METHODOLOGY TO EVALUATE EXISTING NOISE BARRIERS

Florida Department of Transportation

Office of Environmental Management

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ACRONYMS

CFR	Code of Federal Regulations
CPBR	Cost per Benefited Receptor
dB(A)	A-weighted Decibel
DNSR	Design Noise Study Report
DPK	Date of Public Knowledge
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
MSE	Mechanically Stabilized Earth
NAC	Noise Abatement Criteria
NRDG	Noise Reduction Design Goal
NSR	Noise Study Report
OEM	Office of Environmental Management
PD&E	Project Development and Environment
ROW	Right-of-Way
SHA	State Highway Agency
TNM	Traffic Noise Model

1. Introduction

The Florida Department of Transportation (FDOT) is responsible for providing policy and guidance on noise analysis for considering and evaluating potential environmental impacts on transportation projects, in accordance with Part 2, Chapter 18 of the *Project Development and Environment (PD&E) Manual* (*Highway Traffic Noise)*, as well as other state, and federal rules and regulations. The Federal Highway Administration (FHWA) issued a guidance document in 2012 called *Consideration of Existing Noise Barriers in a Type I Noise Analysis – FHWA-HEP-12-051* to assist state highway agencies (SHAs) in the assessment of existing noise barriers on Type I projects. However, this document is not specific to each SHA's policy. Since many roadways in Florida have existing noise barriers and are being expanded to accommodate the current growth, there is a need to refine this methodology further to address FDOT's current projects.

The purpose of this document is to provide a methodology for considering the feasibility and reasonableness of improving or replacing existing noise barriers within FDOT right-of-way (ROW) that are not in conflict with the proposed roadway design. When a proposed design conflicts with an existing noise barrier such that a partial or in-kind replacement is warranted, possible replacement scenarios should be discussed with the District Noise Specialist. Coordination with FHWA may also be necessary. [1]

2. Methodology to Evaluate Existing Noise Barriers

During the project noise analysis, if impacts are predicted as a result of the proposed roadway design (future Build condition) behind or in proximity to an existing noise barrier within FDOT ROW at a noise sensitive site that meets the project's Date of Public Knowledge (DPK)[2], there are three available abatement options:

Option 1. Lengthen the existing noise barrier.

Option 2. Replace the existing noise barrier with a taller noise barrier.

Option 3. Maintain the existing noise barrier in its current location, with its existing dimensions.

The methodology to evaluate existing noise barriers to determine the most feasible and reasonable option comprises six steps, as shown in **Figure 1** and **Figure 2**. Questions regarding the application of this methodology to project-specific conditions should be directed to the FDOT District Noise Specialist.

[1] For existing noise barriers that are in conflict with the proposed FDOT roadway design, the analyst should consult with the District Noise Specialist before proceeding with the analysis. A conflict usually occurs when the existing noise barriers are mounted on a roadway's outside shoulder; however, conflicts may also exist along the existing ROW.

[2] The Date of Public Knowledge is the date of approval of the Categorical Exclusion (CE), the Finding of No Significant Impact (FONSI), or the Record of Decision (ROD), as defined in Title 23 of the Code of Federal Regulations Part 772 (23 CFR 772) and Chapter 18 of the FDOT PD&E Manual.

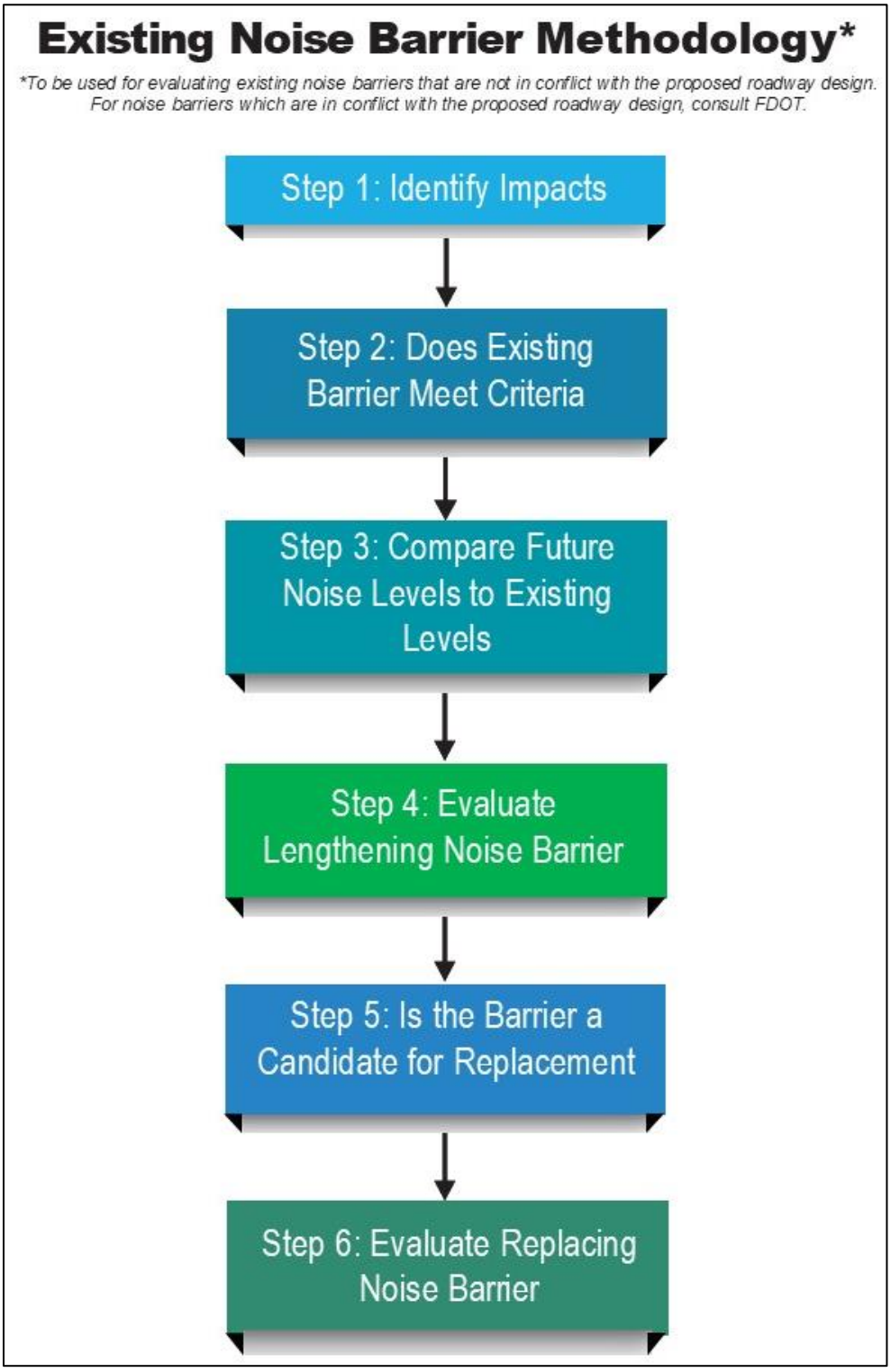

Figure 1: Existing Noise Barrier Methodology Summary

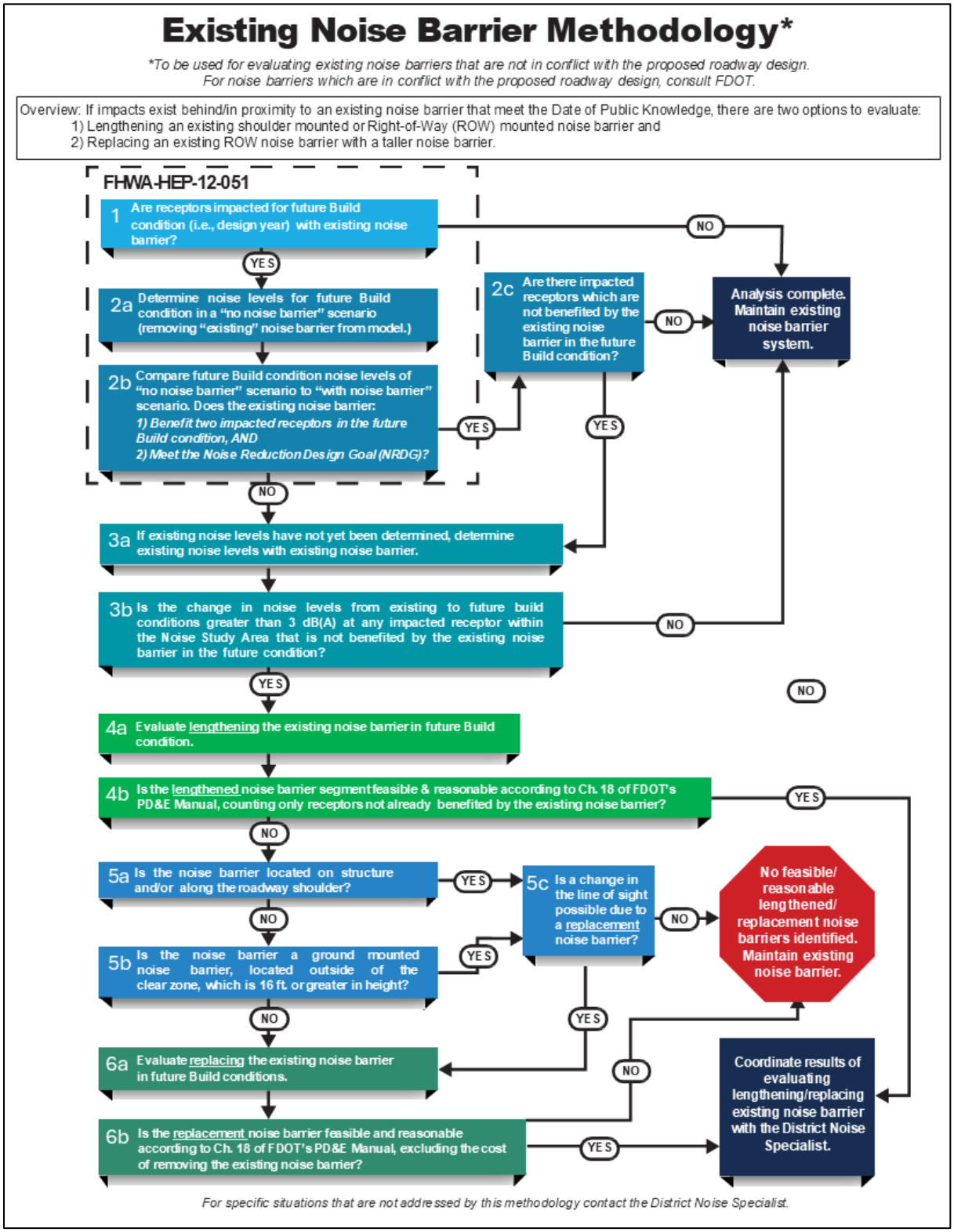

Figure 2: Existing Noise Barrier Methodology Flowchart

Documentation of decisions and rationale should be provided in the PD&E phase Noise Study Report (NSR) or in the final design phase Design Noise Study Report (DNSR). It is suggested that the evaluation tables and graphic illustrations summarizing the analyses be included in an "Existing Noise Barrier Evaluation" appendix.

2.1. Step 1: Identify Impacts

To initiate an evaluation of noise abatement from highway traffic noise, the predicted noise levels for the proposed roadway design (future Build condition) must be identified. These tasks should follow procedures listed in Title 23 Code of Federal Regulations Part 771 (23 CFR 772) and the latest version of the FDOT PD&E Manual, Chapter 18 (*Highway Traffic Noise*), and use the latest FDOT-approved version of FHWA's Traffic Noise Model (TNM).

Step 1 (**Figure 3**) entails predicting the impacts of the proposed roadway design, which includes the influence of the existing noise barrier system on the noise environment. Accurate elevation data for the top and bottom wall elevations is required to obtain accurate design year noise levels behind and in proximity to an existing noise barrier. If available, the as-built noise barrier plans should be used in the modeling to assess impacted sites. During the Design phase noise study, if elevation data is unavailable, design survey of the top and bottom wall elevations should be obtained and used.

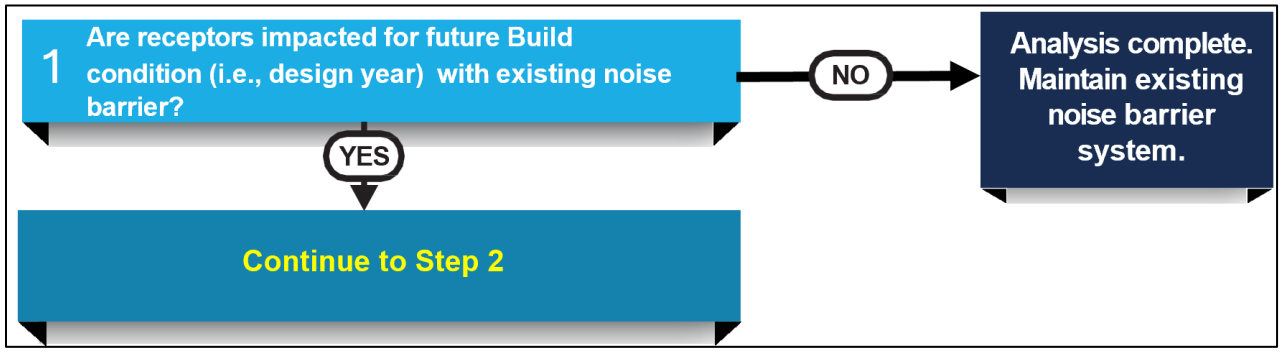

Figure 3: Step 1- Identify Impacts

The analysis is complete if no impacts are identified behind or near the existing noise barrier, and the project design plans should include the existing noise barrier's location and dimensions without modification. However, if impacts are predicted, the existing noise barrier evaluation proceeds to Step 2.

2.2. Step 2: Determine if Existing Barrier Meets Requirements

The intent of Step 2 (**Figure 4**) is to determine the abatement merits of the existing noise barrier and if it meets the FDOT acoustic feasibility and reasonableness requirements with the future Build condition[3].

If the existing barrier is proven to provide acoustically feasible abatement to all impacted receptors and meets the Noise Reduction Design Goal (NRDG), the existing barrier is not a candidate for further abatement strategies.

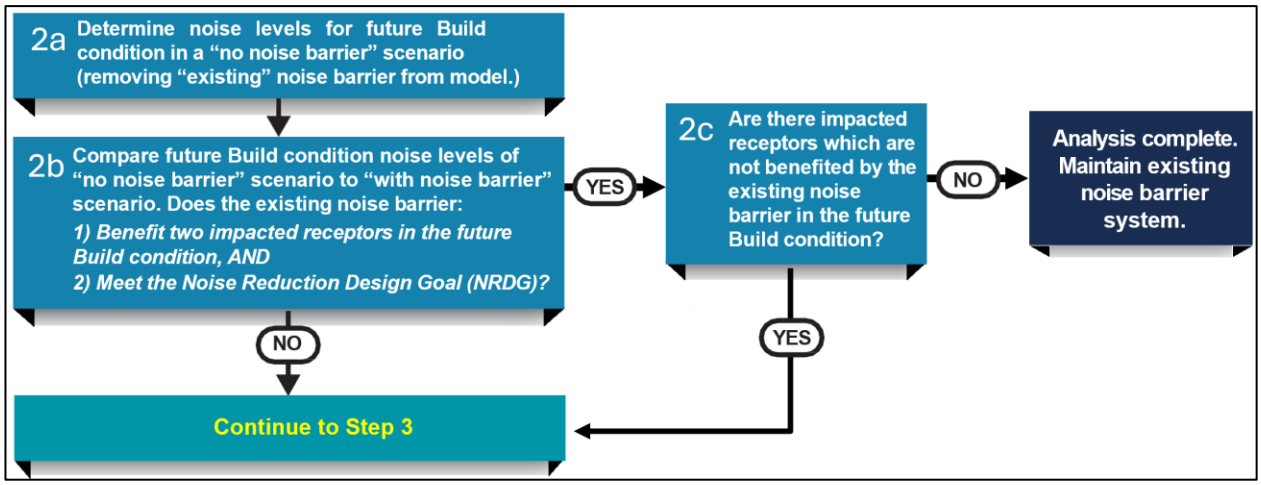

Figure 4: Step 2 - Compare "No Barrier vs Barrier" Noise Levels

This is accomplished by comparing the predicted noise levels for the future Build condition with the existing wall in place (calculated in Step 1) to a future Build scenario that does not include the existing noise barrier. To predict future Build noise levels without the influence of the existing noise barrier, save the applicable Build TNM run with a new name (i.e., No Exist Barrier), lower the existing barrier height to "0" and recalculate. The results are then compared with Step 1, the "with existing barrier" results. The difference in noise levels between the two scenarios will identify if the existing wall meets the acoustical feasible and reasonable criteria and if receptors are impacted by the future Build design but not benefited by the existing noise barrier. This latter distinction is important because any additional noise abatement strategies are focused on impacted, but not currently benefited, receptors.

The analysis is complete if the existing noise barrier benefits at least two impacted receptors, meets the NRDG, and benefits all impacted receptors (Step 2c). The results are documented in the NSR /DNSR, and the comparison table is included in the Existing Noise Barrier Evaluation appendix.

[3] A receptor that receives at least a 5 dB(A) noise reduction is considered benefited by a barrier. For the existing barrier to be considered acoustically feasible, it must reduce noise levels by at least 5 dB(A) to a minimum of two impacted receptors. To be considered acoustically reasonable, the existing barrier must meet the FDOT 7 dB(A) Noise Reduction Design Goal (NRDG) to at least one benefited receptor.

An example of documentation for an existing noise barrier meeting criteria is provided below:

> *"Based on the evaluation, the existing noise barrier provides the FDOT acoustic feasible and reasonable noise abatement to all impacted receptors under the future Build design. As such, the Build design will maintain the existing noise barrier dimensions and location without modification."*

Figure 5 is an example of how a noise level comparison table might look in the noise report appendix. In this example, even though the future Build condition impacts six receptors, these receptors receive at least a 5 A-weighted decibels (dB[A]) noise reduction (i.e., a benefit) from the existing noise barrier, with one receptor (NB1-05) receiving at least 7 dB(A) of noise reduction (i.e., NRDG). Therefore, the existing barrier in the sample project meets the acoustic feasibility and reasonableness requirements, and the existing barrier is maintained.

SAMPLE PROJECT #1

Scenario: Existing barrier benefits all impacted receptors and meets the NRDG [4]

Receptor ID	Receptor Status *(See Footnotes)*	No. of Residences Represented	STEP 1 Build Noise Level ***With*** Existing Barrier dB(A) *Meets/ Exceeds FDOT NAC*	STEP 2a Build Noise Level ***Without*** Existing Barrier dB(A) *Meets/ Exceeds FDOT NAC*	STEP 2b Existing Barrier Noise Reduction dB(A) *(Step 2a - Step 1)*
NB1-01	2	1	70.7	75.9	5.2
NB1-02	1	1	61.2	65.8	4.6
NB1-03	3	1	65.7	71.4	5.7
NB1-04	3	1	65.6	71.2	5.6
NB1-05	2	1	66.0	75.4	9.4
NB1-06	3	1	65.8	71.8	6.0
NB1-07	2	1	66.4	71.8	5.4
NB1-08	2	1	68.1	73.5	5.4
NB1-09	2	1	68.2	73.5	5.3
NB1-10	2	1	69.2	75.0	5.8

1- Not impacted by future Build design and not benefited by existing noise barrier.
2- Impacted by future Build design and benefited by existing noise barrier.
3- Not impacted by future Build design but benefited by existing noise barrier.
4- A benefit is defined as 5 dB(A) noise reduction from a barrier; NRDG is the FDOT 7 dB(A) Noise Reduction Design Goal to a receptor behind a barrier.

Figure 5: Step 2 Comparison Summary Example

However, if the existing noise barrier does not benefit all impacted receptors, the analysis proceeds to Step 3.

2.3. Step 3: Comparison to Existing Noise Levels

Thus far in the evaluation, the following conditions for the existing noise barrier have been met:

1. The existing noise barrier does not meet the acoustic feasible and reasonable criteria according to Chapter 18 of FDOT's PD&E Manual (Step 2b);

   OR

2. The existing noise barrier meets the acoustic feasible and reasonable criteria (Step 2b), but there are impacted receptors not benefiting from the existing barrier (Step 2c).

The intent of Step 3 (**Figure 6**) is to compare the future Build condition and existing noise levels to determine the extent of the proposed roadway design's noise increase. For PD&E projects, the existing noise levels have already been determined as part of the noise study. However, the calculations may be invalid for a PD&E re-evaluation or in the Design phase. If the PD&E existing noise levels cannot be utilized, they must be determined in Step 3a.

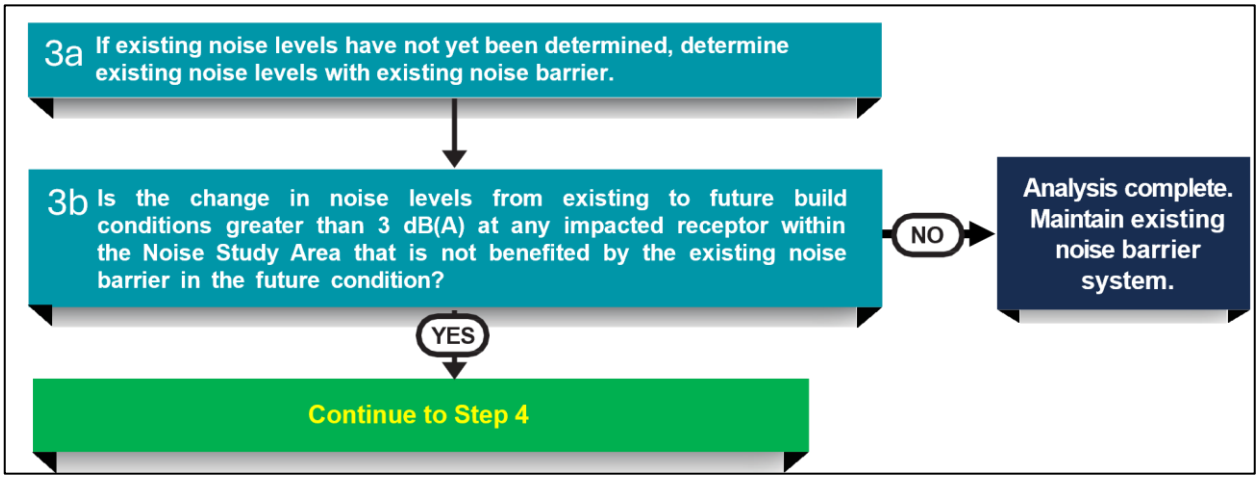

Figure 6: Step 3 - Compare Project Noise Levels to Existing Noise Levels

When discussing noise level increases or decreases, a change of 3 dB(A) is barely perceptible to most people.[4] Consequently, if the future Build condition does not increase noise levels over the existing condition by more than 3 dB(A) at any impacted receptor that does not benefit from the existing noise barrier, the existing barrier is not a candidate for further abatement strategies. The analysis is complete, and the results are documented in the NSR /DNSR, with the comparison table included in the Existing Noise Barrier Evaluation appendix. An example of text documentation for a noise barrier that meets the criteria but the increase in noise is not discernable is provided below:

> *"Based on the evaluation, the future Build design does not increase noise levels by more than 3 dB(A) over the existing condition at any impacted, but not benefited receptor. As such, the Build design will maintain the existing noise barrier dimensions and location without modification."*

Figure 7 shows how a noise level comparison table might look in the noise report appendix. In this example, receptors SB1-08,-09, and -10 are impacted by the future Build condition but are not benefited by the existing 18-foot-tall noise barrier. The evaluation focuses only on these three receptors even though impacted receptor SB1-01 shows a future noise level increase of 6.3 dB(A) because it receives a 7.3 dB(A) benefit from the existing barrier.

[4] FHWA Highway Traffic Noise Analysis and Abatement Policy and Guidance: Noise Fundamentals, Table 3, 8/24/2014.

SAMPLE PROJECT #2

Scenario: Existing 18' tall barrier does not benefit all impacted receptors, but future Build noise level increases do not exceed 3 dB(A) [4]

Receptor ID	Receptor Status *(See Footnotes)*	No. of Residences Represented	STEP 1 Build Noise Level *With* Existing Barrier dB(A) *Meets/ Exceeds FDOT NAC*	STEP 2a Build Noise Level *Without* Existing Barrier dB(A) *Meets/ Exceeds FDOT NAC*	STEP 2b Existing Barrier Noise Reduction dB(A) *(Step 2a-Step1)*	STEP 3a Existing Noise Level *With* Existing Barrier dB(A) *Meets/ Exceeds FDOT NAC*	STEP 3b Future Buld Noise Level Increase dB(A) *(Step 1 - Step 3a)*
SB1-01	2	1	75.5	82.8	7.3	69.2	6.3
SB1-02	1	1	61.2	65.8	4.6	59.2	2.0
SB1-03	3	1	65.7	71.4	5.7	64.2	1.5
SB1-04	3	1	65.6	71.2	5.6	63.7	1.9
SB1-05	2	1	66.0	75.4	9.4	64.2	1.8
SB1-06	3	1	65.8	71.8	6.0	63.8	2.0
SB1-07	2	1	66.4	71.8	5.4	64.1	2.3
SB1-08	2	1	70.6	73.5	2.9	68.2	2.4
SB1-09	2	1	70.4	73.5	3.1	67.9	2.5
SB1-10	2	1	69.2	74.1	4.9	67.4	1.8

1- Not impacted by future Build design and not benefited by existing noise barrier.
2- Impacted by future Build design and benefited by existing noise barrier.
3- Not impacted by future Build design but benefited by existing noise barrier.
4- A benefit is defined as 5 dB(A) noise reduction from a barrier; NRDG is the FDOT 7 dB(A) Noise Reduction Design Goal to a receptor behind a barrier.

Figure 7: Step 3 Summary Table Example

Since future Build noise levels do not increase more than 3 dB(A) at the three impacted/not currently benefited receptors, the existing barrier in the sample project should be maintained without modification. However, if future Build noise levels increase more than 3 dB(A) over existing noise levels at any impacted/not currently benefited receptor, the evaluation progresses to Step 4.

2.4. Step 4: Evaluate Lengthening Existing Barrier

Thus far in the evaluation, the following conditions for the existing noise barrier have been met:

1. The existing noise barrier does not meet the acoustic feasible and reasonable criteria according to Chapter 18 of FDOT's PD&E Manual (Step 2b);

   OR

2. The existing noise barrier meets the acoustic feasible and reasonable criteria (Step 2b), but there are impacted receptors not benefiting from the existing barrier (Step 2c);

   AND

3. Future Build noise levels are more than 3 dB(A) over existing levels at the impacted/not currently benefited receptors (Step 3b).

The intent of Step 4 (**Figure 8**) is to determine if the existing noise barrier can be lengthened to provide effective noise reduction to the impacted, but not currently benefited, receptors identified in Step 2.

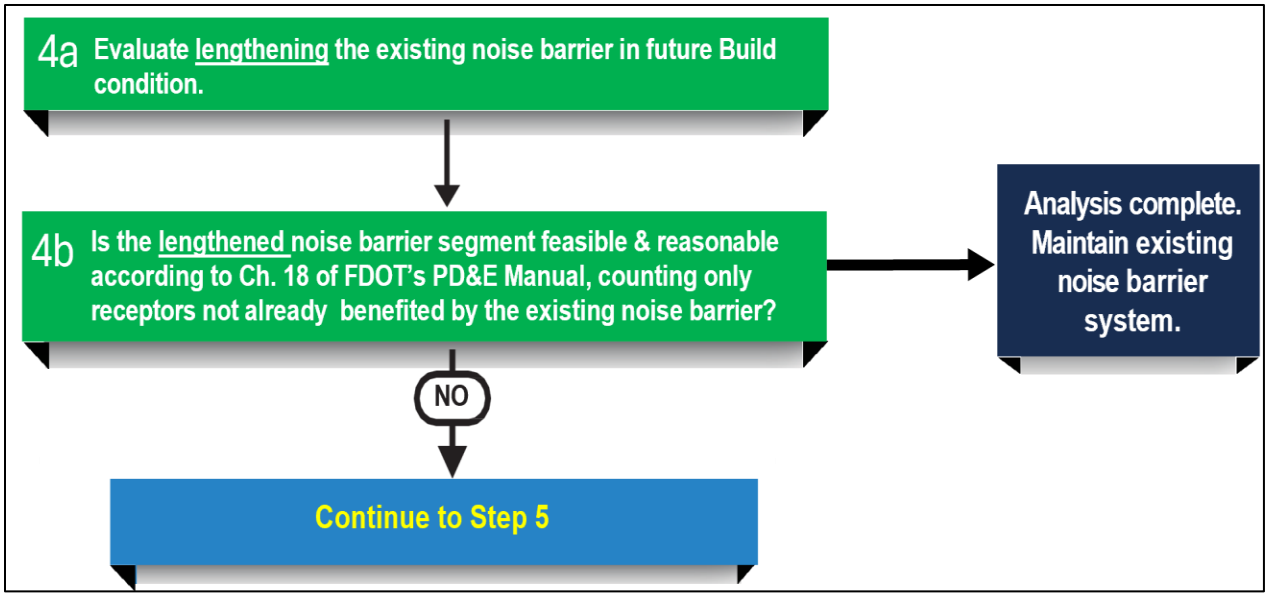

Figure 8: Step 4 - Evaluate Lengthening Options

Lengthening the existing barrier is accomplished by adding panels to either end or filling in existing gaps between panels following the FDOT *Traffic Noise Modeling & Analysis Practitioners Handbook*.[5]

When evaluating the additional barrier segment(s), all potential heights should be considered without regard to the existing noise barrier height.[6] For instance, if an existing ROW barrier height is 18 feet, the analysis should include heights from 8 to 22-foot scenarios while keeping the existing panels at 18 feet. To transition between the existing barrier and the taller lengthened segment, the height of the new panels can be "stepped" up or down at incremental heights to make the barrier visually appealing.[7]

To determine if the "lengthened noise barrier" scenario meets the feasibility and reasonableness criteria, a comparison is made between the lengthened noise barrier scenario and the "without noise barrier" results from Step 2a. This allows for a more meaningful understanding of the effectiveness of the extension because the existing noise barrier already reduces noise levels.

[5] This guidance only addresses lengthening a shoulder-mounted or ground-mounted ROW noise barrier and/or replacing a ROW noise barrier with a taller ROW noise barrier. If a shoulder-mounted noise barrier needs to be supplemented with a ROW noise barrier (or vice versa), the District Noise Specialist should be consulted.

[6] Maximum heights for the lengthened segments are as follows: Mechanically Stabilized Earth (MSE) and structure-mounted barriers are limited to 8 feet; shoulder-mounted barriers are limited to 14 feet, and ROW ground-mounted noise barriers are limited to 22 feet.

[7] Any difference in height between the existing noise barrier and additional lengthened segment(s) must follow the FDOT Standard Plans Index (SPI) 534-200. The index requires noise barrier panels to have a height increase of no more than 6 inches to 1 ½ feet greater than the adjacent barrier panel.

When counting the number of benefited receptors to include in the cost reasonableness calculation, the receptors that already receive at least a 5 dB(A) benefit from the existing noise barrier (identified in Step 2b) must be disregarded as the noise barrier extension is not being built for them. Additionally, the cost calculation should include only the dimensions of the lengthened portion of the noise barrier.

The analysis is complete if the lengthened noise barrier segment(s) meets the FDOT's feasible/reasonable criteria outlined in Chapter 18 of FDOT's PD&E Manual. To reiterate, feasibility is achieved if at least two impacted receptors that were not previously benefited by the existing noise barrier receive a noise reduction of 5 dB(A) or more from the noise barrier extension. Design, construction, safety, access, ROW, maintenance, drainage, and utility factors should also be assessed if the project is in the Design phase.

Reasonableness is achieved if the noise barrier extension attains the 7.0 dB(A) NRDG at a receptor not previously receiving a 7 dB(A) reduction from the existing noise barrier. Additionally, the cost of the noise barrier extension should not exceed $64,000 per benefited receptor. Viewpoints of the benefitted receptors should also be assessed if the project is in the Design phase and noted in PD&E studies.

After consultation with the District Noise Specialist, the results are documented in the NSR/DNSR, which should include an evaluation summary table.[8]

Figure 9 illustrates the continued analysis from Sample Project #2 (**Figure 7**). In this example, three lengthening options were evaluated for the three impacted receptors not currently benefited by the existing noise barrier (receptors SB1-8, -9, -10). An 18-foot-tall extension would match the existing noise barrier's height and benefit the three impacted/not currently benefited receptors while meeting the 7 dB(A) NRDG. However, it does not meet the cost-effectiveness criterion of $64,000 per benefited receptor. Analyzing a lower height of 16 feet for the extension does not meet the NRDG. The 20-foot option meets the NRDG and benefits the not-impacted/not currently benefited receptor SB1-02 but does not meet the cost criterion. Only the 22-foot-tall option meets all FDOT criteria.

In this instance, the first additional panel that connects to the 18-foot-tall existing noise barrier cannot be taller than 19 ½ feet to conform with the SPI 534-200. The height of the second additional panel would then be 21 feet. The third panel would begin at the optimum height of 22 feet.

If the lengthened noise barrier segment(s) is not feasible and reasonable while maintaining the existing barrier's height, the analysis continues to Step 5.

[8] The summary table should follow the format illustrated in Section 2.2.5 of the FDOT *Traffic Noise Modeling & Analysis Practitioners Handbook*.

SAMPLE PROJECT #2
LENGTHENED BARRIER EVALUATION

Evaluated Lengthening Options			Number of Impacted Residences[2]	Number of Impacted Residences Within a Noise Reduction Range			Number of Benefited Residences[3]				Impacted Res. Not Benefited[5]	Total Estimated Cost[6]	Cost per Benefited Residence[7]
Barrier Height[1] (feet)	Barrier Length[1] (feet)	Barrier Location		5-5.9 dB(A)	6-6.9 dB(A)	≥ 7.0 dB(A)	Impacted[2]	Not Impacted[4]	Total	Avg. Reduction dB(A)			
22	290	ROW[8]	3	0	1	2	3	1	4	7.7	0	$255,200	$63,800
20	340	ROW[8]		0	2	1	3	1	4	7.4	0	$272,000	$68,000
18	380	ROW[8]		1	1	1	3	0	3	7.2	0	$273,600	$91,200
16	380	ROW[8]		2	1	0	NA[9]	NA[9]	NA[9]	NA[9]	NA[9]	NA[9]	NA[9]

[1] Full height is for the length indicated. If a shoulder noise barrier location is indicated, the length of vertical height tapers at the shoulder barrier's terminus (See FDOT Standard Plans) would be in addition to the

[2] Residences that are impacted by the future Build condition (predicted noise levels of 66 dB(A) or greater), but not benefited by the existing noise barrier (receive a noise reduction of less than 5 dB(A).)

[3] Residences that receive a minimum 5 dB(A) reduction from evaluated lengthened barrier segments.

[4] Residences that are not impacted by the future Build condition and not benefited by the existing noise barrier.

[5] Impacted residences that do not received a minimum 5 dB(A) reduction from evaluated noise barrier.

[6] Only the barrier extension is included in the cost analysis, using FDOT's current unit cost of $40/ft^2.

[7] FDOT Reasonable Cost Guideline is $64,000.

[8] ROW – Noise barrier offset 10' inside FDOT ROW.

[9] FDOT Noise Reduction Design Goal (NRDG) is 7 dB(A) at a minimum of 1 benefited receptor. Analysis ends if NRDG is not achieved.

Figure 9: Existing Barrier Lengthening Evaluation Summary Example

2.5. Step 5: Is the Barrier a Candidate for Replacement

Once it has been established that lengthening the existing barrier is not feasible or reasonable, it is suggested that replacement options be evaluated. However, it must be possible for a potential replacement noise barrier to be at least 6 feet taller than the existing noise barrier. According to FHWA guidance, an additional 6 feet in height equals an approximate 3 dB(A) decrease, assuming the line of sight is blocked[9]. A 3 dB(A) decrease is the lowest perceptible difference in noise reduction unless a change in the line of sight from any receptor to the roadway occurs.

Step 5a (**Figure 10**) determines if the existing noise barrier is located along the roadway shoulder or mounted on a structure or Mechanically Stabilized Earth (MSE). If the answer is "Yes," the existing noise barrier is not eligible to be replaced unless a change in the line of sight from any receptor to the roadway is possible. For example, an existing 8-foot tall structure-mounted barrier is already at maximum height and requires a design variation to replace it. However, replacing an 8-foot tall shoulder-mounted noise barrier with a 14-foot noise barrier (i.e., a 6-foot height increase) may result in a minimally perceptible difference in noise because a change in the line of sight is possible. If the line of sight on the existing shoulder-mounted noise barrier can be changed, or a design variation is granted for a structure-mounted noise barrier, a replacement noise barrier should be evaluated (Step 6).

[9] FHWA *Noise Barrier Design Handbook*, Section 3.5.1.

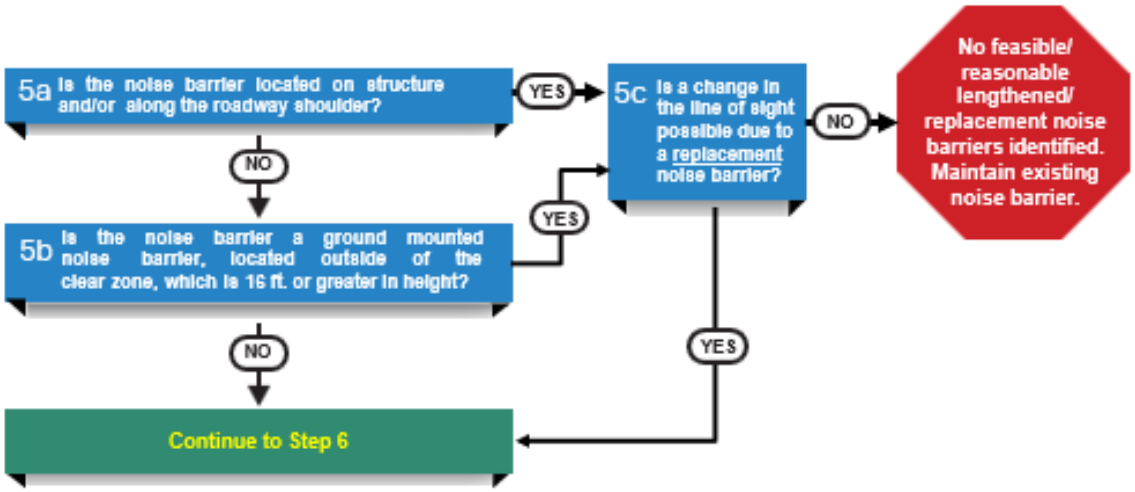

Figure 10 Step 5: Can the Noise Barrier Height Be Raised?

However, if a change in the line of sight is not possible for a shoulder-mounted barrier or a design variation is not possible for a structure-mounted noise barrier, the analysis is complete, and the results are documented in the NSR /DNSR. An example of text documentation for a noise barrier that meets criteria but the line of sight change is not possible is provided below:

> *"Based on the existing noise barrier evaluation, no feasible/reasonable options for lengthening or replacing the existing barrier have been identified because the existing noise barrier is located along the roadway shoulder and is at the maximum allowable height. There is no opportunity for a taller barrier to change the line of sight to the roadway to provide additional noise abatement. As such, the Build design will maintain the existing noise barrier dimensions and location without modification."*

If the answer to Step 5a is "No," the existing noise barrier is not mounted on the roadway shoulder or structure, the evaluation proceeds to Step 5b. In this step, the existing noise barrier is ground-mounted outside the roadway's clear zone, either along the ROW or offset from the shoulder. If the existing barrier's height is not greater than 16 feet, a line of sight change may be possible, and the analysis proceeds to Step 6.

Conversely, if the existing ground-mounted barrier is taller than 16 feet, the potential replacement barrier would be less than 6 feet taller than the existing height and not a candidate for replacement unless the line of sight is altered (Step 5c). For example, replacing an 18-foot tall noise barrier with a 22-foot noise barrier is only an increase of 4 feet, equating to a less than a 3 dB(A) insertion loss (unless the line of sight is altered; Step 5c). In this instance, coordination with the District Noise Specialist is required to discuss the viability of replacing an existing noise barrier with a noise barrier that is less than 6 feet taller.

If the barrier is not a candidate for replacement due to the existing height, the analysis is complete, and the results are documented in the NSR /DNSR. An example of text documentation for a noise barrier that is ground-mounted and more than 16 feet in height is provided below:

> *"Based on the existing noise barrier evaluation, no feasible/reasonable options for lengthening or replacing the existing barrier have been identified because the existing noise barrier is taller than 16 feet and is, therefore, not eligible for replacement. As such, the Build design will maintain the existing noise barrier dimensions and location without modification."*

2.6. Step 6: Evaluate Replacing Existing Noise Barrier

For the Step 6 evaluation of replacement options (**Figure 11**), it is recommended that the height of the replacement barrier be at the tallest allowable limit, where appropriate, to abate future noise conditions while meeting FDOT's feasible/reasonable criteria outlined in Chapter 18 of FDOT's PD&E Manual.

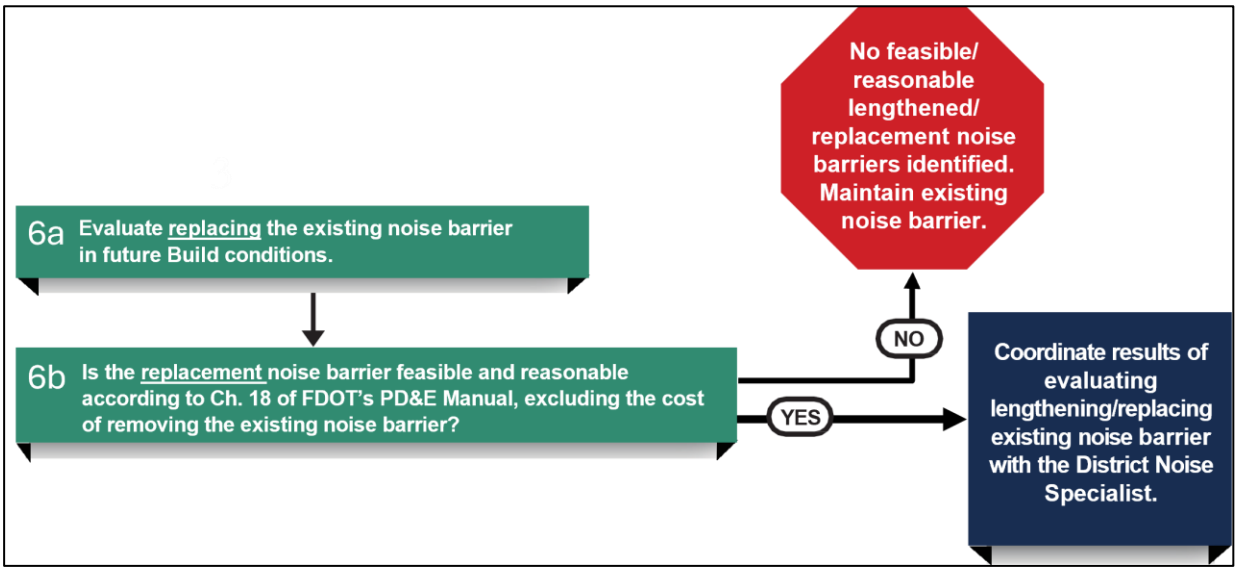

Figure 11: Step 6 - Evaluate Replacing Existing Noise Barrier

Following the FDOT *Traffic Noise Modeling & Analysis Practitioners Handbook*, evaluate the optimum replacement barrier dimensions (length and height). To calculate a receptor's noise reduction from the replacement barrier, compare the "replacement noise barrier" scenario to a "no noise barrier" scenario (Step 2a). This allows for a more achievable noise reduction, as the existing noise barrier already provides a reduction in noise levels. Include all newly benefitted receptors (those not benefited by the existing noise barrier) and the entire length/height of the replacement noise barrier in the cost-effectiveness calculation, excluding the cost of removing the existing noise barrier. For example, if the existing noise barrier provides a benefit to 10 out of the 20 analyzed receptors, and the replacement noise barrier

provides a benefit to 15 of the 20 receptors, only the 5 newly benefited receptors would be included in the calculation of cost-effectiveness.

If the replacement barrier does not achieve the FDOT feasibility/reasonableness criteria, the analysis is complete and the results are documented in the NSR /DNSR. **Figure 12** illustrates the suggested format for the noise barrier summary table in the noise report. In this sample project, the replacement barrier exceeds the cost-effectiveness criteria and is not considered feasible and reasonable. An example of text documentation for a ROW noise barrier that does not meet the criteria for lengthening or replacement is provided below:

> *"Based on the existing noise barrier evaluation, no feasible/reasonable options for lengthening or replacing the existing barrier have been identified. As such, the Build design will maintain the existing noise barrier dimensions and location without modification."*

SAMPLE PROJECT #3
REPLACEMENT BARRIER EVALUATION

Evaluated Dimensions of Replacement Barrier			Number of Impacted Residences[2]	Number of Impacted Residences Within a Noise Reduction Range			Number of Benefited Residences[3]				Impacted Res. Not Benefited[5]	Total Estimated Cost[6]	Cost per Benefited Residence[7]
Barrier Height[1] (feet)	Barrier Length[1] (feet)	Barrier Location		5-5.9 dB(A)	6-6.9 dB(A)	≥ 7.0 dB(A)	Impacted[2]	Not Impacted[4]	Total	Avg. Reduction dB(A)			
22	540	ROW[8]	3	0	1	2	3	1	4	7.7	0	$475,200	$118,800
20	600	ROW[8]		1	1	1	3	1	4	7.4	0	$480,000	$120,000
18	820	ROW[8]		2	1	0	3	0	3	6.9	0	$590,400	$196,800

[1] Full height is for the length indicated. If a shoulder noise barrier location is indicated, the length of vertical height tapers at the shoulder barrier's terminus (See FDOT Standard Plans) would be in addition to the length indicated.

[2] Residences that are impacted by the future Build condition (predicted noise levels of 66 dB(A) or greater), but not benefited by the existing noise barrier (receive a noise reduction of less than 5 dB(A).)
[3] Residences that receive a minimum 5 dB(A) reduction from evaluated lengthened barrier segments.
[4] Residences that are not impacted by the future Build condition and not benefited by the existing noise barrier.
[5] Impacted residences that do not received a minimum 5 dB(A) reduction from evaluated noise barrier.
[6] Only the barrier extension is included in the cost analysis, using FDOT's current unit cost of $40/ft^2.
[7] FDOT Reasonable Cost Guideline is $64,000.
[8] ROW – Noise barrier offset 10' inside FDOT ROW.
[9] FDOT Noise Reduction Design Goal (NRDG) is 7 dB(A) at a minimum of 1 benefited receptor. Analysis ends if NRDG is not achieved.

Figure 12: Step 6 - Barrier Replacement Summary Table Example

If the replacement barrier is feasible and reasonable according to Chapter 18 of the PD&E Manual, excluding the cost of removing the existing noise barrier, consultation with the District Noise Specialist is required before the results are documented and the barrier summary table is included in the NSR /DNSR.

3. Illustration of Existing Noise Barrier Analysis

The primary goal of the existing noise barrier evaluation is to illustrate the effectiveness of an existing barrier under the future Build condition. It is important to differentiate impacted and not-impacted receptors that currently benefit from the existing barrier from those that do not benefit from the existing barrier. Additionally, it is important to illustrate the effectiveness of extending or replacing the existing barrier. These goals can be achieved through tables, graphics, or a combination of both.

Examples of tables have been discussed in the previous sections. The intent of this section is to establish continuity throughout FDOT while allowing for project-specific graphics as needed. The following are examples of graphics that FDOT Districts are currently using. Please note that these examples are provided as an informative tool. Coordination with the District Noise Specialist is required to determine the best illustrative approach for the specific project.

In the first example, **Figure 13**, the District differentiates between the benefits of the existing ROW noise barrier and the analyzed extensions. Each category of receptor impact/benefits is given a unique color, as indicated in the legend. In this example, the graphic clearly identifies the effectiveness of the existing barrier and of providing an extension. This approach may be easier to accomplish on projects with a small number of receptors behind or adjacent to the existing noise barrier.

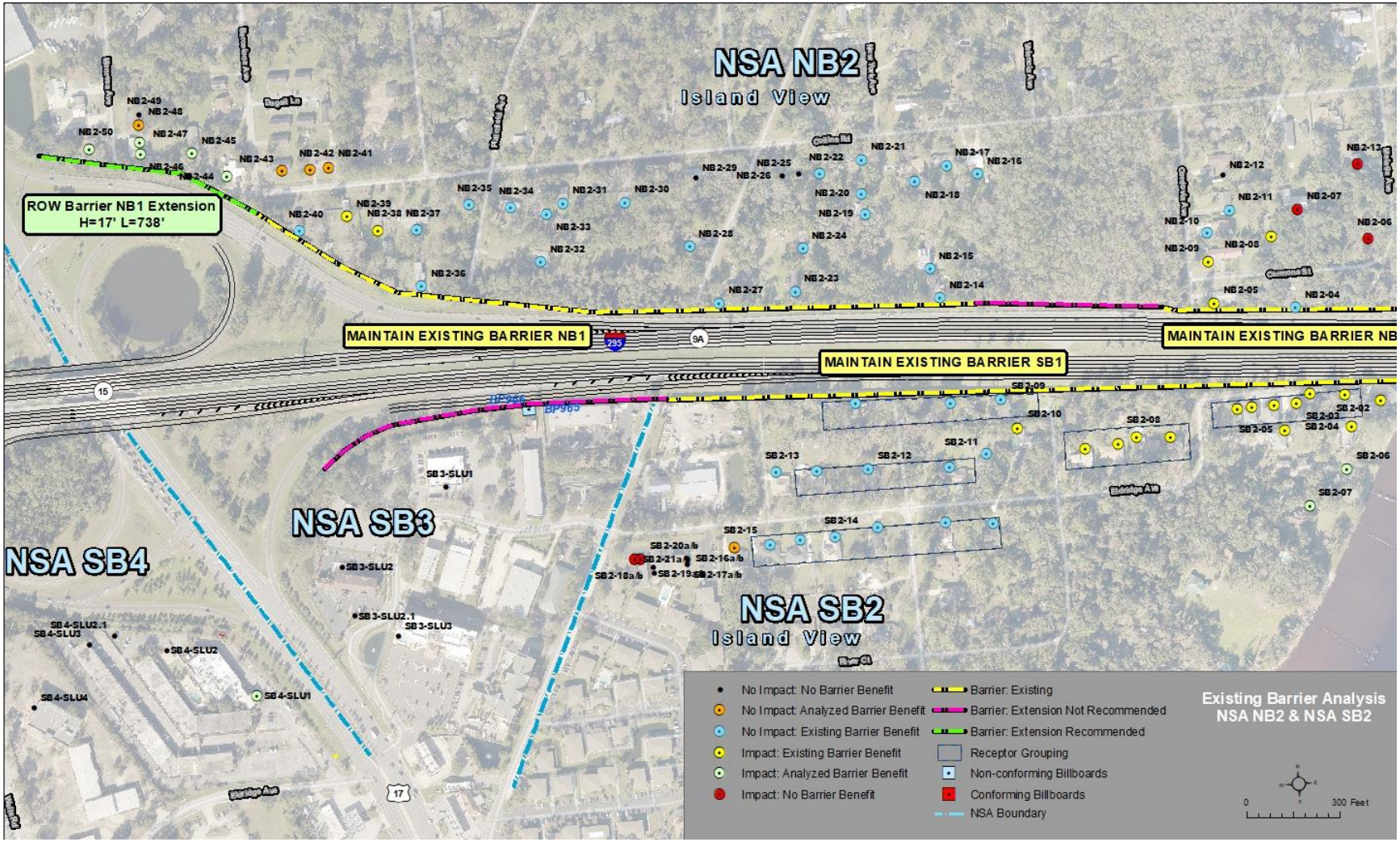

Figure 13: Barrier Evaluation Graphic Example 1

In this next example, **Figure 14,** the District identifies the existing ROW noise barrier and a recommended extension and supplemental shoulder barrier (Noise Wall 1). The graphic does not differentiate between the impacts/benefits of the existing noise barrier from the proposed barrier system. However, it is easy to discern the benefits of the proposed system because each category of receptor impact/benefits is given a unique color, as indicated in the legend.

The District supplemented this graphic with an annotation of the methodology flowchart (**Figure 15**) in the report text. With the combination of texts and graphics, the reader gains an understanding that the existing noise barrier does not provide a benefit to all project-impacted receptors and that additional benefits are achieved with the proposed extension and shoulder barrier.

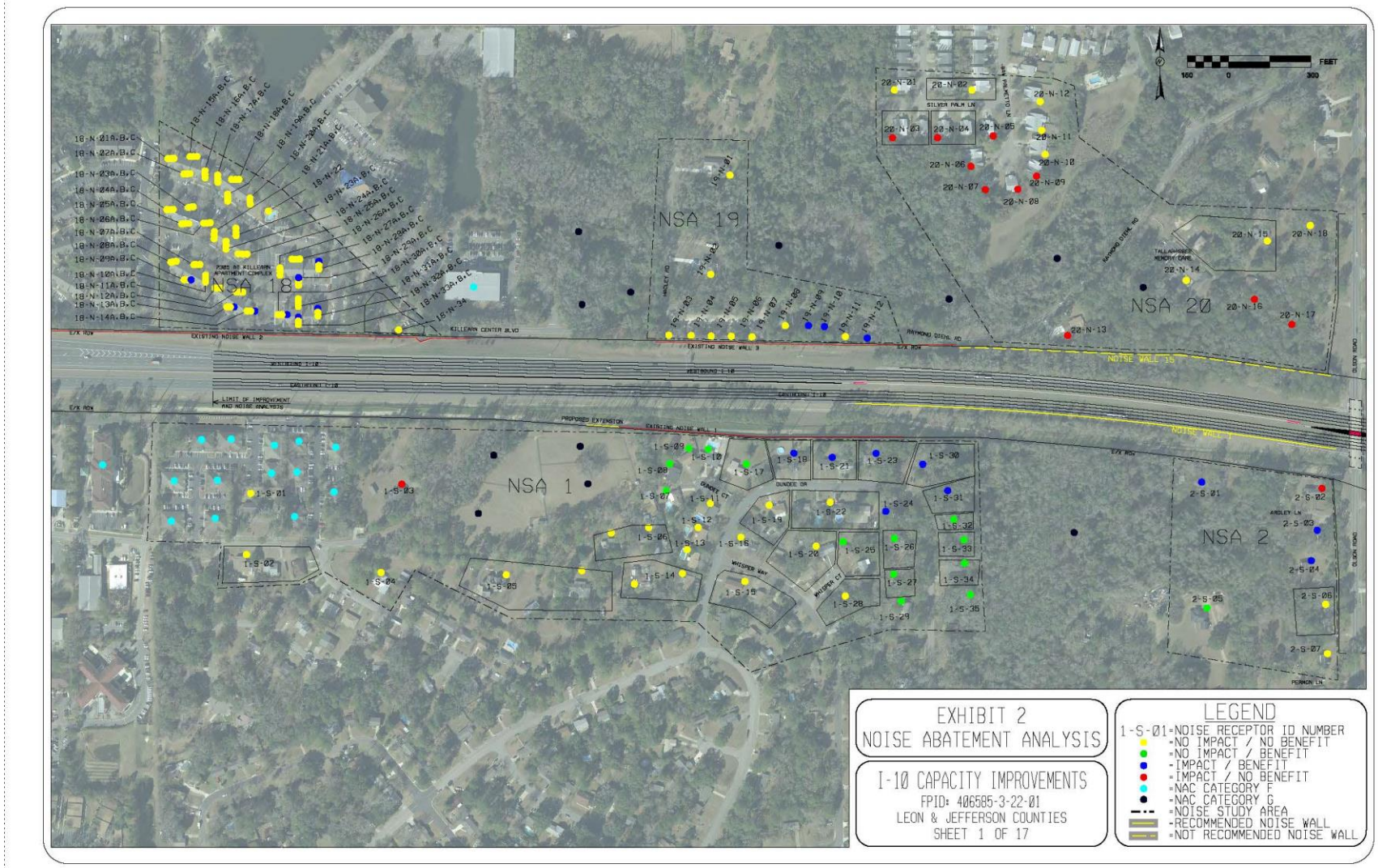

Figure 14: Barrier Evaluation Graphic Example 2a

Figure 2: Existing Noise Barrier Methodology, Existing Noise Wall 1

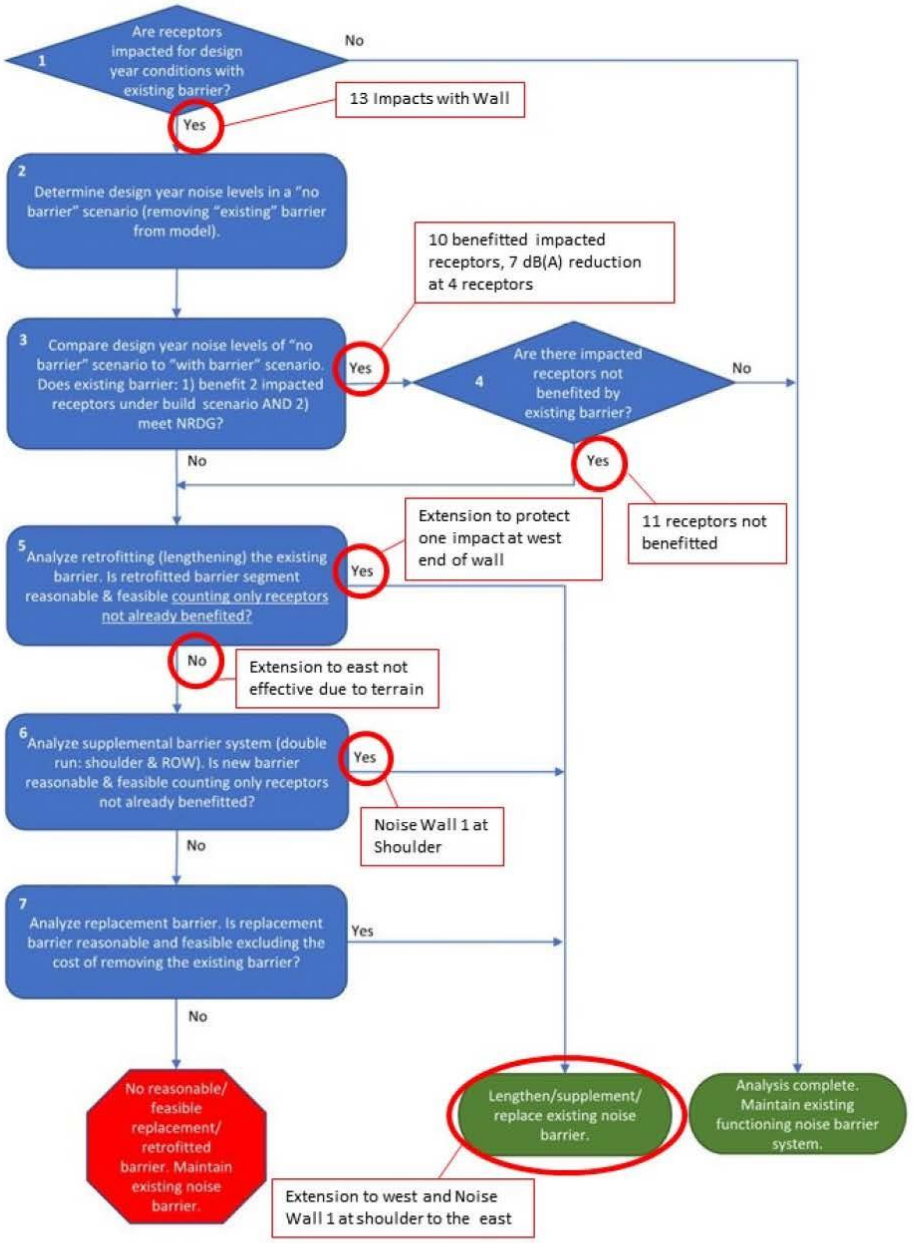

Figure 15: Barrier Evaluation Graphic Example 2b

In the following examples, there are several existing noise barriers within a large project corridor. **Figure 16** illustrates that all noise receptors behind or in the vicinity of the existing ROW noise barrier are not impacted by the project. Because the receptor icon indicates "Not Impacted/Not Benefited," the District inserts a text callout behind the existing barrier to inform the reader that there are no impacts with the existing barrier in place. No distinction is made of which receptors are benefited from the existing noise barrier, and those that are not benefited.

Figure 17 illustrates a section of the project where two scenarios occur. First, an existing ROW noise barrier is maintained but supplemented with a shoulder barrier. The second scenario involves an existing ROW barrier that is replaced with a taller barrier and supplemented with a shoulder barrier. The callouts provided on the graphic aids the reader in understanding the current dimensions of the existing noise barrier and how it will be modified (e.g., made taller) to abate project impacts. Due to the large number of noise receptors behind existing noise barriers, the focus of the project's abatement graphics is on project-related impacts and proposed noise barrier system benefits.

The examples provided herein illustrate the varying degree of complexity between FDOT projects and highlight the need for coordination with the District Noise Specialist to determine the best reporting techniques for a specific project.

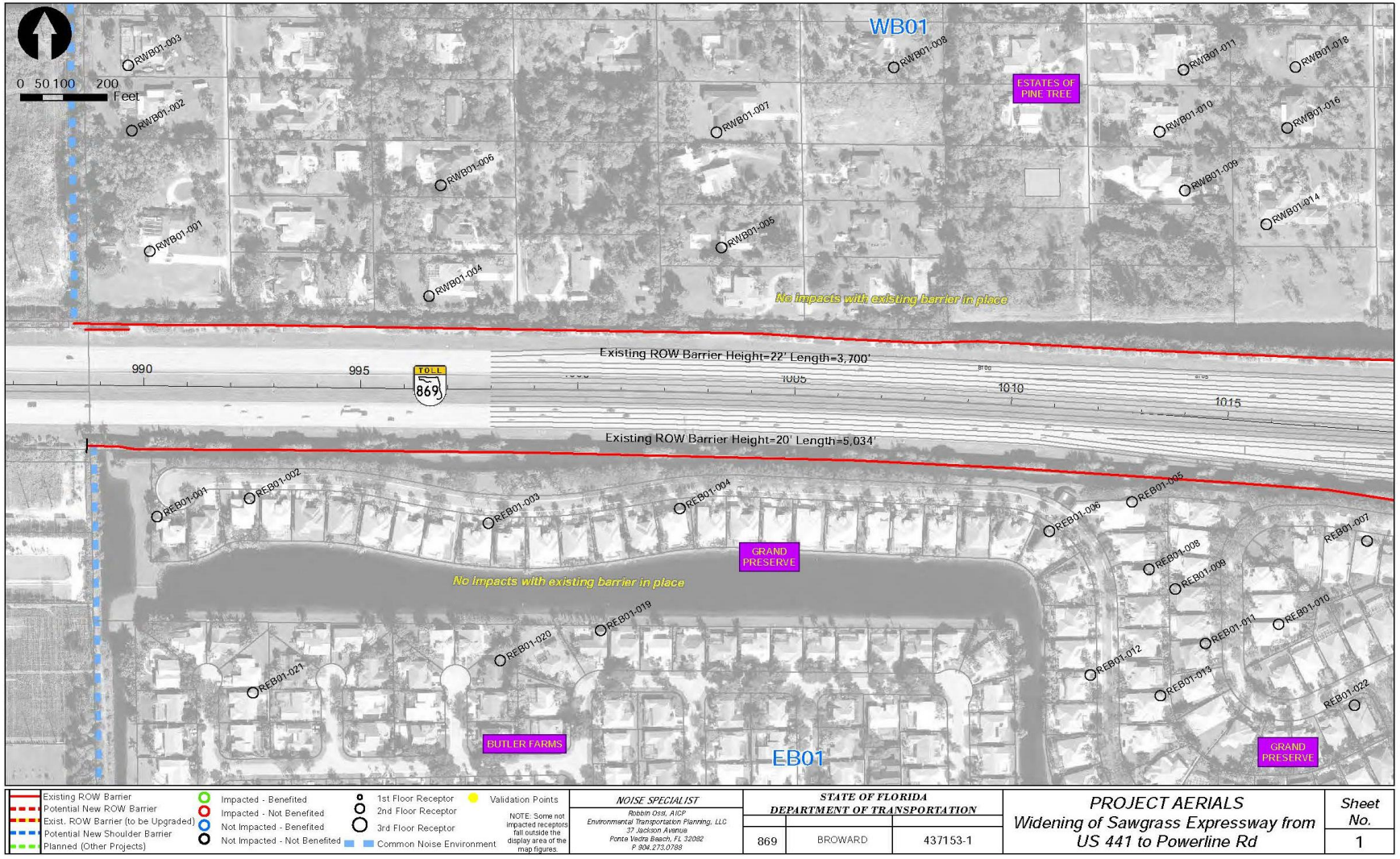

Figure 16: Barrier Evaluation Graphic Example 3a

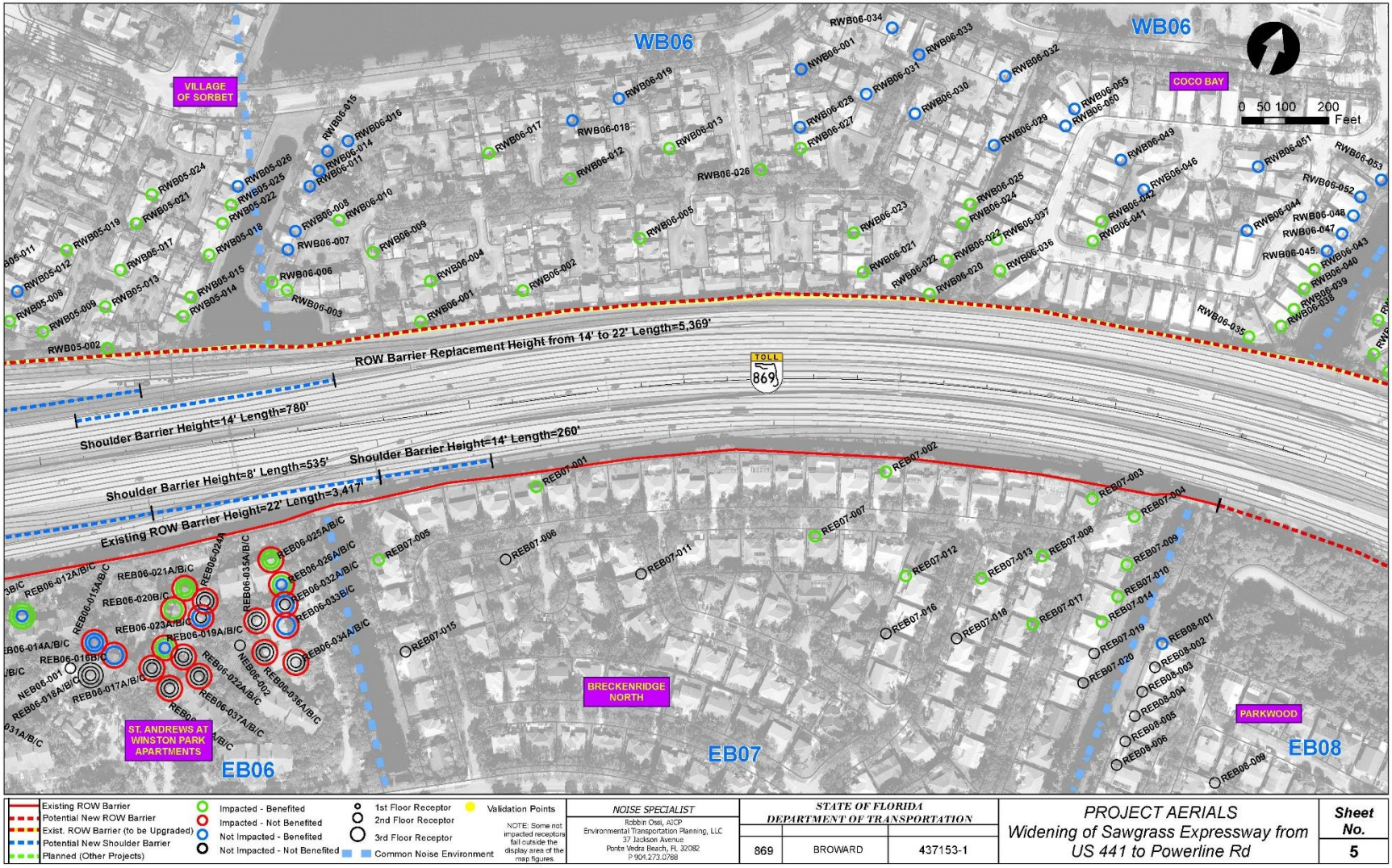

Figure 17: Barrier Evaluation Graphic Example 3b

4. Conclusions

This guidance document provides a state-wide procedure for determining and documenting an existing noise barrier's effectiveness in abating traffic noise impacts from a proposed project and evaluating the feasibility and reasonableness of improving or replacing the existing barrier when project noise impacts are identified. The guidance focuses solely on existing noise barriers within FDOT ROW that are not in conflict with the proposed roadway design. When a proposed design conflicts with an existing noise barrier such that a partial or in-kind replacement is warranted, possible replacement scenarios should be discussed with the District Noise Specialist.

During the project noise analysis, if impacts are predicted as a result of the proposed roadway design (future Build condition) behind or in proximity to an existing noise barrier within FDOT ROW at a noise sensitive site that meets the project's DPK, there are three available abatement options: lengthen the existing noise barrier; replace the existing noise barrier with a taller noise barrier; or do nothing and maintain the existing noise barrier in its current location, with its existing dimensions. The flowchart illustrated in **Figure 2** guides the Noise Analyst through the series of evaluations necessary to determine the appropriate option to employ.

Examples of possible report tables and graphics are provided in this guidance document as informative tools. The intent is to establish continuity throughout FDOT while allowing for project-specific approaches as needed. Coordination with the District Noise Specialist is required to determine the best reporting techniques for a specific project. In circumstances not outlined by this guidance document, Noise Analysts should coordinate with the District Noise Specialist.

References

23 CFR Part 772, "*Procedures for Abatement of Highway Traffic Noise and Construction Noise*", Federal Register, Vol. 75, No. 133, Tuesday, July 13, 2010; pages 39834-39839.

FDOT, *"Highway Traffic Noise"*, Part 2, Chapter 18. *Project Development and Environment Manual*, FDOT, Tallahassee, July 31, 2024.

FDOT, "*FDOT Traffic Noise Modeling & Analysis Practitioners Handbook*," December 31, 2018.

Federal Highway Administration, Report FHWA-HEP-10-025, *"Highway Traffic Noise: Analysis and Abatement Guidance,"* December 2011; 75 pages.