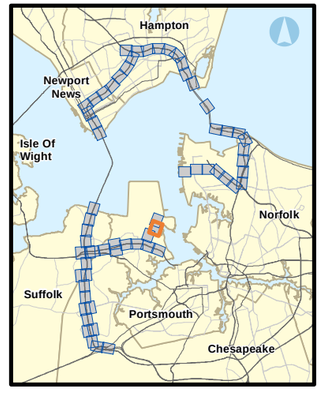


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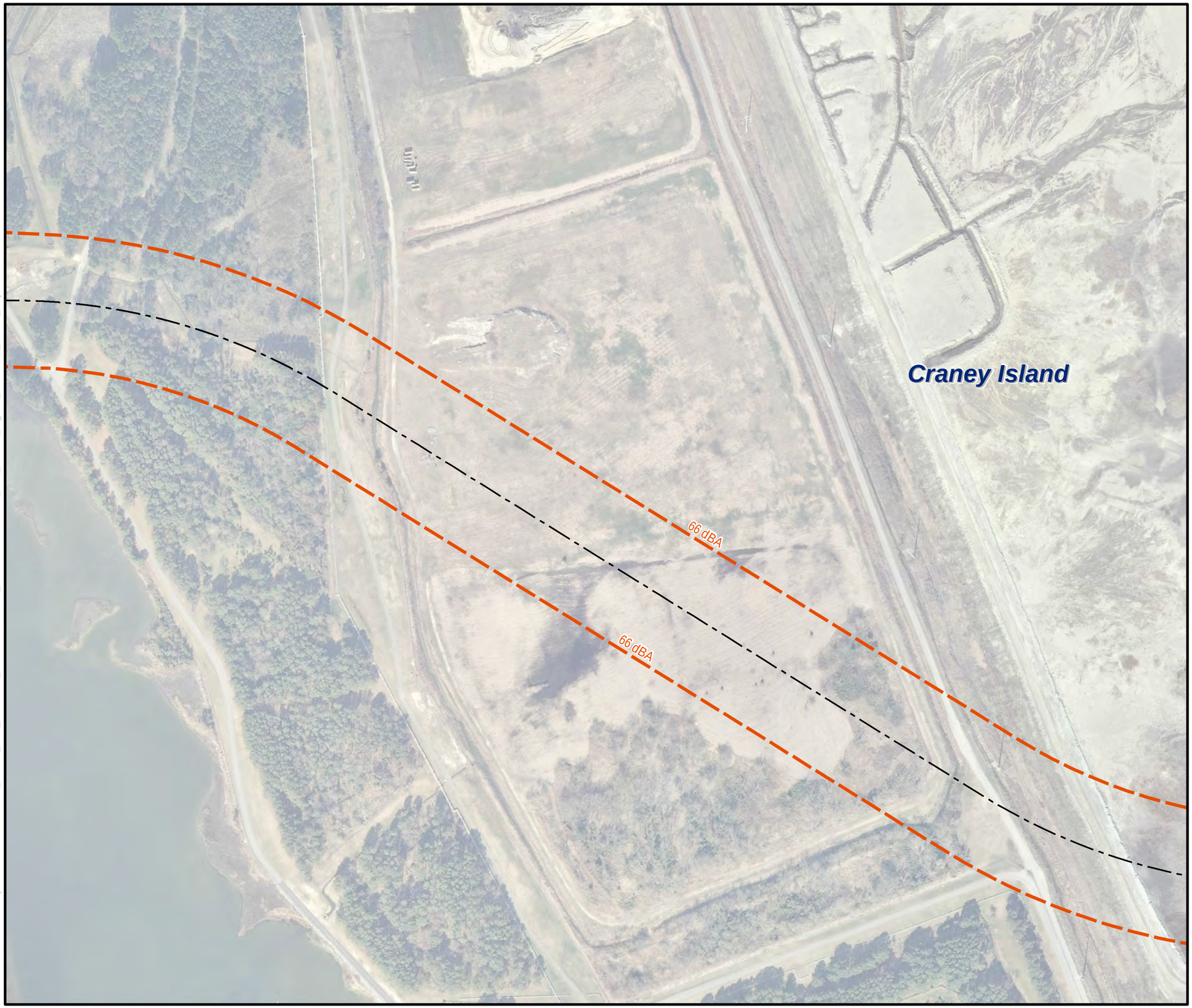




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# Figure 4-1
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- Planned
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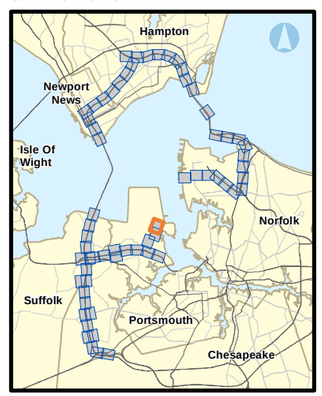
- CNE Boundary
- 66 dBA Noise Contour

Sheet 35 of 64

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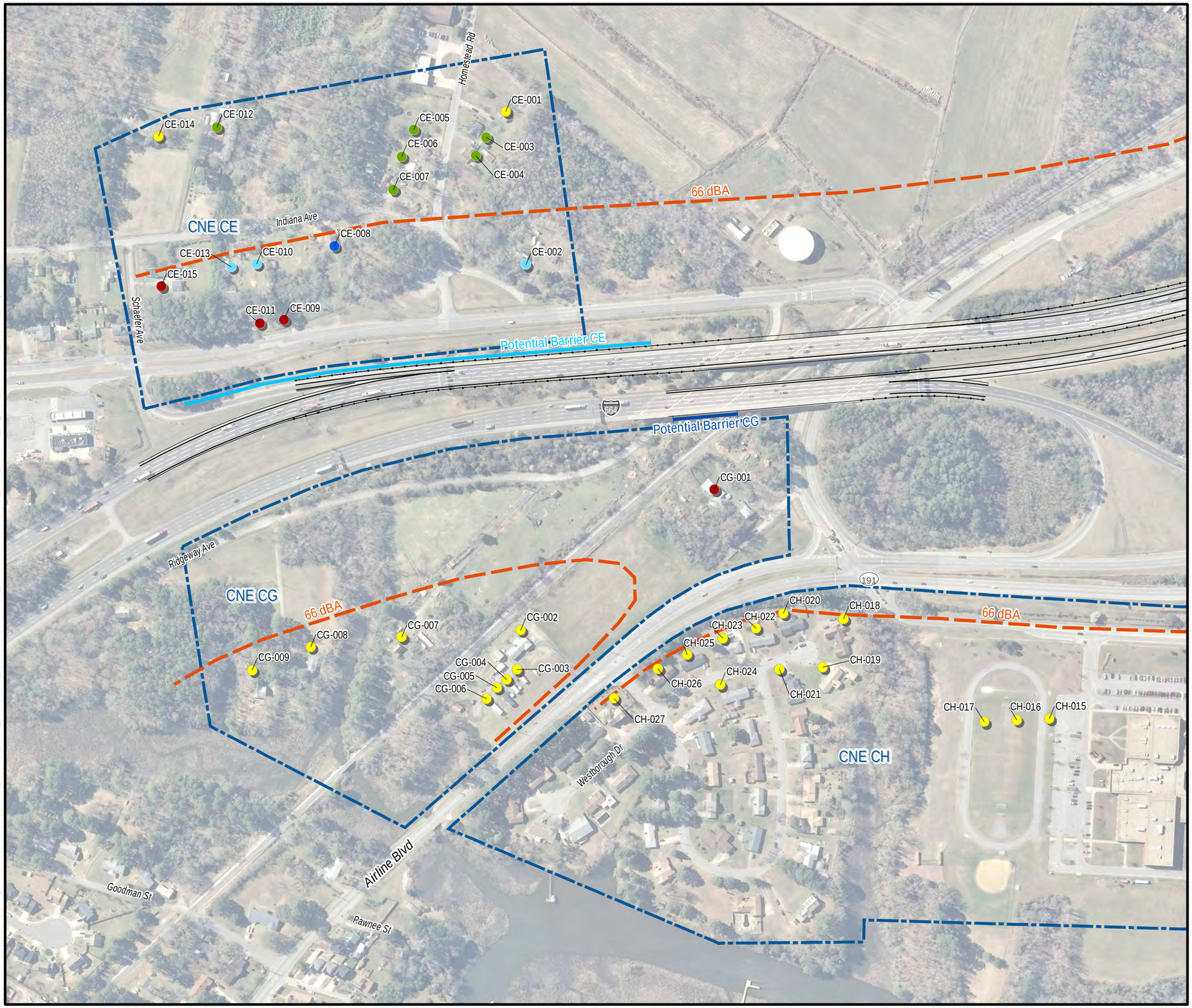


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

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Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

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- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

CNE Boundary
66 dBA Noise Contour

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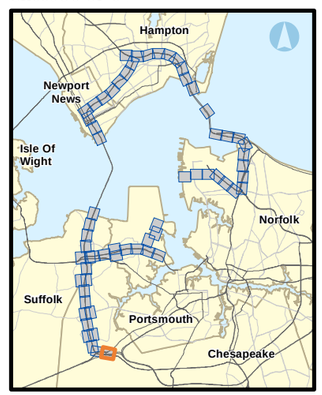


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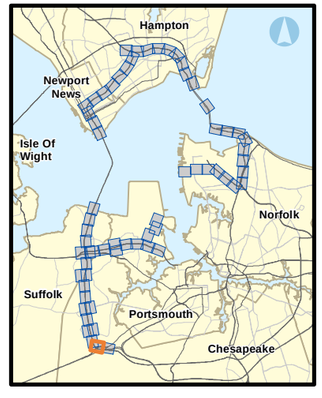


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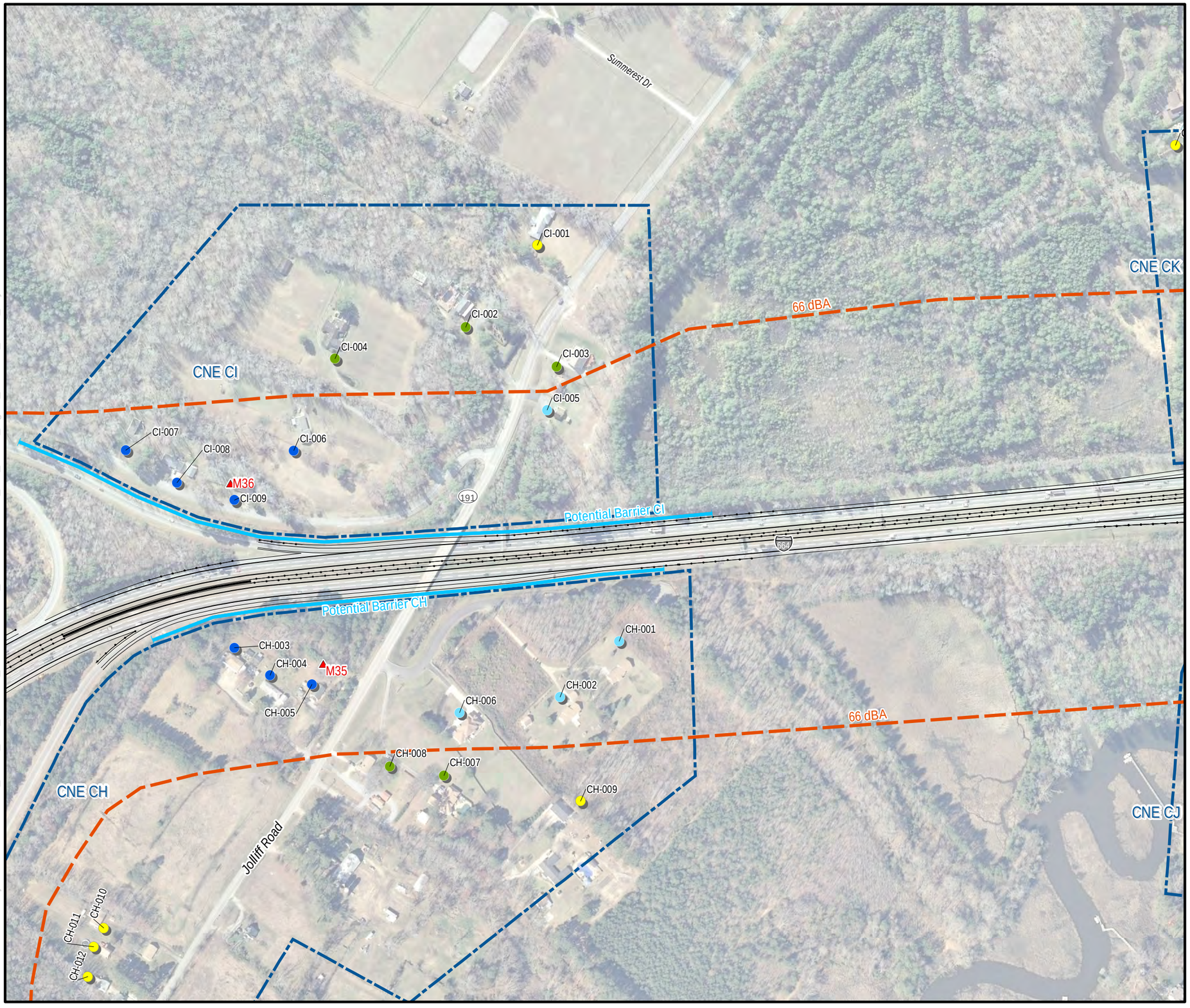




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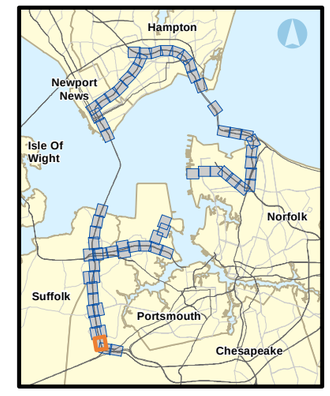
- 66 dBA Noise Contour

Sheet 38 of 64

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# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

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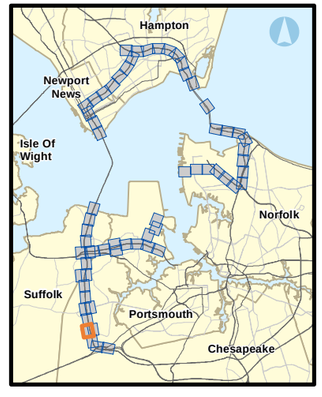
Sheet 39 of 64

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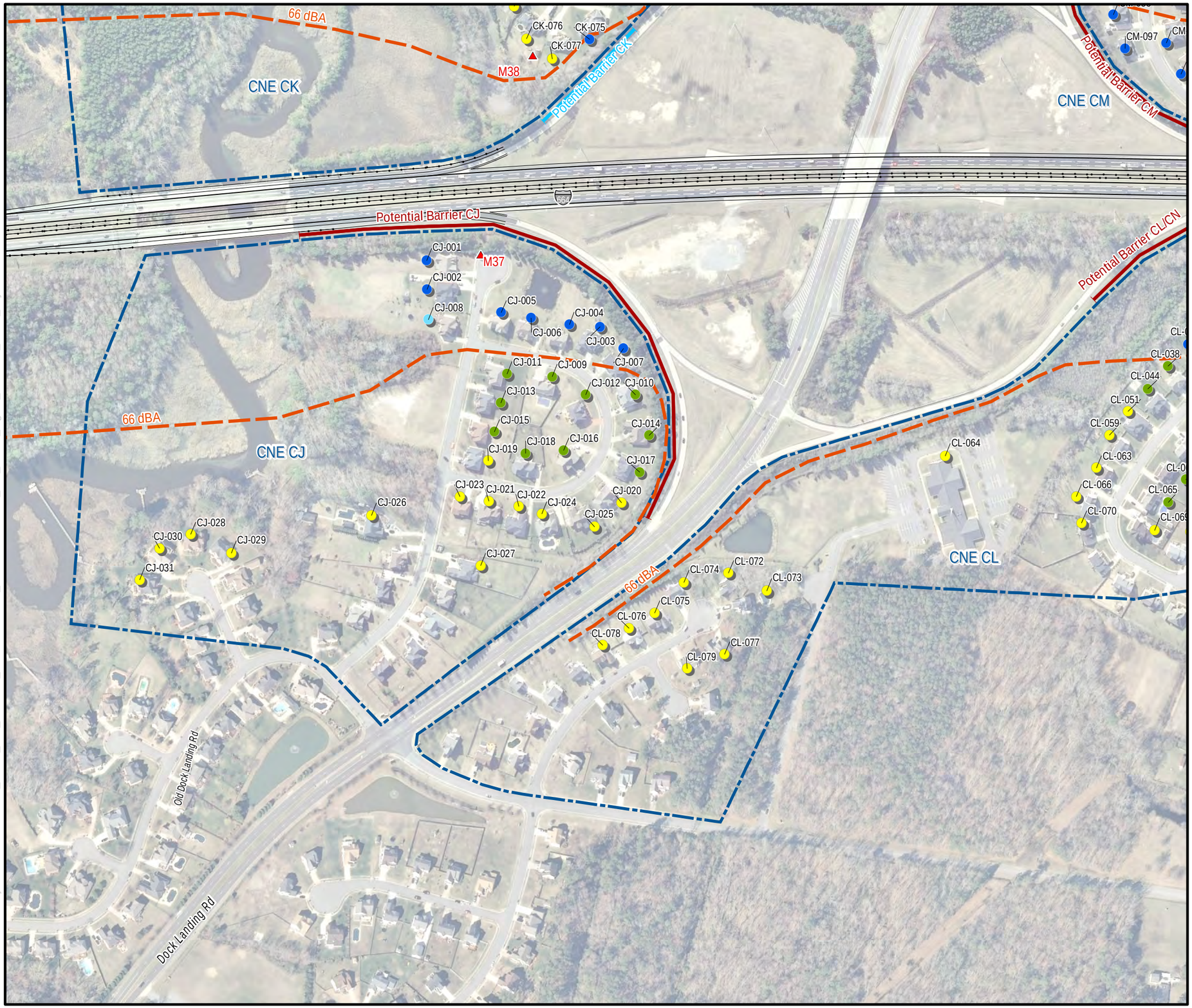


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- CNE Boundary
- 66 dBA Noise Contour

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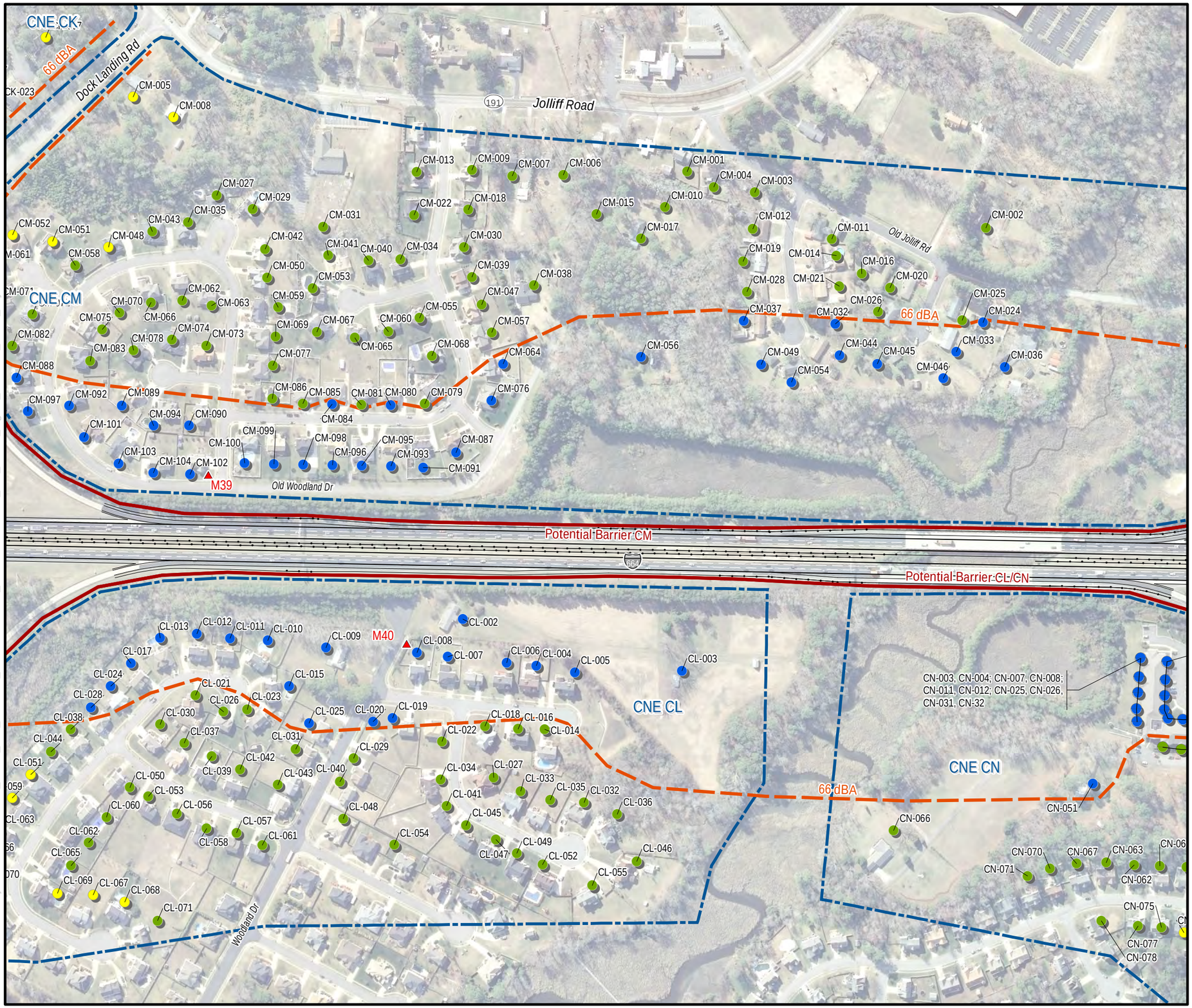


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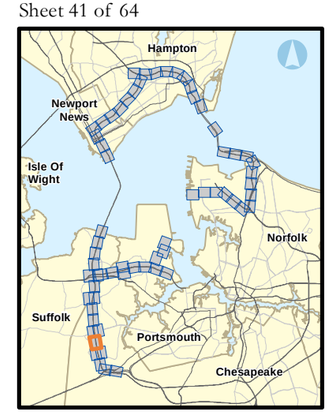


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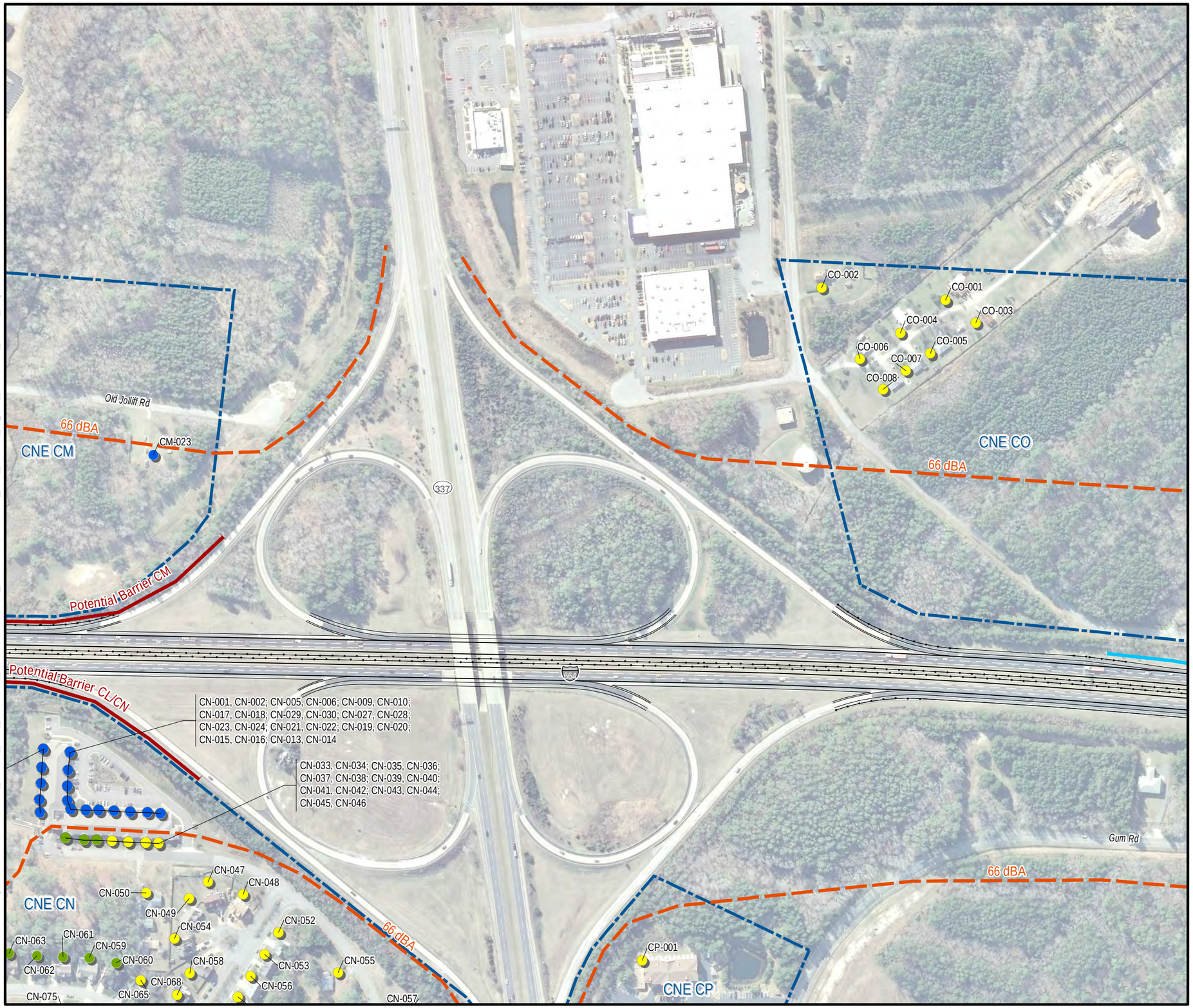


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VDOT Virginia Department of Transportation

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CNE Boundary
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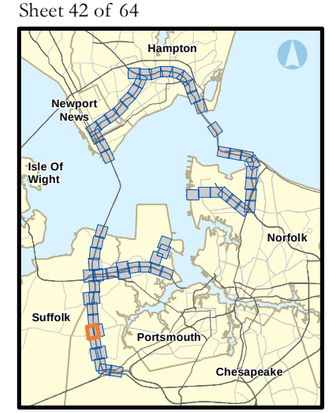


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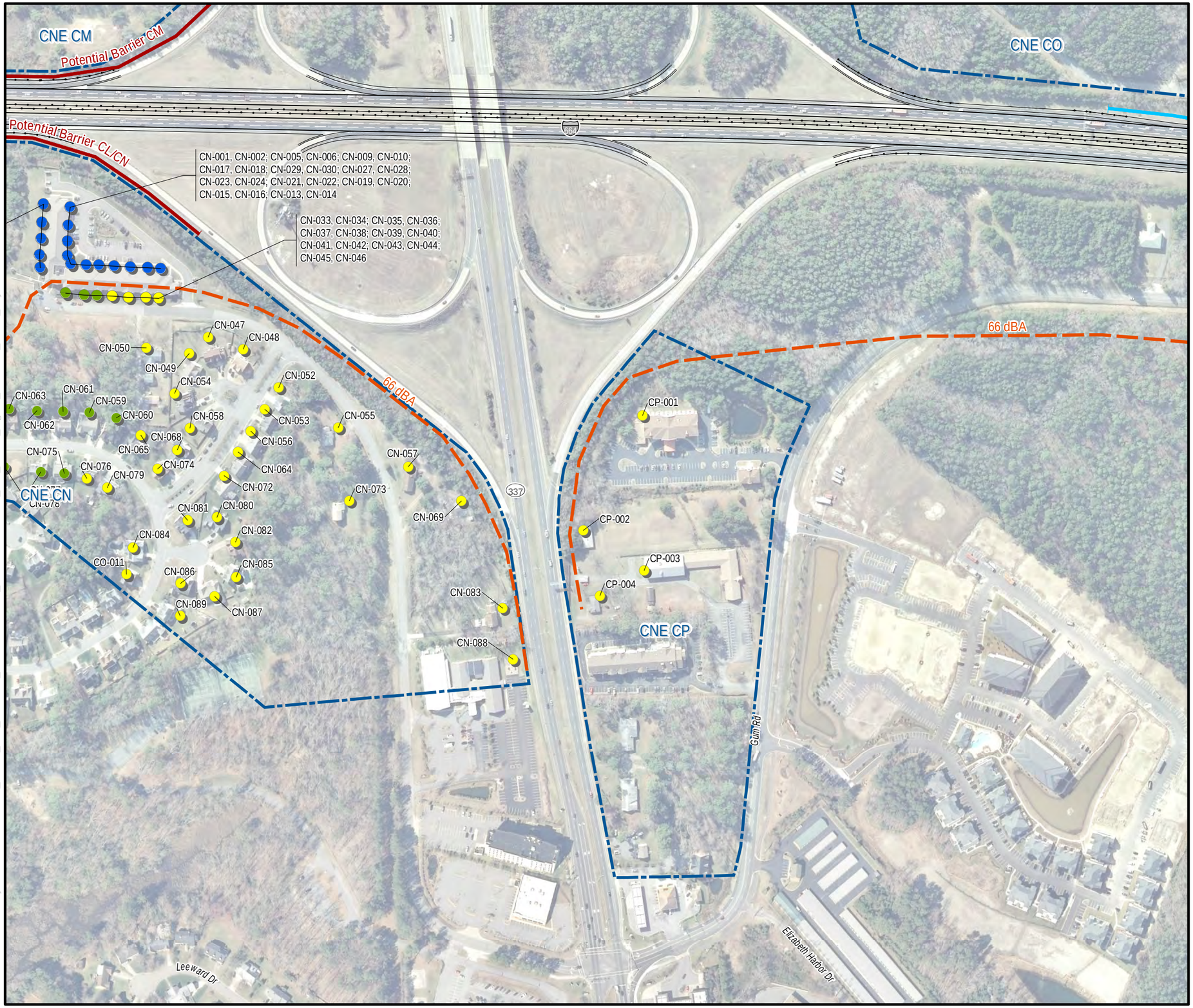


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CNE Boundary
66 dBA Noise Contour

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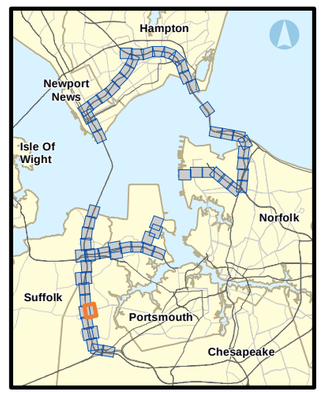


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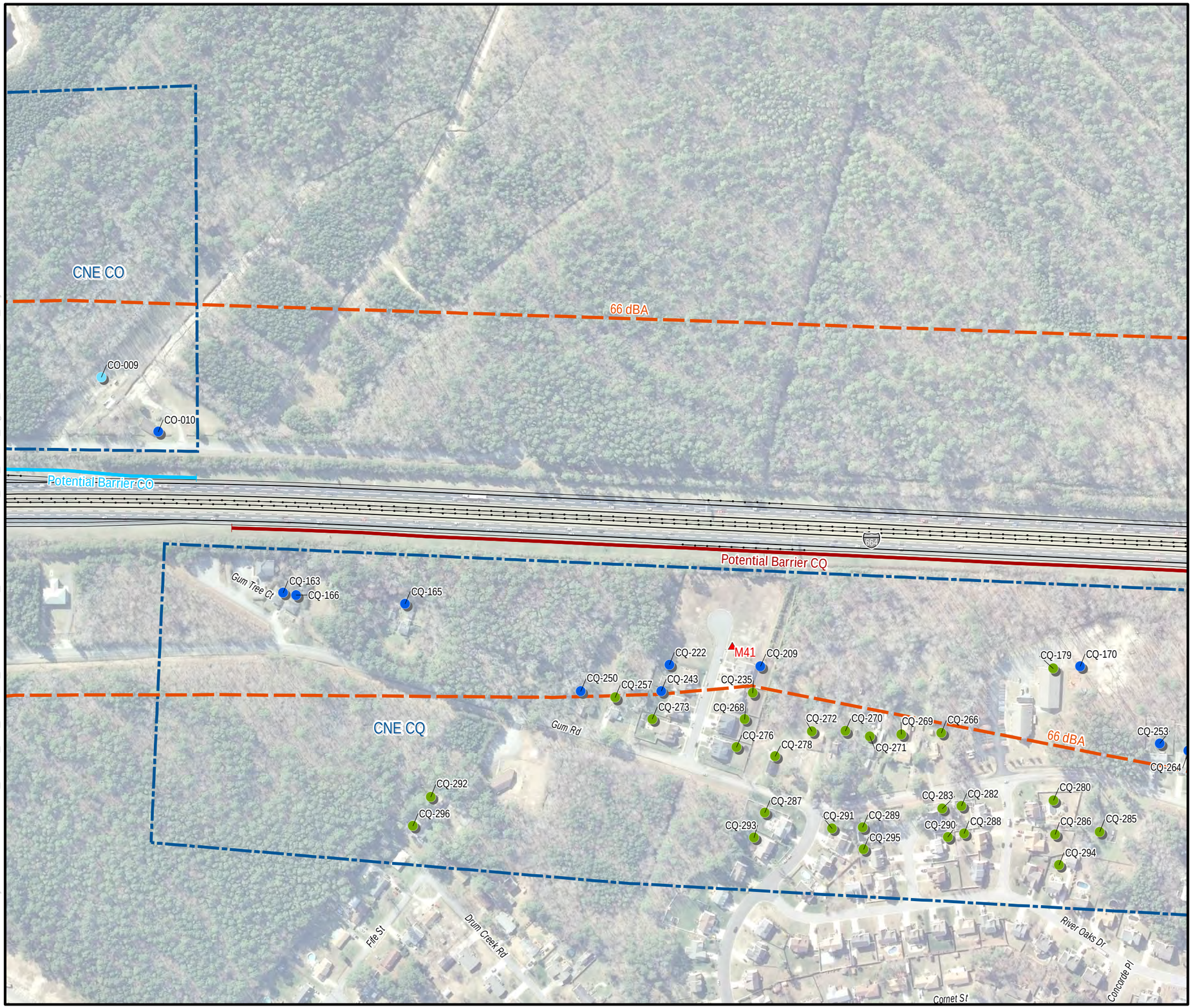


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VDOT Virginia Department of Transportation

# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

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- 66 dBA Noise Contour

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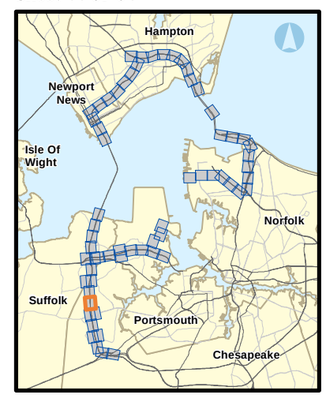


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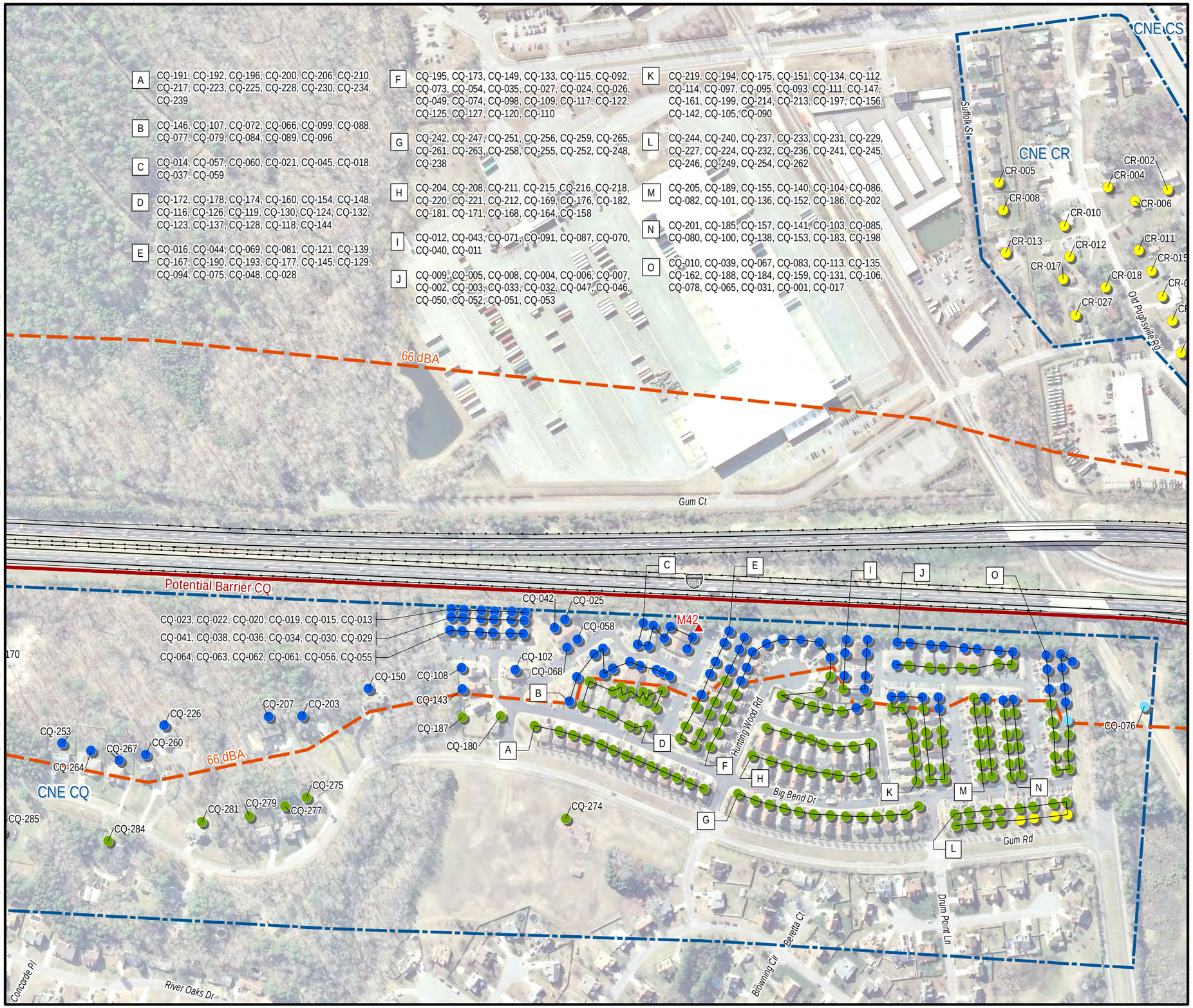




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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

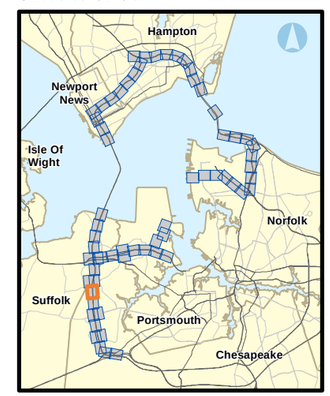
Note: Grouped Receiver Labels are in order of Leader Occurrence.

- M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 45 of 64

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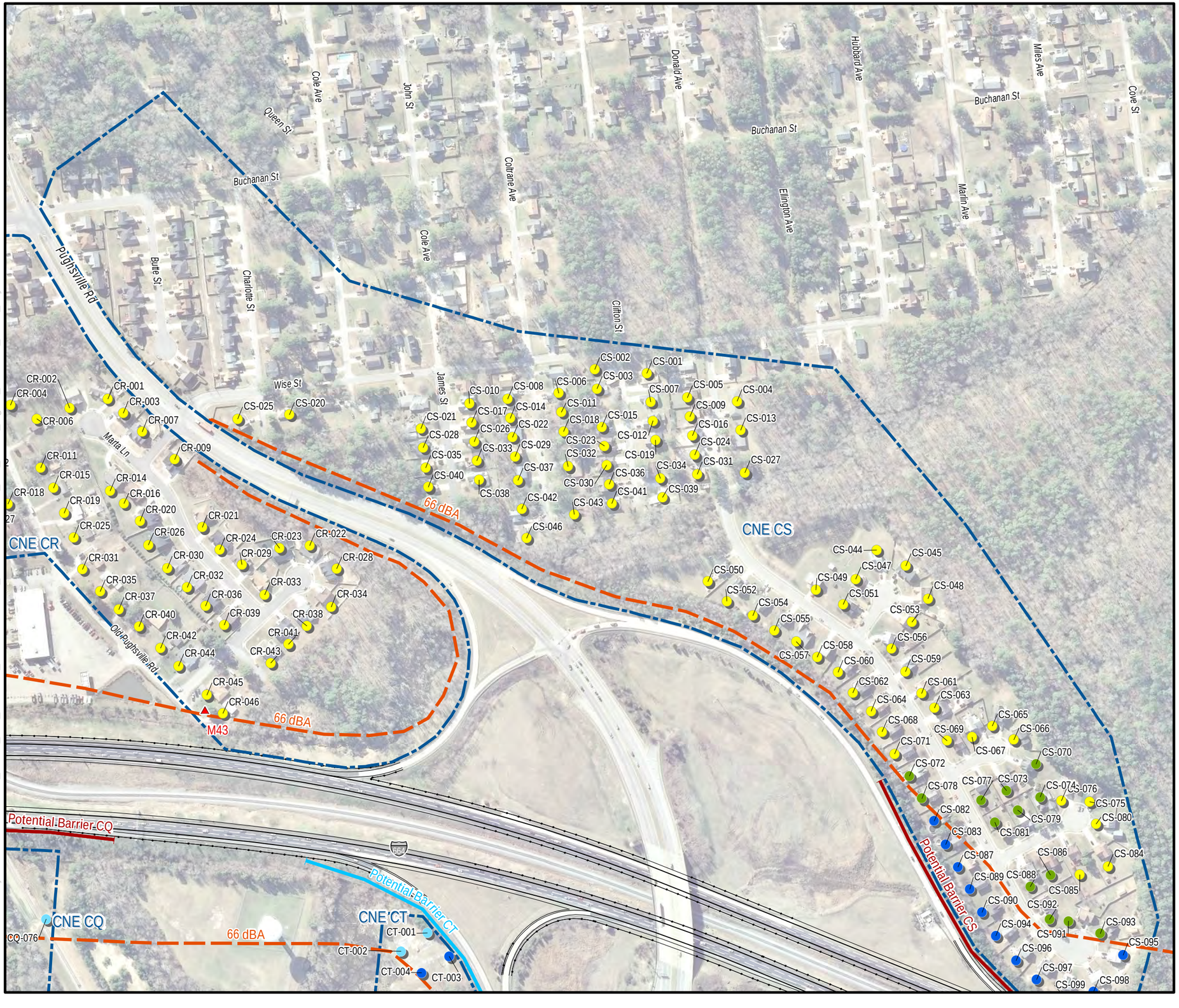




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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

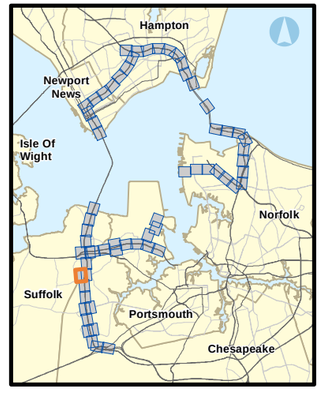
Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 46 of 64

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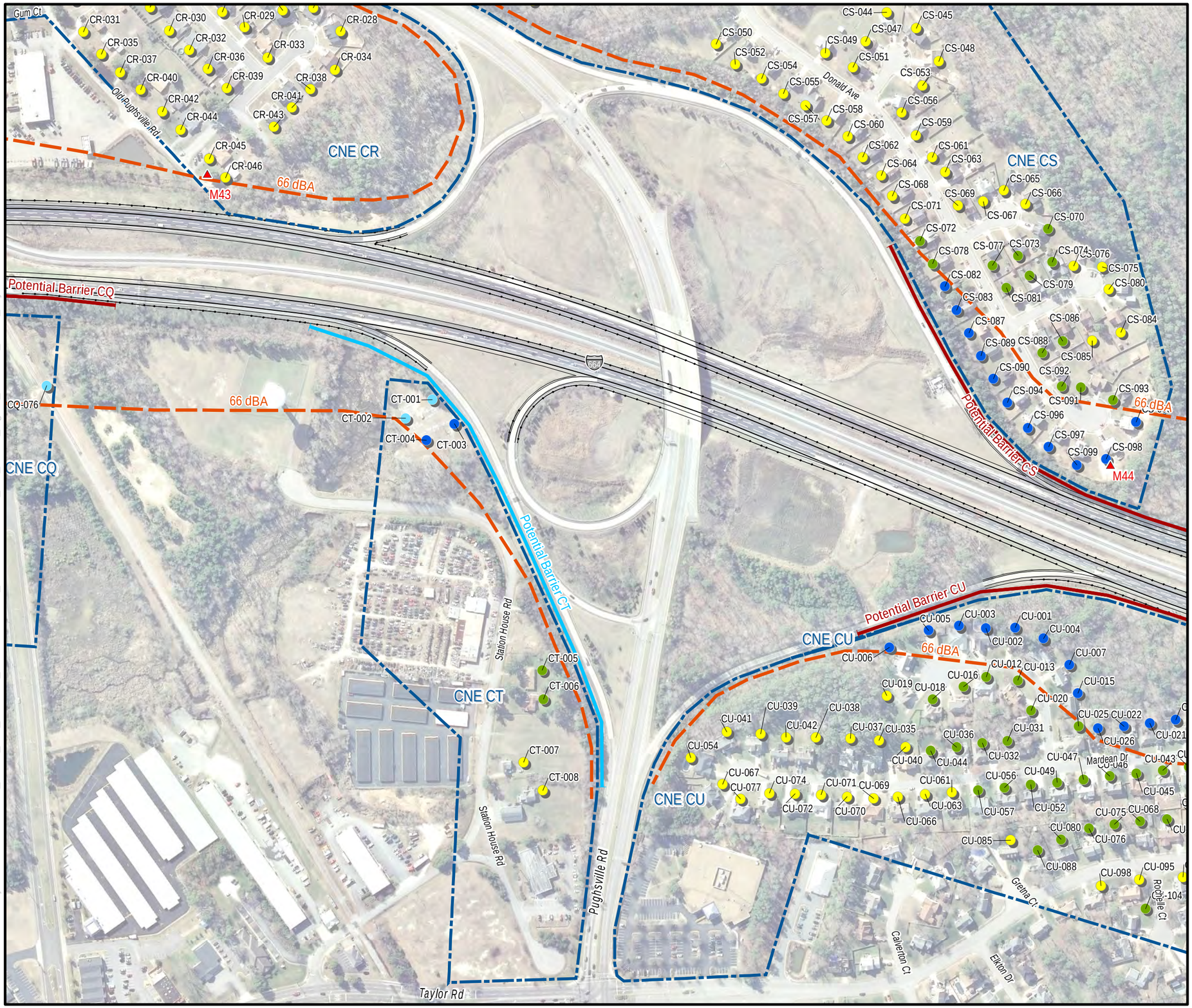


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined

Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

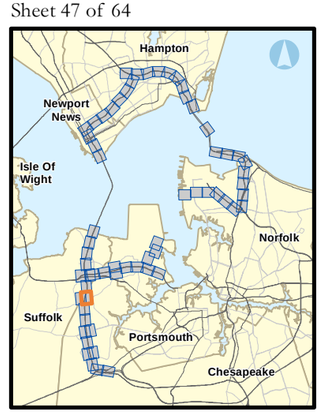
Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 47 of 64

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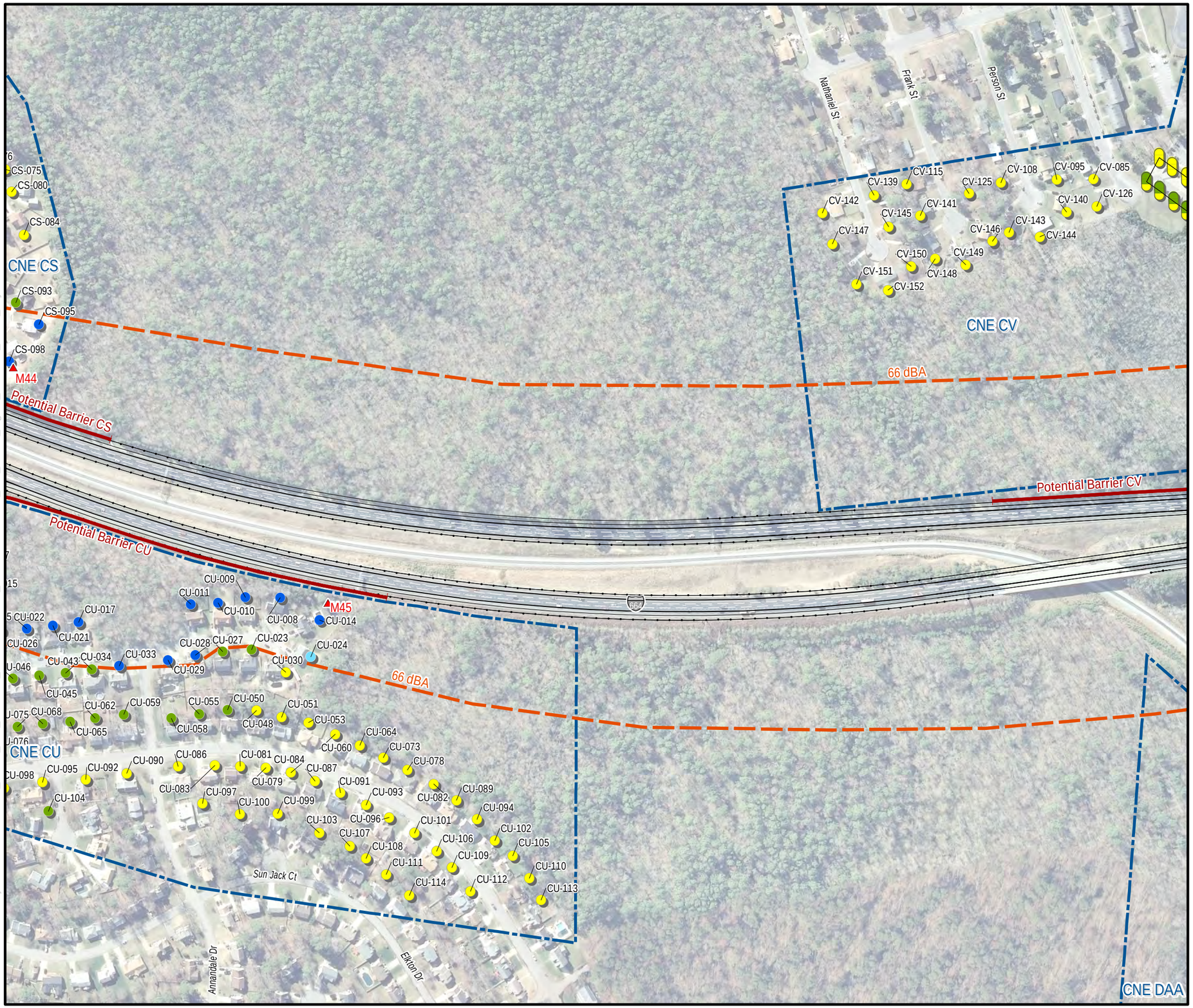


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C/D (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined

Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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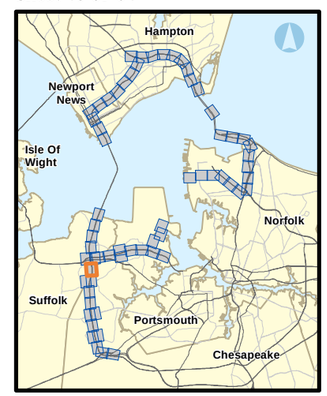


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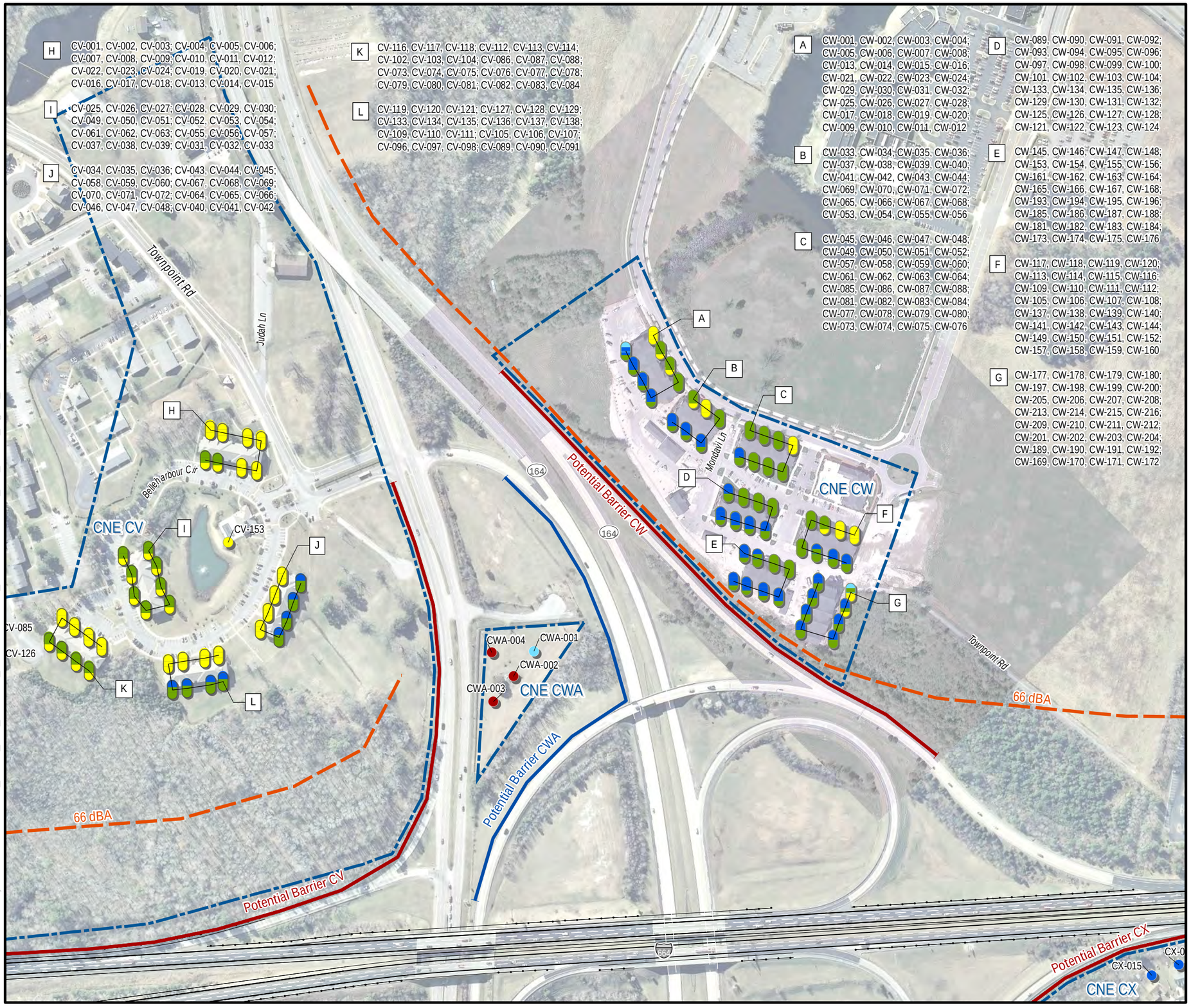


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative D (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number

- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers

- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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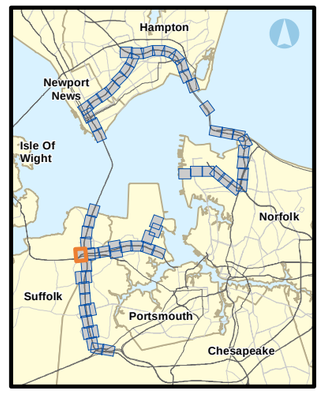


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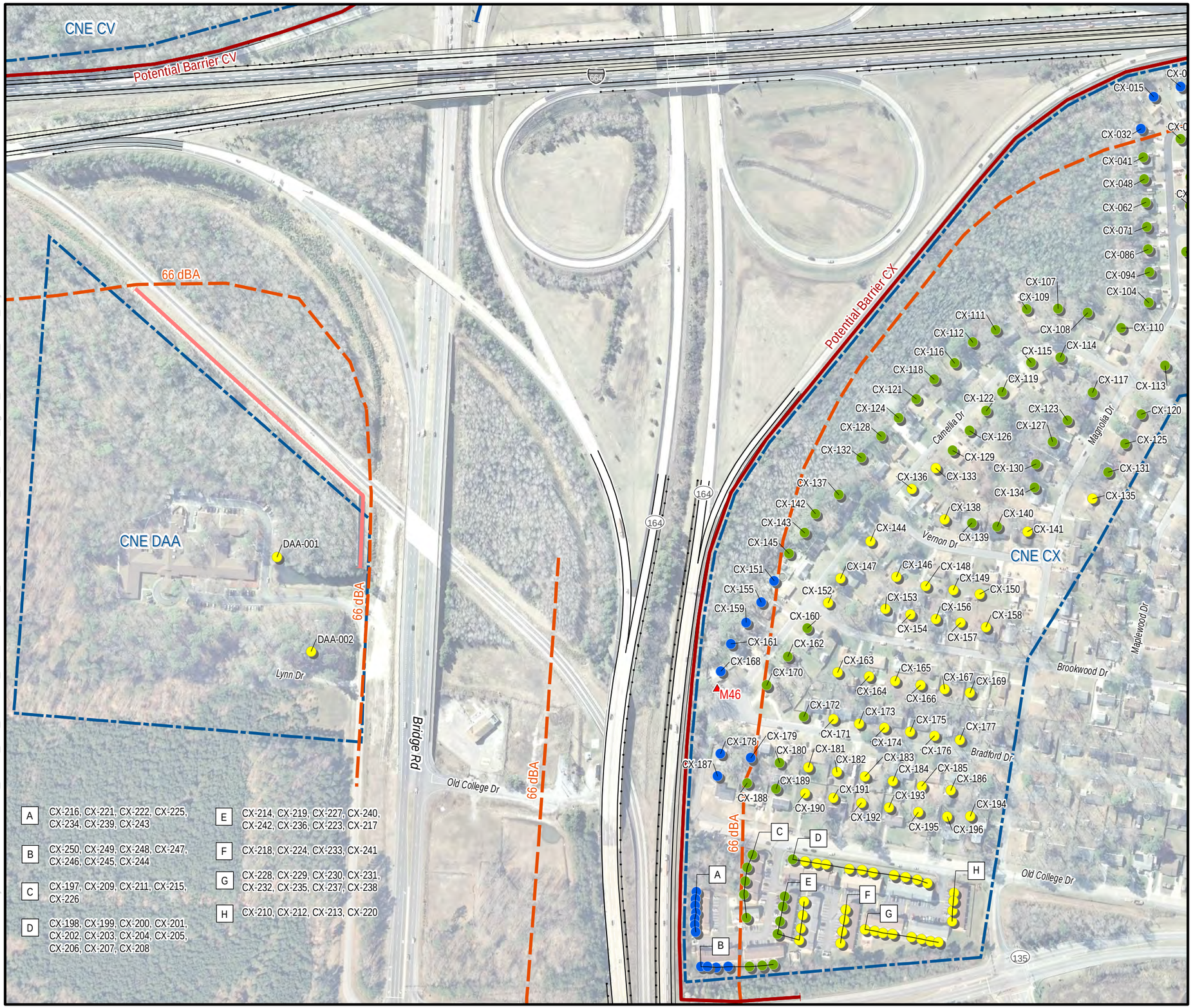


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative D (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
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- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

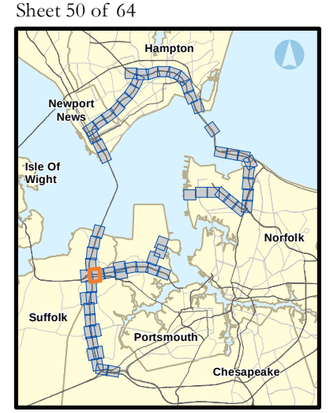
Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 50 of 64

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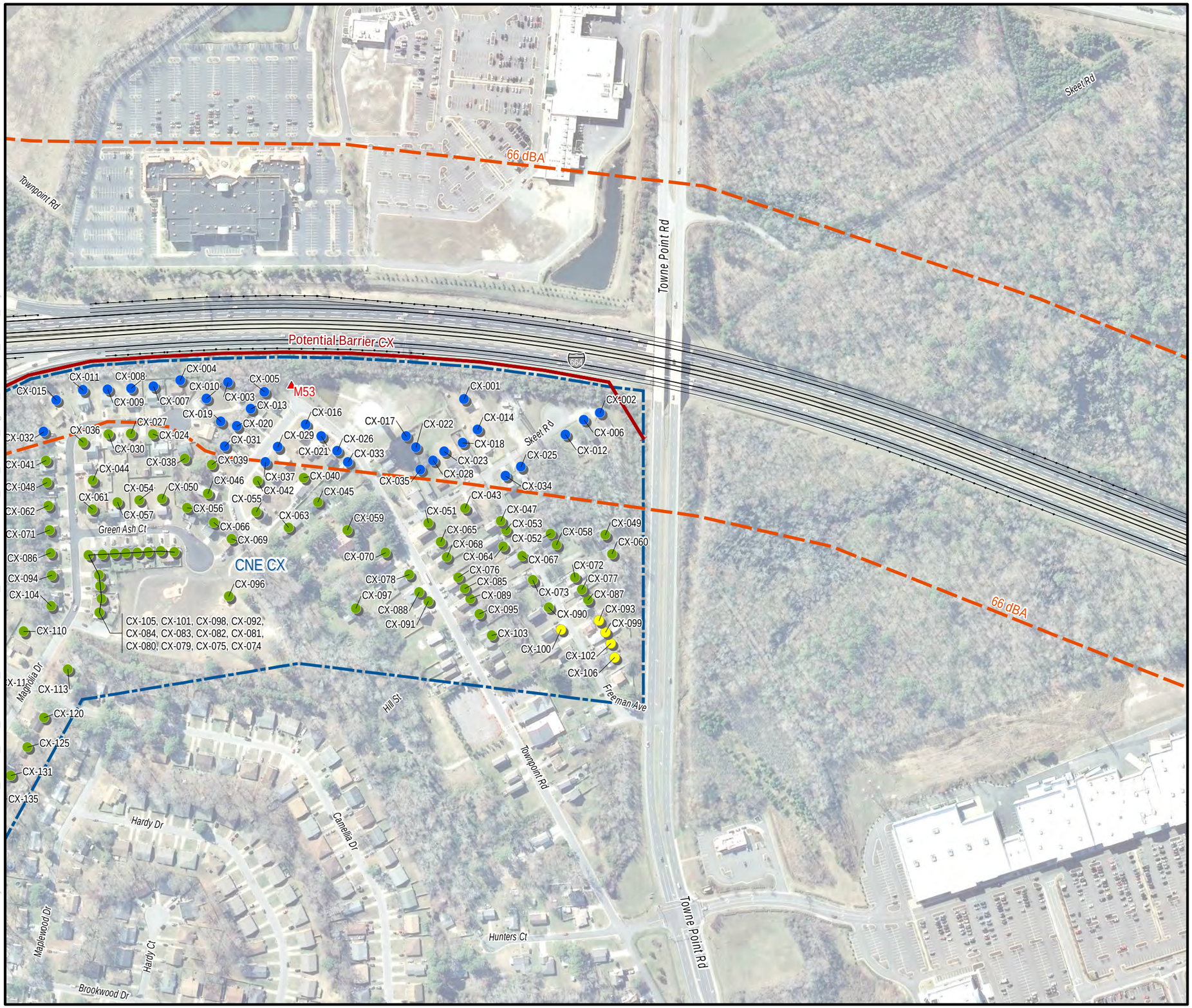




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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative D (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
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- Benefited but Not Impacted
- Not Benefited or Impacted
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- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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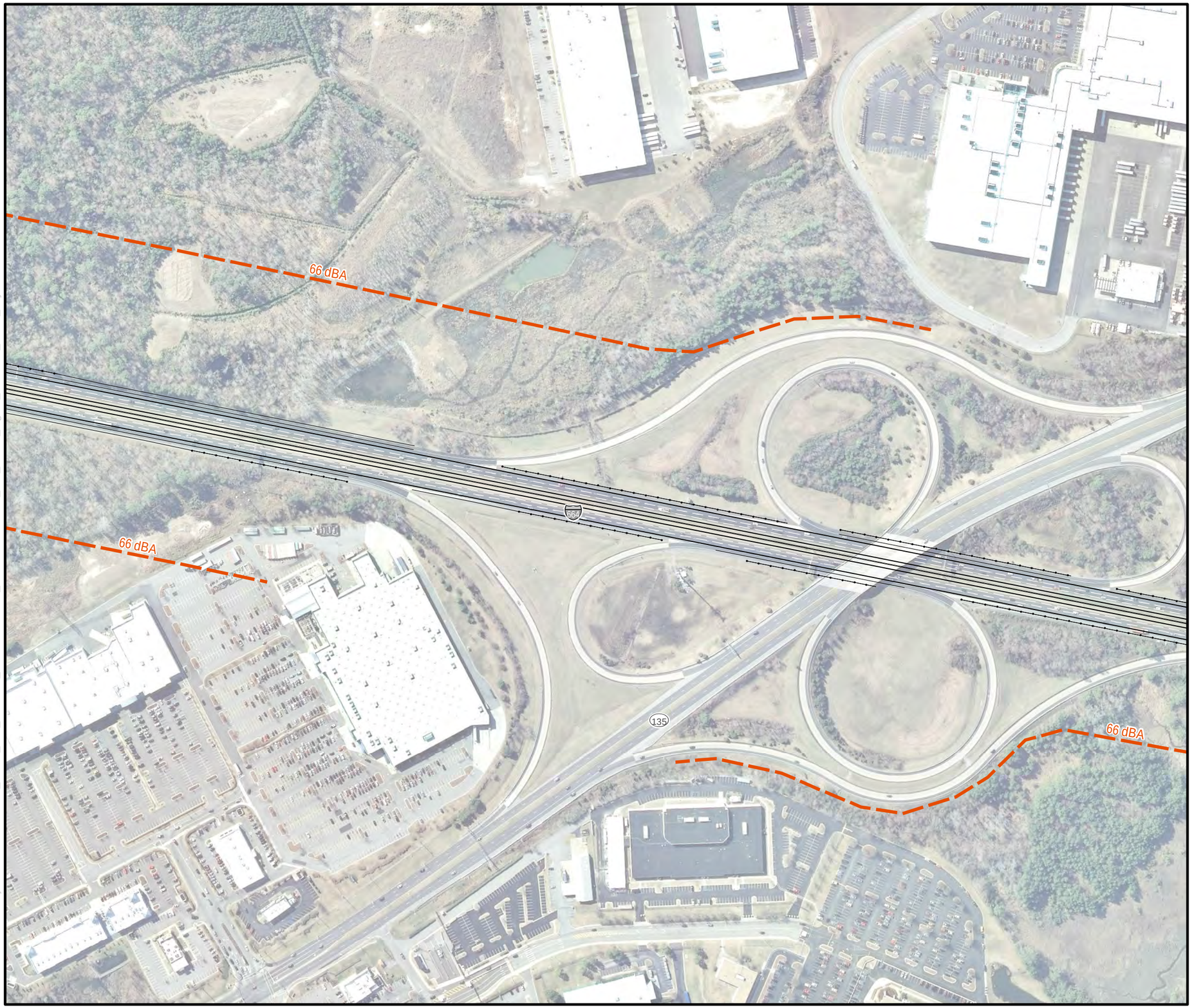


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative D (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

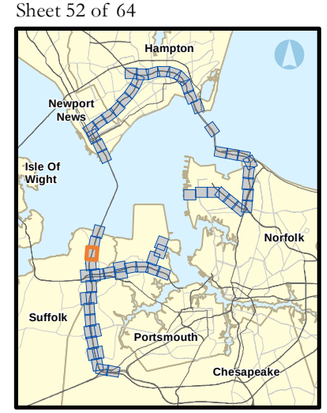
Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 52 of 64

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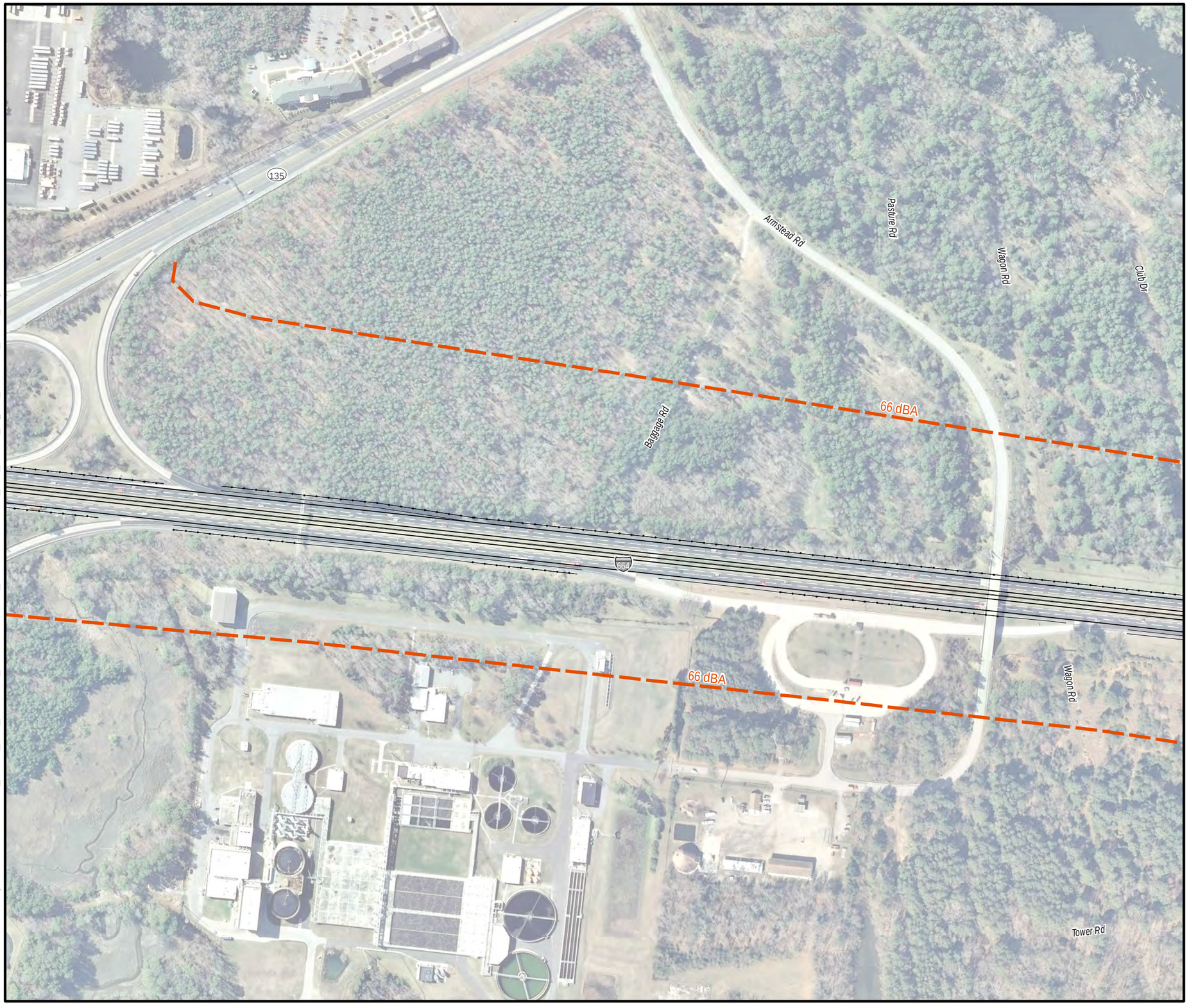


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative D (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

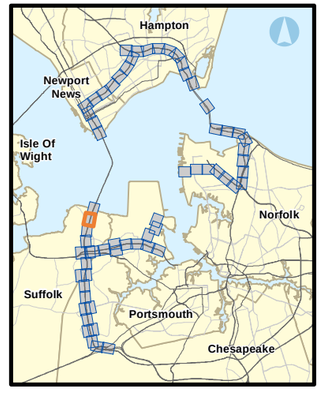
Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 53 of 64

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VDOT Virginia Department of Transportation

# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative D (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
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- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined

Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

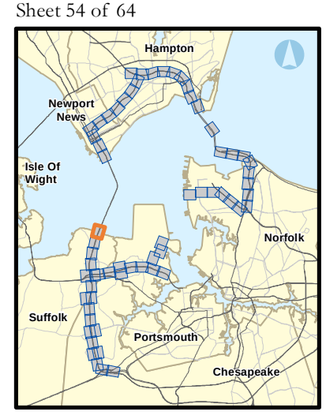
Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

CNE Boundary
66 dBA Noise Contour

Sheet 54 of 64

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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

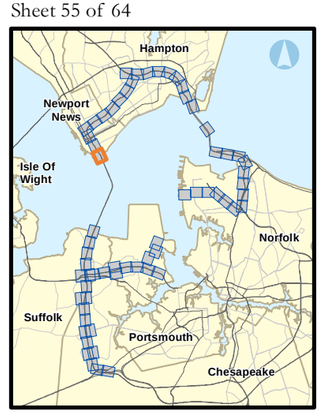
Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 55 of 64

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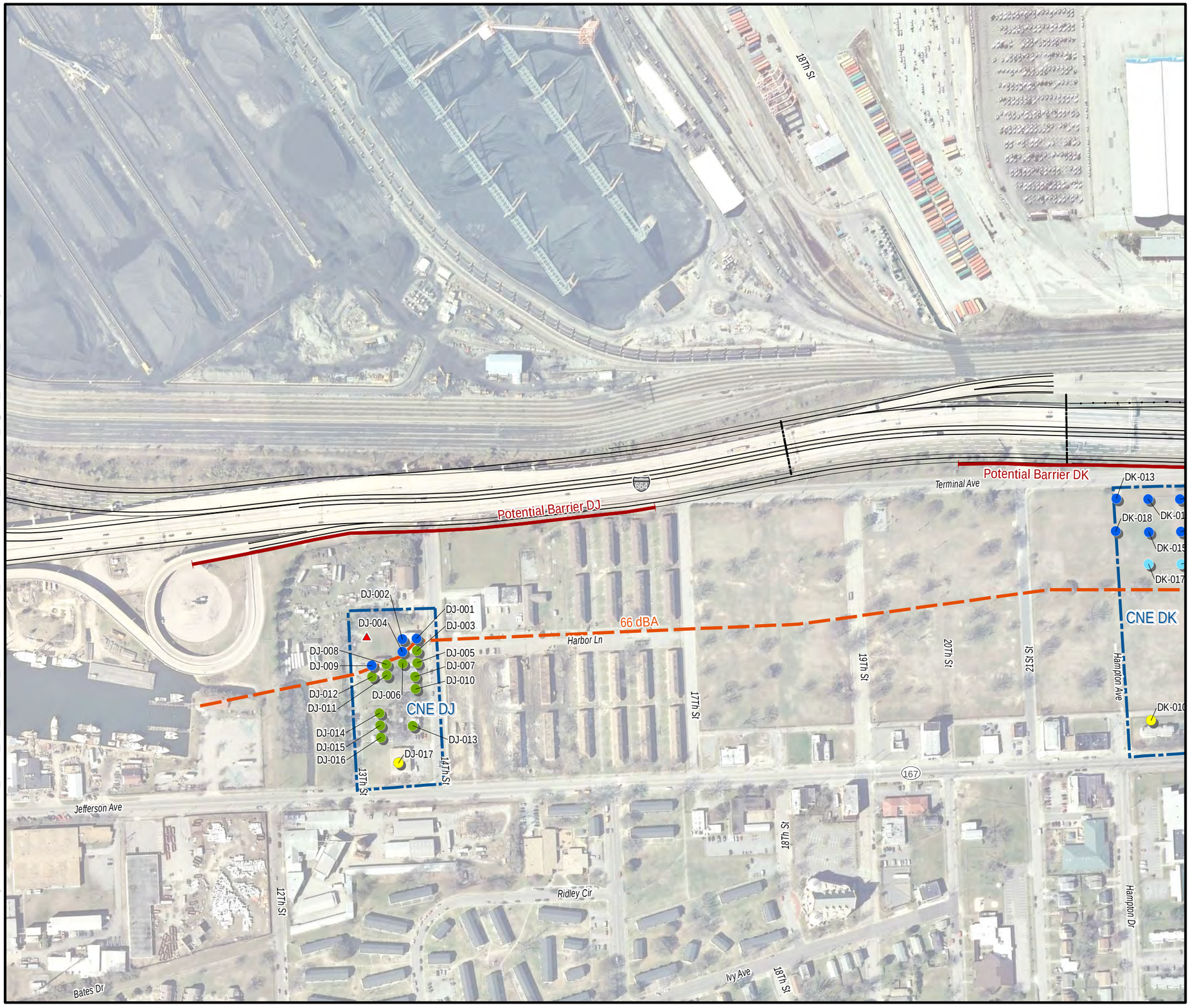


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Virginia Department of Transportation

# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
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▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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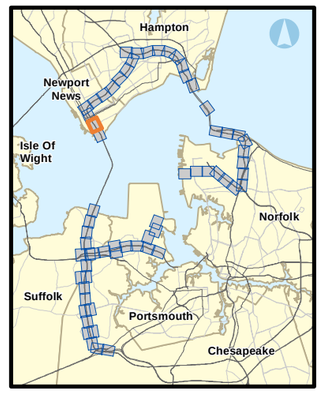


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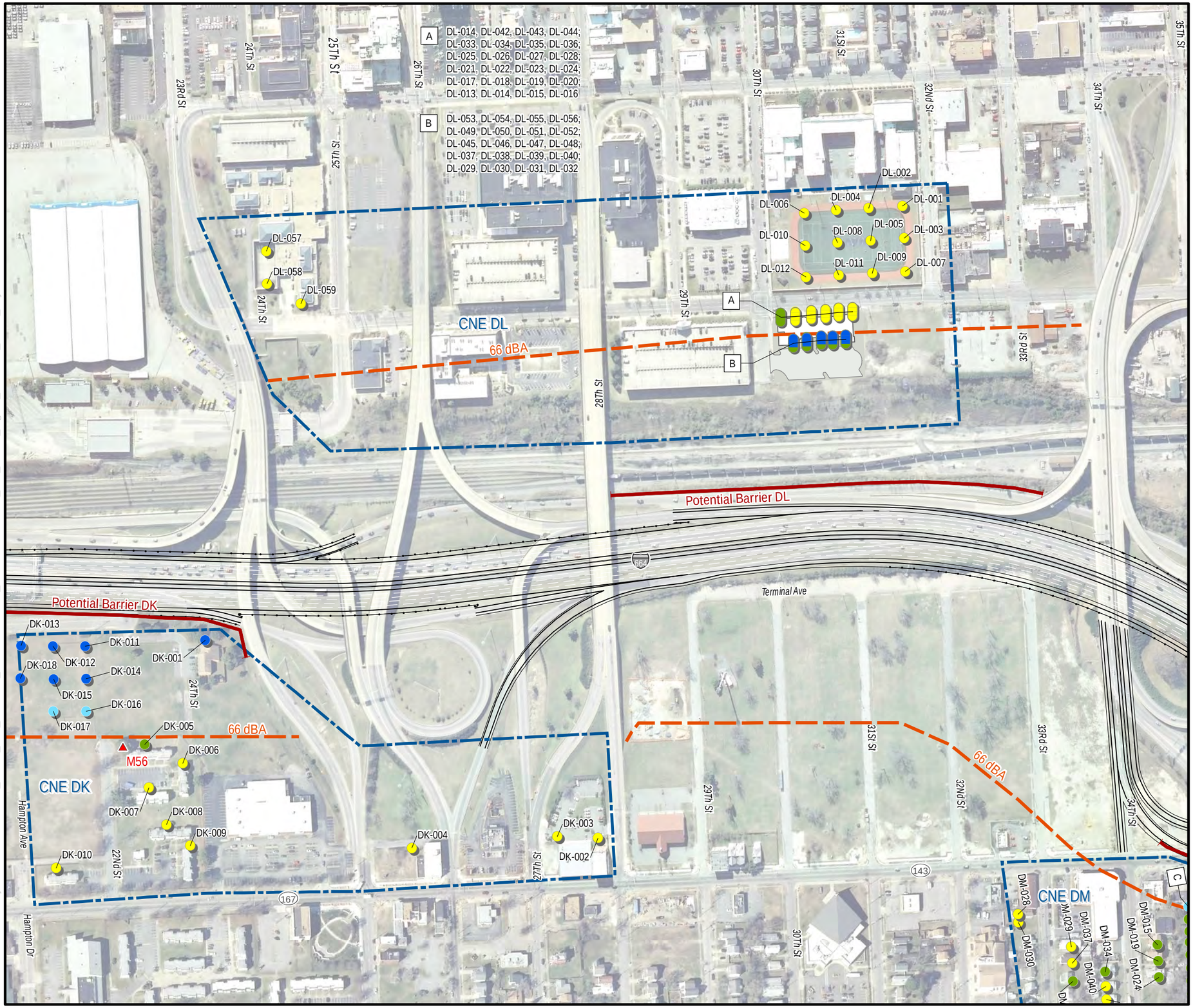


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

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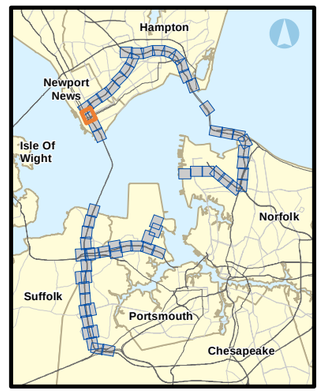


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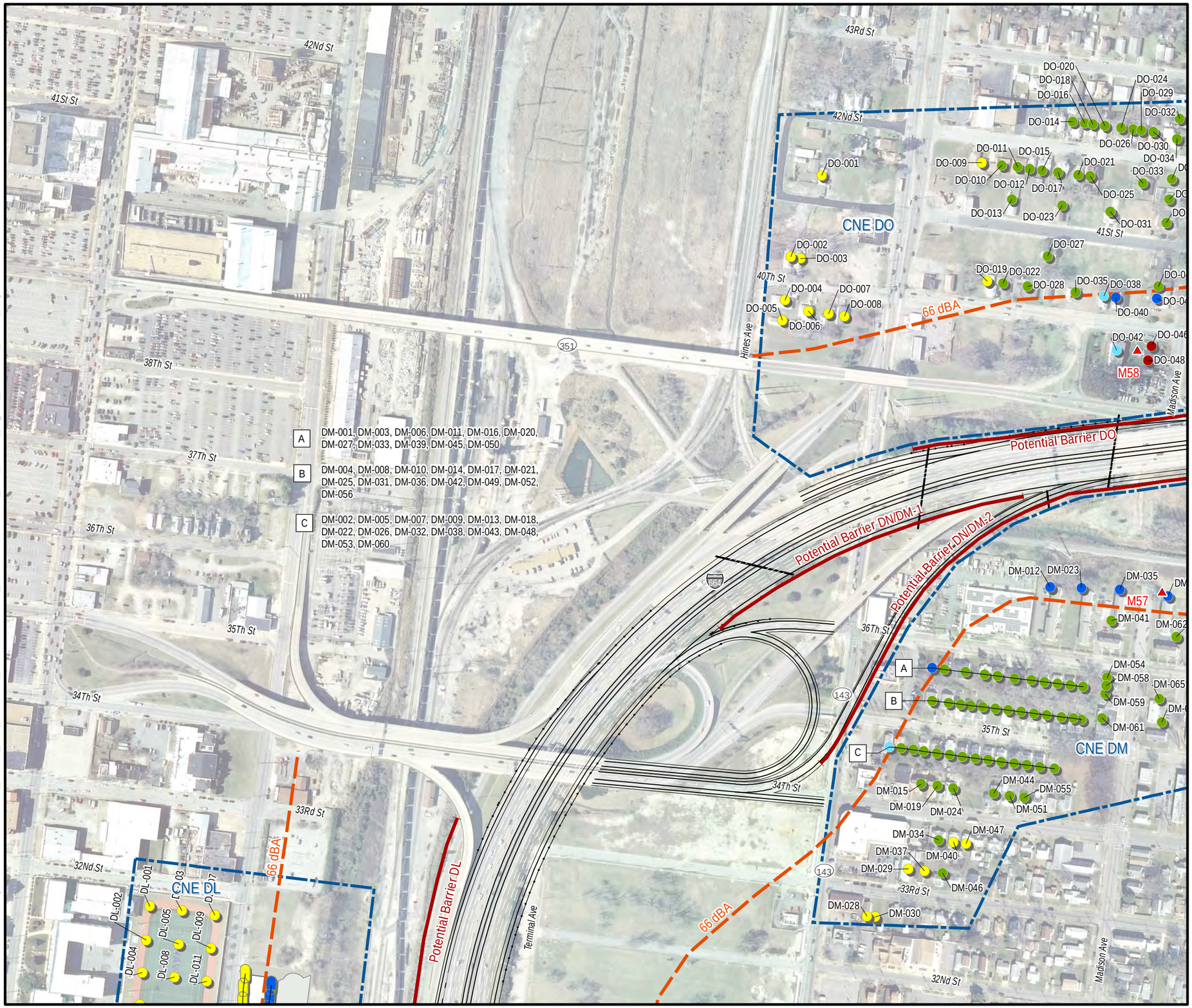


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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

Receiver Site and Number
- Impacted and 5 or 6 dBA Insertion Loss
- Impacted and 7 dBA or more Insertion Loss
- Impacted but Not Benefited
- Benefited but Not Impacted
- Not Benefited or Impacted
- Potential Acquisition
- Not impacted, benefit not determined
- Top Floor Noise Prediction Result
- Bottom Floor Noise Prediction Result

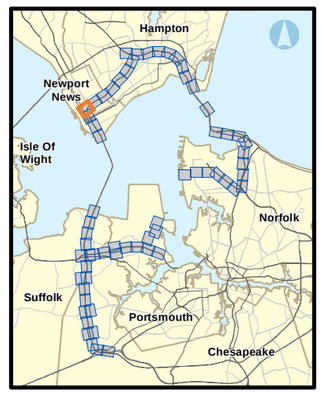
Note: Grouped Receiver Labels are in order of Leader Occurrence.

▲ M# Measurement Site

Noise Barriers
- Feasible and Reasonable
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 58 of 64

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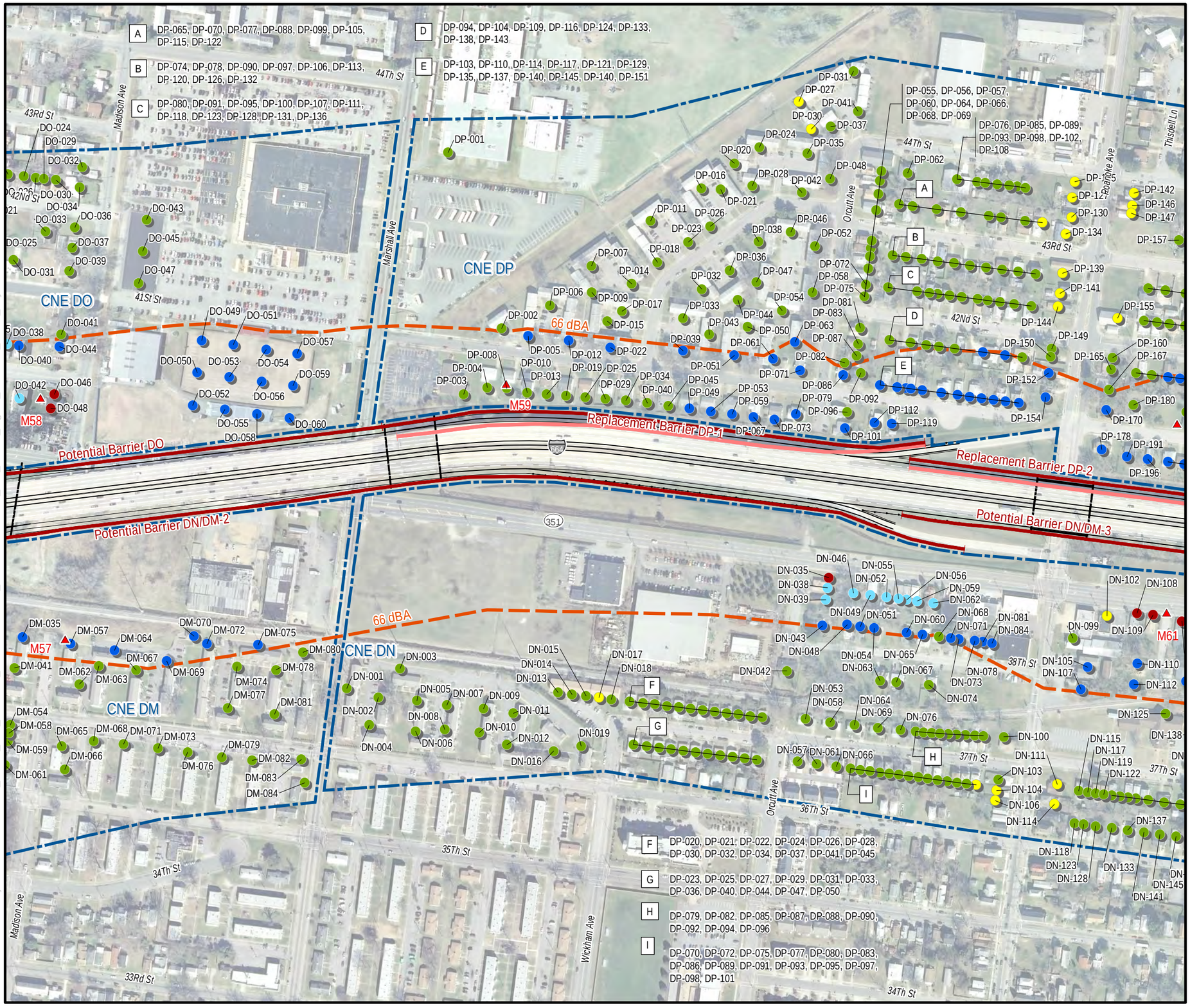


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VDOT Project No. 0064-965-081, P101; UPC No. 106724

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Note: Grouped Receiver Labels are in order of Leader Occurrence.

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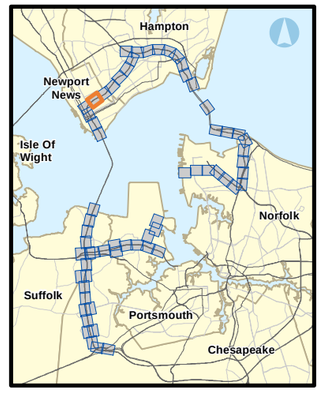
- Feasible and Not Reasonable
- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

- CNE Boundary
- 66 dBA Noise Contour

Sheet 59 of 64

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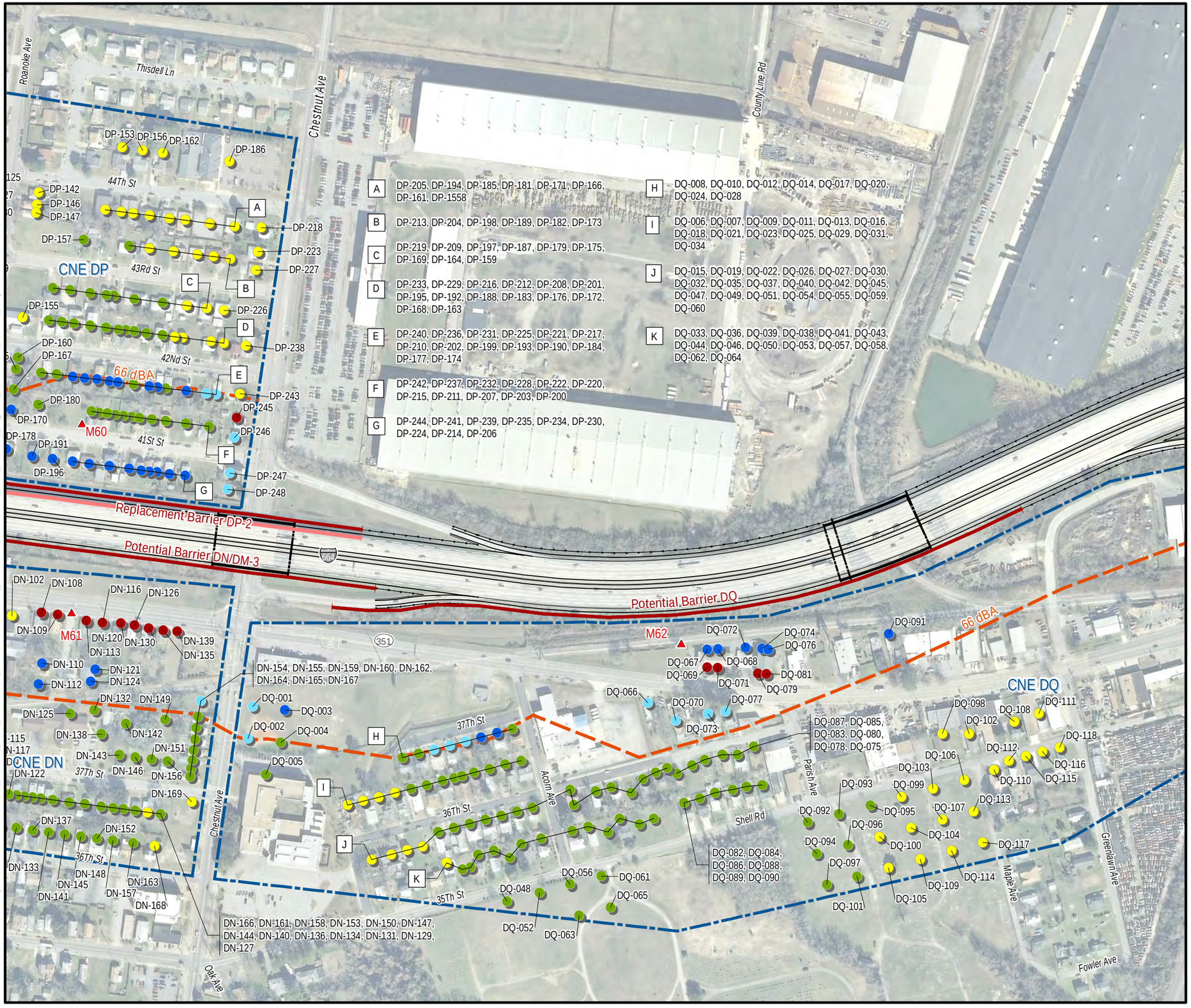


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VDOT Virginia Department of Transportation

# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

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VDOT Project No. 0064-965-081, P101; UPC No. 106724

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- Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

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- Existing Barrier to be Replaced

CNE Boundary

66 dBA Noise Contour

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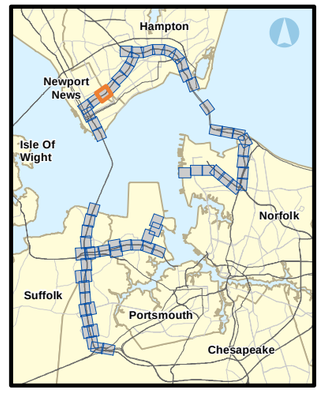


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Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

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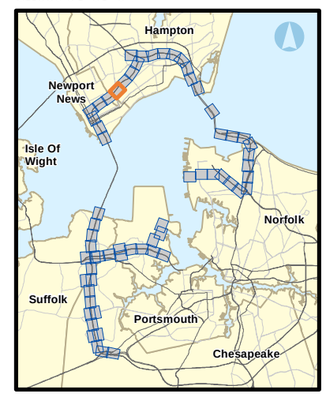
- Existing Barrier to be Replaced

CNE Boundary
66 dBA Noise Contour

Sheet 61 of 64

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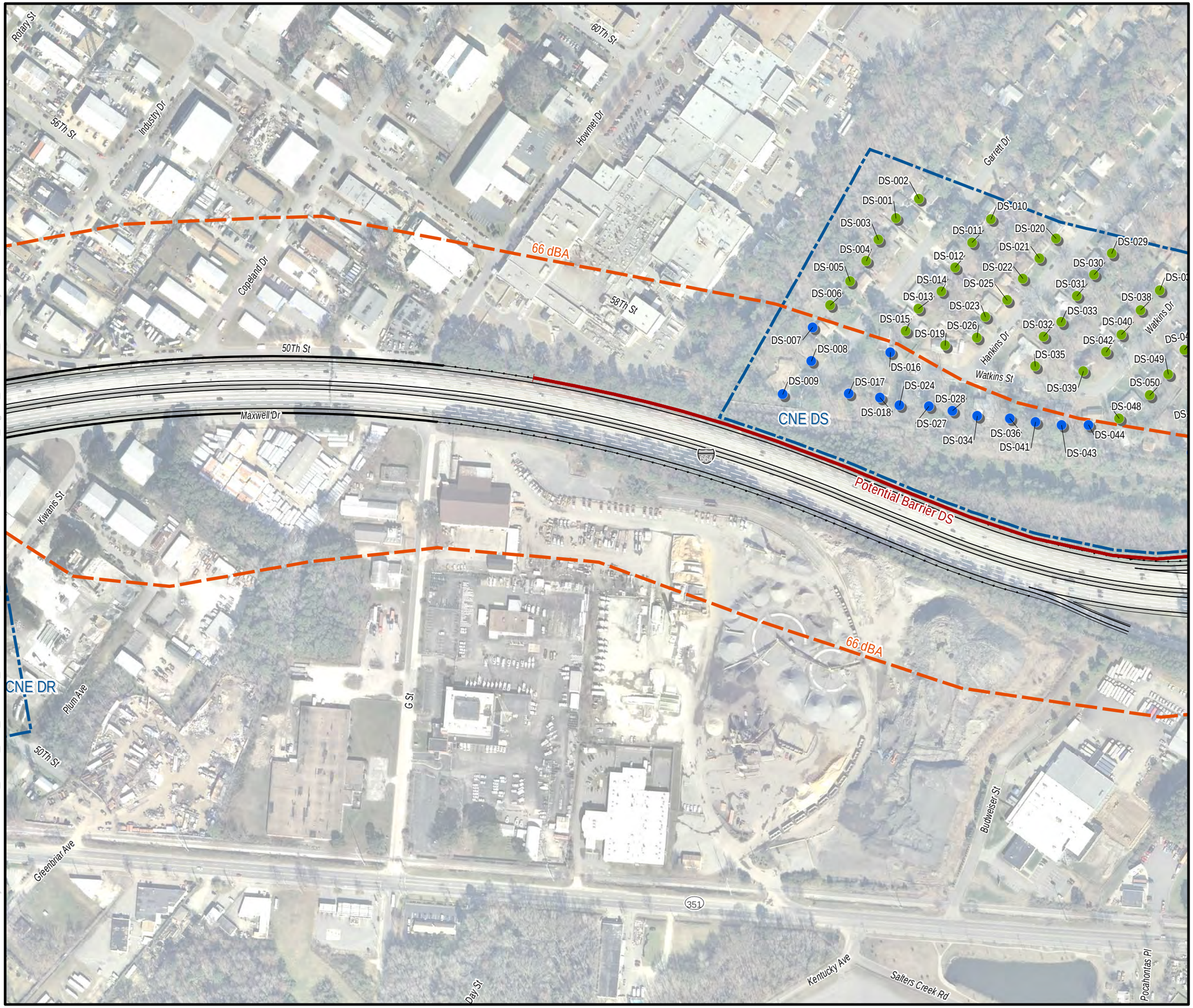


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Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

M# Measurement Site

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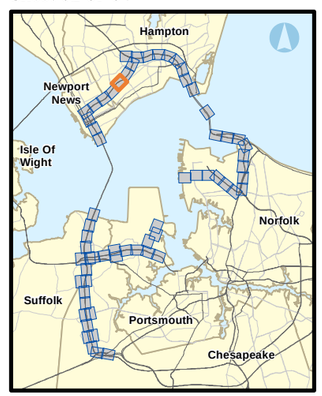
- Existing Barrier to be Replaced

CNE Boundary
66 dBA Noise Contour

Sheet 62 of 64

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# Figure 4-1
# Location Map for Common Noise Environments, Receptors, Build Contours and Barriers

## Hampton Roads Crossing Study Supplemental EIS Alternative C (Loudest)

VDOT Project No. 0064-965-081, P101; UPC No. 106724

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Note: Grouped Receiver Labels are in order of Leader Occurrence.

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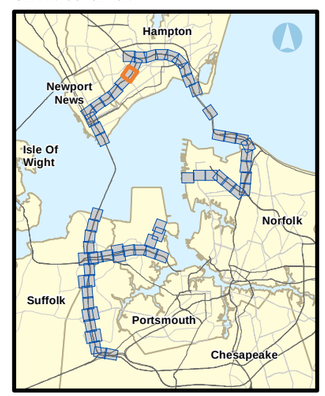


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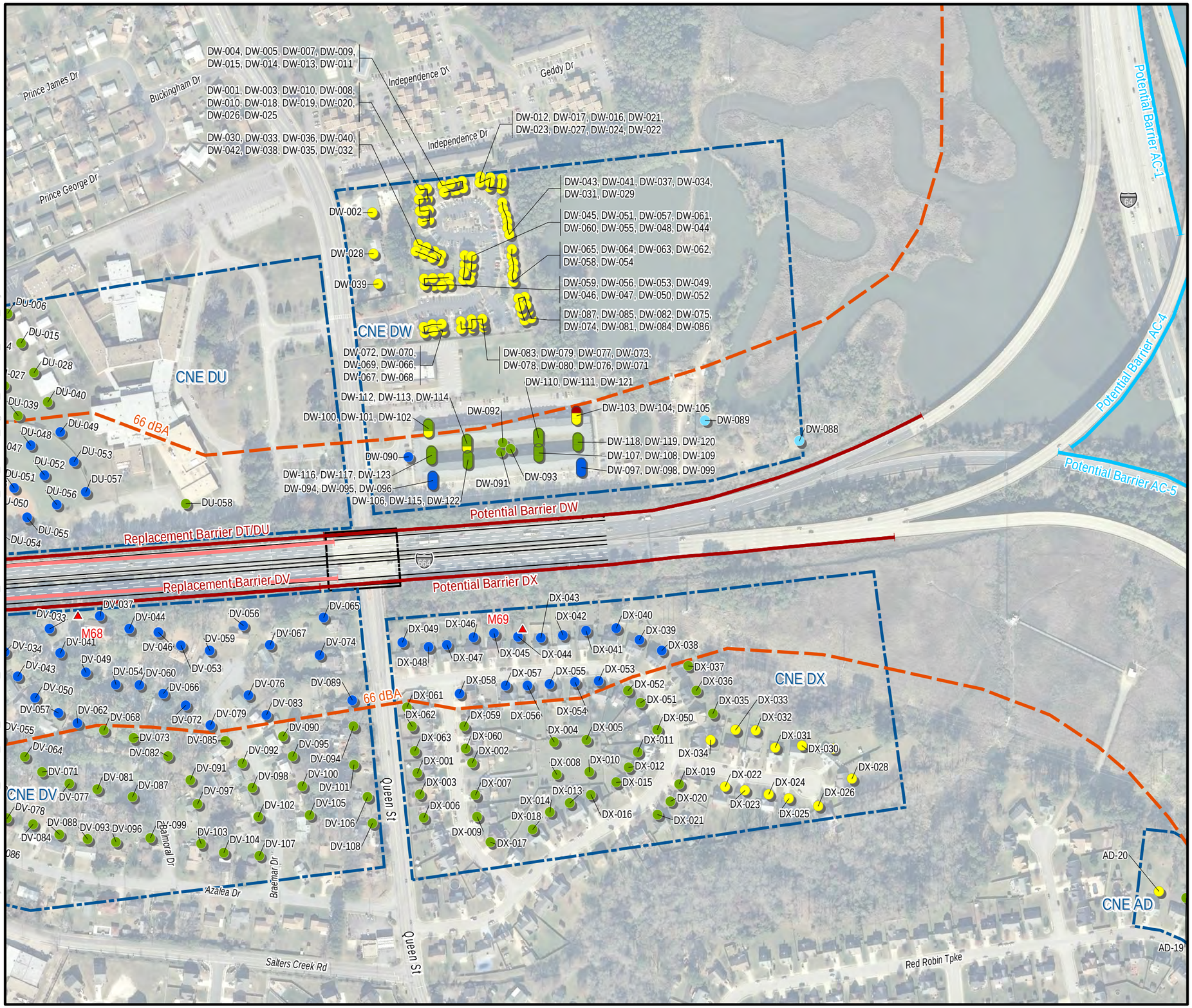


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VDOT Virginia Department of Transportation

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Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

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- Not Feasible
- Planned
- Existing Barrier to Remain
- Existing Barrier to be Replaced

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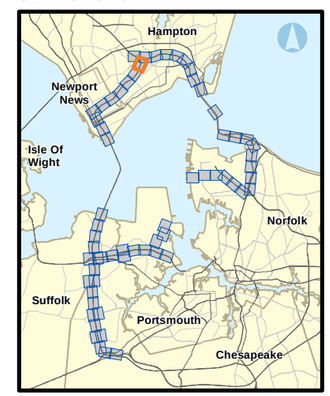


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the loudest Build Alternative for those corridors. Alternative C is the loudest alternative along I-564 and along I-664 in Chesapeake, Newport News and Hampton. Alternative D is slightly louder than Alternative C along I-664 in Suffolk, so its results are shown in that section of I-664. The legend in the many sheets of **Figure 4-1** changes to indicate which alternative is being shown.

The NAC is 67 dBA Leq at all residential and recreational receptors, and 72 dBA at the commercial and office land uses. At sites where there are patios/balconies at multiple levels, the color of the bottom half of the dot represents the first floor patio or balcony, and the top half of the dot represents the top floor balcony of that building. These receptor dots are shown with either a light blue, dark blue, or red dot indicating impact with 5 or 6 dBA insertion loss, impact with 7 dBA or more of insertion loss, and impact with less than 5 dBA of insertion loss from a noise barrier, respectively. Receptors represented by green dots are not predicted to be impacted by project noise but would be benefited and receive at least 5 dB of insertion loss from a barrier. The yellow dots indicate sites that would be neither impacted by highway traffic noise nor benefited by the proposed noise mitigation. Dark gray symbols represent properties that may be potential acquisitions related to the project. **Section 6** discusses the details of the barriers.

Overall, predicted exterior noise levels range from around 50 up to 77 dBA. On average for all receptors, sound levels are predicted to increase by approximately 1 decibel from the 2015 Existing case to the 2040 No-build condition, due to increases in projected traffic volumes. Sound level increases from Existing to the 2040 Build Alternatives are similar to those for the No-build, that is, approximately 1 decibel or slightly more greater than Existing levels, except in places where there are proposed improvements that would bring roadways closer to affected communities, or in places where existing shielding, such as existing noise barriers must be removed as part of the project construction. In those areas, sound level increases are higher, and particularly where barriers would be removed, can constitute “Substantial Increases” in existing noise levels greater than 10 dBA. While VDOT has a policy of replacing existing barriers that must be removed for roadway improvements, the sound levels and impact without the replacement barriers are reported initially. **Section 6** discusses the replacement barriers.

Notably, the existing noise barriers along I-64 in Hampton and Norfolk are not affected by the roadway widening, which is planned to occur to the inside of the existing lanes. Therefore, these barriers have been retained for the Build Alternative noise analysis, and their benefits accrue to the receptors in all alternatives. However, the existing barriers along VA 164 in Portsmouth and along I-664 in Hampton and Newport News must all be removed in the Build Alternatives that apply to those roadways to accommodate the roadway widening.

# 5. NOISE IMPACT ASSESSMENT

The potential noise impact of the HRCS project was assessed according to FHWA and VDOT noise assessment guidelines, described in detail in Section 2. In summary, noise impact would occur wherever Project noise levels are expected to approach within one decibel or exceed 67 dBA Leq at noise-sensitive land uses in Activity Categories B (residential) and C (recreational), and approach within one decibel or exceed 72 dBA Leq at noise-sensitive land uses in Activity Category E (outdoor commercial) during the loudest hour of the day. For Category D (noise-sensitive institutional) land uses such as schools and church buildings, noise impact would occur where predicted interior noise levels due to the Project approach or exceed 52 dBA Leq during the loudest hour of the day. Noise impact also would occur wherever Project noise levels cause a substantial increase over existing noise levels—an increase of 10 dB or more is considered substantial by VDOT.

**Figure 4-1,** the study area graphic presented in the previous section, shows the locations of individual receptors where noise impacts are predicted to occur in the loudest Build Alternative in each area. **Figure 4-1** also includes a noise impact contour for the loudest alternative in each corridor without abatement in the residential and recreational areas (at the applicable Categories B and C NAC of 67 dBA, which is represented by 66 dBA Leq for ground floor receptors).

**Table 5-1** presents a summary of the predicted noise impact for the 2015 Existing and 2040 No Build and Build Alternatives. In this table, the impacts are summarized by major corridor in the study area and by FHWA land use activity categories. In addition, a grand total of noise impact by alternative is given at the bottom. Alternative D has the greatest total impact, since it represents all of the project corridors. Alternative B has the next-highest total impact, and it is greater than the No-build Alternative impact primarily because of the removal of the existing noise barriers along VA 164 in Portsmouth, where there are 859 more impacts in Alt. B than in the No-build. All of the Build Alternatives are predicted to have less impact than the No-Build Alternative in the I-64 corridor, due to two factors related to the roadway widening occurring to the inside of the existing roadway throughout much of the corridor. Where I-64 is elevated on structure, such as over the water near Willoughby Spit and at overpasses, the gap between the eastbound and westbound structures would be closed by the widening. That would prevent noise from the far direction lanes from traveling under the structure carrying the near direction lanes to receivers below the roadway. Closing this gap results in reductions in traffic noise levels of up to 2 or 3 decibels in some areas, relative to the existing and no-build conditions. The second benefit of widening to the inside is that the existing noise barriers along I-64 in Norfolk and Hampton are expected to be able to remain in place, so the existing benefit they provide was also assumed to occur in the future Build conditions.

The I-64 corridor has many Category C recreational land uses along it that are predicted to be impacted under all of the alternatives, including several cemeteries, golf courses and playing fields.

Along the I-664 corridor, Alternatives C and D show similar levels of impact, although, the slightly higher traffic volumes forecast for Alternative C on the peninsula would result in somewhat higher noise impact there. The removal of noise barriers along I-664 in Newport News and Hampton would result in noticeably higher impact under the Build Alternatives as compared with the Existing and No-build alternatives.

**Table 5-1: Noise Impact Summary by Corridor and Land Use Activity Category**

| Corridor | Alternative | Number of Receptors Impacted by Activity Category | | | | |
|---|---|---|---|---|---|---|
| | | Residential Category B | Recreational/ Parks Category C | Institutional Interior Category D | Commercial Category E | Total |
| I-64 | 2015 Existing | 653 | 125 | 0 | 0 | 778 |
| | 2040 No-build | 826 | 176 | 0 | 0 | 1002 |
| | 2040 Alternative A | 780 | 173 | 0 | 0 | 953 |
| | 2040 Alternative B | 780 | 173 | 0 | 0 | 953 |
| | 2040 Alternative D | 705 | 159 | 0 | 0 | 864 |
| I-564 | 2015 Existing | 1 | 17 | 0 | 0 | 18 |
| | 2040 No-build | 7 | 0 | 0 | 0 | 7 |
| | 2040 Alternative B | 10 | 8 | 0 | 0 | 18 |
| | 2040 Alternative C | 14 | 8 | 0 | 0 | 22 |
| | 2040 Alternative D | 14 | 8 | 0 | 0 | 22 |
| VA 164 | 2015 Existing | 26 | 0 | 0 | 0 | 26 |
| | 2040 No-build | 51 | 0 | 0 | 0 | 51 |
| | 2040 Alternative B | 901 | 6 | 3 | 0 | 910 |
| | 2040 Alternative C | 1 | 0 | 0 | 0 | 1 |
| | 2040 Alternative D | 751 | 6 | 3 | 0 | 760 |
| I-664 Southside | 2015 Existing | 243 | 11 | 0 | 0 | 254 |
| | 2040 No-build | 315 | 14 | 0 | 0 | 329 |
| | 2040 Alternative B | 104 | 2 | 0 | 0 | 106 |
| | 2040 Alternative C | 386 | 14 | 0 | 0 | 400 |
| | 2040 Alternative D | 397 | 16 | 0 | 0 | 413 |
| I-664 Peninsula | 2015 Existing | 124 | 30 | 0 | 1 | 155 |
| | 2040 No-build | 263 | 45 | 0 | 1 | 309 |
| | 2040 Alternative C | 520 | 70 | 0 | 1 | 591 |
| | 2040 Alternative D | 422 | 66 | 0 | 1 | 489 |
| Alternative A Totals | 2015 Existing A | 653 | 125 | 0 | 0 | 778 |
| | 2040 No-build A | 826 | 176 | 0 | 0 | 1002 |
| | 2040 Build A | 780 | 173 | 0 | 0 | 953 |
| Alternative B Totals | 2015 Existing B | 722 | 143 | 0 | 0 | 865 |
| | 2040 No-build B | 930 | 178 | 0 | 0 | 1108 |
| | 2040 Build B | 1795 | 189 | 3 | 0 | 1987 |
| Alternative C Totals | 2015 Existing C | 368 | 58 | 0 | 1 | 427 |
| | 2040 No-build C | 585 | 59 | 0 | 1 | 645 |

| Corridor | Alternative | Number of Receptors Impacted by Activity Category | | | | |
|---|---|---|---|---|---|---|
| | | Residential Category B | Recreational/ Parks Category C | Institutional Interior Category D | Commercial Category E | Total |
| | 2040 Build C | 921 | 92 | 0 | 1 | 1014 |
| Alternative D Totals | 2015 Existing D | 1047 | 183 | 0 | 1 | 1231 |
| | 2040 No-build D | 1462 | 235 | 0 | 1 | 1698 |
| | 2040 Build D | 2289 | 255 | 3 | 1 | 2548 |

**Table 5-2** summarizes the predicted noise impact by corridor and by impact type. "NAC" impact includes all receptors where the NAC is predicted to be approached or exceeded, including those where a substantial increase in existing noise levels is also predicted. The "Substantial Increase" impact type includes all receptors where impact due to a substantial increase is predicted, including those where NAC impact may also occur. "Both NAC and Subs. Incr." shows the number of receptors where NAC impact is expected as well as Substantial Increase impact. Total impact indicates the total number of receptors where noise impact is predicted to occur, whether it is NAC impact or impact due to Substantial Increase. This total is usually lower than the sum of the NAC and Substantial Increase impacts, since both types of impact occurs at many receptors. Nearly all of the receptors where impact due to substantial increases in existing noise is predicted are behind existing noise barriers that must be removed due to the roadway widening. While VDOT has a policy of replacing existing barriers that must be removed for roadway improvements, the sound levels and impact without the replacement barriers are reported initially. **Section 6**, Noise Abatement Measures, discusses the replacement barriers.

**Tables 5-3 through 5-7** summarize the total noise impacts by CNE. One table is provided for each major corridor in the study area. The tables are organized in the order of the CNE labels, roughly in a clockwise fashion around the study area starting in the north at the I-64/I-664 interchange in Hampton. Residential impact is scattered along the project corridor, some in sparsely-settled areas, and some in existing densely-settled residential subdivisions. The color-coding of the receptors and the noise contour shown in **Figure 4-1** for the loudest alternative in each area enables a quick visual determination of where the residential and recreational noise impacts are predicted. In each CNE, the predicted noise levels and impacts are similar for the Build Alternatives that are represented in the CNE; the variation among alternatives would result in slight shifts in the noise contour line toward from the roadway.

**Table 5-2: Noise Impact Summary by Corridor and Impact Type**

| Corridor | Alternative | Number of Receptors Impacted by Type | | | |
|---|---|---|---|---|---|
| | | NAC* | Substantial Increase* | Both NAC and Subs. Incr.* | Total Impact** |
| I-64 | 2015 Existing | 778 | NA | NA | 778 |
| | 2040 No-build | 1002 | 0 | 0 | 1002 |
| | 2040 Alternative A | 953 | 0 | 0 | 953 |
| | 2040 Alternative B | 953 | 0 | 0 | 953 |
| | 2040 Alternative D | 864 | 0 | 0 | 864 |
| I-564 | 2015 Existing | 18 | NA | NA | 18 |
| | 2040 No-build | 7 | 0 | 0 | 7 |
| | 2040 Alternative B | 18 | 0 | 0 | 18 |
| | 2040 Alternative C | 22 | 0 | 0 | 22 |
| | 2040 Alternative D | 22 | 0 | 0 | 22 |
| VA 164 | 2015 Existing | 26 | NA | NA | 26 |
| | 2040 No-build | 51 | 0 | 0 | 51 |
| | 2040 Alternative B | 543 | 793 | 426 | 910 |
| | 2040 Alternative C | 1 | 0 | 0 | 1 |
| | 2040 Alternative D | 476 | 626 | 342 | 760 |
| I-664 Southside | 2015 Existing | 254 | NA | NA | 254 |
| | 2040 No-build | 329 | 0 | 0 | 329 |
| | 2040 Alternative B | 106 | 0 | 0 | 106 |
| | 2040 Alternative C | 400 | 0 | 0 | 400 |
| | 2040 Alternative D | 413 | 0 | 0 | 413 |
| I-664 Peninsula | 2015 Existing | 155 | NA | NA | 155 |
| | 2040 No-build | 309 | 0 | 0 | 309 |
| | 2040 Alternative C | 591 | 21 | 21 | 591 |
| | 2040 Alternative D | 489 | 20 | 20 | 489 |

*Notes:* All receptors with NAC impact and Substantial Increase impact are reported*
*** Total Impact is receptors where NAC or Substantial Increase impact is predicted*

**Table 5-3: Total Noise Impact by CNE – I-64 Corridor in Hampton and Norfolk**

| Area Land Use and Description | CNE ID | Cate-gory | Dwellings, Recreational Units and Institutions Impacted by Noise | | | |
|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alts. B & A | Alt. D |
| **HAMPTON** | | | | | | |
| Hampton Coliseum (Concert Venue) and multi-family development North of I64 off of Coliseum Dr/Freeman Dr | AC | B, D | 51 | 58 | 65 | 58 |
| Single-family residences South of I-64 and West of I-664 on Red Robin Turn | AD | B | 6 | 10 | 11 | 10 |
| Our Lady of Vietnam Catholic Church and Horizon Plaza multi-family residences and recreation areas, South of I-64 Off LaSalle Ave/Michigan Dr | AE | B, C | 1 | 2 | 2 | 2 |
| Hampton Family YMCA, VA Baseball Academy, Perfecting Saints Church, and single-family residences, LaSalle/Armistead | AF | B, D | 3 | 5 | 5 | 5 |
| Single-family residences, South of I-64 and east of Armistead Ave | AG | B | 24 | 26 | 26 | 26 |
| Single-family residences North of I-64 and Northeast of Armistead Ave | AH | B | 5 | 6 | 6 | 6 |
| Community center baseball field and park, single-family residences, and multi-family apartments, North of I-64 and East of LaSalle Ave | AI | B, C, E | 27 | 38 | 41 | 38 |
| Single-family residences, South of I-64 and north of E Pembroke Ave | AJ | B | 12 | 18 | 18 | 18 |
| Single-family residences and multi-family apartments, North of I-64 on River St, Cooper St, and Creek Ave | AK | B | 0 | 8 | 9 | 8 |
| River Street Park, South of I-64 and underneath bridge, off of River St | AL | C | 3 | 3 | 3 | 3 |
| Single-family residences, multi-family apartment complex and marina, South of I-64 on Brough Ln | AM | B, C | 19 | 27 | 22 | 20 |
| Single-family residences, North of I-64 on S Boxwood St and Magnolia Pl | AN | B | 8 | 10 | 10 | 8 |
| Woodlands Golf Course and Hampton Tennis Center, Northeast of I-64 off Woodland Rd | AO | C | 23 | 36 | 36 | 28 |
| Hampton University Mall, West of I-64 and North of Marshall Ave | AP | C | 0 | 0 | 0 | 0 |
| Hampton University Baseball Stadium/Field, West of I-64 on Emancipation Dr | AQ | B, C | 5 | 7 | 6 | 5 |
| Single-family residences, West of I-64, Emancipation Dr | AR | B | 4 | 4 | 4 | 4 |
| Hampton Veterans Affairs Medical Center, Domicilliary Section D, Building 148, benches | AS | C | 0 | 0 | 0 | 0 |
| Hampton national Cemetery Phoebus Addition, East of I-64, on W County St and Bainbridge Ave | AT | C | 12 | 14 | 14 | 14 |
| Single-family residences, East of I-64 on Cameron St | AU | B | 0 | 2 | 2 | 2 |
| McDonald's outdoor seating, East of I-64 on S Mallory St | AV | E | 0 | 0 | 0 | 0 |

| Area Land Use and Description | CNE ID | Cate-gory | Dwellings, Recreational Units and Institutions Impacted by Noise | | | |
|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alts. B & A | Alt. D |
| Single-family residences, East of I-64 on S Mallory St and Downes St | AW | B | 1 | 2 | 2 | 2 |
| Fort Monroe Park and Old Point Comfort Marina, East of I-64 Bridge/Tunnel, on McNair Dr | AX | C | 0 | 0 | 0 | 0 |
| Fort Wool, East of I-64 Bridge/Tunnel on Rip Raps Island | AY | C | 0 | 0 | 0 | 0 |
| **NORFOLK** | | | | | | |
| Willoughby Harbor Marina | AZ | C | 7 | 15 | 13 | 18 |
| Residences on Willoughby Spit south of I-64 | BA | B, C | 45 | 48 | 50 | 49 |
| Beach area at west end of Willoughby Spit, north of I-64 | BB | C | 8 | 8 | 8 | 7 |
| Residences west of 15th View Street, north of I-64 | BC | B | 57 | 59 | 59 | 57 |
| Residences between 15th View Street and 13th View Street, north of I-64 | BD | B | 121 | 131 | 131 | 126 |
| Residences between 13th View Street and the end of Little Bay Avenue, north of I-64 | BE | B | 121 | 193 | 128 | 111 |
| Captain's Quarters Nature Center and Park | BF | B, C | 4 | 8 | 6 | 6 |
| Residences between the end of Little Bay Avenue and 4th View Street, north of I-64 | BG | B | 4 | 8 | 8 | 8 |
| Outdoor land use at Norfolk Visitor's Center | BH | C | 0 | 0 | 0 | 0 |
| Residences at Willoughby Bay military housing complex | BI | B | 6 | 24 | 24 | 6 |
| Residences from Orange Avenue to Ridgewell Avenue, west of I-64 | BJ | B | 44 | 50 | 52 | 48 |
| Residences between 1st View Street and W Bay Avenue, west of I-64 | BK | B | 33 | 35 | 35 | 34 |
| Willoughby Elementary School | BL | D | 0 | 0 | 0 | 0 |
| Baseball field at Ocean View Elementary School | BM | C | 0 | 0 | 0 | 0 |
| Residences between W Government Avenue and Mace Arch, east of I-64 | BN | B | 16 | 17 | 17 | 16 |
| Residences, Mace Arch to W Bay Avenue, east of I-64 | BO | B | 8 | 10 | 8 | 8 |
| Residences along W Bay Avenue EB, west of I-64 | BP | B | 0 | 0 | 0 | 0 |
| Residences from Commodore Drive to W Bayview Boulevard, west of I-64 | BQ | B | 3 | 3 | 4 | 4 |
| Residences from W Bayview Boulevard to the south end of Executive Drive, west of I-64 | BR | B | 28 | 28 | 36 | 28 |
| Military baseball fields along Patrol Road near on-ramp to I-64 EB, west of I-64 | BS | C | 1 | 3 | 5 | 4 |
| Military baseball field along Patrol Road near I- 564 interchange, west of I-64 | BT | C | 4 | 5 | 6 | 6 |
| Residences from W Chester Street to E Bayview Boulevard, east of I-64 | BU | B, D | 4 | 5 | 5 | 3 |
| Residences from E Bayview Boulevard to the I-64 WB on-ramp from Granby Street, east of I-64 | BV | B | 13 | 13 | 13 | 13 |
| Forest Lawn Cemetery, Girl Scouts Camp | BW | C | 47 | 63 | 63 | 55 |

**Table 5-4: Total Noise Impact by CNE – I-564 Corridor in Norfolk**

| Area Land Use and Description | CNE ID | Cate-gory | Dwellings, Recreational Units and Institutions Impacted by Noise | | | | |
|---|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. B | Alt. C | Alt. D |
| Residences southwest of I-564/I-64 Interchange near Bradford St. | BZ | B, C | 1 | 7 | 10 | 14 | 14 |
| Residences and Golf Course southwest of I-564 and Ingersol Ave. | CA | C | 17 | 0 | 8 | 8 | 8 |
| Residences south of Intermodal Connector and east of Hampton Blvd. | CB | B, C | 0 | 0 | 0 | 0 | 0 |
| Pool north of Intermodal Connector and east of Hampton Blvd. | CC | B, C | 0 | 0 | 0 | 0 | 0 |

**Table 5-5: Total Noise Impact by CNE – VA 164 Corridor in Portsmouth**

| Area Land Use and Description | CNE ID | Cate-gory | Dwellings, Recreational Units and Institutions Impacted by Noise | | | | |
|---|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. B | Alt. C | Alt. D |
| Residences on Magnolia Dr. north of VA 164, Old Dominion University | CY | B, D | 0 | 0 | 0 | NA | 0 |
| Single-family residences, Pepperwood Townhomes, The Village Church of Portsmouth, north of VA 164, west of Towne Point Rd | CZ | B, C, D | 0 | 0 | 176 | NA | 151 |
| Single-family residences, apartments, Sleep Inn & Suites, south of VA 164, west of Towne Point Rd | DB | B,E | 0 | 0 | 327 | NA | 269 |
| Single-family residences, apartments, Churchland North Baptist Church, north of VA 164, east of Towne Point Rd | DC | B, D | 21 | 21 | 244 | 0 | 205 |
| Residences, churches, Ebony Heights Park, cemetery, south of VA 164, east of Towne Point Rd | DD | B, C, D | 0 | 0 | 162 | 0 | 134 |
| Residences, Churchland House Assisted Living, south of VA 164, east of Cedar Ln | DE | B, D | 0 | 0 | 0 | 0 | 0 |
| Residences, First Baptist Church, south of VA 164, east of Cedar Ln | DF | B, D | 5 | 30 | 1 | 1 | 1 |
| Churchland High School baseball diamond | DG | C | 0 | 0 | 0 | 0 | 0 |
| US Coast Guard patio | DH | C | 0 | 0 | 0 | 0 | 0 |

**Table 5-6: Total Noise Impact by CNE – I-664 Corridor, Southside**

| Area Land Use and Description | CNE ID | Cate-gory | Dwellings, Recreational Units and Institutions Impacted by Noise | | | | |
|---|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. B | Alt. C | Alt. D |
| **CHESAPEAKE** | | | | | | | |
| America's Best Value Inn, single-family residences, South of I-664 off S Military Hwy | CE | B, E | 3 | 3 | NA | 7 | 7 |
| Single-family residences, mobile homes, North of I-664 off Airline Blvd and Ridgeway Ave | CG | B | 2 | 2 | NA | 1 | 1 |
| Jolliff Middle School and associated track/field, single family residences, North/East of I-664 off of Jolliff Rd and Airline Blvd | CH | B, C, D | 4 | 5 | NA | 6 | 6 |
| Single-family residences West of I-664, on Jolliff Rd and Branchview Way | CI | B | 4 | 5 | NA | 5 | 5 |
| Single-family residences East of I-664 on Dock Landing Rd and Clark's Circle | CJ | B | 2 | 2 | NA | 8 | 8 |
| Single-family residences West of I-664, South of Dock Landing Rd, on Jolliff Rd, Swan Lake Crescent, Old Dock Landing Rd | CK | B | 0 | 0 | NA | 1 | 1 |

| Area Land Use and Description | CNE ID | Cate-gory | Dwellings, Recreational Units and Institutions Impacted by Noise | | | | |
|---|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. B | Alt. C | Alt. D |
| Alexander Baptist Church, single-family residences, East of I-664, North of Dock Landing Rd, off Woodland Dr | CL | B, C | 13 | 15 | NA | 19 | 19 |
| Union Bethel Baptist Church, single-family residences, West of I-664, off Jolliff Rd, Woodland Dr, Quivers Keep | CM | B, C | 22 | 24 | NA | 34 | 32 |
| Sunstone Apartments multi-family, single-family residences, East of I-664 on Peek Trail, River Peral Way, and Waterstone Way | CN | B, C | 33 | 37 | NA | 45 | 45 |
| Single-family residences West of I-664 on Jolliff Rd | CO | B | 2 | 2 | NA | 2 | 2 |
| Holiday Inn Express, Horizon Community Church, single-family residences, East of I-664 off Gum Rd and Portsmouth Blvd | CP | B, D, E | 0 | 0 | NA | 0 | 0 |
| Living Waters Christian Fellowship, Chesapeake Public Trail, Hunters Cove Park, | CQ | B, C, D | 80 | 107 | NA | 116 | 114 |
| Single-family residences, West of I-664, South of Pughsville Road | CR | B | 0 | 0 | NA | 0 | 0 |
| Single-family residences, West of I-664, North of Pughsville Road | CS | B | 6 | 9 | NA | 11 | 11 |
| Residences, New Hope Baptist Church cemetery, East of I-664, South of Pughsville Road | CT | B, C | 2 | 4 | NA | 4 | 4 |
| Single-family residences, East of I-664, North of Pughsville Road | CU | B | 12 | 15 | NA | 21 | 20 |
| **SUFFOLK** | | | | | | | |
| Belleville Harbour Apartments multi-family units, West of I-664 Off Townpoint Rd & Belleharbour Cir | CV | B | 0 | 5 | 0 | 8 | 8 |
| Meridian Harbourview multi-family apartments, West of I-664 and VA164, on Harbour Towne Pkwy | CW | B | 17 | 35 | 33 | 58 | 72 |
| Single-family residences, West of I-664 and South of VA164 | CWA | C | 1 | 2 | 2 | 2 | 4 |
| Little Grove Baptist Church, Children's Corner Daycare, and single-family residences, West of I-664, North of VA164, and East of College Dr | CX | B, C | 51 | 57 | 71 | 52 | 54 |
| Lakeview Medical Center, East of I-664 and South of VA164, on Western Branch Blvd | DA | D | 0 | 0 | 0 | 0 | 0 |
| Bon Secours Maryview Nursing, East of I-664 off of Bridge Rd | DAA | B, C | 0 | 0 | 0 | 0 | 0 |

**Table 5-7: Total Noise Impact by CNE – I-664 Corridor, Peninsula**

| Area Land Use and Description | CNE ID | Cate-gory | Dwellings, Recreational Units and Institutions Impacted by Noise | | | |
|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. C | Alt. D |
| **NEWPORT NEWS** | | | | | | |
| King Lincoln Park, East of I-664 on Jefferson Ave | DI | C | 0 | 5 | 3 | 0 |
| Agape Hands Cathedral Trustees, single-family residences on East of I-664 Jefferson Ave, 13th & 14th St | DJ | B, D | 6 | 16 | 8 | 21 |
| Multi-family residences and ballfield, East of I-664 on Jefferson Ave in between 22nd and 28th St | DK | B, C | 14 | 16 | 16 | 16 |
| Navy Field, Brennan Pointe multi-family residences, and Juvenile Center, west of I-664 on Warwick Blvd in between 30th and 32nd St | DL | B, C, D | 10 | 10 | 15 | 12 |
| Multi-family and single-family residences, Southeast of I-664, between 32nd and 36th St/Jefferson Ave and Marshall Ave | DM | B | 0 | 69 | 83 | 82 |
| Friendship Baptist Church & Playground, Gethsemane Baptist Academy Playground, Alpha & Omega Christian Worship, House of Judah Deliverance Church, single-family, and multi-family residences, South of I-664 between Marshall Ave and Roanoke Ave | DN | B, C, D | 15 | 36 | 37 | 34 |
| Apprentice Builders Stadium, single-family residences, Northwest of I-664, between Jefferson Ave and Marshall Ave | DO | B, C | 14 | 16 | 18 | 17 |
| Newsome Park Elementary School, New Grafton Baptist Church, Full Gospel Deliverance Church, Bethlehem Judah, Family Light Baptist Church, Kingdom Hall Jehovah's Witness, single-family, and multi-family residences, North of I-664 between Marshall Ave and Chestnut Ave | DP | B, C, D | 2 | 3 | 97 | 89 |
| Booker T Washington Middle School & Baseball Field, Greenlawn Memorial Park, and single-family residences Southeast of I-664, between 35th and 39th, East of Chestnut Ave | DQ | B, C, D | 0 | 5 | 8 | 3 |
| **HAMPTON** | | | | | | |
| Hampton Coliseum (Concert Venue) and multi-family development North of I64 off of Coliseum Dr/Freeman Dr | AC | B, D | see I-64 table* | see I-64 table* | 64 | see I-64 table* |
| Single-family residences South of I-64 and West of I-664 on Red Robin Turn | AD | B | see I-64 table* | see I-64 table* | 9 | see I-64 table* |
| Single-family residences, apartments, Greenlawn Cemetery, East of I-664, South of Aberdeen Rd | DQ | B, C, D | 9 | 18 | 18 | 12 |
| Single-family residences, playground, church, picnic table, East of I-664, North of Aberdeen Rd | DR | B, C, D, E | 37 | 42 | 45 | 40 |
| Single-family residences, Briar Queen Pool, West of I-664, South of Powhatan Pkwy | DS | B, C | 11 | 16 | 16 | 14 |
| Single-family residences, West of I-664, North of Powhatan Pkwy | DT | B | 6 | 6 | 24 | 23 |

| Area Land Use and Description | CNE ID | Cate-gory | Dwellings, Recreational Units and Institutions Impacted by Noise | | | |
|---|---|---|---|---|---|---|
| | | | Existing | No-Build | Alt. C | Alt. D |
| Hampton High School, building and athletic fields, West of I-664, South of W Queen St | DU | C, D | 7 | 12 | 38 | 37 |
| Single-family residences, East of I-664, South of W Queen St | DV | B | 5 | 18 | 64 | 62 |
| Single-family residences, townhomes, assisted living facility, West of I-664, North of W Queen St | DW | B | 8 | 9 | 10 | 9 |
| Single-family residences, West Cemetery, East of I-664, North of W Queen St | DX | B, C | 11 | 12 | 18 | 18 |

** Note: Impact for these CNEs and alternatives reported in Table 5-3, I-64 Hampton.*

## 5.1 SECTION 4(F) EVALUATION

Section 4(f) refers to a provision of the Department of Transportation Act (DOT Act) of 1966 that prohibited FHWA and other DOT agencies from approving the use of certain environmental resources such as, historical sites, and publicly-owned lands for highway projects unless "there is no prudent and feasible alternative" and actions are taken to minimize harm to those properties. Use includes "constructive use," which impacts a 4(f) resource such that the protected activities, features, and attributes would be substantially impaired, even if it does not involve physical use of the property.

Noise can be a Section 4(f) constructive use issue if predicted noise levels from a project in proximity to a Section 4(f) resource interfere with the use and enjoyment of a noise-sensitive facility or exterior activity associated with that resource. Examples of noise-sensitive activities that may invoke Section 4(f) protection include:

- hearing performances at an outdoor amphitheater,
- sleeping in the sleeping area of a campground,
- enjoyment of a historic site where a quiet setting is a generally recognized feature or attribute of the site's significance,
- enjoyment of an urban park where serenity and quiet are significant attributes, or
- viewing wildlife in an area of a wildlife and waterfowl refuge intended for such viewing.

When these types of facilities and activities are present adjacent to a project, it is important that these facilities and activities be modeled so that FHWA can determine whether or not a Section 4(f) constructive use is going to occur because of noise increases on the project.

Noise-sensitive Section 4(f) resources are evaluated under the appropriate Noise Abatement Criteria activity category in 23 CFR 772 (usually Activity Category C). In order for FHWA to begin considering whether or not a highway traffic noise increase may constitute a constructive use under Section 4(f), there must be:

1. a future highway traffic noise level that approaches or exceeds 67 dBA, **or**
2. existing noise levels which approach or exceed 67 dBA and a predicted increase with the future Build Alternative greater than 3 dBA or more above the predicted No-build alternative noise level.

Table 5-8 lists public land uses in the study corridor that have been identified as 4(f) resources. All of the resources are addressed as Activity Category C exterior uses, with public parks and recreation areas listed first, followed by historic sites. Predicted future noise levels for the loudest Build Alternative have been modeled or estimated at the receptor nearest the project roadways for each of these resources, and they are shown in the table. For each receptor, the CNE and site number are given, along with the name or description of the resource, and the applicable Build Alternatives. The highest predicted Build Alternative noise level is shown in **bold** if the site is predicted to be impacted by noise. The other potential Section 4(f) noise impact criterion shown under 2. above is not listed in the table, since only one impact of that type was identified (at the Hampton High Schools Athletic Fields), and the site is already identified as impacted under the first criterion. Properties that are so far away from the Build Alternatives that there is no potential for noise impact are not included in the table. The noise impact zone (defined by the 66 dBA noise contour shown in Figure 4-1) in the loudest Build Alternative typically ranges up to 300 feet to 500 feet from the edge of the highway along I-64, VA 164, and I-664 in Suffolk, Newport News and Hampton, and up to 400 to 650 feet from the highway along I-664 in Chesapeake.

**Table 5-8: Potential Noise Impacts at 4(f) Resources**

| CNE Site No. | Description/Address | Official Jurisdiction | Applicable Alternatives | Build Leq (dBA) |
|---|---|---|---|---|
| **Public Parks and Recreation Areas** | | | | |
| AC-14 | Newmarket Creek Park Trail | City of Hampton | B, D | **70** |
| AI-03 | Y. H. Thomas Park | City of Hampton | B, D | 56 |
| AL-04 | River Street Park | City of Hampton | B, D | **70** |
| AF-12 | Peninsula Metropolitan YMCA | City of Hampton | B, D | 41 |
| AO-01 | Woodlands Golf Course | City of Hampton | B, D | **68** |
| DU-029 | Hampton High School Athletic Fields | Hampton Public Schools | C, D | **76** |
| BA-29 | Willoughby Boat Ramp | City of Norfolk | B, D | **68** |
| BF-1 | Captain's Quarters Park | City of Norfolk | B, D | **70** |
| BM-20 | Willoughby Elementary School Recreational Fields | City of Norfolk | B, D | 60 |
| DR-076 | Park Place Playground | City of Hampton | C, D | **74** |
| DQ-01 | Booker T. Washington Middle School Recreational Fields | Newport News Public Schools | C, D | **66** |
| DD-107 | Ebony Heights Park | City of Portsmouth | B, C, D | **75** |
| DG-002 | Churchland Park | City of Portsmouth | B, C, D | 60 |
| DG-002 | Churchland Park Recreational Fields | City of Portsmouth | B, C, D | 59 |
| **Historic Sites** | | | | |
| AC-14 | Hampton Coliseum | City of Hampton | B, D | 45 |
| AL-04 | Pasture Point Historic District | City of Hampton | B, D | **70** |
| AJ-01 | Elmerton Cemetery | City of Hampton | B, D | 64 |
| AQ-09 | Hampton Institute | City of Hampton | B, D | **70** |

| CNE Site No. | Description/Address | Official Jurisdiction | Applicable Alternatives | Build Leq (dBA) |
|---|---|---|---|---|
| AT-06 | Hampton National Cemetery | City of Hampton | B, D | **76** |
| AW-11 | Phoebus-Mill Creek Terrace Historic District | City of Hampton | B, D | 63 |
| AS-01 | Hampton Veterans Affairs Medical Center Historic District | City of Hampton | B, D | 61 |
| AX-03 | Fort Monroe | City of Hampton | B, D | 58 |
| AX-02 | Chamberlin Hotel | City of Hampton | B, D | 57 |
| AX-01 | Old Point Comfort Lighthouse | City of Hampton | B, D | 59 |
| AY-01 | Fort Wool | City of Hampton | B, D | 57 |
| AW-43 | Battle of Hampton Roads | City of Hampton | B, D | **68** |
| AX-01 | Battle of Sewell's Point | City of Norfolk | B, D | 59 |
| DH-001 | Battle of Craney Island | City of Portsmouth | B, C, D | 54 |
| BJ-5 | Norfolk Naval Base Historic District | City of Norfolk | B, D | **75** |
| BP-1 | Merrimack Landing Historic District | City of Norfolk | B, D | 64 |
| BL-1 | Willoughby Elementary School | City of Norfolk Schools | B, D | 63 |
| BW-21 | Forest Lawn Cemetery | City of Norfolk | B, D | **69** |
| BZ-15 | Bradford Avenue Historic District | City of Norfolk | B, C, D | **68** |
| CA-72 | Norfolk Naval Base Golf Course Historic District | City of Norfolk | B, C, D | 63 |
| DL-056 | Noland Company Building | City of Newport News | C, D | **68** |
| DL-007 | Peninsula Catholic High School, St Vincent's School For Girls | City of Newport News | C, D | 58 |
| DL-001 | Brown Manufacturing, Coca Cola Bottling Works | City of Newport News | C, D | 56 |
| CE-002 | Sunray Agricultural Historic District | City of Chesapeake | C, D | **69** |

*Note: Properties that are so far away from the Build Alternatives that there is no potential for noise impact are not included in the table. See text for impact zones.*

# 6. NOISE ABATEMENT MEASURES

FHWA has identified certain noise abatement measures that may be incorporated in projects to reduce traffic noise impact. In general, mitigation measures can include alternative measures (traffic management, the alteration of horizontal and vertical alignment, and low-noise pavement), in addition to the construction of noise barriers.

## 6.1 ALTERNATIVE NOISE ABATEMENT MEASURES

VDOT guidelines recommend a variety of mitigation 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 mitigation, additional mitigation measures exist that have the potential to provide considerable noise reductions under certain circumstances. Mitigation measures considered for this project include:

- Traffic management measures,
- Alteration of horizontal and vertical alignments,
- Acoustical insulation of public-use and non-profit facilities,
- Acquisition of buffer land,
- Construction of earth berms,
- Construction of noise barriers.

Traffic management measures normally considered for noise abatement include reduced speeds and truck restrictions. Reduced speeds would not be an effective noise mitigation measure alone since a substantial decrease in speed is necessary to provide a significant noise reduction. Typically, a 10 mph reduction in speed will result in only a 2 dBA decrease in noise level, which is not considered a sufficient level of attenuation to be considered feasible. Further, a 2 dBA change in noise level is not considered to be generally perceptible. Restricting truck usage on the different Study Area Corridors is not practical since one of the primary purposes of those facilities is to accommodate trucks. Diversion of truck traffic to other roadways would increase noise levels in heavily developed residential areas.

A significant alteration of the horizontal alignment of the Study Area Corridors would be necessary to make such a measure effective in reducing noise, since a doubling of distance to the highway is usually needed to effect a 5-decibel reduction. However, such shifts would create undesirable impacts by increasing right-of-way acquisitions and relocations. Also, shifting the horizontal alignment is not practical since there are impacted receptors on both sides of the corridor throughout much of the study area. Shifting the alignment away from receptors on one side of the road would bring it closer to receptors on the other side of the road. Further alteration of the vertical alignment would not be feasible since the project involves widening an existing facility. Particularly given the large number of interchanges, raising or lowering the vertical alignment of the Study Area Corridors would result in significant environmental impacts to the surrounding environment and costly engineering challenges.

Acoustical Insulation of public-use and non-profit facilities 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.

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.

Berms are considered a more attractive alternative to noise walls where there is sufficient land and fill available for them. However, berms do not appear feasible for the HRCS because they would greatly increase the cost and the footprint of the project by substantially increasing the amount of right of way required to accommodate the berms. Since much of the study corridor is densely developed, many costly and disruptive residential displacements necessarily would result from acquiring the needed right of way. The feasibility of berms in any areas with available unimproved property adjacent to the project may be reevaluated during the detailed noise study during final design.

Additionally, the Noise Policy Code of Virginia (HB 2577, as amended by HB 2025) states: *Requires that 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 sound 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.* Consideration would be given to these measures during the final design stage, where feasible. The response to this requirement from project management is included **Appendix F**.

## 6.2 NOISE BARRIERS

The only remaining abatement measure for consideration is the construction of noise barriers. The feasibility of noise barriers is evaluated for locations where noise impact is predicted to occur in the Build condition. Where the construction of noise barriers is found to be physically practical, barrier noise reduction is estimated based on roadway, barrier, and receiver geometry as described below.

To be constructed, any noise barriers identified in this document must satisfy VDOT's feasibility and reasonableness criteria. Therefore, the noise barrier design parameters and cost identified in this document are preliminary and should not be considered final. A final decision on the feasibility and reasonableness of noise barriers would be made during final design when the project design is developed and traffic updated. If a noise barrier is determined to be feasible and reasonable, the affected public would be given an opportunity to decide whether they are in favor of construction of the noise barrier. VDOT's formal policies for involving the public in noise abatement decisions are described in their Guidance Manual, in section 7.3.10.1 *Viewpoints of the benefited receptors*, section 12.3 *Affected Receptors/Community*, and section 12.4 *Voting Procedures*.

### 6.2.1 Feasibility and Reasonableness

FHWA and VDOT require that noise barriers be both "feasible" and "reasonable" to be recommended for construction.

To be feasible, a barrier must be effective, that is it must reduce noise levels at noise sensitive locations by at least five decibels, thereby "benefiting" the property. VDOT requires that at least 50 percent of the impacted receptors receive five decibels or more of insertion loss from the proposed barrier for it to be feasible.

A second feasibility criterion is that it must be possible to design and construct the barrier. Factors that enter into constructability include safety, barrier height, topography, drainage, utilities, maintenance of

the barrier, and access to adjacent properties. VDOT has a maximum allowable height of 30 feet for noise barriers.

Barrier reasonableness is based on three factors: cost-effectiveness, ability to achieve VDOT's insertion loss design goal, and views of the benefited receptors. To be "cost-effective," a barrier cannot require more than 1600 square feet per benefited receptor. VDOT's maximum barrier height of 30 feet figures into the assessment of benefited receptors. Where multi-family housing includes balconies at elevations above 30 feet, these receptors are not assessed and included in the determination of a barrier's feasibility or reasonableness.

The second reasonableness criterion is VDOT's noise reduction design goal of seven decibels. This goal must be achieved for at least one of the impacted receptors, for the barrier to be considered reasonable.

The third reasonableness criterion relates to the views of the owners and residents of the potentially benefited properties. A majority of the benefited receptors must favor the barrier for it to be considered reasonable to construct. Community views would be surveyed in the final design phase of projects.

### 6.2.2 Existing Barriers to Remain in Place

Several existing noise barriers along I-64 are expected to be able to remain in place, since the widening of I-64 to the inside does not require their removal. No noise impact is predicted for the Build Alternatives behind the three existing barriers along I-64 in Norfolk, in CNEs BN, BQ, BR and BU. Since the barriers would provide adequate noise reduction in 2040, they can remain in place as is. The barrier in CNE AW along I-64 in Hampton can also remain in place as is, for the same reasons.

Noise impact is predicted for some receptors behind the existing barrier in CNE AK in Hampton. Therefore, this existing barrier was evaluated according to VDOT's policy in such cases, which requires that the existing barrier be evaluated to determine if it meets VDOT's feasibility and reasonableness requirements. In particular, at least 50 percent of the receivers impacted without the barrier in place must be benefited with five decibels of noise reduction by the existing barrier, and at least one receptor must achieve the noise reduction design goal of seven decibels. Existing barrier AK was evaluated in this manner, and was found to meet those goals. The existing noise barrier is acoustically feasible, since it benefits 39 of the 43 residential and recreational units located behind it. The barrier is 6 to 14 feet high and 2,079 feet long with a surface area of 20,031 square feet. Because it provides seven decibels or more of noise reduction at 14 impacted units and has a surface area per benefited receptor value of 477, the existing noise barrier is also reasonable.

### 6.2.3 Existing Barriers to be Replaced

The proposed roadway widening would impact the existing barriers adjacent to I-664 in Newport News and Hampton and Newport News, and along VA 164. Replacement barriers that would provide at least the same level of protection as the existing barriers have been evaluated for each of these existing barriers in accordance with VDOT's policy, and are discussed in detail below. All replacement barriers are feasible and reasonable.

### 6.2.4 Planned Barriers for the I-564 Intermodal Connector (IC) Project

The noise study for the I-564 Intermodal Connector (IC) Project (Jacobs, 2015) found that noise barriers are feasible and reasonable at two locations along the existing I-564 corridor. Alternatives A, B and D would not affect these barriers and they could be constructed as planned as part of the I-564 IC project.

Alternative C would affect the barriers and those effects are described as well. The planned barriers and the effects of Alternative C are described here.

Barrier 3 in the Jacobs noise study report would be located along the eastbound lanes of I-564 just north of Terminal Boulevard. Barrier 3 is 12 to 16 feet high and 3,529 feet long, with a surface area of 49,801 square feet and a SF/BR value of 356. This planned (but not yet constructed) noise barrier is designed to mitigate noise impacts from the Intermodal Connector project in HRCS CNE CA, south of Signonella Avenue. Because Build Alternative C (only) under consideration for the HRCS Project would impact a relatively small section of this planned noise barrier – approximately 230 feet at its north end – the impact assessment for Alternative C assumed that the barrier would largely remain in place – if it were built as part of the I-564 IC Project. There are no impacts with any of the HRCS Build Alternatives behind this planned noise barrier. The modified planned barrier is shown in Figure 4-1, Sheets 20 and 21 as Planned Barrier CA-1

Barrier 4 (in the 2015 Jacobs report) would be located along the eastbound lanes of I-564 just south of the proposed I-564 IC. It is designed to mitigate noise impacts from the I-564 IC Project at eight recreational units between Mogadishu Street and Ingersol Street. However, Alternative C would impact this entire planned noise barrier. Since planned Barrier 4 has not yet been constructed, a *relocated* noise barrier (rather than a *replacement* noise barrier) was evaluated to mitigate potential noise impacts for those same recreational receptors, which are located in CNE CA north of Signonella Avenue. The relocated barrier is designated as CA-R for this study and it is discussed in the following section. Both the planned barrier and Relocated Barrier CA-R are shown in Figure 4-1, Sheet 21.

### 6.2.5 Summary of Feasible and Reasonable Barriers

**Table 6-1** summarizes separately for each corridor and city, the total length, estimated cost and benefits that would be provided by the potential and replacement barriers evaluated that are found to be warranted, feasible and reasonable. All replacement barriers are feasible and reasonable.

**Table 6-1: Summary of Feasible and Reasonable Noise Barriers**

| Corridor and City | Alterna-tives | Length (mi.) | Estimated Cost ($31/square feet) | Number of Benefited Receptors | | |
|---|---|---|---|---|---|---|
| | | | | Impacted | Not impacted | Total |
| I-64 Hampton | A, B, D | 3.7 | 9,902,609 | 174 | 239 | 413 |
| I-64 Norfolk | A, B, D | 5.3 | 19,159,888 | 574 | 718 | 1,292 |
| I-564 Norfolk | B, D | 1.2 | 2,759,496 | 14 | 93 | 107 |
| I-564 Norfolk | C | 1.3 | 3,100,155 | 22 | 94 | 116 |
| VA 164 Portsmouth | B, D | 3.1 | 11,000,164 | 545 | 1,152 | 1,697 |
| I-664 Chesapeake | C, D | 3.8 | 12,950,746 | 243 | 349 | 592 |
| I-664 Suffolk | C, D | 1.9 | 7,653,094 | 145 | 284 | 429 |
| I-664 Newport News | C, D | 3.5 | 14,018,665 | 281 | 782 | 1,063 |
| I-664 Hampton | C, D | 2.9 | 8,714,968 | 213 | 386 | 599 |

### 6.2.6 Details of Replacement and Potential Barriers

As described earlier in this report, **Figure 4-1** shows the impact and barrier benefit status at receptor locations for the loudest Build Alternative in each corridor. These are Alternative B for I-64 and VA 164,

Alternative C along I-564 and I-664 in Hampton, Newport News, and Chesapeake, and Alternative D for I-664 in Suffolk. For most corridors where Alternative D and one other alternative are under evaluation, the two alternatives are physically identical. The exceptions to this are I-664 on the Peninsula, where Alternative C is slightly wider for transit lanes, but the additional width is slight, and the geometries of the two alternatives there are very similar, and near the I-564 intermodal connector in Norfolk. In addition to these similarities, small differences in forecast peak-hour traffic among the Build Alternatives yield small changes in predicted sound levels, all other things being equal. The sound level differences among alternatives due to traffic alone are all less than one-half decibel. Therefore, the noise barrier designs developed for the loudest Build Alternative in each corridor would be appropriate for the other Build Alternatives being evaluated in that corridor. As a result, only the barrier designs for the loudest Build Alternative in each corridor are reported in the tables and narratives in this section, and the reader may assume that the barriers for the other Build Alternative(s) under evaluation in that corridor would have the same physical and acoustical characteristics.

It is important to point out that the barrier analysis conducted for this EIS was conducted in an efficient manner, evaluating barriers in five-foot height increments. Where they would be on fill, barriers at heights from 15 feet to 30 feet (VDOT's maximum barrier height) were evaluated, and where they would be on bridge or elevated structure, heights from 10 feet to 25 feet were investigated, also in five-foot increments. This efficient processing does not allow for fine-tuning of reasonableness via the surface area per benefited receptor factor with a variety of barrier heights, as would be carried out in a noise abatement final design analysis. As a result, this analysis gives initial impressions of the potential cost-effectiveness of barriers for each CNE, but cannot and should not be construed as definitive findings about the eventual reasonableness of any of the noise barriers evaluated. As mentioned earlier, all noise-sensitive areas adjacent to the project corridor would be reevaluated for noise abatement in a much more detailed manner during the design phase of this project following this NEPA environmental documentation process. The barrier analysis was largely conducted separately for each CNE, unless the receptors in two adjacent CNEs clearly needed to be combined for a barrier evaluation. Barriers evaluated separately for adjacent CNEs may overlap somewhat near the border between the two CNEs. Therefore, if both barriers would be cost-reasonable where overlap occurs, the actual total barrier length may be somewhat less than the sum of the barrier lengths shown for the two barriers evaluated separately.

Details of each of the evaluated barriers are given in **Tables 6-2** through **6-6** and in narratives following the tables. Each of the barriers is also shown in **Figure 4-1** as a solid line. The color of the line indicates whether it would be reasonable and feasible (red), feasible and not reasonable (light blue), or not feasible (dark blue). Existing barriers are shown as orange lines. Where existing barriers would be replaced, the replacement barrier is shown adjacent to or on top of the existing barrier line.

The potential barriers evaluated and shown in the graphics have not been intentionally placed outside of VDOT right of way. While the need for right of way to construct some barriers for this project is not anticipated, it also cannot be precluded in the future, given the limited information available for this noise analysis. Final placement of barriers and determination of additional right of way needed will occur during the project's final design phase. In some cases, the potential barriers shown on the graphic indicate designs with significant length that do not meet either reasonableness criteria in order to make clear that the situation cannot yield a reasonable barrier but still provide the most insertion loss for impacted receptors.

**Table 6-2. Details of Replacement and Potential Noise Barriers – I-64 Corridor in Hampton and Norfolk**

| Barrier No. & Type (R/P)* | Build Alts. | Barrier Data | | | | | | Total Number of Impacted Receptors | Impacted and Benefited Receptors | Non-Impacted and Benefited Receptors | Total Benefited Receptors | Surface Area of Barrier per Benefited Receptor (SF/BR)* | Barrier Status* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noise Reduction (dBA) | | Length (ft) | Height Range (ft) | Surface Area* (sq ft) | Cost at $31/sq ft | | | | | | |
| | | Range | Avg. | | | | | | | | | | |
| **HAMPTON** | | | | | | | | | | | | | |
| AC-P | ABD | 5-8 | 6.1 | 5,477 | 15-20 | 98,608 | 3,056,848 | 32 | 32 | 21 | 53 | 1,861 | F & NR |
| AD-P | ABD | 5-8 | 6.9 | 2,228 | 15 | 33,424 | 1,036,144 | 11 | 11 | 7 | 18 | 1,857 | F & NR |
| AE-P | ABD | 5-7 | 6.0 | 1,018 | 10-15 | 13,260 | 411,060 | 2 | 2 | 0 | 2 | 6,630 | F & NR |
| AF/AG-P | ABD | 6-14 | 8.9 | 2,964 | 15-20 | 58,467 | 1,812,477 | 32 | 29 | 8 | 37 | 1,580 | F & R |
| AH/AI-R/P | ABD | 5-14 | 8.2 | 5,166 | 15 | 77,116 T<br>57,710 N | 2,390,596 | 47 | 40 | 105 | 145 | 532 T<br>398 N | F & R |
| AJ/AM-P | ABD | 5-11 | 8.3 | 4,369 | 15-25 | 86,202 | 2,672,262 | 43 | 43 | 54 | 97 | 889 | F & R |
| AN/AO-P | ABD | 5-9 | 6.3 | 4,662 | 10-15 | 58,821 | 1,823,451 | 46 | 46 | 32 | 78 | 754 | F & R |
| AQ/AR-P | ABD | 5-15 | 9.6 | 1,808 | 20 | 36,153 | 1,120,743 | 10 | 10 | 3 | 13 | 2,781 | F & NR |
| AT/AU-P | ABD | 5-13 | 7.1 | 2,589 | 15 | 38,833 | 1,203,823 | 16 | 16 | 40 | 56 | 693 | F & R |
| AW-P | ABD | 5-10 | 6.5 | 1,013 | 25-30 | 29,088 | 901,728 | 2 | 2 | 3 | 5 | 5,818 | F & NR |
| **NORFOLK** | | | | | | | | | | | | | |
| AZ/BA-P | ABD | 6-16 | 10.4 | 4,222 | 30 | 126,626 | 3,925,406 | 63 | 56 | 24 | 80 | 1,583 | F & R |
| BB/BC-P | ABD | 5-14 | 8.9 | 2,401 | 25 | 60,026 | 1,860,806 | 67 | 67 | 46 | 113 | 531 | F & R |
| BD/BE/BF/ BG-P | ABD | 5-16 | 9.8 | 9,458 | 20 | 189,118 | 5,862,658 | 273 | 268 | 335 | 603 | 314 | F & R |
| BI/BJ-P | ABD | 6-16 | 10.4 | 3,438 | 20-25 | 85,248 | 2,642,688 | 76 | 76 | 50 | 126 | 677 | F & R |
| BK-P | ABD | 5-10 | 6.6 | 1,807 | 15-20 | 29,225 | 905,975 | 35 | 35 | 136 | 171 | 171 | F & R |
| BN/BO-P | ABD | 6-11 | 8.6 | 2,487 | 15 | 37,288 | 1,155,928 | 25 | 25 | 76 | 101 | 369 | F & R |

| Barrier No. & Type (R/P)* | Build Alts. | Barrier Data | | | | | | Total Number of Impacted Receptors | Impacted and Benefited Receptors | Non-Impacted and Benefited Receptors | Total Benefited Receptors | Surface Area of Barrier per Benefited Receptor (SF/BR)* | Barrier Status* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noise Reduction (dBA) | | Length (ft) | Height Range (ft) | Surface Area* (sq ft) | Cost at $31/sq ft | | | | | | |
| | | Range | Avg. | | | | | | | | | | |
| BQ-P | ABD | 6-11 | 9.2 | 485 | 20 | 9,712 | 301,072 | 4 | 4 | 0 | 4 | 2,428 | F & NR |
| BR/BS-P | ABD | 5-10 | 7.9 | 1,987 | 15 | 29,808 | 924,048 | 41 | 41 | 28 | 69 | 432 | F & R |
| BT-P | ABD | 5-9 | 6.5 | 2,162 | 25 | 54,026 | 1,674,806 | 6 | 6 | 12 | 18 | 3,001 | F & NR |
| BU/BV-P | ABD | 6-7 | 6.3 | 721 | 25-30 | 20,304 | 629,424 | 7 | 5 | 0 | 5 | 4,061 | F & NR |
| BW-1-P | ABD | 5-11 | 6.5 | 4,344 | 25 | 105,339 | 3,265,509 | 60 | 28 | 77 | 105 | N/A | NF |
| BW-2-P | ABD | 5-12 | 7.4 | 1,985 | 25-30 | 59,109 | 1,882,379 | 19 | 18 | 23 | 41 | 1,442 | F & R |

** Notes:*
*- Barrier type R is Replacement, type P is Potential.*
*- Replacement barriers show T = Total surface area and SF/BR, and N = Net surface area and SF/BR, which excludes the existing barrier surface area*
*- Where Net SF/BR exceeds VDOT's maximum of 1600, a barrier would not be considered cost-reasonable*
*- Barrier Status: F & R – Feasible and Reasonable; F & NR – Feasible and Not Reasonable; NF – Not Feasible.*

**Table 6-3. Details of Replacement and Potential Noise Barriers – I-564 Corridor in Norfolk**

| Barrier No. & Type (R/P)* | Build Alts. | Barrier Data | | | | | | Total Number of Impacted Receptors | Impacted and Benefited Receptors | Non-Impacted and Benefited Receptors | Total Benefited Receptors | Surface Area of Barrier per Benefited Receptor (SF/BR)* | Barrier Status* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noise Reduction (dBA) | | Length (ft) | Height Range (ft) | Surface Area* (sq ft) | Cost at $31/sq ft | | | | | | |
| | | Range | Avg. | | | | | | | | | | |
| BZ-P | B, C, D | 5-7 | 5.4 | 6,251 | 10-15 | 89,016 | 2,759,496 | 14 | 14 | 93 | 107 | 832 | F & R |
| CA-R | C | 6-8 | 7.0 | 731 | 14-16 | 10,989 T<br>16 N | 340,659 | 8 | 8 | 1 | 9 | 1,221 T<br>2 N | F & R |

** Notes:*
*- Barrier type R is Replacement, type P is Potential.*
*- Replacement barriers show T = Total surface area and SF/BR, and N = Net surface area and SF/BR, which excludes the existing barrier surface area*
*- Where Net SF/BR exceeds VDOT's maximum of 1600, a barrier would not be considered cost-reasonable*
*- Barrier Status: F & R – Feasible and Reasonable; F & NR – Feasible and Not Reasonable; NF – Not Feasible.*

**Table 6-4. Details of Replacement and Potential Noise Barriers – VA 164 Corridor in Portsmouth**

| Barrier No. & Type (R/P)* | Build Alts. | Barrier Data | | | | | | Total Number of Impacted Receptors | Impacted and Benefited Receptors | Non-Impacted and Benefited Receptors | Total Benefited Receptors | Surface Area of Barrier per Benefited Receptor (SF/BR)* | Barrier Status* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noise Reduction (dBA) | | Length (ft) | Height Range (ft) | Surface Area* (sq ft) | Cost at $31/sq ft | | | | | | |
| | | Range | Avg. | | | | | | | | | | |
| **Portsmouth** | | | | | | | | | | | | | |
| CZ-R | B,D | 5-18 | 9.3 | 3,198 | 20 | 63,933 T<br>1,172 N | 1,981,923 | 76 | 76 | 176 | 252 | 254 T<br>5 N | F & R |
| DB-R | B,D | 5-16 | 9.2 | 3,402 | 15 | 51,004 T<br>752 N | 1,581,124 | 191 | 191 | 322 | 513 | 99 T<br>1 N | F & R |
| DC-R/P | B,D | 5-20 | 10.8 | 4,801 | 25 | 120,013 T<br>42,848 N | 3,720,403 | 225 | 225 | 497 | 722 | 166 T<br>59 N | F & R |
| DD-R | B,D | 5-18 | 10.4 | 4,797 | 25 | 119,894 T<br>13,402 N | 3,716,714 | 53 | 53 | 157 | 210 | 571 T<br>64 N | F & R |
| DF-P | B,C,D | 5-8 | 6.4 | 801 | 30 | 24,004 | 744,124 | 1 | 1 | 1 | 2 | 12,002 | F & NR |

** Notes:*
*- Barrier type R is Replacement, type P is Potential.*
*- Replacement barriers show T = Total surface area and SF/BR, and N = Net surface area and SF/BR, which excludes the existing barrier surface area*
*- Where Net SF/BR exceeds VDOT's maximum of 1600, a barrier would not be considered cost-reasonable*
*- Barrier Status: F & R – Feasible and Reasonable; F & NR – Feasible and Not Reasonable; NF – Not Feasible.*

**Table 6-5. Details of Replacement and Potential Noise Barriers – I-664 Corridor, Southside**

| Barrier No. & Type (R/P)* | Build Alts. | Barrier Data | | | | | | Total Number of Impacted Receptors | Impacted and Benefited Receptors | Non-Impacted and Benefited Receptors | Total Benefited Receptors | Surface Area of Barrier per Benefited Receptor (SF/BR)* | Barrier Status* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noise Reduction (dBA) | | Length (ft) | Height Range (ft) | Surface Area* (sq ft) | Cost at $31/sq ft | | | | | | |
| | | Range | Avg. | | | | | | | | | | |
| **Chesapeake** | | | | | | | | | | | | | |
| CE-P | C,D | 5-7 | 5.4 | 1,601 | 20 | 32,002 | 992,062 | 7 | 4 | 6 | 10 | 3,200 | F & NR |
| CG-P | C,D | 0 | 0.0 | 201 | 30 | 6,030 | 186,930 | 1 | 0 | 0 | 0 | N/A | NF |
| CH-P | C,D | 5-9 | 6.5 | 1,599 | 20 | 31,972 | 991,132 | 6 | 6 | 2 | 8 | 3,997 | F & NR |
| CI-P | C,D | 5-10 | 6.8 | 2,200 | 15 | 32,999 | 1,022,969 | 5 | 5 | 3 | 8 | 4,125 | F & NR |
| CJ-P | C,D | 5-10 | 7.0 | 1,802 | 15 | 27,010 | 837,310 | 8 | 8 | 10 | 18 | 1,501 | F & R |
| CK-P | C,D | 8 | 8.0 | 401 | 15 | 6,005 | 186,155 | 1 | 1 | 0 | 1 | 6,005 | F & NR |
| CL-CN-P | C,D | 5-16 | 10.8 | 4,172 | 25 | 104,286 | 3,232,866 | 64 | 64 | 62 | 126 | 828 | F & R |
| CM-P | C,D | 5-13 | 9.1 | 4,570 | 15 | 68,543 | 2,124,833 | 34 | 34 | 64 | 98 | 699 | F & R |
| CO-P | C,D | 5-7 | 5.8 | 601 | 15 | 9,015 | 279,465 | 2 | 2 | 0 | 2 | 4,508 | F & NR |
| CQ-P | C,D | 5-14 | 10.2 | 6,000 | 25 | 150,008 | 4,650,248 | 117 | 105 | 167 | 272 | 552 | F & R |
| CS-P | C,D | 5-13 | 8.6 | 1,403 | 20 | 28,043 | 869,333 | 11 | 11 | 13 | 24 | 1,168 | F & R |
| CT-P | C,D | 5-8 | 5.7 | 1,795 | 25 | 44,877 | 1,391,187 | 4 | 4 | 2 | 6 | 7,480 | F & NR |
| CU-P | C,D | 5-13 | 7.7 | 1,994 | 20 | 39,876 | 1,236,156 | 21 | 21 | 33 | 54 | 738 | F & R |
| **Suffolk** | | | | | | | | | | | | | |
| CV-P | B,C,D | 5-9 | 6.1 | 2,599 | 30 | 78,002 | 2,418,062 | 8 | 8 | 44 | 52 | 1,500 | F & R |
| CW-P | B,C,D | 5-15 | 8.7 | 1,801 | 30 | 53,998 | 1,673,938 | 72 | 72 | 117 | 189 | 286 | F & R |
| CWA-P | B,C,D | 5 | 5.2 | 1,599 | 30 | 47,993 | 1,487,783 | 4 | 1 | 0 | 1 | N/A | NF |
| CX-P | B,C,D | 5-15 | 8.6 | 5,743 | 20 | 114,874 | 3,561,094 | 65 | 65 | 123 | 188 | 611 | F & R |

| Barrier No. & Type (R/P)* | Build Alts. | Barrier Data | | | | | | Total Number of Impacted Receptors | Impacted and Benefited Receptors | Non-Impacted and Benefited Receptors | Total Benefited Receptors | Surface Area of Barrier per Benefited Receptor (SF/BR)* | Barrier Status* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noise Reduction (dBA) | | Length (ft) | Height Range (ft) | Surface Area* (sq ft) | Cost at $31/sq ft | | | | | | |
| | | Range | Avg. | | | | | | | | | | |

** Notes:*
*- Barrier type R is Replacement, type P is Potential.*
*- Replacement barriers show T = Total surface area and SF/BR, and N = Net surface area and SF/BR, which excludes the existing barrier surface area*
*- Where Net SF/BR exceeds VDOT's maximum of 1600, a barrier would not be considered cost-reasonable*
*- Barrier Status: F & R – Feasible and Reasonable; F & NR – Feasible and Not Reasonable; NF – Not Feasible.*

**Table 6-6. Details of Replacement and Potential Noise Barriers – I-664 Corridor, Peninsula**

| Barrier No. & Type (R/P)* | Build Alts. | Barrier Data | | | | | | Total Number of Impacted Receptors | Impacted and Benefited Receptors | Non-Impacted and Benefited Receptors | Total Benefited Receptors | Surface Area of Barrier per Benefited Receptor (SF/BR)* | Barrier Status* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noise Reduction (dBA) | | Length (ft) | Height Range (ft) | Surface Area* (sq ft) | Cost at $31/sq ft | | | | | | |
| | | Range | Avg. | | | | | | | | | | |
| **NEWPORT NEWS** | | | | | | | | | | | | | |
| DI-P | C, D | 5-8 | 6.4 | 2,440 | 25 | 61,022 | 1,891,682 | 3 | 3 | 18 | 21 | 2,906 | F & NR |
| DJ-P | C, D | 5-7 | 6.6 | 1,443 | 15 | 21,627 | 670,437 | 8 | 8 | 18 | 26 | 832 | F & R |
| DK-P | C, D | 5-14 | 9.1 | 1,252 | 10-15 | 17,822 | 552,482 | 16 | 16 | 6 | 22 | 810 | F & R |
| DL-P | C, D | 5-9 | 7.7 | 1,332 | 25 | 33,310 | 1,032,610 | 15 | 15 | 9 | 24 | 1,388 | F & R |
| DM/DN/DQ-P | C, D | 5-14 | 9.6 | 9,255 | 25-30 | 276,533 | 8,572,523 | 145 | 130 | 439 | 569 | 486 | F & R |
| DO/DP-R/P | C, D | 5-12 | 7.6 | 5,145 | 20 | 102,923 T<br>69,520 N | 3,190,613 | 115 | 112 | 310 | 422 | 244 T<br>165 N | F & R |
| **HAMPTON** | | | | | | | | | | | | | |
| DR-P | C, D | 5-14 | 8.9 | 2,357 | 20 | 47,130 | 1,461,030 | 45 | 45 | 75 | 120 | 393 | F & R |
| DS-P | C, D | 5-14 | 8.6 | 2,883 | 25 | 72,065 | 2,234,015 | 16 | 16 | 49 | 65 | 1,109 | F & R |
| DT/DU/DW - R/P | C, D | 5-14 | 7.5 | 5,394 | 16 | 86,330 T<br>29,750 N | 2,676,230 | 71 | 70 | 186 | 256 | 337 T<br>116 N | F & R |
| DV/DX-R/P | C, D | 5-15 | 9.4 | 4,727 | 16 | 75,603 T<br>48,873 N | 2,343,693 | 82 | 82 | 76 | 158 | 479 T<br>309 N | F & R |

** Notes:*
*- Barrier type R is Replacement, type P is Potential.*
*- Replacement barriers show T = Total surface area and SF/BR, and N = Net surface area and SF/BR, which excludes the existing barrier surface area*
*- Where Net SF/BR exceeds VDOT's maximum of 1600, a barrier would not be considered cost-reasonable*
*- Barrier Status: F & R – Feasible and Reasonable; F & NR – Feasible and Not Reasonable; NF – Not Feasible.*

**Potential and Replacement Barriers – I-64 Corridor in Hampton**

**Barrier AC-P** is a potential noise barrier system covering CNE AC, which is located directly north of the northern terminus of I-664 at I-64, and contains both multi-family residences as well as the Hampton Coliseum concert venue. Shown in Figure 4-1, Sheets 1 and 2, the barrier system would consist of five segments: three along the I-64 westbound mainline and two covering the I-64 westbound interchange flyover ramps. With the system, 32 impacted receptors would be benefited with 5 to 8 decibels of noise reduction as well as 21 additional non-impacted receptors with 5 to 6 decibels of noise reduction. With Alternatives A, B and D, Barrier AC-P would be 5,477 feet in length with a surface area of 98,608 square feet. All barrier portions on ground would be 20 feet tall, while all on structure would be 15 feet. This barrier system is feasible, but not reasonable. Although the barrier would meet the 7 decibel noise reduction goal, the surface area per benefited receptor is 1,861, surpassing the maximum value of 1,600.

**Barrier AD-P** is a potential noise barrier for single-family residences on Red Robin Turn in CNE AD, which is located on the eastbound side of I-64 and on the northbound side of I-664. It is shown in Figure 4-1, Sheets 2 and 3. All eleven impacted and seven additional non-impacted residences would be benefited with noise reductions of 5 to 8 decibels. With Alternatives A, B and D, the barrier would be 15 feet height and 2,228 feet long with a surface area of 33,424 square feet. While this potential barrier would be feasible, and would meet the 7 decibel noise reduction goal, it would not be reasonable because it has a surface area per benefited receptor of 1,857, which exceeds VDOT's maximum SF/BR of 1,600.

**Barrier AE-P** is a potential noise barrier system for a basketball court and swing set associated with a multi-family complex at the northwest corner of CNE AE, which is located south of eastbound I-64 and west of LaSalle Avenue. It is shown in Figure 4-1, Sheet 3. One recreational receptor was assigned to each of these two recreational facilities. The basketball court would receive 7 decibels of noise reduction from the barrier system, and the swing set would receive 5 decibels of reduction. The barrier system would contain two barrier segments: a 15 foot tall section along the eastbound I-64 mainline spanning 617 feet, and a 10 foot tall section along the off ramp to LaSalle Avenue spanning 401 feet. The total square footage of the system would be 13,260 feet, with a surface area per benefited receptor of 6,630. The barrier would meet the 7 decibel noise reduction design goal, but because the SF/BR ratio exceeds VDOT's maximum value of 1,600, Barrier AE-P is feasible but not reasonable.

**Barrier AF/AG-P** is a potential noise barrier for CNEs AF and AG, shown in Figure 4-1, Sheets 3 and 4. Located south of eastbound I-64, CNE AG spans from Rip Rap Road to N Armistead Avenue, and CNE AF extends from Armistead Avenue to LaSalle Ave. Both CNEs contain primarily single-family residences, although AF also has Category D interior use at Hampton Family YMCA and Perfecting Saints Church, which are not predicted to be impacted. The barrier would provide benefits of 6 to 14 decibels of noise reduction for 29 of the 32 impacted receptors, as well as 6 to 7 decibels of noise reduction for 8 other non-impacted receptors. Three of the impacted receptors are not benefited due to their close proximity to Armistead Avenue, which is unshielded. Barrier AF/AG-P would be 2,964 feet in length and have a height of 15 feet when on structure and 20 feet when on the ground. The barrier meets the 7 decibel noise reduction design goal for many impacted receivers. Its surface area would be 58,467 square feet and the surface area per benefited receptor 1,580, making the barrier both feasible and reasonable.

**Barrier AH/AI-R/P** is a combination replacement and potential barrier system for CNEs AH and AI, which are located along the westbound side of I-64, southeast of the North Armistead Avenue (Route 134) interchange. The barriers are shown in Figure 4-1, Sheets 3, 4 and 5. CNEs AH and AI primarily contain residential land use, as well as recreational land use and an outdoor activity area associated with a

commercial establishment. CNE AH and the western portion of CNE AI are behind an existing noise barrier, while the eastern portion of CNE AI has no existing noise barrier. The existing noise barrier is 5 to 9 feet in height and 2,651 feet long with a surface area of 19,406 square feet. With Alternatives A, B and D (and the existing noise barrier in place), noise levels are expected to approach or exceed the NAC at 14 dwelling units behind the existing noise barrier, plus another 32 residential units and one recreational unit in the eastern portion of CNE AI. While the Project would not impact the existing noise barrier (there are no proposed roadway improvements in this area), VDOT policy is to examine the feasibility and reasonableness of the existing noise barrier with the Build Alternative(s). If the existing noise barrier were removed, 48 residential receptors *in CNE AH and the eastern portion of CNE AI* would be exposed to impact with Alternatives A, B and D. Since the existing noise barrier would benefit only 22 of the 48 impacted receptors in this hypothetical scenario, the existing noise barrier would not meet VDOT's acoustical feasibility goal. Therefore, the Project must consider a *replacement* noise barrier for *CNE AH* and the *western portion of CNE AI*. With Alternatives A, B and D and *the existing noise barrier*, a total of 47 residential and recreational units *throughout all of CNEs AH and AI* would be impacted. Barrier AH/AI-R/P would benefit 40 of the 47 impacted units. One impacted/non-benefited receptor is located at the west end of the replacement barrier and has a line of sight to traffic on North Armistead Avenue. Predicted noise levels at the other six impacted/non-benefited receptors are dominated by traffic on Rip Rap Road. With Alternatives A, B and D, Barrier AH/AI-R/P would be 15 feet high and 5,166 feet long with a total surface area of 77,116 square feet. This replacement/potential noise barrier would benefit another 105 non-impacted units. Barrier AH/AI-R/P would provide an average insertion loss of 8.2 decibels and meet VDOT's 7 decibel noise reduction goal. With a total surface area per benefited receptor (SF/BR) of 532, and a net SF/BR of 398, Barrier AH/AI-R/P would be both feasible and reasonable.

**Barrier AJ/AM-P** is a potential noise barrier for single family residences in CNE AJ, as well as single family residences, an apartment complex and a marina in CNE AM. They are shown in Figure 4-1, Sheets 5 and 6. Both CNEs are located south of eastbound I-64, CNE AJ being between N King Street and the Hampton River and CNE AM including both the Hampton River itself and all receptors off of Brough Lane. The barrier would benefit 43 impacted receptors with 7 to 12 decibels of noise reduction as well as 54 additional receptors with 5 to 11 decibels of noise reduction. Barrier AJ/AM-P provides an average weighted insertion loss of 8.3 decibels and meets VDOT's 7-decibel noise reduction goal. The height would vary between 15, 20 and 25 feet – near CNE AJ, 15 feet for sections on structure and 20 feet for those on the ground, and near CNE AM, 20 feet for sections on structure and 25 feet on ground. The length would be 4,369 feet, and the total surface area 86,202 square feet. With the surface area per benefited receptor of 889, Barrier AJ/AM-P would be both feasible and reasonable.

**Barrier AN/AO-P** is a potential noise barrier for CNEs AN/AO located along westbound I-64, shown in Figure 4-1, Sheets 6 and 7. CNE AN contains single-family residences on South Boxwood Street and Magnolia Place. Woodlands Golf Course and Hampton Tennis Center are located northwest of Woodland road in CNE AO. Barrier AN/AO-P would benefit all 46 impacted receptors and 32 additional non-impacted receptors with a noise reduction of 5 to 9 decibels, and meet the 7-decibel noise reduction design goal. With Alternatives A, B and D, the potential barrier would be 10 feet high for sections on structure and 15 feet high for ground-mounted sections. The barrier would be 4,662 feet in length, have a surface area of 58,821 square feet, and have a surface area per benefited receptor of 754, making it both feasible and reasonable.

**Barrier AQ/AR-P** is a potential noise barrier for CNE AQ/AR located between Route 143/I-64 EB on-ramp and Emancipation Drive, shown in Figure 4-1, Sheet 7. Within the CNEs is Hampton University Baseball

Stadium (CNE AQ) and single-family residences (CNE AR). The potential barrier would benefit ten impacted and three non-impact receptors with a noise reduction of 5 to 15 decibels. With Alternative A, B, and D the barrier would be 20 feet high, 1,808 feet in length, and have a surface area of 36,153 square feet. While this potential barrier would be feasible and meet the 7-decibel noise reduction design goal, it would not be reasonable because it has a surface area per benefited receptor of 2,781, which exceeds VDOT's maximum SF/BR of 1,600.

**Barrier AT/AU-P** is a potential noise barrier for CNE AT/AU along westbound I-64, shown in Figure 4-1, Sheets 7 and 8. Hampton National Cemetery, Phoebus Addition is located in CNE AT on West Country Street and Bainbridge Avenue. CNE AU also contains single-family residences on Cameron Street. The potential barrier extends from the South Mallory Street/I-64 WB on-ramp to the I-64 WB/Woodland Road off-ramp and would benefit 16 impacted and 40 non-impact receptors with a noise reduction of 5 to 13 decibels. With Alternatives A, B and D, the most cost-effective barrier that meets the 7-decibel noise reduction design goal for all receptors would be 15 feet high and 2,589 feet in length. The barrier would have a surface area of 38,883 square feet and a surface area per benefited receptor of 694, making it both feasible and reasonable.

**Barrier AW-P** is a potential noise barrier for the southern portion of CNE AW located along westbound I-64, and is shown in Figure 4-1, Sheet 8. The northern portion is mitigated with an existing barrier that is not affected by the project, and is expected to remain in place without modification. CNE AW contains single-family residences bordered by South Mallory Street, Downes Street, and Mill Creek. Barrier AW-P would benefit two impacted receptors with 7 to 10 decibels of noise reduction and three additional receptors with 5 decibels of noise reduction. With Alternatives A, B and D, the most cost-effective potential barrier would be 25 feet high for sections on structure and 30 feet high for ground-mounted sections. The barrier would be 1,013 feet in length and have a surface area of 29,088 square feet. While this potential barrier would be feasible and meet the noise reduction design goal, it would not be reasonable because it has a surface area per benefited receptor of 5,818, which exceeds VDOT's maximum SF/BR of 1,600.

**I-64 Corridor in Norfolk**

**Barrier AZ/BA-P** is a potential barrier system for CNEs AZ and BA, which are located along the eastbound side of I-64, along Bayville Street, and shown in Figure 4-1, Sheets 11 and 12. CNE AZ contains recreational land use – Willoughby Harbor Marina. CNE BA contains single and multifamily homes in addition to one recreational center off Bayville Street and 13th View Street. The barrier would benefit 56 impacted receptors with a noise reduction 6-16 decibels, and an additional 24 receptors with a noise reduction 5 to 10 decibels. With Alternatives A, B and D, Barrier AZ/BA-P would be 30 feet high and 4,222 feet long with a surface area of 126,626 square feet. This potential noise barrier would meet the 7-decibel noise reduction design goal, and would be feasible and reasonable with a surface area per benefited receptor of 1,583.

**Barrier BB/BC-P** is a potential noise barrier along the westbound side of I-64 for CNEs BB and BC, shown in Figure 4-1, Sheet 11. CNE BB is a recreational beach area at the west end of Willoughby spit. CNE BC consists of single- and multifamily houses directly west of 15th View street. The barrier would benefit all 67 impacted receptors with a noise reduction of 6 to 14 decibels, and an additional 46 receptors with a noise reduction of 5 to 10 decibels. With Alternatives A, B and D, Barrier BB/BC-P would be 25 feet high (the maximum height considered for noise barriers on structure) and 2,401 feet long with a surface area of 60,026 square feet. This potential noise barrier would meet the 7-decibel noise reduction design goal, and would be feasible and reasonable with a surface area per benefited receptor of 531.

**Barrier BD/BE/BF/BG-P** is a potential noise barrier for CNEs BD, BE, BF and BG all of which are located along the westbound side of I-64 along Willoughby Spit. The barrier is shown in Figure 4-1, Sheets 11, 12, 13 and 14. Single- and multi-family housing is located between 15th View Street and 13th view street (CNE BD), and between 13th View Street and Little Bay Avenue (CNE BE). CNE BF includes Captain's Quarters Nature Center and Park. Single- and multifamily housing are located in CNE GD along West Ocean View Avenue, between Captain's Quarters Recreation center and 4th View Street. The barrier would benefit 268 impacted receptors and 335 additional receptors with a noise reduction of 5 to 16 decibels. With Alternatives A, B and D, Barrier BD/BE/BF/BG-P would be 20 feet high and 9,458 feet long with a surface area of 189,118 square feet. This potential noise barrier would meet the 7-decibel noise reduction design goal, and would be feasible and reasonable with a surface area per benefited receptor of 314.

**Barrier BI/BJ-P** is a potential noise barrier for CNEs BI and BJ, both of which are entirely residential and are located along the eastbound side of I-64. The barrier is shown in Figure 4-1, Sheets 14 and 15. CNE BI consists of a Military Housing Complex at Willoughby Bay, while CNE BJ contains single family residences between Orange Avenue and Ridgewell Avenue. The barrier would benefit all 76 impacted receptors with a noise reduction of 6 to 16 decibels, along with 50 additional receptors with a noise reduction of 7 to 12 decibels. With Alternatives A, B and D, Barrier BI/BJ-P would be 25 feet tall for segments on the ground and 20 feet tall for those on structure. The barrier would be 3,438 feet in length and would have a surface area of 85,248 feet, with a surface area per benefited receptor of 677. This barrier would meet the 7-decibel noise reduction design goal, and would be feasible and reasonable.

**Barrier BK-P** is a potential noise barrier for CNE BK, which is located along the eastbound side of I-64 directly north of Bay Avenue and includes residential land use and place of worship – First View Baptist Church. The barrier is shown in Figure 4-1, Sheets 15 and 16. The barrier would benefit 35 impacted residential receptors with 6 to 10 decibels of noise reduction, and an additional 136 receptors with 5 to 10 decibels of noise reduction. With Alternatives A, B and D, Barrier BK-P would be 15 feet tall for portions on structure and 20 feet tall for portions on the ground. It would be 1,807 feet long and have a surface area of 29,225 square feet. This potential noise barrier would meet the 7-decibel noise reduction design goal, and would be feasible and reasonable with a surface area per benefited receptor of 171.

**Barrier BN/BO-P** is a potential noise barrier system for CNE BO and the southernmost receptors in CNE BN, and is shown in Figure 4-1, Sheets 15 and 16. The northern receptors in BN are not impacted and are benefited by an existing barrier that would remain in place, to which Barrier BN/BO would connect. Both CNEs consist of single family residences along the westbound side of I-64. CNE BO spans from W Bay Avenue to Mace Arch and the southern receptors of CNE BN run from Mace Arch to 1st View Street – the northern receptors of CNE BN, running to W. Government Avenue, are benefited by the existing barrier. Aircraft noise is present in the area due to the proximity of Norfolk Naval Air Station, but it has not been accounted for directly in the noise barrier analysis. The noise reduction benefits of the potential noise barrier would only apply to the highway noise; it is not expected to reduce aircraft noise to any appreciable degree. Barrier BN/BO would be 15 feet tall and benefit 25 receptors with 9 to 11 decibels of noise reduction, along with an additional 76 receptors with 6 to 10 decibels of noise reduction. With Alternatives A, B and D, this barrier would be 2,487 feet in length and have a surface area of 37,288 square feet. The barrier would meet the 7-decibel noise reduction design goal, and has a surface area per benefited receptor of 369, making it both feasible and reasonable.

**Barrier BQ-P** is a potential noise barrier for the four northernmost receptors in CNE BQ. The southern receptors in this CNE are benefited by an existing barrier that would remain in place without modification, behind which there is no predicted noise impact. The northernmost receptors are all single-family residences located along the eastbound side of I-64 and northernmost part of Commodore Drive. Aircraft noise is present in the area due to the proximity of Norfolk Naval Air Station, but it has not been accounted for directly in the noise barrier analysis. The noise reduction benefits of the potential noise barrier would only apply to the highway noise; it is not expected to reduce aircraft noise to any appreciable degree. This barrier would benefit each of the four receptors with a noise reduction of 6 to 11 decibels. With Alternatives A, B and D, the barrier would be 20 feet tall with a surface area of 9,712 square feet. Barrier BQ-P would be feasible and would meet the 7-decibel noise reduction design goal, but it is not reasonable, due to its surface area per benefited receptor of 2,428, which exceed VDOT's maximum value of 1,600.

**Barrier BR/BS-P** is a potential noise barrier for CNE BS and the southern half of CNE BR, both of which are located along the eastbound side of I-64. The barrier is shown in Figure 4-1, Sheet 17. CNE BR is benefited by an existing barrier that would remain in place without modification. CNE BS is on the south side of Oastes Creek and contains a baseball field, while CNE BR is on the north side of Oastes Creek and includes single and multi-family residences. Aircraft noise is present in the area due to the proximity of Norfolk Naval Air Station, but it has not been accounted for directly in the noise barrier analysis. The noise reduction benefits of the potential noise barrier would only apply to the highway noise; it is not expected to reduce aircraft noise to any appreciable degree. Barrier BR/BS-P would benefit all 41 impacted receptors, 35 residential and 6 in the baseball field, with a noise reduction of 7 to 10 decibels. In addition, 28 other receptors would be benefited with a noise reduction of 5 to 10 decibels. With Alternatives A, B and D, the barrier would be 15 feet height and 1,987 feet long with a surface area of 29,808 square feet. This potential noise barrier would be feasible and meet the 7-decibel noise reduction design goal, and it would have a surface area per benefited receptor of 432, making it reasonable.

**Barrier BT-P** is a potential noise barrier for CNE BT, a military baseball field on Navy property along Patrol Road near the I- 564 interchange, west of I-64. It is shown in Figure 4-1, Sheets 18 and 19. The barrier would benefit 6 impacted recreational receptors with a noise reduction of 7 to 9 decibels, and 5 to 7 decibels for 12 non-impacted receptors. With Alternatives A, B and D, Barrier BT-P would be 25 feet high and 2,162 feet long with a surface area of 54,026 square feet. While this potential barrier would be feasible and it would meet the 7-decibel noise reduction design goal, it would not be reasonable because it has a surface area per benefited receptor of 3,001, which exceeds VDOT's maximum SF/BR of 1600.

**Barrier BU/BV-P** is a potential noise barrier for CNE BV and the two southernmost receptors of CNE BU, shown in Figure 4-1, Sheet 17. The northern receptors in CNE BU are benefited by an existing barrier that can remain in place without modification. Both CNEs are located along the eastbound side of I-64 and contain single family residences. The homes in CNE BV are located between the south edge of E Bayview Boulevard and the I-64 WB on-ramp from Granby Street, while the two receptors in BU are directly north of East Bayview Boulevard. The impacted first-row receptors along and east of Granby Street cannot be benefited with 5 dB of insertion loss from a barrier along I-64 due to the contribution of traffic noise from Granby Street. At an example of these receptors, BV-12, the total predicted Leq sound level from Alt. B without a barrier is 68.6 dBA. The predicted sound level from Granby Street alone is 65.9 dBA, approximately 3 decibels less than the total. This shows that a net 5-decibel reduction cannot be achieved at this receiver or at the other receptors along Granby Street at similar distances,

even if the noise from I-64 were completely eliminated by a barrier. Barrier BU/BV was investigated to benefit the receptors between I-64 and Granby Street. Also, aircraft noise is present in the area due to the proximity of Norfolk Naval Air Station, but it has not been accounted for directly in the noise barrier analysis. The noise reduction benefits of the potential noise barrier would only apply to the highway noise; it is not expected to reduce aircraft noise to any appreciable degree. The barrier would benefit 5 of 7 impacted receptors with a noise reduction of 6 to 7 decibels. Greater benefit is not achievable due to the traffic noise contribution from Granby Street. With Alternatives A, B and D, the length of the potential barrier would be 721 feet, and the height would be 30 feet for sections on ground and 25 feet for sections on structure. This potential barrier would meet the noise reduction design goal of 7 decibels, and while it would be feasible, it would not be reasonable because it has a surface area per benefited receptor of 4,061, which exceeds VDOT's maximum SF/BR of 1600.

**Barrier BW-1-P** is a potential noise barrier system for the northern portion of CNE BW, Forest Lawn Cemetery and a Girl Scouts of the Colonial Coast facility, along Granby Street, east of I-64. The barrier system is shown in Figure 4-1, Sheets 17 and 18. The barrier would only benefit 28 of the 60 impacted receptors with a noise reduction of 5 to 11 decibels. The limited benefit is due to the contribution of traffic noise from Granby Street (Route 460), which is parallel to and east of I-64, between the barrier and the cemetery receptors. The first-row receivers in the cemetery along Granby Street cannot be benefited with 5 dB of insertion loss from a barrier along I-64 due to the Granby Street contribution. The table below shows the sound levels without a barrier at five of the first-row receivers in the cemetery along Granby Street. The table shows three sound levels for each receiver, the total, the levels from I-64 alone and the levels from Granby Street alone. At most of the receivers, the sound level from Granby Street alone is nearly as high as that from I-64 alone, and averages 3 to 4 decibels less than the total. This shows that a net 5-decibel reduction cannot be achieved at these receivers, or at the other receptors along Granby Street at similar distances, even if the noise from I-64 were completely eliminated by a barrier. An additional 77 non-impacted receivers would benefit with 5 to 8 decibels of noise reduction. With Alternatives A, B and D, Barrier BW-1-P would be 25 feet high and 4,344 feet long with a surface area of 105,339 square feet. However, this barrier fails to meet VDOT's feasibility requirement because it does not benefit at least 50percent of impacted receptors.

| Receiver ID. | Predicted Leq Noise Level, Alternative B, dBA | | |
|---|---|---|---|
| | Total | I-64 Only | Granby St. Only |
| BW-33 | 68.4 | 65.9 | 64.8 |
| BW-38 | 68.1 | 65.5 | 64.6 |
| BW-44 | 68.2 | 65.8 | 64.5 |
| BW-50 | 67.7 | 65.0 | 64.4 |
| BW-56 | 67.3 | 64.4 | 64.2 |
| BW-61 | 67.1 | 65.5 | 62.0 |

**Barrier BW-2-P** is a potential noise barrier for the southern portion of CNE BW, Forest Lawn Cemetery, northeast of I-64; it is shown in Figure 4-1, Sheet 18. The barrier would benefit 18 of the 19 impacted receptors with a noise reduction of 5 to 12 decibels. An additional 23 non-impacted receivers would benefit with 5 to 8 decibels of noise reduction. With Alternatives A, B and D, Barrier BW-2-P would be 30 feet in height for sections on ground and 25 feet for sections on structure. The barrier would be 1,985 feet long with a surface area of 59,109 square feet. This barrier meets VDOT's feasibility and

reasonableness requirements, meeting the 7 dBA noise reduction design goal at 17 impacted receptors, and with a surface area per benefited receptor of 1,442.

**I-564 Corridor in Norfolk**

**Barrier BZ-P** is a potential noise barrier system for CNE BZ located southwest of I-564/I-64 interchange near Bradford Street, shown in Figure 4-1, Sheets 19 and 20. CNE BZ contains singe- and multifamily residences and the Sterling Oaks swimming pool. The barrier system contains one segment along the I-564 eastbound lanes, one along eastbound Terminal Boulevard flyover ramp, one along the I-564 eastbound off-ramp, and one along I-564/Granby Street off-ramp. All barrier segments are necessary to obtain maximum a noise reduction of 5 to 7 decibels for 14 impacted receptors and 93 additional receptors. The noise reduction provided by this system of barriers is limited by the contribution of freight train noise to the predicted sound levels. The train noise was included in the preliminary modeling for this corridor, and it would be also be included in the modeling for the detailed final design noise study. During final design, alternate noise barrier locations also would be evaluated. With Alternatives B, C and D, Barrier system BZ-P would be 10 feet high for sections on structure and 15 feet high for ground-mounted sections. The barrier would meet the 7 dB insertion loss noise reduction design goal, be 6,251 feet in length, have a surface area 89,016 square feet, and have a surface area per benefited receptor of 832, making it both feasible and reasonable.

**Barrier CA-R** is a *relocated* noise barrier planned for the I-564 Intermodal Connector project, located along the eastbound lanes of I-564 just south of the proposed Connector. The barrier is shown in Figure 4-1, Sheets 20 and 21. In the Final Design Noise Technical Report for the Intermodal Connector Project (Jacobs, 2015), a noise barrier (Barrier 4) was found to be feasible and reasonable for eight impacted recreational units between Mogadishu Street and Ingersol Street. Only Build Alternative C under consideration for the HRCS Project would impact the location of that noise barrier. Since Barrier 4 from the I-564 IC Project has not yet been constructed, a *relocated* noise barrier (rather than a replacement noise barrier) was evaluated in this study for those same impacted recreational units. It was assumed that the construction of this barrier would be delayed until a decision is made about the outcome of the HRCS, therefore no demolition factor was included. Barrier CA-R provides 6 to 8 decibels of noise reduction for eight impacted recreational receptors and one additional non-impacted recreational receptor, and would meet the 7-decibel noise reduction design goal. The noise reduction provided by the relocated barrier is limited by the contribution of freight train noise to the predicted sound levels. With Alternative C only, Barrier CA-R would be 14 to 16 feet high and 731 feet long, with a surface area of 10,989 square feet. The square-foot per benefited receptor (SF/BR) value for this barrier is 1,221. Note that Barrier 4 in the I-564 IC Project was 14 to 16 feet high and 724 feet long, with a surface area of 10,973 square feet and a SF/BR value of 1,372.

**VA 164 Corridor in Portsmouth**

**Barrier CZ-R** is a replacement barrier that would be located in CNE CZ, the single-family residence and townhome neighborhood to the north of the westbound lanes of VA 164 adjacent to Alternatives B and D. The barrier is shown in Figure 4-1, Sheet 26. Barrier CZ would replace the existing barrier along the mainline of VA 164 where it is being widened, but the eastern end would be connected to the section of the existing barrier that would remain in place along the ramp to Towne Point Road, and the western end of Barrier CZ would be connected to the section of the existing barrier that would remain in place perpendicular to VA 164 west of the western end of Old Farm Road. Barrier CZ-R would benefit all 76 impacted receptors as well as 176 non-impacted receptors, bringing the total number of benefits to 252. Barrier CZ-R would be 20 feet high and 3,198 feet long with a surface area of 63,933 square feet and

provide 5 to 18 decibels of noise reduction at benefited receptors. Barrier CZ-R would be feasible because it would benefit at least 50 percent of impacted receptors. Also, the barrier would meet the 7-decibel noise reduction design goal, and with a net surface area per benefited receptor of 5, Barrier CZ-R would be reasonable.

The surface area of the existing barrier to be removed is 62,761 square feet. Barrier CZ-R would be 1,172 square feet greater than the existing barrier. This barrier would be both feasible and reasonable.

**Barrier DB-R** is a replacement barrier that would be located in CNE DB, the motel and neighborhood to the south of the eastbound lanes of VA 164 adjacent to Alternatives C and D; it is shown in Figure 4-1, Sheet26 and 28. Barrier DB would replace the existing barrier along the mainline of VA 164 where it is being widened, but it would be connected to the existing barrier, which would remain in place along the ramps to the cross streets. Barrier DB-R would benefit all 191 impacted receptors as well as 322 non-impacted receptors, benefiting a total of 513. Barrier DB-R would be 15 feet high and 3,402 feet long with a surface area of 51,004 square feet and provide 5 to 16 decibels of noise reduction at benefited receptors. Barrier DB-R would be feasible because it would benefit at least 50 percent of impacted receptors, and it would meet the 7-decibel noise reduction design goal. Also, with a net surface area per benefited receptor of 1, Barrier DB-R would be reasonable.

The surface area of the existing barrier to be removed is 50,252 square feet. Barrier DB-R would be 752 square feet larger than the existing barrier. This barrier would be both feasible and reasonable.

**Barrier DC-R/P** is a replacement/potential barrier that would be located in CNE DC, the neighborhood to the north of the westbound lanes of VA 164 adjacent to Alternatives B and D. The barrier is shown on Figure 4-1, Sheets 27, 29 and 30. Barrier DC would replace the existing barrier along the mainline of VA 164 where it is being widened, but it would be connected to the existing barrier, which would remain in place along the ramps to the cross streets. Barrier DC-R/P would benefit all 225 impacted receptors as well as 497 non-impacted receptors, bringing the total number of benefits to 722. Barrier DC-R/P would be 25 feet high and 4,801 feet long with a surface area of 120,013 square feet and provide 5 to 20 decibels of noise reduction at benefited receptors. Barrier DC-R/P would be feasible because it would benefit at least 50 percent of impacted receptors. Also, the barrier would meet the 7-decibel noise reduction design goal, and with a net surface area per benefited receptor of 59, Barrier DC-R/P would be reasonable.

The surface area of the existing barrier to be removed is 77,165 square feet. Barrier DC-R/P would be 42,848 square feet larger than the existing barrier. This barrier would be both feasible and reasonable.

**Barrier DD-R** is a replacement barrier that would be located in CNE DD, the single-family residence neighborhood to the south of the eastbound lanes of VA 164 adjacent to Alternatives B and D. It is shown in Figure 4-1, Sheets 28, 29 and 30. Barrier DD would replace the existing barrier along the mainline of VA 164 where it is being widened, but it would be connected to the existing barrier, which would remain in place along the ramps to the cross streets. Barrier DD-R would benefit all 53 impacted receptors as well as 157 non-impacted receptors, bringing the total number of benefits to 210. Barrier DD-R would be 25 feet high and 4,797 feet long with a surface area of 119,894 square feet and provide 5 to 18 decibels of noise reduction at benefited receptors. Barrier DD-R would be feasible because it would benefit at least 50 percent of impacted receptors. It would meet the 7-decibel noise reduction design goal, and with a net surface area per benefited receptor of 64, Barrier DD-R also would be reasonable.

The surface area of the existing barrier to be removed is 106,492 square feet. Barrier DD-R would be 13,402 square feet larger than the existing barrier. This barrier would be both feasible and reasonable.

**Barrier DF-P** is a potential barrier that would be located in CNE DF, the single-family residence neighborhood to the south of the eastbound lanes of VA 164 adjacent to Alternatives B, C, and D, and is shown in Figure 4-1, Sheet 32. Barrier DF-P would benefit the one impacted receptor as well as one non-impacted receptor. Barrier DF-P would be 30 feet high and 801 feet long with a surface area of 24,004 square feet and provide 5 to 8 decibels of noise reduction at benefited receptors. Barrier DF-P would be feasible because it would benefit at least 50 percent of impacted receptors, and it would meet the 7-decibel noise reduction design goal. However, with a surface area per benefited receptor of 12,002, Barrier DF-P would not be reasonable because it would exceed the allowable maximum of 1,600.

**I-664 Corridor in Chesapeake**

**Barrier CE-P** is a potential barrier that would be located in CNE CE, the residential neighborhood to the south of the eastbound lanes of South Military Highway adjacent to Alternatives C and D. The barrier is shown in Figure 4-1, Sheet 36. Barrier CE-P would benefit 4 of 7 impacted receptors as well as 6 non-impacted receptors, bringing the total number of benefits to 10. Barrier CE-P would be 20 feet high and 1,601 feet long with a surface area of 32,002 square feet and provide 5 to 7 decibels of noise reduction at benefited receptors. Barrier CE-P would be feasible because it would benefit at least 50 percent of impacted receptors, and it would meet the 7-decibel noise reduction design goal. However, with a surface area per benefited receptor of 3,200, Barrier CE-P would not be reasonable because it would exceed the allowable maximum of 1,600.

**Barrier CG-P** is a potential barrier that would be located in CNE CG, the single family residence neighborhood to the north of the westbound lanes of I-664 adjacent to Alternatives C and D. The barrier is shown in Figure 4-1, Sheet 36. Barrier CG-P would not benefit the one impacted receptor or any non-impacted receptors. Barrier CG would be 30 feet high and 201 feet long with a surface area of 6,030 square feet and provide no net noise reduction at benefited receptors. Barrier CG-P would not be feasible because it would not benefit any impacted receptors.

**Barrier CH-P** is a potential barrier that would be located in CNE CH, the single family residence neighborhood to the east of the westbound lanes of I-664 adjacent to Alternatives C and D. It is shown in Figure 4-1, Sheet 38. Barrier CH-P would benefit all 6 impacted receptors as well as 2 non-impacted receptors, benefiting a total of 8. Barrier CH-P would be 20 feet high and 1,599 feet long with a surface area of 31,972 square feet and provide 5 to 9 decibels of noise reduction at benefited receptors. Barrier CH-P would be feasible because it would benefit at least 50 percent of impacted receptors. While the barrier would meet the 7-decibel noise reduction design goal, with a surface area per benefited receptor of 3,997, Barrier CH-P would not be reasonable because it would exceed the allowable maximum of 1,600.

**Barrier CI-P** is a potential barrier that would be located in CNE CI, the single family residence neighborhood to the west of the eastbound lanes of I-664 adjacent to Alternatives C and D. It is shown in Figure 4-1, Sheet 38. Barrier CI-P would benefit all 5 impacted receptors as well as 3 non-impacted receptors, bringing the total number of benefits to 8. Barrier CI-P would be 15 feet high and 2,200 feet long with a surface area of 32,999 square feet and provide 5 to 10 decibels of noise reduction at benefited receptors. Barrier CI-P would be feasible because it would benefit at least 50 percent of impacted receptors. While the barrier would meet the 7-decibel noise reduction design goal, with a

surface area per benefited receptor of 4,125, Barrier CI-P would not be reasonable because it would exceed the allowable maximum of 1,600.

**Barrier CJ-P** is a potential barrier that would be located in CNE CJ, the single family residence neighborhood to the east of the westbound lanes of I-664 adjacent to Alternatives C and D, shown in Figure 4-1, Sheet 40. Barrier CJ-P would benefit all 8 impacted receptors as well as 10 non-impacted receptors. Barrier CJ-P would be 15 feet high and 1,802 feet long with a surface area of 27,010 square feet and provide 5 to 10 decibels of noise reduction at benefited receptors. Barrier CJ-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would meet the 7-decibel noise reduction design goal, and with a surface area per benefited receptor of 1,501, Barrier CJ-P would be reasonable.

**Barrier CK-P** is a potential barrier that would be located in CNE CK, the single family residence neighborhood to the west of the eastbound lanes of I-664 adjacent to Alternatives C and D. The barrier is shown in Figure 4-1, Sheet 39. Barrier CK-P would benefit the one impacted residence but no other receptors. Barrier CK-P would be 15 feet high and 401 feet long with a surface area of 6,005 square feet and provides 8 decibels of noise reduction at the benefited receptor. Barrier CK-P would be feasible because it would benefit the impacted receptor, and it would meet the 7-decibel noise reduction design goal. However, with a surface area per benefited receptor of 6,005, Barrier CK-P would not be reasonable because it would exceed the allowable maximum of 1,600.

**Barrier CL/CN-P** is a potential barrier that would be located in CNEs CL and CN, the single-family and apartment neighborhood to the east of the westbound lanes of I-664 between Dock Landing Road and Route 337 adjacent to Alternatives C and D. It is shown in Figure 4-1, Sheets 40, 41 and 42. Barrier CL/CN-P would benefit all 64 impacted receptors as well as 62 non-impacted receptors, yielding a total of 126 benefited receptors. Barrier CL/CN-P would be 25 feet high and 4,172 feet long with a surface area of 104,286 square feet and provide 5 to 16 decibels of noise reduction at benefited receptors. Barrier CL/CN-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would meet the 7-decibel noise reduction design goal, and with a surface area per benefited receptor of 828, Barrier CL/CN-P would be reasonable.

**Barrier CM-P** is a potential barrier that would be located in CNE CM, the single-family residential neighborhood to the west of the eastbound lanes of I-664 between Dock Landing Road and Route 337 adjacent to Alternatives C and D. The barrier is shown in Figure 4-1, Sheets 39, 41 and 42. Barrier CM-P would benefit 34 of 34 impacted receptors as well as 64 non-impacted receptors, bringing the total number of benefits to 98. Barrier CM-P would be 15 feet high and 4,570 feet long with a surface area of 68,543 square feet and provide 5 to 13 decibels of noise reduction at benefited receptors. Barrier CM-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would meet the 7-decibel noise reduction design goal, and with a surface area per benefited receptor of 699, Barrier CM-P would be reasonable.

**Barrier CO-P** is a potential barrier that would be located in CNE CO, a residential area to the northwest of the I-664/Portsmouth Blvd Interchange along Jolliff Road adjacent to Alternatives C and D. Barrier CO-P would benefit both impacted receptors with 5 to 7 decibels of noise reduction. Barrier CO-P would be 15 feet high and 601 feet long with a surface area of 9,015 square feet. Barrier CO-P would be feasible because it would benefit at least 50 percent of impacted receptors, and it would meet the 7-decibel noise abatement design goal. However, with a surface area per benefited receptor of 4,508, Barrier CO-P would not be reasonable because it would exceed the allowable value of 1,600.

**Barrier CQ-P** is a potential barrier that would be located in CNE CQ, the residential neighborhood to the east of I-664 adjacent to Alternatives C and D between the Route 337 and Pughsville Rd. interchanges. The barrier is shown in Figure 4-1, Sheets 44, 45, and 47. Barrier CQ-P would benefit 105 of 117 impacted receptors as well as 167 non-impacted receptors, bringing the total number of benefits to 272. Barrier CQ-P would be 25 feet high and 6,000 feet long with a surface area of 150,008 square feet and provide 5 to 14 decibels of noise reduction at benefited receptors. Barrier CQ-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would satisfy VDOT's 7-decibel noise reduction design goal for many receptors, and with a surface area per benefited receptor of 552, Barrier CQ-P would be reasonable.

**Barrier CS-P** is a potential barrier that would be located in CNE CS, the single family residence neighborhood to the west of the eastbound lanes of I-664 adjacent to Alternatives C and D. The barrier is shown in Figure 4-1, Sheet 46, 47 and 48.Barrier CS-P would benefit all 11 impacted receptors as well as 13 non-impacted receptors, totaling 22 benefits. Barrier CS-P would be 20 feet high and 1,403 feet long with a surface area of 28,043 square feet and provide 5 to 13 decibels of noise reduction at benefited receptors. Barrier CS-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would meet the 7-decibel noise reduction design goal, and with a surface area per benefited receptor of 1,168, Barrier CS-P would be reasonable.

**Barrier CT-P** is a potential barrier that would be located in CNE CT, a cemetery located in the southeast quadrant of the I-664 interchange with Pughsville Rd. adjacent to Alternatives C and D. It is shown in Figure 4-1, Sheet 47. Barrier CT-P would benefit all four impacted receptors as well as two non-impacted receptors, bringing the total number of benefits to six. Barrier CT-P would be 25 feet high and 1,795 feet long with a surface area of 44,877 square feet and provide 5 to 8 decibels of noise reduction at benefited receptors. Barrier CT-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would meet the 7 decibel noise reduction design goal, but with a surface area per benefited receptor of 7,480, Barrier CT-P would not be reasonable because it would far exceed the allowable area of 1,600 square feet per benefit.

**Barrier CU-P** is a potential barrier that would be located in CNE CU, the single-family residence neighborhood to the east of the westbound lanes of I-664 north of Pughsville Road, adjacent to Alternatives C and D. The barrier is shown in Figure 4-1, Sheets 47 and 48. Barrier CU-P would benefit all 21 impacted receptors as well as 33 non-impacted receptors, totaling 54 benefits. Barrier CU-P would be 20 feet high and 1,994 feet long with a surface area of 39,876 square feet and provide 5 to 13 decibels of noise reduction at benefited receptors. Barrier CU-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would meet the 7-decibel noise reduction design goal, and it would be reasonable, with a surface area per benefited receptor of 738.

**I-664 Corridor in Suffolk**

**Barrier CV-P** is a potential barrier that would be located in CNE CV, the single family residence and apartment neighborhood to the southwest of the eastbound lanes of I-664, the eastbound lanes of VA 164, and south of US 17 / Bridge Road adjacent to Alternatives B, C, and D. The barrier is shown in Figure 4-1, Sheets 48 and 49. Barrier CV-P would benefit all eight impacted receptors as well as 44 non-impacted receptors, bringing the total number of benefits to 52. Barrier CV-P would be 30 feet high and 2,599 feet long with a surface area of 78,002 square feet and provide 5 to 9 decibels of noise reduction at benefited receptors. Barrier CV-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would meet the 7-decibel noise reduction design goal at all impacted receptors, and with a surface area per benefited receptor of 1,500, Barrier CV-P would be reasonable.

**Barrier CW-P** is a potential barrier that would be located in CNE CW, the apartment neighborhood in the northwest quadrant of the I-664 interchange with VA 164 adjacent to Alternatives B, C, and D. It is shown in Figure 4-1, Sheet 49. Barrier CW-P would benefit all 72 impacted receptors as well as 117 non-impacted receptors, for a total of 189. Barrier CW-P would be 30 feet high and 1,801 feet long with a surface area of 53,998 square feet and provide 5 to 15 decibels of noise reduction at benefited receptors. Barrier CW-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would meet the 7-decibel noise reduction design goal, and with a surface area per benefited receptor of 286, Barrier CW-P would be reasonable because it would not exceed the allowable maximum of 1,600.

**Barrier CWA-P** is a potential barrier that would be located in CNE CWA, the cemetery in the southwest quadrant of the I-664 interchange with VA 164 adjacent to Alternatives B, C, and D. Shown in Figure 4-1, Sheet 49, Barrier CWA-P would benefit one of the four impacted receptors and no other receptors. Contribution of traffic noise from Bridge Road, south of the cemetery prevents Barrier CWA-P from providing sufficient noise reduction to most of the cemetery receptors. Barrier CWA-P would be 30 feet high and 1,599 feet long with a surface area of 47,993 square feet and provide 5 decibels of noise reduction at the benefited receptor. Barrier CWA-P would not be feasible because it would not benefit at least 50 percent of impacted receptors.

**Barrier CX-P** is a potential barrier that would be located in CNE CX, the single-family residential neighborhood to the northeast of the westbound lanes of I-664 and the westbound lanes of VA 164 adjacent to Alternatives B, C, and D. The barrier is shown in Figure 4-1, Sheets 50 and 51. Barrier CX-P would benefit all 65 impacted receptors as well as 123 non-impacted receptors, bringing the total number of benefits to 188. Barrier CX-P would be 20 feet high and 5,743 feet long with a surface area of 114,874 square feet and provide 5 to 18 decibels of noise reduction at benefited receptors. Barrier CX-P would be feasible because it would benefit at least 50 percent of impacted receptors. The barrier would meet the 7-decibel noise reduction design goal, and with a surface area per benefited receptor of 611, Barrier CX-P also would be reasonable.

**I-664 Corridor in Newport News**

**Barrier DI-P** is a potential noise barrier for CNE DI which covers the King-Lincoln Park, along the northbound side of I-664. It is shown in Figure 4-1, Sheet 55. The barrier would benefit three impacted recreational receptors with only 6 decibels of noise reduction, and 18 additional receptors with 5 to 8 decibels of noise reduction. With Alternatives C and D, Barrier DI-P would be 25 feet high (the maximum height that was considered for noise barriers on structure) and 2,440 feet long with a surface area of 61,022 square feet. While the potential barrier would be feasible, it is not reasonable because 1) the barrier does not achieve the noise reduction goal at any impacted receptors, and 2) it has a surface area per benefited receptor of 2,906, which exceeds VDOT's maximum SF/BR of 1600.

**Barrier DJ-P** is a potential noise barrier for CNE DJ, which is located along the northbound side of I-664 and includes residential land use and a place of worship – Agape Hands Cathedral. The barrier is shown in Figure 4-1, Sheet 56. This potential barrier would benefit eight impacted residential receptors with 7 decibels of noise reduction, and an additional 18 receptors with 5 to 7 decibels of noise reduction. With Alternatives C and D, Barrier DJ-P would be 15 feet high and 1,443 feet long with a surface area of 21,627 square feet. This potential noise barrier would meet the 7-decibel noise reduction design goal, and would be feasible and reasonable with a surface area per benefited receptor of 832.

**Barrier DK-P** is a potential noise barrier for CNE DK, which contains multi-family residences and a ballfield, is located east of I-664 on Jefferson Ave between 22nd and 28th Streets, and shown in Figure 4-1, Sheets 56 and 57. This barrier would benefit 16 impacted receptors with a noise reduction of 6 to 14 decibels as well as 6 additional receptors with 5 decibels of noise reduction. With Alternatives C and D, Barrier DK-P would be 10 feet high for sections on structure and 15 feet high for ground-mounted sections. The barrier would be 1,252 feet in length, have a surface area 17,822 square feet, meet the 7-decibel noise reduction design goal, and have a surface area per benefited receptor of 810, making it both feasible and reasonable.

**Barrier DL-P** is a potential noise barrier for CNE DL, which is located along the southbound side of I-664 and includes residential receptors in the proposed and permitted Brennan Pointe development, the Newport News Juvenile Detention center and recreational area, and an athletic field on US Navy property. The barrier is shown in Figure 4-1, Sheet 57. The barrier would benefit 15 impacted residential receptors with 8 to 11 decibels of noise reduction, and nine additional residential receptors with 5 to 9 decibels of noise reduction. With Alternatives C and D, Barrier DL-P would be 25 feet high and 1,332 feet long with a surface area of 33,310 square feet. This potential noise barrier would meet the 7-decibel noise reduction design goal, and would be feasible and reasonable with a surface area per benefited receptor of 1,388.

**Barrier DM/DN/DQ-P** is a potential noise barrier system for CNEs DM, DN and DQ on the northbound side of I-664, shown in Figure 4-1, Sheets 58, 59 and 60. CNE DM, containing single and multifamily residences, is located south of I-664 between 32nd and 36th Street/Jefferson Avenue and Marshall Avenue. CNE DN is located directly east of CNE DM between Marshall Avenue and Roanoke Avenue and contains single- and multifamily residences, Friendship Baptist Church and Playground, Gethsemane Baptist Academy Playground, Alpha & Omega Christian Worship, and House of Judah Deliverance Church. CNE DQ is located between Chestnut Avenue and Aberdeen Road and consists of single family residences, Greenlawn Memorial Park, and Booker T. Washington Middle School & Baseball Field. Four barrier sections are needed to achieve appropriate noise reduction for the three CNEs. Two barrier segments are along the I-664 northbound outer lane, the third along the Huntington Avenue/I-664 on ramp to I-664/Roanoke Avenue off ramp, and the fourth from the Chestnut Avenue on ramp to Greenlawn Avenue. The proposed barrier would benefit 130 out of 145 impacted receptors with a noise reduction of 5 to 14 decibels, as well as 65 additional receptors with a noise reduction of 5 to 13 decibels. 15 impacted receptors are not benefited because of limitations of the barrier's coverage. These receptors receive shielding from the I-64 mainline, but have no shielding from Route 351/39th Street/Pembroke Avenue, the noise from which limits the potential insertion loss. With Alternatives C and D, Barrier DM/DN/DQ-P would be 30 feet high for sections on the ground and 25 feet high for sections on structure. The total length would be 9,255 feet and the surface area would be 276,533 square feet. This barrier would meet the 7-decibel noise reduction design goal, and would be both feasible and reasonable with a surface area per benefited receptor of 486.

**Barrier DO/DP-R/P** is a potential noise barrier system for CNE DO and a replacement barrier for CNE DP located along the southbound side of I-664, and is shown in Figure 4-1, Sheets 58, 59 and 60. CNE DO is between Jefferson Avenue and Marshall Avenue and consists of single-family residences and Apprentice Builders Stadium. CNE DP is located between Marshall Avenue and Chestnut Avenue and consists of single- and multifamily residences, Newsome Park Elementary School, and several houses of worship. The barrier system is composed of one section along the I-664 southbound lanes in CNE DP and a second from Roanoke Avenue/I-664 on-ramp along the I-664 southbound lanes in CNE DM/DM. Barrier

system DO/DP-P would benefit 112 of 115 impacted receptors and 310 additional non-impacted receptors with a noise reduction of 5 to 12 decibels. Two impacted/non-benefited receptors located in CNE DO are in the line of sight of west Pembroke Avenue, which increases the ambient noise and decreases the noise reduction benefits of the barrier. Similarly, the single impacted/non-benefited receptor is in direct line of site with Chestnut Ave and the I-664 southbound off-ramp. With Alternatives C and D, the barrier system would be 20 feet height and 5,145 feet long with a total surface area of 102,923 square feet. The existing barrier that would be replaced is 33,403 square feet. This replacement and potential noise barrier would meet the 7-decibel noise reduction design goal, and would have a total surface area per benefited receptor of 397, a net SF/BR of 165, and would be both feasible and reasonable.

**I-664 Corridor in Hampton**

**Barrier DR-P** is a potential noise barrier for CNE DR which is located along the northbound side of I-664 that extends east of old Aberdeen Road to Plum Avenue, northwest of West Pembroke Ave. The barrier is shown in Figure 4-1, Sheet 61. The CNE contains single-family residences, Park Place Playground, and Park Place Baptist Church. The barrier would benefit all 45 impacted receptors with a noise reduction of 8 to 14 decibels, and 5 to 11 decibels of noise reduction for 75 non-impacted receptors. With Alternatives C and D, Barrier DR-P would be 20 feet high and 2,357 feet long with a surface area of 47,130 square feet. This potential noise barrier would meet the 7-decibel noise reduction design goal, and would be feasible and reasonable with a surface area per benefited receptor of 393.

**Barrier DS-P** is a potential noise barrier for CNE DS along the southbound side of I-664 and extends west of Power Plant Parkway to Garrett Drive, shown in Figure 4-1, Sheets 62 and 63. Located within this CNE are single-family homes and Briar Queen Pool. The barrier would benefit 16 impacted receptors with a noise reduction of 7 to 14 decibels, and 49 additional non-impacted receptors with a noise reduction of 5 to 10 decibels. With Alternatives C and D, Barrier DS-P would be 25 feet high and 2,883 feet long with a surface area of 72,065 square feet. This potential noise barrier would meet the 7-decibel noise reduction design goal and would be feasible and reasonable with a surface area per benefited receptor of 1,109.

**Barrier DT/DU/DW-R/P** is a replacement noise barrier for CNEs DT/DU and a potential barrier for CNE DW, all located along the southbound side of I-664, and is shown in Figure 4-1, Sheets 64 and 64. CNE DT is located north of Powhatan Parkway and contains single-family residences. Hampton High School and athletic fields are located in CNE DU, directly south of west Queen Street. CNE DW is north of West Queen Street with single-family residences, townhomes, and an assisted living facility. With Alternatives C and D, Barrier DT/DU/DW-R/P would benefit 70 of the 71 impacted receptors and 186 additional non-impacted receptors with a noise reduction of 5 to 14 decibels. The limited benefit is due the height of a third floor dwelling. This replacement and potential barrier would be 16 feet in height and 5,394 feet long for a total of 86,330 square feet. The barrier replaces an existing barrier of 56,580 square feet, and would meet the 7-decibel noise reduction design goal. The additional surface area of Barrier DT/DU/DW-R/P would be feasible and reasonable with a total surface area per benefited receptor of 337, and a net SF/BR of 116.

**Barrier DV/DX-R/P** is a replacement barrier for CNE DV and potential noise barrier for CNE DX located along the northbound side of I-664, and shown in Figure 4-1, Sheet 63 and 64. Single-family residences are in CNE DV, located directly south of West Queen Street. CNE DX contains single-family residences and West Cemetery, located north of West Queen Street. With Alternatives C and D, Barrier DV/DX-R/P

would benefit all 82 impacted receptors and 76 additional non-impacted receptors with a noise reduction of 5 to 15 decibels. This replacement and potential barrier would be 16 feet in height and 4,727 feet long for a total of 75,603 square feet. The barrier replaces an existing barrier of 26,730 square feet, and would meet the 7-decibel noise reduction design goal. The additional surface area of Barrier DV/DX-R/P would be feasible and reasonable with a total surface area per benefited receptor of 479, and a net SF/BR of 309.

## 7. CONSTRUCTION NOISE CONSIDERATION

Construction noise provisions are contained in Section 107.16(b)3 Noise of the 2007 VDOT Road and Bridge Specifications. 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.
- The Department 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.
- The Department may prohibit or restrict to certain portions of the project any work that produces objectionable noise between 10 P.M. and 6 A.M. 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.

# 8. INFORMATION FOR LOCAL GOVERNMENT OFFICIALS

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 information on noise-compatible land-use planning, noise impact zones in undeveloped land in the highway project corridor and federal participation in Type II projects (noise abatement only). This section of the report provides that information, as well as information about VDOT's noise abatement program.

## 8.1 NOISE-COMPATIBLE LAND-USE PLANNING

Section 9.0 of VDOT's 2011 noise policy outlines VDOT's approach to communication with local officials and provides 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 it. A link to this brochure on FHWA's website is provided:

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, and
- 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 significant 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

## 8.2 VDOT'S NOISE ABATEMENT PROGRAM

Information on VDOT's noise program is provided in "Highway Traffic Noise Impact Analysis Guidance Manual (Version 2)," updated September 16, 2011. This document is available from VDOT's Noise Abatement Section, Virginia Department of Transportation, 1401 E. Broad St., Richmond, VA 23219.

## 9. REFERENCES

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