

25 April 2017



Phoenix Noise & Vibration, LLC  
5216 Chairmans Court, Suite 107  
Frederick, Maryland 21703  
301.846.4227 (phone)  
301.846.4355 (fax)  
[www.phoenixnv.com](http://www.phoenixnv.com)

## WMAL North Bethesda Phase I Noise Analysis

Montgomery County, Maryland

Report #150730

For: Toll Bros. Inc.

By: Kody Snow

## 1 EXECUTIVE SUMMARY

Phoenix Noise & Vibration has conducted an analysis of transportation noise impact upon the WMAL North Bethesda property, a proposed residential development in Montgomery County, Maryland. Dependent upon the final site configuration, the residential development will consist of single-family residences, townhomes, and MPDUs, as well as outdoor activity areas. This study was limited to noise impact from Interstate 495, Interstate 270 Spur, and Interstate 270 Spur entrance and exit ramps for Democracy Boulevard, and included:

- On-site 24-hour noise level measurements.
- Computer modeling.
- Determination of future noise levels.
- Preliminary mitigation recommendations to meet Montgomery County's residential noise guidelines.

Noise impact upon the WMAL property will vary with height and location; therefore noise levels have been presented at the ground level (5.5 feet) and upper level (25 feet). All calculated noise levels are "unmitigated," and account for the presence of existing residences surrounding the property, other significant structures, trees, and surrounding topography. Structures along roadways act as noise barriers, providing protection from noise exposure and reducing the impact and extent of any potential mitigation, if any, to comply with Montgomery County's recommended noise level guidelines.

According to Montgomery County's noise level guidelines, outdoor noise levels are to be maintained below 65 dBA Ldn throughout designated outdoor activity areas (i.e. parks, backyards, playgrounds, etc.). With the proposed site plan and trees present on the site within the limit of disturbance, future noise levels above 65 dBA Ldn from the surrounding roadways will encroach onto the northern and southern portion of the site. The southern bounds of the site, along Interstate 495, will experience higher levels of roadway noise than the northern bounds.

Noise barriers will be required to provide mitigation of future transportation noise levels within the rear yards of the future homes. Due to the forest retention requirements for the site, the removal of trees within the property's bounds for the construction of a noise barrier is not possible. Therefore, to provide mitigation of noise generated from Interstate 495 upon the property, a noise barrier has been modeled within the Maryland State Highway Administration (MDSHA) right-of-way. The noise barrier on the southern portion of the property, parallel to Interstate 495, will require a height of 30 feet to mitigate noise levels to below 65 dBA Ldn at the ground level.

The exposure to transportation noise levels above 65 dBA Ldn on the northern portion of the site from the Interstate 270 spur will be mitigated by a series of noise fences located along the rear yards of Lots 1-11. The noise fences will require a height of 8.5 feet. Due to the height and location of the noise fences along the rear yards, as well as the trees that will remain on the northern portion of the site, the reflection of noise from Interstate 270 upon existing residences at the northern portion of the property will not be an issue.

Of the proposed residences, 87 will be impacted by noise levels greater than 65 dBA Ldn at the upper level. With the construction of the noise barriers on the site, the number of residences impacted by noise levels greater than 65 dBA Ldn will decrease to 69, with the highest level of noise impact being 68 dBA Ldn. When residential units are impacted by transportation noise levels greater than 65 dBA Ldn, Montgomery County requires further analysis of the proposed structures to determine if they are capable of maintaining indoor noise levels at the indoor noise level requirement of 45 dBA Ldn.

Once architectural drawings are developed for the future residences, further analysis should be completed to determine if the residences impacted by noise levels greater than 65 dBA Ldn will be capable of maintaining indoor noise levels below 45 dBA Ldn with their proposed construction.

## **2 NOISE TERMINOLOGY**

### **2.1 dB vs. dBA**

While the standard unit of measurement for sound is the decibel (dB), discussions of noise impacting the human ear use “dBA.” The “A” refers to a frequency weighting network used to simulate the human ear’s unequal sensitivity to different frequencies. The A-weighted noise level is therefore more representative of a human’s perception of a noise environment than the unweighted overall noise level in dB and is currently used in most all environmental noise studies.

### **2.2 Ldn vs. Leq**

The day-night average noise level, or Ldn, is the equivalent sound pressure level averaged over a 24-hour period, obtained by adding 10 dB to sound pressure levels measured from 10:00 p.m. to 7:00 a.m. This 10 dB “penalty” accounts for the added sensitivity caused by noise generated during the nighttime hours.

The Ldn is NOT a measurement of the instantaneous noise level. It is very possible to have several short term events (tractor trailer, emergency vehicle siren, car horn, etc.) which generate a relatively high noise level (e.g. 85 dBA) during a given time period, yet have a more moderate overall Ldn value (e.g. 65 dBA Ldn).

The equivalent-continuous sound level, or Leq, is the sound level averaged over a given time period. The Leq does not include any penalties or adjustments. Generally, it is found that the Ldn value at a receiver is greater than or equal to the loudest hour Leq when measuring transportation noise. This is due to the 10 dB “penalty” that is accounted for in the Ldn calculation. Additionally, the Ldn value increases when traffic patterns shift from day to night.

### **2.3 Summing Noise Levels**

Noise levels from multiple sources do not add arithmetically; i.e. when two noise sources generate 60 dB individually, they do not produce 120 dB when combined. Noise levels are measured using a logarithmic scale; therefore they must be summed logarithmically. In the decibel scale, two identical, non-coherent noise sources having the same noise level produce a 3 dB increase above the condition of one source alone (i.e. two 80 dB lawnmowers running at the same time generates 83 dB).

Similarly, two different noise sources with a difference of 10 dB in their individual levels results in no measureable increase in noise when they are combined. Put another way, the quieter noise source does not increase the overall noise generated by the louder source; i.e. adding an 80 dB lawnmower into a noise environment where a 90 dB lawnmower is already running does not increase the noise level above 90 dB.

### 3 NOISE GUIDELINES

Traffic noise impact for proposed residential developments in Montgomery County is governed by Table 2-1 (reprinted in Table 1) on page 8 of the *Staff Guidelines for the Consideration of Transportation Noise Impacts In Land Use Planning and Development* (June 1983). Accompanying this table is Map 2-1 (see Figure 1), indicating recommended outdoor noise levels not to be exceeded throughout the County.

**Table 1: Maximum Levels for Exterior Noise & Building Line<sup>1</sup> For Noise Sensitive Land Uses (Table 2-1).**

Guideline Value	Area of Application
Ldn = 55 dBA	This guideline is suggested as an appropriate goal in permanent rural areas of the County where residential zoning is for five or more acres per dwelling unit and background levels are low enough to allow maintenance of a 55 dBA Level. This guideline is consistent with Federal, State, and County goals for residential areas.
Ldn = 60 dBA	This is the basic residential noise guideline which will be applied in most areas of the County where suburban densities predominate. Maintenance of this level will protect health and substantially prevent activity interference both indoors and outdoors. Noise attenuation measures will be recommended to allow attainment of this level.
Ldn = 65 dBA	This guideline will generally be applied in the urban ring, freeway, and major highway corridor areas, where ambient levels are such that application of a stricter guideline would be infeasible or inequitable. Significant activity interference will occur outdoors and indoors if windows are partially opened, but available evidence indicates hearing is adequately protected. Noise attenuation measures will be strongly recommended to attain this level.

<sup>1</sup> Building line as used here refers to habitable structures only. It does not include garages, sheds, or recreational accessory buildings.

According to Map 2-1, the WMAL North Bethesda site is located within the 65 dBA Ldn noise zone, indicating that noise levels in outdoor activity areas throughout the site are recommended to be maintained at or below 65 dBA Ldn. Any outdoor area exposed to future transportation noise levels above 65 dBA Ldn typically requires further analysis to determine the mitigation designs necessary to comply with this recommendation.

When outdoor noise levels exceed 65 dBA Ldn, Montgomery County also requires an analysis of indoor noise levels in residential buildings. According to Sections 2.2.2 and 2.2.3 of the *Staff Guidelines*, any residential building impacted by noise levels above 65 dBA Ldn must be evaluated to certify that the building structure will be capable of maintaining indoor noise levels at 45 dBA Ldn.





## 4 SITE DESCRIPTION

WMAL North Bethesda (approximate property line shown in red in Figure 2) is located north of Interstate 495, east of the Interstate 270 Spur, and is also located south of Democracy Boulevard. In the vicinity of the site, the Interstate 270 Spur is composed of three northbound and three southbound lanes with entrance and exit lanes onto Democracy Boulevard. Interstate 495 is composed of three eastbound and three westbound lanes. Interstate 270 Spur is approximately 250 feet from the nearest property line, whereas Interstate 495 is approximately 40 feet from the nearest property line.

**Figure 2: Existing site and surroundings. Aerial image dated April 11, 2015, courtesy of Google Earth.**



## 5 NOISE MEASUREMENTS

On July 15 – 16, 2015, Phoenix Noise & Vibration conducted an on-site noise measurement survey to determine existing transportation noise levels throughout the site created by the Interstate 270 Spur and Interstate 495. This involved continuous noise level measurements and monitoring for one 24-hour period. Measurements were made using three Norsonic Type 118 and one Type 140 Precision Integrating Sound Level Meters. All meters were calibrated prior to the survey traceable to National Institute of Standards and Technology (NIST). Each meter meets the ANSI S1.4 standard for Type 1 sound level meters.

During the 24-hour measurement, noise levels were recorded and averaged over five-minute time intervals. Noise measurements were then used to calculate the site's 24-hour average day-night noise level (Ldn), which includes the 10 dBA penalty for noise levels measured during nighttime hours. Noise level measurements were made at the locations shown in Figure 3. Measurements were made at 5.5 feet (ground level, GL) and 25 feet (upper level, UL) above adjacent grade. Measurement results are presented in Table 1.

**Table 2: 24-hour noise measurement results.**

Measurement Location	Distance Above Grade (ft.)	Measured Noise Level (dBA Ldn)
A	25	64.3
B	5.5	63.7
	25	65.5
C	25	79.4

Figure 4 presents the roadway measurement results graphically, showing the noise level as measured in five minute increments throughout the survey. Figure 4 indicates the actual measured values over the 24-hour period. While the 10 dBA nighttime penalty is not shown graphically, it was included in the Ldn calculations.

As presented in Table 2, the measured noise level at location B varied between the ground level and upper level. This difference is caused by absorption or shielding present at the ground level. At the ground level, grass, foliage, and topography provide absorption or shielding of noise generated by a roadway upon the receiving location. When determining the mitigation requirements for a multi-story residence it is valuable to know the difference in noise level at the ground and upper level, as the noise level upon the upper level (2<sup>nd</sup>-story) of residences is typically higher and will require a greater level of mitigation.

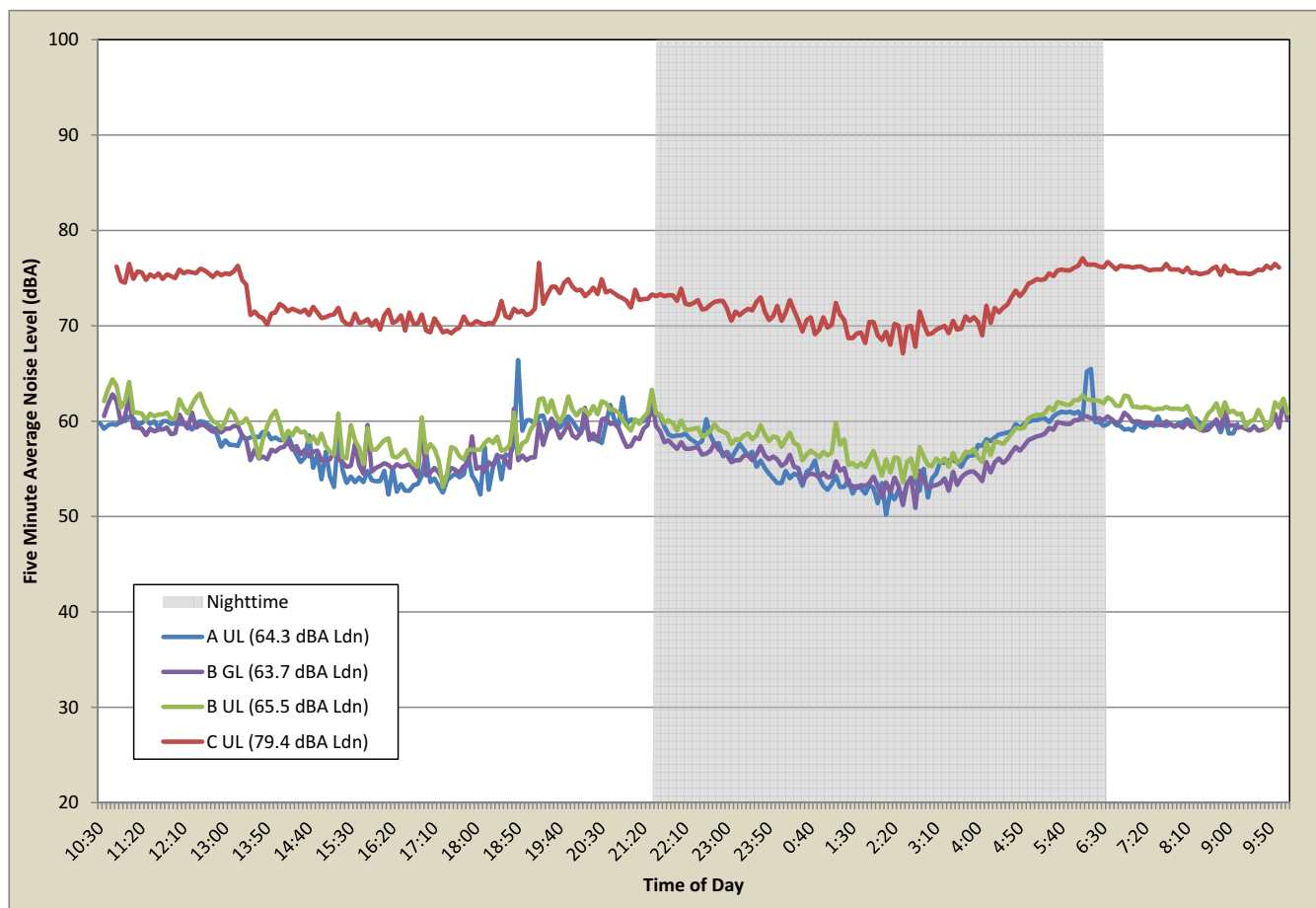
Note that some of the measurement locations contain isolated instances during the 24-hour measurement period at which the noise level appears inconsistent with the rest of the noise profile (i.e. peaks, spikes, or dips in the graph). These inconsistencies are typically due to extraneous occurrences unrelated to roadway noise, such as emergency sirens or temporary traffic congestion. Such short term events, while producing a relatively high or low noise level and which may have a significant impact on the five-minute average, generally have an insignificant effect on the overall, 24-hour Ldn value.



Figure 3: Long-term noise measurement locations.



**Figure 4: Five minute average noise levels recorded during 24-hour noise survey.**



## 6 COMPUTER MODELING

The existing site was computer modeled using the CadnaA software program, a three-dimensional noise propagation model capable of determining the noise level impact from multiple noise sources across vertical and horizontal surfaces while accounting for factors such as topography, ground absorption, reflections, and roadway data (traffic volumes, speeds, and vehicle classifications, etc.). Noise levels can be presented either in spot locations or as noise contours of equal value throughout a defined surface area.

### 6.1 Current Model

A current model was developed to simulate the existing site and its surroundings using an existing topographic map<sup>1</sup>, information taken from Montgomery County's GIS database, and data collected during the 24-hour measurement survey. The information was then used to input the existing topography, roadway alignments, and surrounding residences into the model. Calculated roadway noise levels were compared to the corrected on-site noise measurements.

Ground level and upper level unmitigated noise contours developed by the current model are presented on Drawings 2 and 3 of the Appendix, respectively.

### 6.2 Future Model

A future model was developed by altering the calibrated current model to include the projected roadway data, future site topography, and the buildings located within the future WMAL development.<sup>2</sup>

The future model calculated the "mitigated" noise levels throughout the site at the ground and upper level. Mitigated noise levels are calculated in the presence of future site topography, trees, and buildings, as well as all existing surrounding buildings, topography, and significant structures. Mitigated noise levels account for the effect of buildings, barriers, and other significant structures in reducing and reflecting roadway noise propagation and are more representative of the noise level actually experienced at a specific location.

Please note that the calculated future noise levels are accounting for mitigation provided by the presence of existing trees on the site. The amount of trees on the site have been limited to the outer bounds of the presented limit of disturbance (LOD), as provided on the site plan from Rodgers Consulting.

#### 6.2.1 Roadway Data

Average annual weekday traffic (AAWDT) volumes, vehicle percentages, and nighttime percentages were based upon the most recent data published by the Maryland State Highway Administration (MDSHA), as shown in Table 3. To estimate the future traffic volumes a conservative 2% increase in traffic compounded annually until 2035 was assumed.<sup>3</sup>

<sup>1</sup> Map of topography for the WMAL site was provided by ESE Consultants Inc., dated 28 July 2015.

<sup>2</sup> Site plan provided by Rodgers Consulting in AutoCAD format on 11 November 2016.

<sup>3</sup> Montgomery County typically requires that roadway noise impact studies be conducted using the projected traffic volumes 20 years from the date of the study.

**Table 3: Roadway traffic data used in the computer models.**

<b>Roadway</b>	<b>Existing AAWDT</b>	<b>2035 AAWDT</b>	<b>Nighttime Volume %</b>	<b>Truck %</b>	<b>Posted Speed Limit (mph)</b>
I-270 Northbound Spur	71,575	115,124	13	9	55
I-270 Southbound Spur	91,963	104,717	20	8	55
I-270 NB Ramp onto Democracy Blvd EB	6,403	10,097	11	4	35
I-270 NB Ramp onto Democracy Blvd WB	2,865	4,518	8	4	35
Democracy Blvd EB Ramp onto I-270 NB	2,606	4,109	5	4	35
Democracy Blvd EB Ramp onto I-270 SB	3,010	4,746	10	4	35
Democracy Blvd WB Ramp onto I-270 SB	4,417	6,965	6	4	35
I-495 Eastbound	51,272	80,851	18	8	55
I-495 Westbound	52,941	83,483	18	9	55

## 7 FUTURE NOISE IMPACT

Future mitigated roadway noise contours at the ground and upper level are presented on Drawings 4 and 5 of the Appendix, respectively. With the future site conditions, both the ground and upper level future 65 dBA Ldn unmitigated noise contours will be located within the property's bounds. Transportation noise levels generated by Interstate 495 will travel further onto the southern portion of the site than noise levels generated by the Interstate 270 Spur upon the northern portion of the site.

Though the site will be impacted by future noise levels greater than 65 dBA Ldn, compliance with Montgomery County's recommend noise level guidelines can be achieved with reasonable modifications to the site and proposed residences. Based upon the future mitigated ground level noise contours, 10 lots on the northern portion of the property and 29 lots on the southern portion of the property will be impacted by noise levels above 65 dBA Ldn at the ground level. Mitigation in the form of a noise barrier will be required to provide mitigation for the rear yards of the residences and provide compliance with Montgomery County's noise level guidelines, see the mitigation section below for more detail. All other outdoor activity areas within the property will be exposed to noise levels less than 65 dBA Ldn, further mitigation is not required for those areas.

Furthermore, 87 of the proposed residences will be impacted by transportation noise levels between 65 and 73 dBA Ldn at the upper level. All other residences throughout the development will not be exposed to future transportation noise levels greater than 65 dBA Ldn.

## 8 MITIGATION

According to Montgomery County's noise level guidelines for residential development, residential sites and buildings impacted by noise levels above 65 dBA Ldn require further analysis to determine the mitigation measures necessary to maintain noise levels in outdoor activity areas and indoor living spaces at 65 and 45 dBA Ldn, respectively.

### 8.1 Outdoor Mitigation

As shown on Drawing 4, it has been determined that the future ground level 65 dBA Ldn unmitigated noise contour will be located on both the northern and southern portions of the site. Therefore, it is recommended that noise barriers be constructed to reduce outdoor noise levels to below 65 dBA Ldn throughout the WMAL property and provide compliance with Montgomery County's noise level guidelines.

Due to the forest retention requirements placed upon the WMAL property, the removal of trees for the construction of a noise barrier on the southern portion of the property is not possible, which creates a limitation on the placement of noise barriers for mitigation of roadway noise. As previously discussed, transportation noise from Interstate 495 impacts the southern portion of the property more than the Interstate 270 Spur upon the northern portion.

To provide mitigation upon the southern portion of the property a noise barrier has been modeled within the MDSHA right-of-way. The proposed barrier was modeled parallel to Interstate 495, connecting to the existing noise barrier to the east and stopping at the bridge for Greentree Road. With the future site conditions, the barrier will be required to have a height of 30 feet above the existing grade to provide mitigation of the future 65 dBA Ldn ground level noise contour. See Drawings 6 and 7 of the Appendix for the barrier location.

With the construction of the 30-foot-tall noise barrier along Interstate 495, the number of residences impacted by noise levels greater than 65 dBA Ldn will decrease from 87 to 69. The highest level of noise impact will also decrease from a level of 73 dBA Ldn to 68 dBA Ldn.

Mitigation of transportation noise greater than 65 dBA Ldn at the ground level upon the northern portion of the WMAL property can be provided by noise fences located along the rears of Lots 1-11 at a height of 8.5 feet above grade. See noise fences 1 and 2 on Drawings 6 and 7 of the Appendix for the locations and height. The noise fences can be constructed of wood or a synthetic wood product as long as there are no gaps or openings in the fence, see the Noise Barrier-Doubled Sided Wood Fence drawing detail provided within the Appendix.

Please note that the location of the noise fences on the northern portion of the property will not generate reflected noise from Interstate 270 upon the existing residences at the northern portion of the property. This is due to the location and height of the fences, as well as the trees and foliage remaining on the site. Comparison of the ground level contours can be done by looking at Drawings 4 and 6 of the Appendix. It can be seen that other than in the rear yards of Lots 1-11, the addition of the noise fences minimally or if at all changes the shape of the noise contours on the northern portion of the site.



## **8.2 Indoor Mitigation (Building Shell Analysis)**

When a residential structure is impacted by transportation noise levels which exceed a governing threshold (65 dBA Ldn), further analysis (a “building shell analysis”) is required to determine if proposed building structures are capable of reducing exterior noise levels to an acceptable indoor level. A building shell analysis calculates the noise reduction provided by an exterior building partition (i.e. the composite assembly of the wall and any windows and doors) and the resulting indoor noise level when impacted by a specific outdoor noise level. The noise reduction provided by an exterior partition is dependent upon the surface area each building element composing the partition occupies and the STC rating of the individual elements.

STC ratings apply to one individual element. The composite STC rating is the overall STC rating of a partition with multiple elements (e.g. a wall with a window) and is usually controlled by the building element with the lowest individual STC rating. In residential construction, this is almost always the glass (windows and doors); therefore, the percentage of the exterior wall occupied by glass becomes critical. This also means the amount of outdoor noise heard inside a unit is primarily dependent on the glass percentage and STC rating, not the wall STC rating.

Modifications to standard building construction may not be necessary for all residences impacted by future noise levels above 65 dBA Ldn. It is possible that the proposed standard building construction will provide sufficient noise reduction to maintain the required 45 dBA Ldn indoor noise level for outdoor noise levels above 65 dBA Ldn.

When architectural drawings are available, noise impact can be analyzed for each of the residences impacted by transportation noise levels above 65 dBA Ldn. Likewise, mitigation requirements will also be provided for those residences needing modifications to proposed building architecture. Calculating minimum STC ratings specific to each unit reduces “overbuilding” (i.e. installing windows/doors with unnecessarily high STC ratings).

## 9 CONCLUSION

Due to transportation noise generated by Interstate 495, the Interstate 270 spur, and the Interstate 270 spur exit/entrance ramps, 87 of the proposed residences at the WMAL site will be impacted by future transportation noise levels above 65 dBA Ldn, with a maximum noise level of 73 dBA Ldn. The addition of noise barriers to the site will provide mitigation of transportation noise at the ground and upper level, while reducing the number of residences impacted by noise levels greater than 65 dBA Ldn to 69 at the upper level. Furthermore, the maximum level of noise impact upon residences will be reduced to 68 dBA Ldn.

With the construction of the proposed noise barriers, the residential lots impacted by noise levels greater than 65 dBA Ldn at the ground level will be reduced to within Montgomery County's outdoor noise level guidelines of 65 dBA Ldn. All outdoor activity areas throughout the residential development will be below 65 dBA Ldn at the ground level, as required by Montgomery County.

Proposed residences impacted by future transportation noise levels greater than 65 dBA Ldn require further analysis and may require modifications to proposed standard building construction to comply with Montgomery County's 45 dBA Ldn indoor noise level limit. Depending upon the noise level specific to each residence, modifications may include increased window/door STC ratings and slight adjustments to exterior wall construction. Further analysis is required to determine the exact mitigation designs necessary, which will be established once architectural plans for the proposed residences are well developed.

***Please Note:*** *The results of this Phase I Noise Analysis have been based upon the site and architectural information made available at the time of this study, including existing and proposed topography, existing and future roadway alignments, projected roadway traffic volumes, the proposed building layout, and proposed building architecture. Should any of this information be altered, additional analysis will be required to determine if the results and recommendations presented herein are capable of reducing outdoor and indoor noise levels to comply with Montgomery County's recommend noise level guidelines for residential development.*

## **APPENDIX**



LEGEND	
	MEASUREMENT LOCATION
	PROPERTY LINE



<b>PHOENIX</b> noise & vibration 5216 Chairmans Court Suite 107 Frederick, MD 21703 301-846-4227				WMAL North Bethesda MEASUREMENT LOCATIONS	
OWS. No.	PRJ. No.	DATE			
1	TLB1501	161105			
SCALE	NOT TO SCALE		DRAWN BY	WCC	



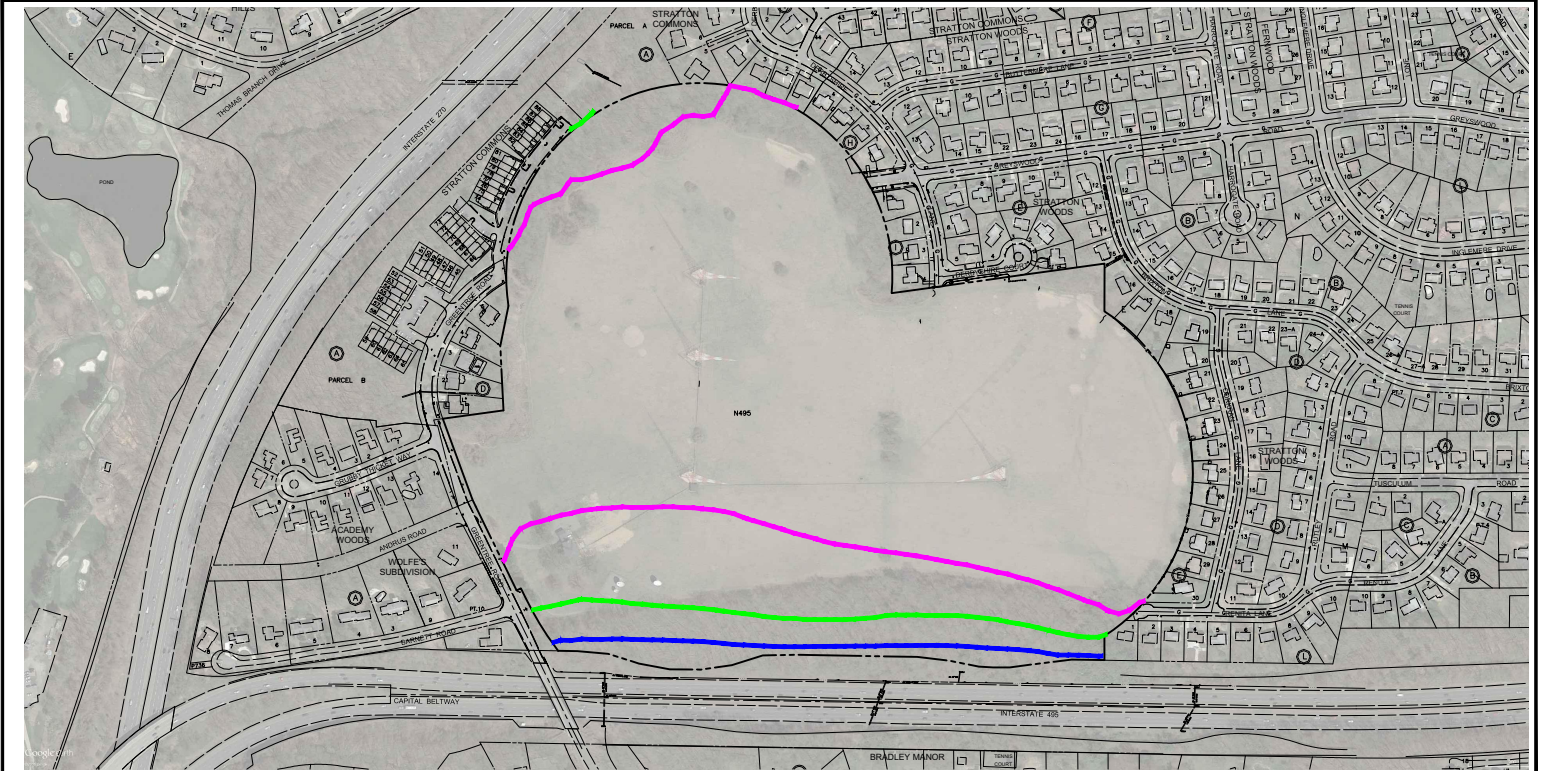


LEGEND	
	75 dBA Ldn (GROUND LEVEL NOISE CONTOUR)
	70 dBA Ldn (GROUND LEVEL NOISE CONTOUR)
	65 dBA Ldn (GROUND LEVEL NOISE CONTOUR)
	PROPERTY LINE



<b>PHOENIX</b> noise & vibration 5216 Chairmans Court Suite 107 Frederick, MD 21703 301-846-4227		WMAL North Bethesda <b>CURRENT GROUND LEVEL UNMITIGATED NOISE CONTOURS</b> OWS No. 2 PRJ. No. TLB1501 DATE 161105 SCALE NOT TO SCALE DRAWN BY WCC	
--	--	---	--





LEGEND	
	75 dBA Ldn (UPPER LEVEL NOISE CONTOUR)
	70 dBA Ldn (UPPER LEVEL NOISE CONTOUR)
	65 dBA Ldn (UPPER LEVEL NOISE CONTOUR)
	PROPERTY LINE

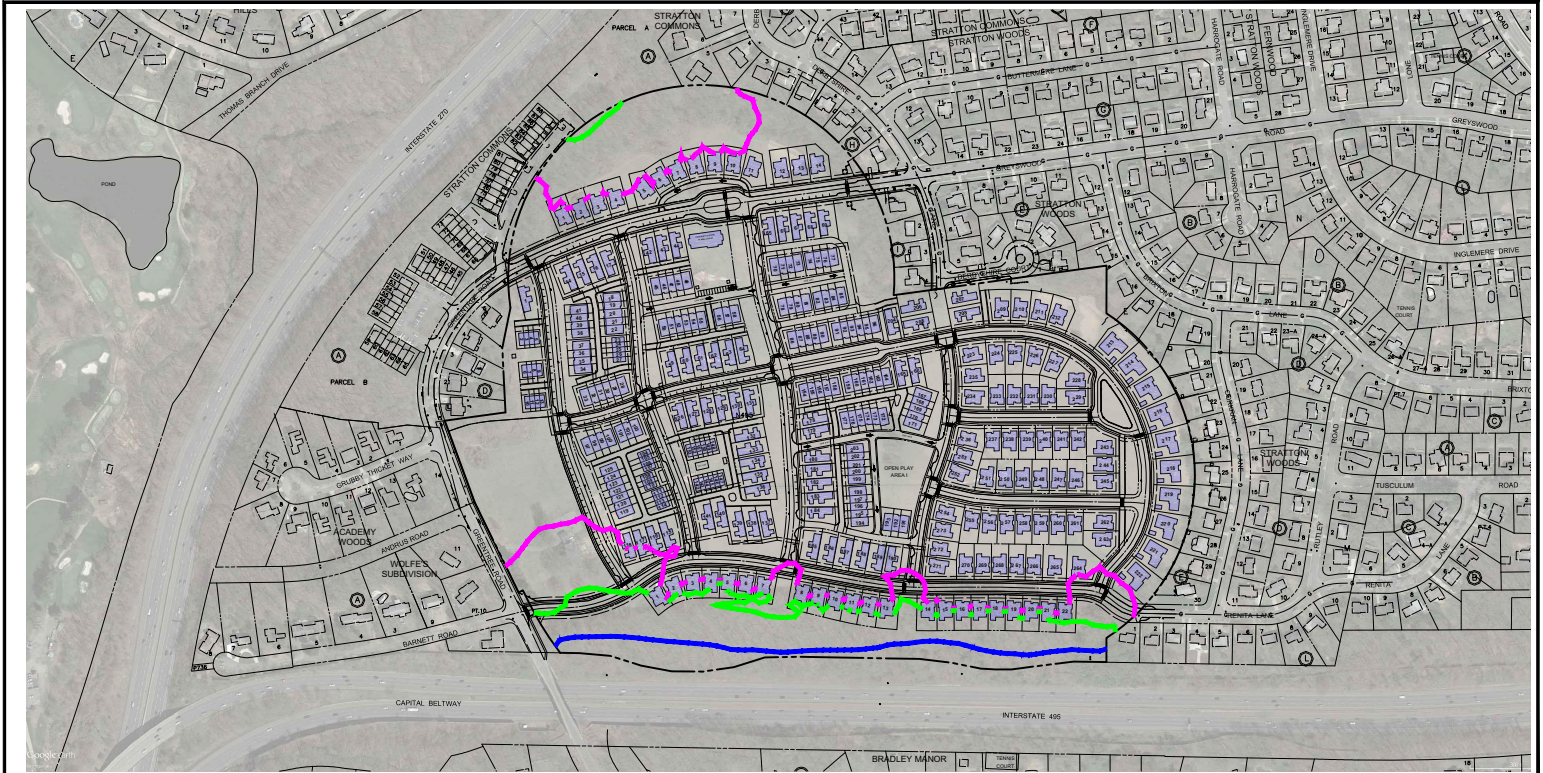


**PHOENIX**  
noise & vibration  
5216 Chairmans Court Suite 107  
Frederick, MD 21703  
301-846-4227

WMAL North Bethesda

CURRENT UPPER LEVEL  
UNMITIGATED NOISE CONTOURS

OWS No.	PRJ No.	DATE
3	TLB1501	161105
SCALE	DRAWN BY	
NOT TO SCALE	WCC	

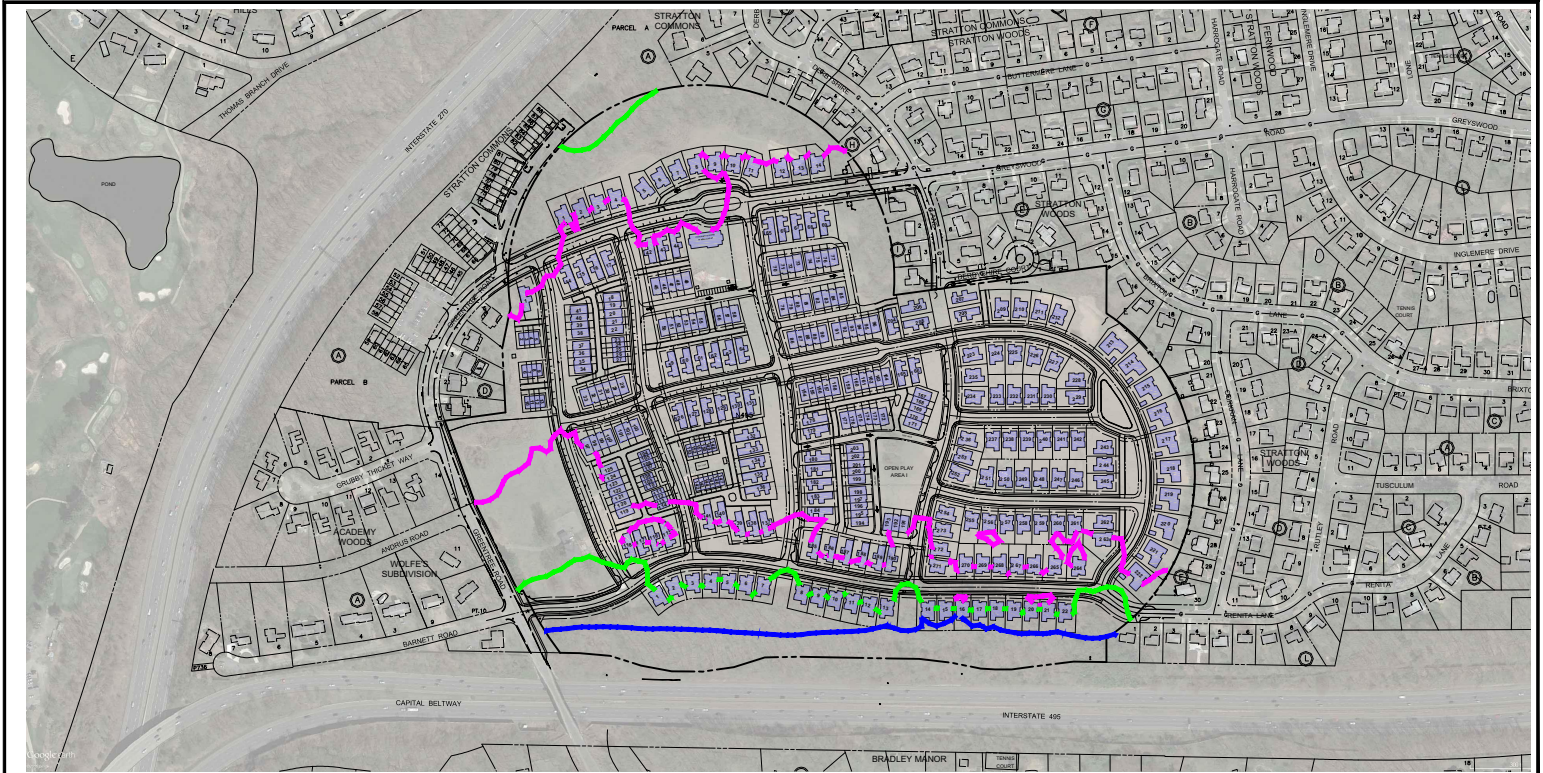


LEGEND	
	75 dBA Ldn (GROUND LEVEL NOISE CONTOUR)
	70 dBA Ldn (GROUND LEVEL NOISE CONTOUR)
	65 dBA Ldn (GROUND LEVEL NOISE CONTOUR)
	PROPERTY LINE



<b>PHOENIX</b> noise & vibration 5216 Chairmans Court Suite 107 Frederick, MD 21703 301-846-4227				<b>WMAL North Bethesda</b> <b>FUTURE GROUND LEVEL UNMITIGATED NOISE CONTOURS</b> OWS No. 4 PRJ No. TLB1501 DATE 170424 SCALE NOT TO SCALE DRAWN BY WCC	
--	--	--	--	--	--

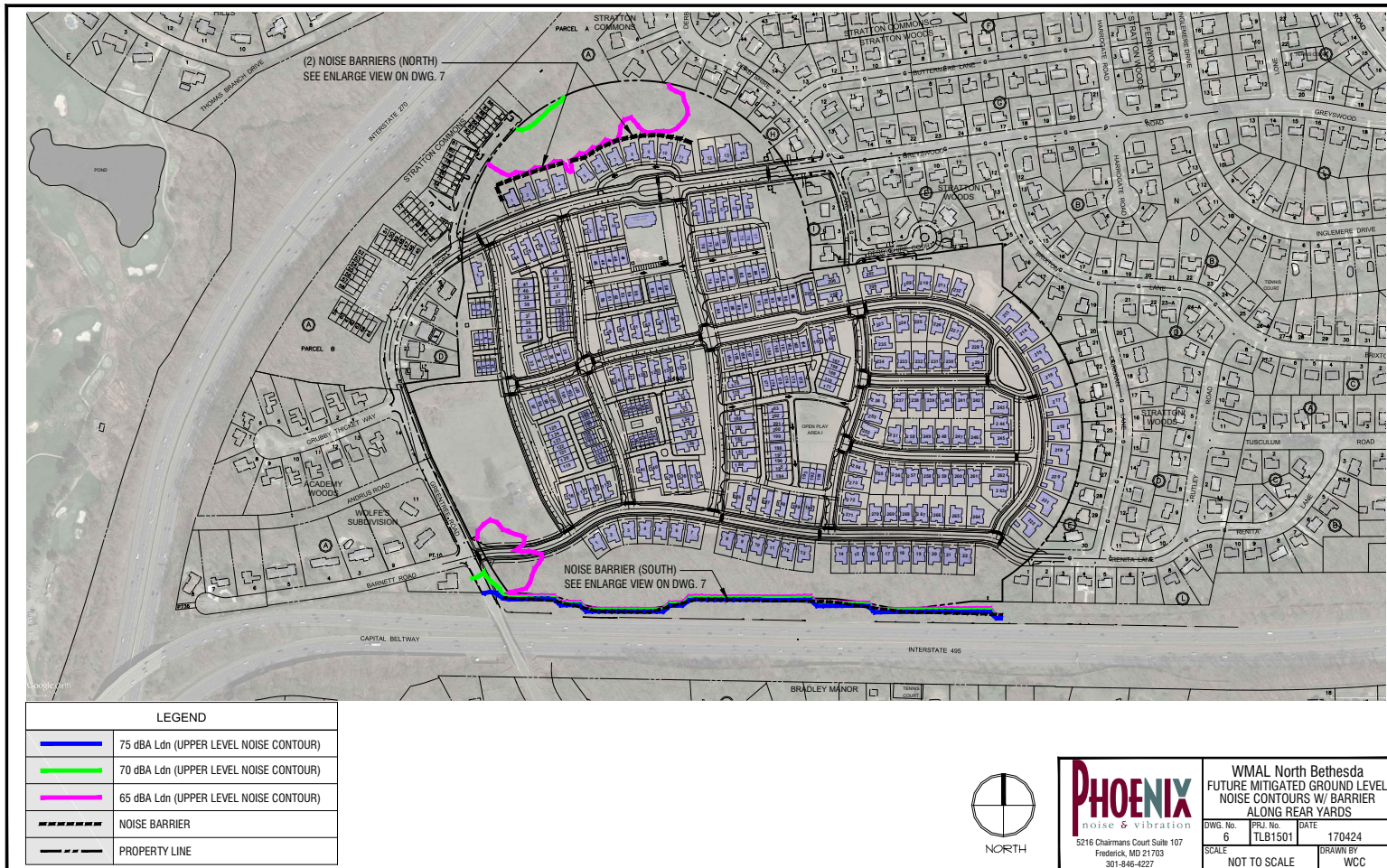





LEGEND	
	75 dBA Ldn (UPPER LEVEL NOISE CONTOUR)
	70 dBA Ldn (UPPER LEVEL NOISE CONTOUR)
	65 dBA Ldn (UPPER LEVEL NOISE CONTOUR)
	PROPERTY LINE



<b>PHOENIX</b> noise & vibration 5216 Chairmans Court Suite 107 Frederick, MD 21703 301-846-4227				WMAL North Bethesda FUTURE UPPER LEVEL UNMITIGATED NOISE CONTOURS	
OWS No.	PRJ No.	DATE			
5	TLB1501	170424			
SCALE		DRAWN BY			
NOT TO SCALE		WCC			



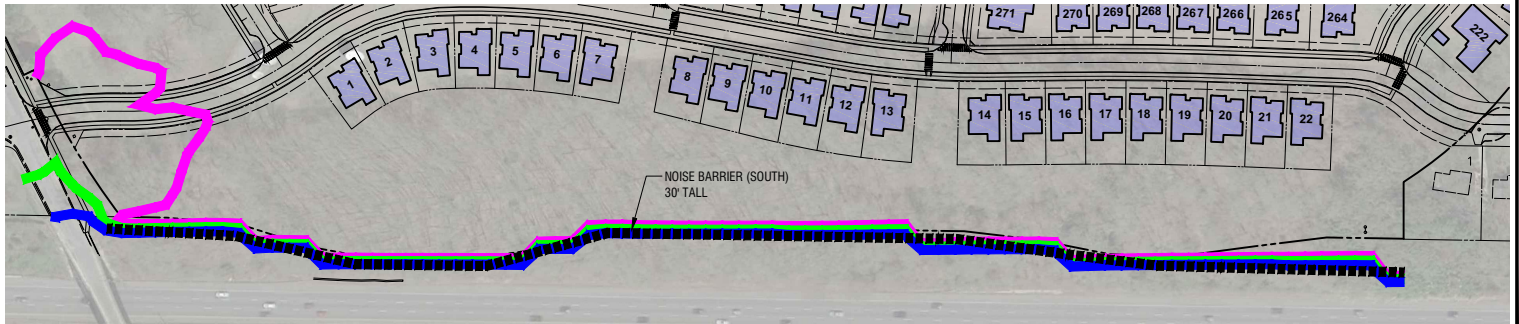
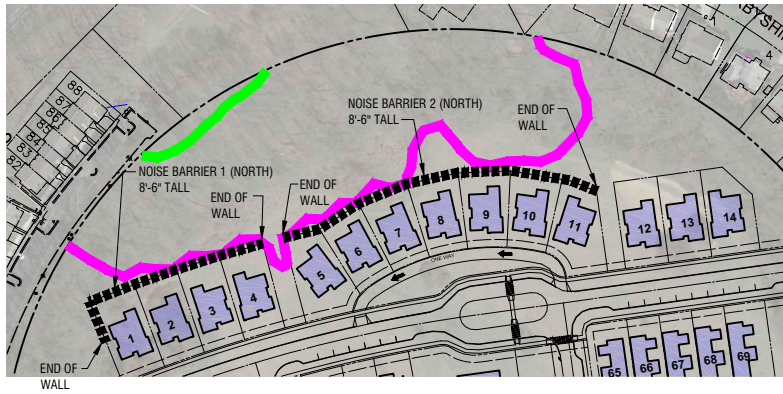


5216 Chairmans Court Suite 107  
Frederick, MD 21703  
301-846-4227

**WMAL North Bethesda**  
FUTURE MITIGATED GROUND LEVEL  
NOISE CONTOURS W/ BARRIER  
ALONG REAR YARDS

DWG. No.	PRJ. No.	DATE
6	TLB1501	170424
SCALE	DRAWN BY	
NOT TO SCALE	WCC	



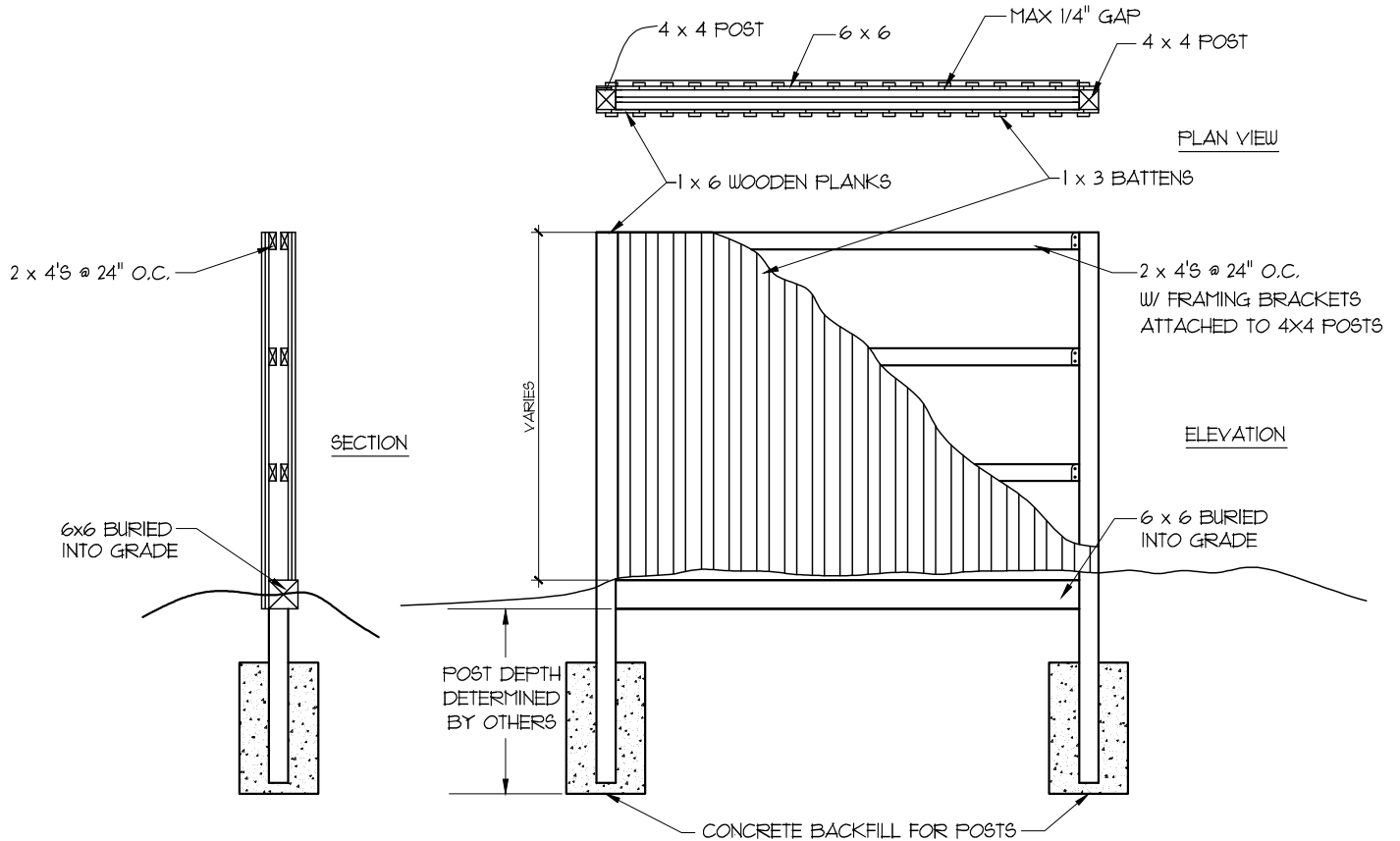


LEGEND	
	75 dBA Ldn (UPPER LEVEL NOISE CONTOUR)
	70 dBA Ldn (UPPER LEVEL NOISE CONTOUR)
	65 dBA Ldn (UPPER LEVEL NOISE CONTOUR)
	NOISE BARRIER
	PROPERTY LINE



<b>PHOENIX</b> noise & vibration 5216 Chairmans Court Suite 107 Frederick, MD 21703 301-846-4227		WMAL North Bethesda ENLARGED VIEWS NOISE CONTOURS W/ BARRIER ALONG REAR YARDS	
		OWS No. 7	DATE 170424
SCALE NOT TO SCALE		DRAWN BY WCC	





NOISE BARRIER - DOUBLE SIDED WOOD FENCE  
NOT TO SCALE

<div><div>PHOENIX</div><div>noise &amp; vibration</div></div> <div>5216 CHAIRMANS COURT, SUITE 107 FREDERICK, MARYLAND 21703-2881 P: 301.846.4227 F: 301.846.4355 <a href="http://www.phoenixnv.com">www.phoenixnv.com</a></div>	SITE			SCALE: NOT SHOWN TO SCALE		
	NOISE BARRIER - DOUBLE SIDED WOOD FENCE					
	FILE:			DWN BY: WCC	CHK BY:	REV: 01
	xDTL-S002_1_2in_Noise_Barrier_Double.dwg			DATE: 140717		ID #: S-002