HDR

Noise and Vibration Technical Memorandum

NICTD Double Track NWI (DT-NWI)
Milepost (MP) 58.8 to MP 32.2

Gary to Michigan City, IN

August 18, 2017

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

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Noise and Vibration Technical Memorandum

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Acronyms

Acronym	Definition
CSS	Chicago South Shore and South Bend Railroad
dB	decibels
dBA	A-weighted Decibels
DT-NWI Project	Double Track Northwest Indiana Project
EA	Environmental Assessment
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GBN	ground-borne noise
GBV	ground-borne vibration
GIS	geographic information system
in/sec	inch per second
L_{dn}	day-night average sound level
L_{eq}	average sound level
$L_{eq(h)}$	average sound level over an hour
MP	Mileposts
mph	miles per hour
NEPA	National Environmental Policy Act
NICTD	Northern Indiana Commuter Transportation District
OCS	overhead contact system
PPV	Peak Particle Velocity
RMS	root mean square
SPL	sound pressure level
SSL	South Shore Line
SWL	sound power level
VdB	vibration decibels

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1.0 INTRODUCTION AND SUMMARY

1.1 PURPOSE OF MEMORANDUM

This memorandum presents the technical assessment of noise and vibration impacts for the Northern Indiana Commuter Transportation District (NICTD) Double Track Northwest Indiana Project (DT-NWI Project). This noise and vibration impact assessment supports an Environmental Assessment (EA) prepared in accordance with the National Environmental Policy Act (NEPA).

This section summarizes the proposed Project, noise and vibration resources, legal and regulatory context, and impact thresholds. Section 2.0 discusses the methods used for the noise and vibration analyses. Section 3.0 describes existing conditions in the Project Area. Section 4.0 presents the potential noise and vibration impacts of the proposed Project. Section 5.0 proposes potential mitigation measures to reduce Project-related noise or vibration impacts. Section 6.0 provides conclusions of the noise and vibration analyses.

1.2 PROJECT DESCRIPTION

The proposed Project limits are defined by mileposts (MPs) and are described from west to east. The proposed Project begins in Gary at MP 58.8, west of Virginia Street, and ends at MP 32.2, near Carroll Avenue in Michigan City. The total distance is 26.6 miles. Nearly 6.5 miles of double-track mainline already exists within the proposed Project limits, generally between the east end of Gary (MP 54.0) and Burns Harbor (MP 47.5). There are also three separate passing sidings totaling 2.2 miles. Therefore, the total distance of existing double track is 8.7 miles.

Within the 26.6-mile Project Area, the proposed Project would include 1.8 miles of signal work at the far west and east ends of the project, generally between MP 58.8 and 58.1 and MP 33.3 and 32.2, and the construction of 16.1 miles of new second mainline track and new overhead contact system (OCS or catenary) between MP 58.1 in Gary and MP 33.3 in Michigan City. These MPs roughly correspond with Tennessee Street in Gary and Michigan Boulevard in Michigan City.

At the east end of the proposed Project, between MP 33.3 (Michigan Boulevard) and MP 35.3 (Sheridan Avenue) and in Michigan City, the proposed Project consists of replacing 1.9 miles of embedded, street-running track in 10th and 11th Streets with a segregated, double mainline track. Along 10th Street, the proposed Project would remove three road and rail crossings. Eight additional at-grade crossings would be removed along 10th Street because of the realignment of the NICTD/CSS track out of the roadway. Ten streets that intersect with 11th Street would have a cul-de-sac north of the newly aligned NICTD/CSS railroad tracks, thereby removing the road and rail crossings. The remaining open crossings would be upgraded with automatic warning devices consisting of flashers, gates, and bells.

The five stations between Gary and Michigan City would be improved to support the additional ridership, service frequency, and operational flexibility of the proposed Project. All stations would need to accommodate the continued operation of the Chicago South Shore and South Bend Railroad (CSS) freight trains.

Current SSL weekday commuter service serves Chicago with 19 daily inbound (westbound) trains and 20 daily outbound (eastbound) trains. The NICTD operates nine peak-hour westbound SSL trains in the morning (AM) peak hours (5:45 to 9 AM) and eight peak-hour eastbound trains in the afternoon (PM) peak hours (3:45 to 6 PM).

The proposed Project would increase the number of commuter trains by up to six trains per day. Additionally, the Project would increase speed within Michigan City up to 45 miles per hour (mph).

Figure 1-1. Project Area

1.2.1 NO BUILD ALTERNATIVE

The No Build Alternative is a required alternative as part of the NEPA environmental analysis and is used for comparison purposes to assess the relative benefits and impacts of implementing the proposed Project

The No Build Alternative would maintain the status quo, representing future conditions if the proposed Project were not implemented. The No Build Alternative would not include any major transit system or station investments or construction, expand system capacity, realign track in Michigan City, or increase the number of trains or speeds.

The No Build Alternative would include maintenance and typical repairs to the SSL and the associated infrastructure based on historic funding levels needed to keep the line functional. Typical repairs include routine bridge replacement, track maintenance, upgrades to switches, catenary renewal, upgrades to maintenance facilities, expanded parking facilities, and upgrades to some existing stations.

1.2.2 BUILD ALTERNATIVE

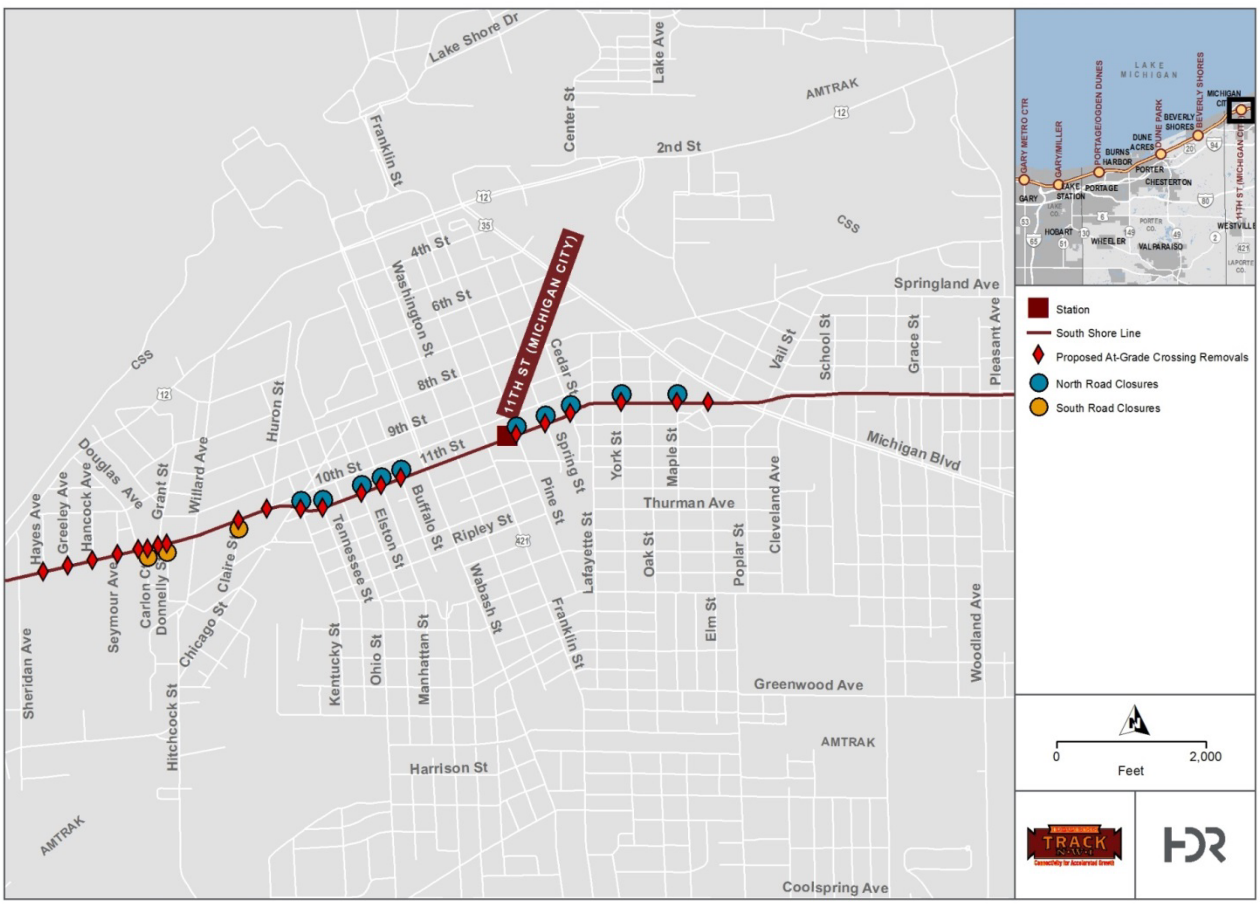
The components of the Build Alternative are described from west to east. Improvements between MP 58.8 (Gary) and MP 35.3 (Sheridan Avenue in Michigan City) are shown in **Figure 1-2** and include:

- Addition of second, adjacent track in locations where only single track currently exists
- Installation of signal and OCS infrastructure
- Construction of new railroad bridges over two roadways (Hobart Road and ArcelorMittal entrance)
- Construction of new railroad bridges over two freight railroads (Norfolk Southern Railway and CSX Transportation)
- Installation of upgrades to the Gary/Miller, Portage/Ogden Dunes, Dune Park, and Beverly Shores Stations
- Installation of high speed universal crossovers

At the east end of the Project, between MP 35.3 (Sheridan Avenue) and MP 32.2 (Carroll Avenue) in Michigan City, the proposed Project would:

- Replace 1.9 miles of embedded street-running track in 10th and 11th Streets with a segregated, double track rail corridor
- Install signal and OCS infrastructure
- Close 13 at-grade road/rail crossings
- Upgrade the remaining at-grade crossings in Michigan City with flashers, gates, and bells
- Construct a new 11th Street (Michigan City) Station, parking lots, parking structure, and platforms located between Pine and Franklin Streets

Figure 1-2. Proposed At-grade Crossing Removals and Road Closures, Michigan City



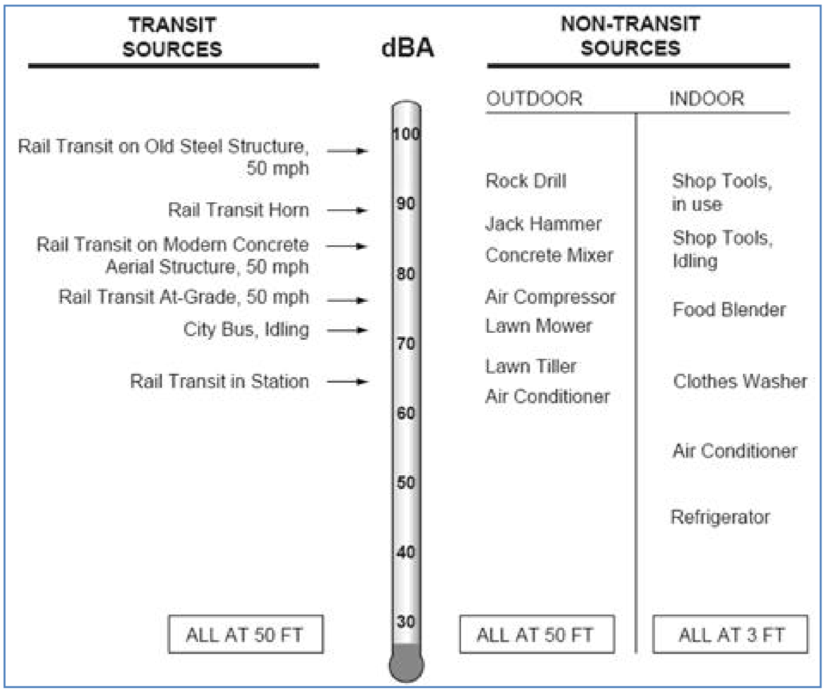
1.3 DESCRIPTION OF RESOURCES

1.3.1 NOISE

Noise is unwanted or undesirable sound. Sound travels through the air as waves of tiny air pressure fluctuations caused by vibration. The intensity or loudness of a sound is determined by how much the sound pressure fluctuates. Sound pressure is expressed in decibels (dB).

Most sounds consist of a broad range of sound frequencies, from low to high frequencies. The average human ear does not perceive all frequencies equally. Therefore, the A-weighting scale (A-weighted decibels or dBA) was developed to approximate the way the human ear responds to sound levels. It mathematically applies less “weight” to frequencies that humans do not hear well, and applies more “weight” to frequencies humans do hear well. Typical A-weighted noise levels for various types of sound sources are summarized in **Figure 1-3**.

Figure 1-3. Typical Noise Levels



Source: *Transit Noise and Vibration Impact Assessment* (FTA 2006)

The equivalent average sound level (L_{eq}) is often used to describe sound levels that vary over time, usually a 1-hour period. The L_{eq} is often described as the constant sound level that is an equivalent exposure level to the actual time-varying sound level over the period (hour). Using 24 consecutive 1-hour L_{eq} values, it is possible to calculate daily cumulative noise exposure. A common community noise rating is the day-night average sound level (L_{dn}). The L_{dn} is the 24-hour L_{eq} but includes a 10-dBA penalty[1] on noise that occurs during the nighttime hours (between 10 PM and 7 AM) where sleep interference might be an issue. The 10-dBA penalty makes the L_{dn} useful when assessing noise in residential areas or among land uses where overnight sleep occurs.

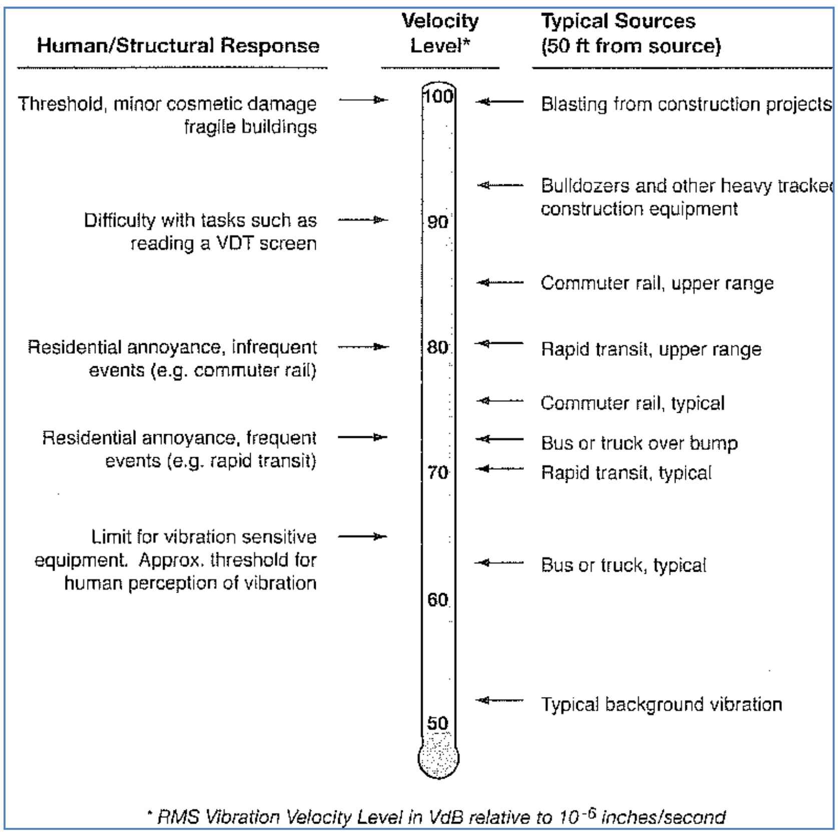
[1] A “penalty” consists of adding 10 dBA to the 24-hour L_{eq} for noise that occurs during nighttime hours.

1.3.2 VIBRATION

Vibration consists of rapidly fluctuating motions. However, human response to vibration is a function of the average motion over a longer (but still short) time, such as 1 second. The root mean square (RMS) amplitude of a motion over a 1-second period is commonly used to predict human response to vibration. For convenience, decibel notation is used to describe vibration relative to a reference quantity. The Federal Transit Administration (FTA) has adopted the notation VdB (for vibration decibels), which is decibels relative to a reference quantity of 1 micro inch per second (10^6 in/sec).

In contrast to airborne noise, ground-borne vibration (GBV) is not an everyday experience for most people. The background vibration level in residential areas is usually 50 VdB or lower. This is well below the threshold of perception for humans, which is around 65 VdB. Levels at which vibration interferes with sensitive instrumentation can be much lower than the threshold of human perception, such as for medical imaging equipment or extremely high-precision manufacturing. Most perceptible indoor vibration is caused by sources within a building, such as the operation of mechanical equipment, movement of people, or slamming of doors. Typical outdoor sources of perceptible GBV are construction equipment, steel-wheeled trains, and traffic on rough roads; however, in most soils GBV dissipates very rapidly. **Figure 1-4** illustrates common vibration sources and the human and structural response to GBV.

Figure 1-4. Typical Vibration Levels and Responses



Source: *Transit Noise and Vibration Impact Assessment (FTA 2006)*

Soil and subsurface conditions are known to have a strong influence on the levels of GBV. Vibration propagation is generally more efficient in stiff, clay-type soils than in loose, sandy soils and at-grade track when the depth to bedrock is 30 feet or less. Soil layering and the depth to the water table can also affect GBV, but the impacts are not always predictable and are not well established (FTA 2006).

GBV can be a serious concern for residents or at facilities that are vibration-sensitive, such as laboratories or recording studios. The impacts of GBV include perceptible movement of building floors, interference with vibration-sensitive instruments, rattling of windows, and the shaking of items on shelves or hanging on walls. Additionally, the vibration of room surfaces attributable to GBV can result in ground-borne noise (GBN). GBN is typically perceived as a low-frequency rumbling sound.

1.3.3 IMPACT SUMMARY

This study evaluated both the construction and operational noise and vibration impacts of the proposed Project.

Construction activities associated with the proposed Project are expected to result in temporary increases in noise and vibration. The increased noise and vibration would be short term and would occur at different places along the corridor during different phases of construction.

The operation of the proposed Project is expected to increase noise and vibration in the communities along the alignment. Noise impacts are projected to occur in Gary and Beverly Shores, and would result from train horn noise at receptors in close proximity to the alignment and public at-grade crossings. The vibration impacts would occur in the Town of Pines, Beverly Shores, and Michigan City. Vibration impacts are attributable to wayside vibration of the trains themselves (wheel-rail rolling vibration).

1.3.4 MITIGATION SUMMARY

The contract documents for the proposed Project would require the development and implementation of a plan for construction activities to minimize potential temporary noise and vibration impacts on adjacent noise-sensitive receptors, while maintaining construction progress.

NICTD would mitigate the noise increase attributable to train horn noise in Gary and Beverly Shores by lowering the horn level on NICTD vehicles to 100 dBA at 50 feet. NICTD would work with Michigan City to implement a quiet zone between Carroll and Sheridan Avenues; the quiet zone requires approval from the Federal Railroad Administration (FRA). This would eliminate the need for routine locomotive horn use by NICTD and freight trains in this segment of the proposed Project.

To mitigate the vibration increase attributable to wayside vibration in the Town of Pines, Beverly Shores, and Michigan City, the railroad would consider installing crosstie pads, ballast mats, resilient rail fasteners, or other alternative track support system modifications. Selection of the final mitigation measure would be made during the final design phase of the proposed Project. Ongoing maintenance programs for wheel truing, vehicle reconditioning, rail grinding, and use of wheel-flat detectors would also be conducted.

1.4 LEGAL/REGULATORY CONTEXT AND METHODS FOR IMPACT EVALUATION

1.4.1 REGULATORY FRAMEWORK

Procedures published by FTA were used to evaluate the potential for noise and vibration impacts at sensitive receiver locations in the Project Area. The criteria are described in the FTA *Transit Noise and Vibration Impact Assessment* (latest FTA Manual; FTA 2006). In addition to the federal criteria, state and local noise ordinances were reviewed to determine their applicability in assessing noise and vibration impacts from the proposed Project. All relevant federal, state, and local criteria are described in the following subsections.

1.4.2 FEDERAL REGULATIONS

The noise and vibration analyses for the proposed Project were prepared in accordance with the FTA Manual. The guidance includes noise and vibration assessment methods and impact thresholds.

1.4.3 STATE AND LOCAL REGULATIONS

This analysis assumed that operation of the proposed Project would not be subject to state or local noise regulations. Construction noise may be subject to Michigan City Municipal Code Chapter 46, which states, “It shall be unlawful to have a noise level in excess of 60 dB(A) at any point on the property line of any private property, or from not closer than 15 feet in any public area located within a residential zone.” Other jurisdictions in the Project Area were not found to regulate construction noise, other than subjective nuisance regulations.

1.5 IMPACT THRESHOLDS

This analysis used impact criteria for noise and vibration for both construction activities and transit operation activities in accordance with the FTA Manual. These are described in **Table 1-1** to **Table 1-5** and illustrated in **Figure 1-5**.

1.5.1 CONSTRUCTION NOISE EVALUATION CRITERIA

The FTA Manual does not provide standardized criteria for construction noise impacts. However, the guidance does suggest that the guidelines in **Table 1-1** and **Table 1-2** are reasonable criteria for assessment. These construction noise criteria are intended to be compared with the combined $L_{eq(h)}$ (average noise level over a 1-hour period) of the two noisiest pieces of construction equipment during 1 hour. These guidelines are higher than Michigan City’s Municipal Code.

Table 1-1. FTA Guidelines for Construction Noise

Land Use	Noise Limit (dBA)	
	Daytime	Nighttime
Residential	90	80
Commercial and Industrial	100	100

Source: FTA Manual (2006)
Note: Noise limit is the combined $L_{eq(h)}$ of the two noisiest pieces of construction equipment during 1 hour.

1.5.2 CONSTRUCTION VIBRATION EVALUATION CRITERIA

The vibration attributable to construction activities can sometimes cause temporary audible or perceptible vibrations in sensitive receptors. It is very rare that construction vibration would damage buildings. A quantitative construction vibration assessment is generally necessary only when the construction activities have a substantial potential for impact. Examples include projects that use blasting, pile-driving, concrete pavement breaking, vibratory compaction, and drilling or excavating in the ground near sensitive structures. In such cases, the general assessment criteria from the operational vibration evaluation criteria is suitable to evaluate annoyance from construction vibration.

However, since construction vibration is usually temporary, the principal concern is damage to structures. The following damage criteria can be applied to protect sensitive or fragile structures, such as those described in **Table 1-2**. This can be used to identify locations that should be considered more carefully during the proposed Project's final design phases. Contract documents can also stipulate that the contractor use specialized equipment or conduct vibration monitoring at certain sites.

Table 1-2. Construction Vibration Damage Criteria

Building Category	PPV (in/sec)	RMS Velocity (VdB)
I. Reinforced-concrete, steel, or timber (no plaster)	0.50	102
II. Engineered concrete and masonry (no plaster)	0.30	98
III. Non-engineered timber and masonry buildings	0.20	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Source: FTA Manual (2006)
Notes: PPV, or Peak Particle Velocity, is used to evaluate a building's response to vibration.
RMS velocity is provided as a reference to the general magnitude of vibration, compared with the operational vibration impact thresholds, and assumes a crest factor of 4 (12 VdB).

1.5.3 OPERATIONAL NOISE EVALUATION CRITERIA

The FTA Manual's noise impact criteria were used to predict future noise impacts from transit operations. FTA noise impact thresholds are a function of land use and existing noise exposure. FTA differentiates noise-sensitive receptors into three distinct categories, as shown in **Table 1-3**.

Table 1-3. Land Use Categories and Metrics for Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq(h)}$	This category includes tracts of land where quiet is an essential element in their intended purpose. It includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	This category includes residences and buildings where people normally sleep. It includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq(h)}$	This category includes institutional land uses with primarily daytime and evening use. It includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. This category also includes places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities. Certain historical sites and parks are also included.

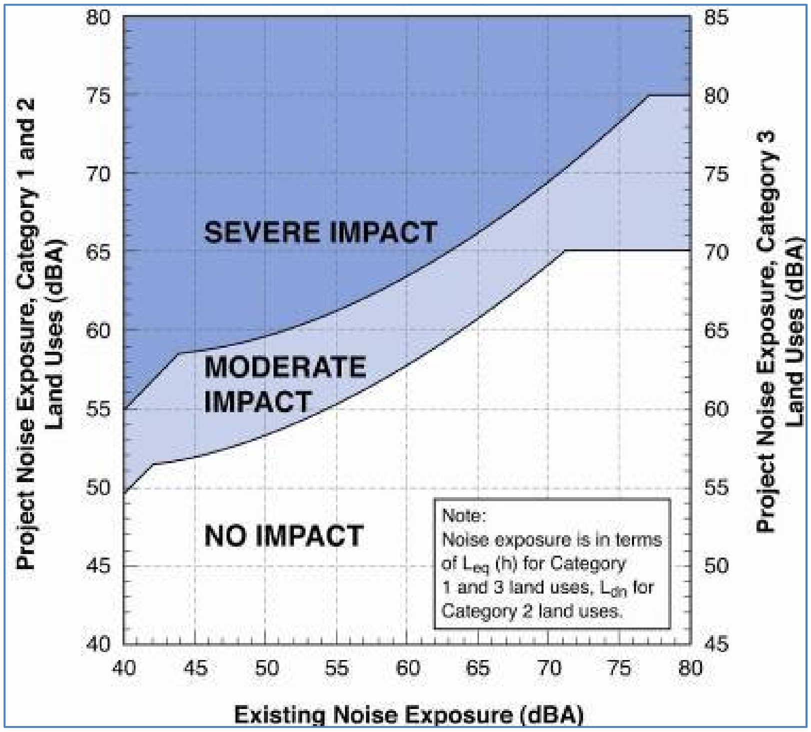
Source: FTA Manual (2006)
Note: Outdoor $L_{eq(h)}$ uses the noisiest hour of transit-related activity during hours of noise sensitivity.

Historic buildings and parks are a special case. For historic buildings, noise sensitivity is determined by the current land use, not the historic land use. For example, a historic house used as a commercial shop is not considered noise sensitive, whereas a historic warehouse converted to multiunit residences is considered under land use Category 2. Parks that are used for passive recreation such as reading, meditation, or sedate conversation are land use Category 3, whereas parks used for active recreation such as sporting fields, playgrounds, trails, or areas where social groups gather are not considered noise sensitive.

The L_{dn} descriptor is used to assess transit-related noise for residential areas and land uses where overnight sleep occurs (Category 2). The $L_{eq(h)}$ descriptor is used to assess transit-related noise at other noise-sensitive receptors (Category 1 and Category 3), specifically during the noisiest hour of transit-related activity concurrent with the receptors' hours of noise sensitivity.

The FTA noise impact criteria are used to predict future noise impacts from transit operations and are shown in **Figure 1-5**. The figure illustrates existing noise exposure and project-related noise exposure, and shows how FTA noise impact thresholds vary with existing noise levels.

Figure 1-5. FTA Noise Impact Criteria



Source: FTA Manual (2006)

Two degrees of noise impacts are included in the FTA criteria. The degree of impact affects whether noise mitigation is implemented.

- **Severe Impact**: In this range, a significant percentage of people are highly annoyed by the noise. Noise mitigation would normally be specified for severe impact areas unless it is not feasible or reasonable (i.e., there is no practical method of mitigating the impact or mitigation measures are cost prohibitive).
- **Moderate Impact**: In this range, other project-specific factors are considered to determine the magnitude of the impact and the need for mitigation. These other factors include the predicted increase over existing noise levels, the types and number of noise-sensitive receptors affected, existing outdoor/indoor sound insulation, and the cost-effectiveness of mitigating noise to more acceptable levels.

1.5.4 OPERATIONAL VIBRATION EVALUATION CRITERIA

The FTA vibration impact criteria were used to predict future vibration impacts from transit operations. FTA identifies separate criteria for both GBV and GBN. GBN is often masked by airborne noise; therefore, GBN criteria are primarily applied to subway operations in which airborne noise is negligible.

FTA differentiates vibration-sensitive receptors into three distinct categories (**Table 1-4**) that are similar but not identical to the noise-sensitive land use categories. These categories are one factor for setting the vibration impact threshold.

Table 1-4. Land Use Categories for Transit Vibration Impact Criteria

Land Use Category	Description of Land Use Category
1	High Vibration Sensitivity: This category includes buildings where it is essential that ambient vibration stay well below levels associated with human annoyance for proper function of equipment or operations within the building. This typically includes places of vibration-sensitive research and manufacturing facilities, hospitals, and university research operations.
2	Residential: This category includes all residential land uses and any building where people sleep, such as hotels and hospitals.
3	Institutional: This category includes schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment, but still have the potential for activity interference. This includes certain office buildings, but not all buildings that have office space.

Source: FTA Manual (2006)
Note: Special buildings such as concert halls, television and recording studios, and theaters have separate vibration impact thresholds because of the unique sensitivity of such buildings.

Vibration Category 1 includes land uses with vibration-sensitive equipment, but does not include buildings where vibration would interfere with human activities or cause annoyance. The Category 1 vibration impact threshold is acceptable for most moderately sensitive equipment. Other highly sensitive equipment would each require a detailed analysis to determine the acceptable vibration levels and the impact of the proposed Project on the equipment. No GBN impact thresholds exist for these type of Category 1 land uses because equipment sensitive to GBV is generally not sensitive to GBN. The land uses with special buildings (e.g., concert halls, television and recording studios, and theaters) have separate vibration impact thresholds for both GBV and GBN. No such types of special buildings exist in the Project Area.

The impact criteria for GBV are related to causing human annoyance or interfering with use of vibration-sensitive equipment. The basis for evaluating FTA vibration impact thresholds is the highest expected RMS vibration levels for repeated vibration events from the same source. The impact thresholds for vibration from rail transit systems are also used to assess vibration impact from freight trains in shared right-of-way situations, such as the proposed Project. However, the locomotive and rail car vibration caused by freight trains must be considered separately because of the greater length, weight, and axle loads of a typical line-haul freight train. Locomotive vibration lasts for only a very short time; therefore, locomotive event frequency is essentially the same as the train event frequency. However, the rail car vibration of a typical line-haul freight train lasts for several minutes; therefore, each freight car is considered a separate event.

The vibration thresholds vary, based on the land use and frequency of the vibration events. FTA uses the following categories to quantify the frequency of events:

- **Frequent Events**: The frequency is more than 70 vibration events per day. Most rapid transit projects fall into this category.

- **Occasional Events**: The frequency is between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
- **Infrequent Events**: The frequency is fewer than 30 vibration events per day. This category includes most commuter rail branch lines.

Table 1-5 shows the GBV and GBN impact criteria for a general assessment (detailed vibration assessments use different impact thresholds). **Table 1-5** incorporates FTA's land use categories and the frequency of vibration events.

Table 1-5. Ground-borne Noise and Vibration Impact Thresholds

Land Use Category	Frequent Events	Occasional Events	Infrequent Events
Ground-borne Vibration Impact Level (VdB re 1 micro in/sec)			
Category 1 (highly sensitive, where vibration would interfere with operations)	65	65	65
Category 2 (where overnight sleep occurs)	72	75	80
Category 3 (institutional with primarily daytime use)	75	78	83
Ground-borne Noise Impact Level (dBA re 20 micropascals)			
Category 2 (where overnight sleep occurs)	35	38	43
Category 3 (institutional with primarily daytime use)	40	43	48

Source: *Transit Noise and Vibration Impact Assessment* (FTA 2006)
Notes: The Category 1 criteria limits are based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define the acceptable vibration levels. Vibration-sensitive equipment is generally not sensitive to GBN.

Using those criteria, FTA considers the existing SSL train traffic to be "Infrequent Events." FTA considers the expected SSL train traffic after completion of the proposed Project to be "Occasional Events" for the purposes of the vibration assessment.

In cases where the new transit project would use an existing railroad right-of-way, such as the proposed Project, the FTA Manual provides guidance based on the existing vibration found in the rail corridor. If the existing vibration levels are 5 VdB lower than the vibration attributable to the project, then the existing vibration can be disregarded and the project vibration levels can be assessed normally for impact. Otherwise, the frequency of existing trains in the rail corridor would guide the assessment of potentially adverse vibration impacts, as follows:

- **Infrequently Used Rail Corridor**: The frequency is fewer than five trains per day. The project vibration levels are assessed normally for impact at vibration-sensitive receptors.
- **Moderately Used Rail Corridor**: The frequency is 5 to 12 trains per day. If the existing vibration levels already exceed the impact criterion at a vibration-sensitive receptor, and the project-related vibration levels are at least 5 VdB less than the existing train vibration, then the project will not cause an impact. Otherwise, the project vibration levels are assessed normally for impact.
- **Heavily Used Rail Corridor**: The frequency is more than 12 trains per day. If the existing vibration levels already exceed the impact criterion at a vibration-sensitive receptor, and the number of vibration events significantly increases because of the project (approximately doubles),

then the project may cause a potential impact. Otherwise, if the realignment results in an increase-over-existing of 3 VdB or more, then the project may cause a potential impact.

- **Moving Existing Tracks**: The location of existing railroad tracks or existing railroad traffic is shifted. If the track realignment and reconstruction results in lower vibration levels than existing levels, then the project will benefit the receptor and will not cause an adverse impact. If the existing vibration levels already exceed the impact criterion at a vibration-sensitive receptor, and the realignment results in more than a 3 VdB increase over existing vibration levels, then the project may cause a potential impact. If the existing vibration levels do not already exceed the impact criterion, then the project will cause an impact if the new project vibration levels exceed the impact criterion for the receptor.

Based on these classifications, the proposed Project would fall into the “Heavily Used Rail Corridor Category.” In certain places, including Gary and Michigan City, the “Moving Existing Tracks” category would also apply. Because the existing vibration levels attributable to SSL train traffic do not already exceed the impact criterion at vibration-sensitive receptors where the existing tracks would be moved, the FTA guidance shown in the “Moving Existing Tracks” category directs the analysis to compare proposed Project vibration levels with the vibration impact criterion at each receptor to assess the potential for vibration impacts.

2.0 METHODS

2.1 CONSTRUCTION NOISE EVALUATION METHODS

This construction noise assessment was based on the methodology described in the FTA Manual. The construction noise analysis identified construction equipment commonly used for this type of project. Data from similar projects were used to estimate for internal combustion engines, numbers of equipment to be used during each phase of construction, the rated horsepower for each piece of equipment, and the duration that each piece of equipment is anticipated to operate during construction activities.

To estimate construction noise levels, a sound power level (SWL) was calculated by converting horsepower to kilowatts, then to SWL. A utilization factor, representing the percentage of time items are in use during an hour, was developed using the FTA Manual. An adjusted SWL was determined by accounting for the number of equipment and their utilization factor. The adjusted SWL was then converted to sound pressure level (SPL) at distances of 100, 200, 500, and 1,000 feet. The SPL is expressed as $L_{eq(h)}$ (an energy-based average noise level over a 1-hour period) in dBA. The resulting noise level from all noise sources during construction (construction equipment) was calculated at fixed distances from the noise source (e.g., bridge or retaining wall locations).

Construction of the proposed Project would likely result in a temporary increase in noise levels. Equipment used to move soil and other earthen materials are often the loudest construction noise sources. **Table 2-1** presents typical noise levels by construction phase. This is based on the typical equipment used for different phases of railroad construction with typical noise levels, quantities, and estimated uses for each type of equipment. **Table A-1** in **Appendix A** shows the typical equipment, uses, and sound levels for construction equipment by phase as well as the SWL used to determine the SPL at different distances.

Table 2-1. Estimated Noise Levels, by Construction Phase

Equipment	SPL (dBA) at distance (feet)			
	100	200	500	1,000
Clearing	89	83	75	69
Utility Relocation	89	83	75	69
Earthwork	91	85	77	71
Bridge Construction for Overpasses	90	84	76	70
Retaining Walls	89	83	75	69
Signals	84	78	70	64
Track Installation	90	84	76	70
Signal Work	84	78	70	64
Install Track and Subballast	91	85	77	71
Final Cut-over and Removal of Turnouts	85	79	71	65

Source: HDR
Note: See **Appendix A** for complete table with construction equipment by phase.

The results presented in **Table 2-1** conservatively overestimate actual expected construction noise levels by assuming that all equipment (e.g., all dump trucks or all pickup trucks) would simultaneously operate at the same location. Typically, construction equipment is spread throughout the construction work zone. Given the linear nature of the proposed Project and relatively confined width of the railroad right-of-way, it is reasonable to assume that all equipment would not operate next to each other in the same (stationary) location for the entirety of 1 hour. In all other cases, the results are assumed to be within 3 dBA of likely construction noise levels, assuming that the equipment has been properly maintained and the mufflers are in good condition.

FTA does not have standardized criteria for construction noise, but the FTA manual suggests reasonable criteria that can be used for assessment purposes. The criteria for residential land uses are 1-hour L_{eq} of 90 dBA during the day and 80 dBA during the night. Construction noise analysis results shown in **Table 2-1** indicate the total combined noise for all equipment types and construction phases never exceeds the 90 dBA threshold at 200 feet, even using a conservative approach to the evaluation.

2.2 CONSTRUCTION VIBRATION EVALUATION METHODS

A quantitative construction vibration assessment is generally necessary in cases where prolonged annoyance or damage from construction vibration is expected. Most construction equipment can cause ground vibration, which diminishes in strength rapidly with distance. Some construction activities have potential for producing higher vibration levels, such as pavement breaking, vibratory compaction, and drilling or excavating the ground near sensitive structures. The highest vibration levels typically result from blasting activities or impact pile driving. The construction activities associated with the proposed Project would not include blasting or impact pile driving. Other activities have potential to create temporary, perceptible vibrations when construction activities move very close to a structure, but these impacts would be temporary and would occur only while the construction equipment moves through that location.

Construction vibration was not evaluated quantitatively because the primary vibration sources or activities of concern are not currently proposed. A brief qualitative assessment is provided, as suggested by the FTA Manual.

2.3 OPERATIONAL NOISE EVALUATION METHODS

The noise assessment was conducted according to the FTA Manual's General Assessment methods. As an overview, the noise assessment consisted of the following general steps:

1. Establish the study area and identify noise-sensitive receptors
2. Evaluate the existing conditions and set corresponding impact thresholds
3. Predict the noise impacts attributable to the proposed Project
4. Identify receptors anticipated to experience moderate noise impacts or severe noise impacts

The FTA Manual provides screening distances with respect to particular project types or features. The screening distance defines the noise study area and the area of potential noise influence attributable to the project. Receptors that are potentially influenced by project noise are those that are described in land use Categories 1, 2, or 3, as described previously in **Table 1-3**.

Noise-sensitive receptors were identified by reviewing a combination of available land use-related geographic information system (GIS) data, windshield surveys, available digital aerial photographs, and other area photography, including publicly available Internet imagery. Receptors in the study area were identified and then categorized for noise sensitivity based on the descriptions in **Table 1-3**.

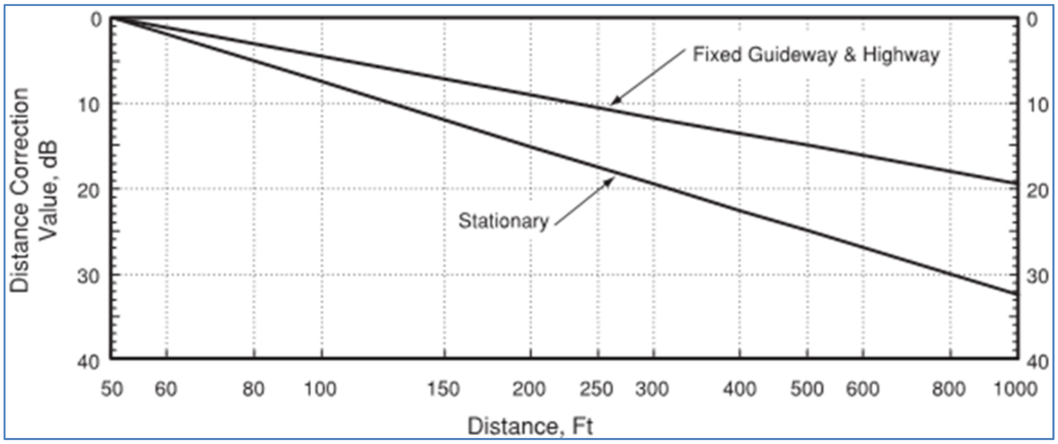
The existing noise environment was characterized by measurements of outdoor noise in the Project Area, as described in Section 3.0. The noise impact thresholds used for this assessment were based on the FTA limits of allowable increase in noise levels and provide the framework for identifying the magnitude of the impact, as described previously.

The need for noise mitigation was determined based on the magnitude of impact and consideration of factors specifically related to the proposed Project and affected land uses.

The FTA Manual provides a method for calculating the noise emissions of rail-related noise sources and the propagation from the source to a receptor. The noise emission of each Project-related noise source was estimated as a sound pressure level at 50 feet. For the proposed Project, the noise sources included the rolling and propulsion noise of the transit vehicle, the rolling over of the frogs in crossovers and turnouts, and the transit vehicle's warning horns. This assessment relied on the default sound exposure level values found in the FTA Manual and adjusted for the particular train volumes, number of cars in each, and speeds of the proposed Project. The existing NICTD transit vehicle horn level was measured by HDR in June 2017 to be approximately 105 dBA at 50 feet; this horn level was used in the noise analysis.

For a noise general assessment, the sound pressure level at 50 feet was adjusted for sound attenuation over distance, as provided in the FTA Manual (see **Figure 2-1**). The sound level at 50 feet was adjusted according to the distance from the source, consistent with Table 5-2 in the FTA Manual (FTA 2006).

Figure 2-1. Adjustment Curve for Sound Attenuation over Distance



Source: Figure 5-2 of the FTA Transit Noise and Vibration Impact Assessment (FTA 2006)

By inspecting the plot, the equation for the fixed-guideway adjustment curve is indicated as:

$$A_{\text{dist}} = -15 \log \frac{D}{50}$$

This equation was used in the general assessment to calculate noise propagation with increasing distance and to modify the screening distances in the screening procedure. The same was done for the stationary noise source curve, but by inspecting the plot, the coefficient of the logarithm is –25 instead of –15 for stationary noise sources. An algebraic solution was used to find the distance to noise impact. The distance to moderate and severe impact thresholds was calculated for the land use categories present in the corridor, and then the impact contours were plotted in GIS.

The FTA Manual also provides a method for a cumulative noise analysis that was applied in Michigan City. Section 3.2.3 of the FTA Manual discusses circumstances where a project proposes to change existing service in an active transit corridor, rather than implement transit service in an area previously without transit service. In cases like this, the FTA Manual notes that it can be difficult to distinguish project-related noise from existing noise. In these circumstances, FTA recommends an assessment of the cumulative changes in noise.

This cumulative method was applied in Michigan City because of the proposed closure of 13 public at-grade crossings in Michigan City and proposed upgrades to the remaining public at-grade crossings to include flashers, gates, and bells. The assessment of cumulative changes in noise was performed by modeling noise from the existing fleet of commuter and freight trains (including train horn use, where appropriate) and by modeling noise from the future fleet of commuter and freight trains (omitting train horn use, where appropriate). The impact assessment was then performed by comparing these two results (existing modeled noise and future modeled noise), determining whether future noise levels would increase, and comparing that increase with Figure 3-2 in the FTA Manual. This cumulative approach is consistent with FTA Manual guidelines and recommendations and also allows the noise analysis to account for the benefits of the proposed Project (reductions in locomotive horn use in Michigan City). FTA approved the use of this method for the proposed Project on April 12, 2017.

2.4 OPERATIONAL VIBRATION EVALUATION METHODS

The vibration assessment was conducted according to FTA's General Assessment methods. The vibration assessment consisted of the following general steps:

1. Establish the study area and identify vibration-sensitive land uses
2. Evaluate the train traffic conditions and set corresponding impact thresholds
3. Predict the vibration impacts attributable to implementation of the proposed Project
4. Identify receptors anticipated to experience vibration impacts

The FTA Manual provides screening distances with respect to particular project types. The screening distance defines the vibration study area for each land use type. Any of the vibration-sensitive land uses described previously could contain receptors that are potentially influenced by project vibration.

Land uses in this study area were identified by reviewing a combination of available land use-related GIS data, windshield surveys, and publicly available digital aerial photographs. Vibration-sensitive receptors in the study area were identified and categorized according to those included in **Table 1-4**.

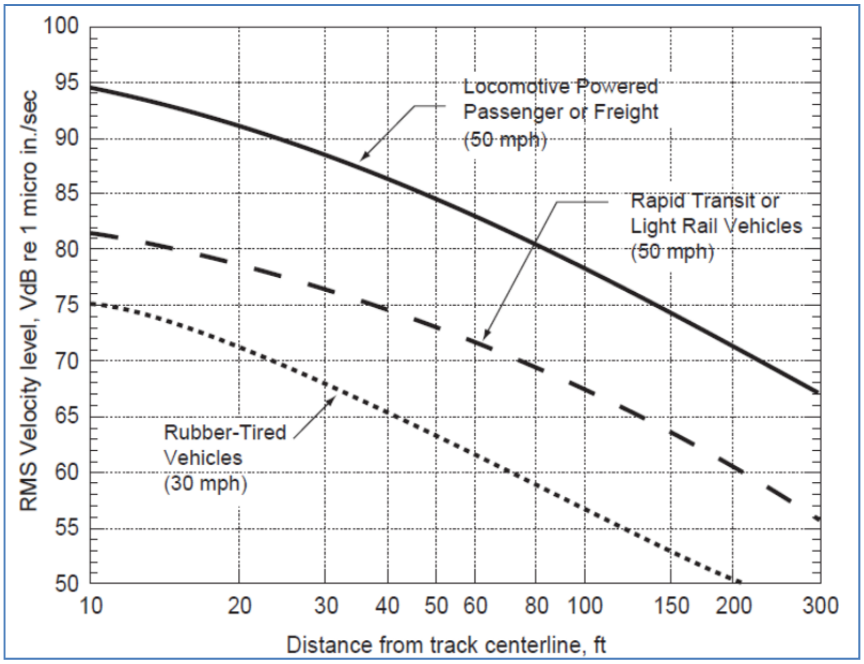
The volume of existing SSL trains combined with the volume of existing freight trains is more than 12 trains per day; therefore, for the vibration assessment, this was considered a “Heavily Used Rail Corridor.” Along 10th Street in Michigan City, the track realignment was considered “Moving Existing Tracks.”

The volume of existing SSL train traffic generates fewer than 30 vibration events per day; therefore, the existing trains were compared with the “Infrequent Events” criteria described in Section 1.5.4. This results in a higher vibration threshold for existing train vibration impacts. Consequently, very few receptors would be considered to be adversely affected by the existing train traffic. Therefore, the existing vibration impacts can be largely discounted for the impact determination of the proposed Project.

The FTA General Assessment methodology is intended to predict approximate vibration levels inside buildings. The vibration prediction begins with selection of a generalized base curve, depending on the mode of rail transit considered in the project. **Figure 2-2** illustrates the three generalized ground surface vibration curves defined by FTA. These curves depict typical ground-surface vibration as a function of distance from the source, based on many GBV measurements of numerous transit sources. They represent the upper range of the measurement data from equipment in good condition. The middle curve represents both heavy- and light-rail vehicles on at-grade rails as well as subway rails, which best represents the SSL trains.

The base curves must then be adjusted to account for project-specific vibration factors that differ from the conditions of the base curve. Adjustment parameters are given in the FTA Manual and include train speed, wheel and rail type and condition, type of track support system, type of building foundation, and the types of impacts of vibration propagating through a building structure to a receiver location in the building. The FTA Manual adjustment parameters are based on typical vibration spectra and are given as generalized single numbers to be applied to the base curve.

Figure 2-2. Generalized Ground Surface Vibration Curves



Source: FTA (2006)

The adjustments are arithmetically added to the reference vibration curve, and the resulting levels are compared with the impact thresholds. This is algebraically equivalent to subtracting the same adjustments from the impact threshold and comparing them with the unadjusted reference curve. In this way, the graphical curves shown in **Figure 2-2** can be used to find the distance to vibration impact. For this assessment, the distance to vibration impact was determined by looking up the level of the adjusted criterion curve on the y-axis, and then finding the distance on the x-axis from the generalized vibration curve.

3.0 EXISTING CONDITIONS

3.1 EXISTING NOISE ENVIRONMENT

Potential noise- and vibration-sensitive receptors in the Project Area include land use Category 2 receptors (e.g., single and multifamily residences and motels) and Category 3 receptors (e.g., churches, park areas, and schools). These types of receptors are most dense along the corridor in the cities and towns of Gary, Portage/Ogden Dunes, Beverly Shores, Pines, and Michigan City. Portage/Ogden Dunes and Beverly Shores have no Category 3 receptors in the corridor.

Between Gary and Michigan City, the proposed Project alignment would be adjacent to the existing NICTD/CSS track. U.S. 12/U.S. 20 is also just south of the existing and proposed track. The Project alignment is also parallel Norfolk Southern dual main tracks from MP 53.5 to MP 47.5. Generally, existing noise in this part of the Project Area is dominated by freight and passenger train traffic on the existing railroads (which is also the primary source of GBN and GBV). Roadway traffic on Dunes Highway, especially truck traffic associated with the ArcelorMittal steel plant, the Port of Indiana (at MP 49), and other industrial land uses in the area, also contributes to the noise environment.

In Michigan City, the proposed Project alignment follows 10th and 11th Streets. In this area, noise is associated with the automobiles and trains traveling on 10th and 11th Streets.

The primary source of project-related noise is the train horns that must be repeatedly sounded because of the many at-grade crossings and potential conflicts with automobiles, pedestrians, and bicyclists. There are seven at-grade crossings in Gary, five in Portage, three in Porter, and six in Beverly Shores. One private crossing is also found in the Town of Pines. There are 39 at-grade crossings in Michigan City between Sheridan and Carroll Avenues. Thirty-two of these are located between Sheridan Avenue and E. Michigan Boulevard, where the track improvements are proposed. All but 7 of these 32 crossings do not have any active warning devices, so the train sounds its horn for the entire 1.9 miles between E. Michigan Boulevard and Sheridan Avenue.

3.2 EXISTING NOISE MEASUREMENT RESULTS

NICTD measured outdoor noise levels at five locations throughout the Project Area. These locations were selected by reviewing digital aerial photographs and determining noise-sensitive receptors. These areas are representative of portions of the Project Area that would be affected by proposed Project-related train noise, including horn noise. The sound level meters were configured to continuously measure ambient noise levels in dBA, and to store data at the end of each hour for 24 continuous hours. Monitoring occurred simultaneously at all five locations from the morning of November 3 through the morning of November 4, 2016. **Table 3-1** summarizes the noise monitoring data in the Project Area. The measurements concluded that the existing noise levels in the Project Area are already relatively high. See **Appendix B** for the noise contours and the locations of the noise measurements.

Table 3-1. Existing Sound Level Measurements in the Project Area

Receptor	MP	Municipality	Location (dBA)	Analysis Segment	L_{eq} (dBA)	L_{dn} (dBA)
1H	57.60	Gary	Dunes Court Apartments, 1738 E 7th Avenue	NV1	64	68
3B	51.00	Ogden Dunes	27 Deer Trail	NV2	64	70
5C	43.70	Chesterton	33 U.S. 12	NV3	63	71
6A	36.65	Town of Pines	Central Avenue near U.S. 12	NV4	66	72
7K	33.95	Michigan City	11th Street Station	NV5	70	76

Note: Receptor numbers were identified for field work purposes and are arbitrary to this analysis.

3.3 EXISTING VIBRATION

Existing vibration sources in the corridor include SSL and CSS rail operations and heavy truck traffic on U.S. 12. The FTA Manual guidelines for a general vibration assessment were followed for the proposed Project to provide a conservative prediction of potential impacts for the Build Alternative at this stage of design.

Table 3-2 shows the existing traffic volume for SSL trains and train speeds for the track segments used in the vibration analysis. These values were considered in the impact evaluation for the proposed Project impacts. See **Appendix C** for the resultant vibration contours. Although the train vehicles would not change, the proposed Project would increase the number of trips in each segment and increase the train speeds in some segments; these are the most influential factors in determining the proposed Project-related vibration impacts.

Table 3-2. Vibration Analysis Segments for Existing Condition

Code	MP Begin	MP End	Daily Trains	Train Speed
NV1	58.1	55.1	28	58.8
NV2	55.1	48.0	28	75.0
NV3	48.0	39.3	28	76.8
NV4	39.3	35.5	28	79.0
NV5	35.5	33.4	28	23.8

Sources: SSL Train Schedule (NICTD, July 1, 2016) and existing track layout (HDR)
Notes: Trains are counted in one-way trips; one train represents a single train pass-by event. Train speed is the linear average of the existing track design speeds throughout the segment defined by the mileposts.

4.0 IMPACTS

4.1 CONSTRUCTION IMPACTS

Construction of the proposed rail alignment would likely result in a temporary increase in noise levels. Equipment used to move soil and other earthen materials are often the loudest construction noise sources. The FTA Manual suggests construction noise criteria for residential land uses are $L_{eq(h)}$ of 90 dBA during the day and 80 dBA during the night. These construction noise criteria are intended to be compared with the combined $L_{eq(h)}$ of the two noisiest pieces of construction equipment during 1 hour. In addition, the Michigan City noise ordinance may apply to construction noise.

The proposed Project is expected to have only temporary, intermittent noise impacts from construction. The estimated noise levels presented in **Table 4-1** show that numerous single pieces of equipment may exceed the FTA levels if running constantly for 1 hour within 100 feet of a receptor. However, the construction equipment would not be within 100 feet of most receptors; rather, it would be within 100 feet of only some of the receptors for some of the time. Refer to **Table A-1** in **Appendix A** for a list of construction equipment and noise levels at different distances. All equipment included in this noise assessment emits noise that is potentially louder than maximum allowable noise levels in Michigan City's noise ordinance. The placement of construction equipment would be evaluated at various times during construction to avoid overexposure at any single receptor and to avoid potential complaints. Coordination and review by the City of Michigan City would be required prior to construction.

It is very rare that construction vibration would cause damage to buildings. Examples include projects that use blasting, pile-driving, concrete pavement breaking, vibratory compaction, and drilling or excavating in the ground near sensitive structures. The proposed Project could include some of these activities, but any vibration impacts would be temporary.

4.2 OPERATIONAL IMPACTS

4.2.1 NOISE IMPACTS FROM OPERATION

Train noise levels under the Build Alternative were calculated throughout the Project Area. These calculations accounted for both wayside noise (wheel-rail noise) and train horn use at public at-grade crossings. Analysis results were used to determine the distance from the tracks at which train noise levels equal the noise impact thresholds for moderate and severe noise impacts at Category 2 and 3 land uses. This information was then used to determine whether any noise-sensitive receptors exist within those distances to the track.

After plotting the distances-to-noise-impact contours, the receptors within the impact contours were counted; these are considered noise impacts as defined by FTA. Figures in **Appendix B** show the noise contours and where noise impacts are projected to occur under the Build Alternative.

To assess the net impact of the proposed Project in Michigan City, this analysis modeled existing NICTD and freight operations, including train horn use, and then modeled future NICTD and freight operations without train horn use. Results of those analyses were compared to determine the cumulative change in noise levels, and the cumulative change was compared with the FTA noise impact thresholds. Results of this cumulative assessment indicate that noise impacts would not occur in Michigan City, and in fact could be reduced by up to 20 dBA. **Table C-1** in **Appendix D** shows the modeled existing and future sound levels for receptors in Michigan City. In Michigan City, the proposed Project would close 13 at-grade crossings. NICTD would work with Michigan City and the FRA to implement a quiet zone between Carroll and Sheridan Avenues. As a result, neither NICTD nor freight trains would need to sound their warning horns on a routine basis. This is a benefit of the proposed Project.

Table 4-1 shows the results of the noise impact assessment conducted using impact contours. There would be three moderate impacts on Category 2 (residential) land uses. These impacts would result from the increase in train horn noise throughout the corridor in areas outside of Michigan City.

Table 4-1. Operational Noise Impact Summary

Municipality	Category 1		Category 2		Category 3	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
Lake County Impacts						
Gary	0	0	1	0	0	0
Porter County Impacts						
Portage	0	0	0	0	0	0
Town of Pines	0	0	0	0	0	0
Beverly Shores	0	0	2	0	0	0
LaPorte County Impacts						
Michigan City	0	0	0	0	0	0

The following subsections provide details regarding the locations and types of noise increase. Maps are included in **Appendix B** that show the locations of the noise impacts. The map sheet number is also indicated for reference.

GARY NOISE IMPACTS

One moderate impact is projected to occur in Gary that would be attributable to train horn noise at the Tennessee and Ohio Streets at-grade crossings (map sheet 1). This impact would occur in the lower range of moderate impacts shown in **Figure 1-5**.

BEVERLY SHORES NOISE IMPACTS

Two moderate noise impacts are projected to occur at residences in Beverly Shores that would be attributable to train horn noise at the Broadway Avenue at-grade crossing (map sheet 44). These impacts would be in the upper range of moderate impacts shown in **Figure 1-5**.

4.2.2 VIBRATION IMPACTS FROM OPERATION

Train vibration levels under the Build Alternative were calculated throughout the Project Area as described in previous sections. Analysis results were used to determine the distance from the tracks at which train vibration levels would equal the vibration impact thresholds for impacts at Category 1, 2, and 3 land uses. This information was then used to determine whether any vibration-sensitive receptors exist within those distances to the track; if so, they could be considered vibration impacts.

After plotting the distance-to-vibration-impact contour, the receptors within the impact contours were inventoried. These receptors were then analyzed in more detail to determine the extent of the impact. This additional analysis included applying a drop off with distance for the additional vibration from crossovers[2] near sensitive receptors within the contour and identifying actual operating speeds at the locations within the impact contour. In some locations, this analysis also calculated existing vibration levels to determine the increase in vibration due to the proposed Project. Based on guidance in the FTA Manual regarding vibration impact assessment in a heavily used rail corridor, no impact was identified in cases where there was no predicted increase in vibration between the existing operations and the proposed operations.

Figures in **Appendix C** show the vibration contours and where vibration impacts are projected to occur under the Build Alternative. Eight vibration impacts could occur: one in the Town of Pines, two in Beverly Shores, and five in Michigan City, These impacts are attributable to train wheels rolling on the rail.

Table 4-2 shows the results of the vibration impact assessment. No impacts to any Category 1 or 3 receptors would occur; all impacts would affect Category 2 land uses, all residential.[3]

The following subsections provide details regarding the locations and types of vibration increase. Maps in **Appendix C** show the locations of the vibration impacts. The map sheet number is also indicated for reference.

[2] Table 10-1 in the FTA Manual discusses the additional vibration from special trackwork and states, “the increase will be less at greater distances from the track.”

[3] Three mobile home residences at the Oak Grove Trailer Court in the Town of Pines, between MPs 37 and 38, are within the vibration contour. Because mobile homes typically have aboveground stands, they are less sensitive to vibration than standard foundations. The vibration impact contours assume that all structures have standard foundations. The analysis concluded that these mobile homes would not experience vibration impacts and they are, therefore, not included in **Table 4-2**.

Table 4-2. Operational Vibration Impact Summary

Municipality	Category 1	Category 2	Category 3
Lake County Impacts			
Gary	0	0	0
Porter County Impacts			
Portage/Ogden Dunes	0	0	0
Beverly Shores	0	2	0
Town of Pines	0	1	0
aPorte County Impacts			
Michigan City	0	5	0

BEVERLY SHORES VIBRATION IMPACTS

Two vibration impacts could occur at residences in Beverly Shores between MPs 39 and 40 (map sheet 44). They are the same locations that would be moderately impacted by noise and are immediately east of Broadway Avenue. The vibration impact threshold is based on the number of vibration events per day as proposed by the Project. The SSL trains added under the proposed Project are expected to emit the same amount of vibration as the existing SSL trains do today (i.e., there would be no increase in vibration levels during an SSL train pass-by event). However, because there would be more SSL trains per day, the proposed Project is subject to the "occasional events" vibration impact thresholds, as previously described in Section 1.5.4. The occasional events vibration impact thresholds are lower than existing (and projected future) vibration levels at these locations. Therefore, the reason for the vibration impact is the lower vibration impact threshold, not an increase in vibration levels each time an SSL train passes by.

TOWN OF PINES VIBRATION IMPACTS

One vibration impact could occur in the town of Pines between MPs 38.1 and 38.2 (map sheet 46). This receptor is located in a residential neighborhood south of the tracks, generally between Lake Shore County Road and Poplar Street. The source of vibration is from the wheel-rail interaction; the structure is located closer to the proposed track than the other structures in the neighborhood. The impact result occurs for the same reason as described in the Beverly Shores subsection, above.

MICHIGAN CITY VIBRATION IMPACTS

Five vibration impacts could occur in Michigan City on the north side of West 11th Street, between Elston and Washington Streets (MPs 34 to 35). These are shown on map sheets 55 and 56. These receptors are in an urban environment near a variety of land uses. The source of vibration is the wheel-rail interaction; the per-event vibration level would increase from the existing level because of the planned increase in train speed in this area.

5.0 POTENTIAL MITIGATION MEASURES

5.1 CONSTRUCTION MITIGATION MEASURES

By virtue of their nature, construction activities generate some degree of noise and vibration, although usually the impacts are temporary and unavoidable. An effective method to limit noise and vibration impacts during construction is to include noise and vibration performance specifications in the construction contract documents.

Additionally, construction contractors would be required to develop a construction noise and vibration management plan. This may be a stand-alone plan, or it may be included in a larger environmental management plan for the construction project. At a minimum, the plan should include:

- An outline of the proposed Project's noise control objectives and potential components
- A summary of noise- and vibration-related criteria and local ordinances for construction contractors to abide by
- The requirement to perform a preconstruction survey to identify receptors potentially affected by construction noise and vibration, and document the preconstruction conditions of particularly susceptible receptors
- A list of potential mitigation measures, a plan to implement mitigation, and an approach for deciding the appropriateness of mitigation by construction activity and receptor
- An approach to minimize noise impacts on adjacent noise-sensitive stakeholders while maintaining construction progress
- A strategy to coordinate with affected Project stakeholders to minimize intrusive construction impacts
- A complaint handling and resolution procedure for any Project stakeholder

Noise and vibration monitoring of construction activities is effective for limiting unanticipated adverse impacts. This can be implemented by the contractor or by an independent third party hired by the Project sponsor.

5.1.1 CONSTRUCTION NOISE MITIGATION

Contractors would adhere to local noise ordinances. Examples of noise control measures that could be applied during construction as needed include, but are not limited to, the following:

- Scheduling the loudest construction activities during daytime hours in residential neighborhoods, and limiting or completely avoiding their use during evening and nighttime hours
- Ensuring all construction equipment has been properly maintained and is in good working order, with mufflers that are at least as good as the original equipment or a higher-performing replacement; in locations where noise-sensitive receptors have the potential to be adversely affected by construction equipment noise, use specially quieted equipment with enclosed engines, noise-reduction packages, and high-performance mufflers
- Locating stationary construction equipment as far as possible from noise-sensitive receptors
- Constructing noise barriers, such as temporary walls or piles of excavated material, between noisy activities and noise-sensitive receptors, where feasible
- Rerouting construction-related truck traffic along roadways that would cause the least disturbance to residents
- Conducting noise monitoring during construction to verify compliance with the limits.
- Coordinating with the City of Michigan City

5.1.2 CONSTRUCTION VIBRATION MITIGATION

To limit vibration impacts from construction activities, the construction contract documents would specify vibration limits for construction activities. Examples of vibration control measures include, but are not limited to, the following:

- Rerouting construction-related truck traffic along roadways that would cause the least disturbance to residents
- Performing a preconstruction survey in the vicinity of sites where vibration activities would occur to document the preconstruction conditions of potentially affected structures
- Restricting the use of certain vibration-producing equipment near sensitive structures
- Conducting vibration monitoring during construction to verify compliance with the limits
- Establishing a complaint resolution procedure to rapidly address any problems that may develop during construction
- Coordinating with the City of Michigan City

5.2 OPERATIONAL MITIGATION MEASURES

5.2.1 MITIGATION MEASURES FOR OPERATIONAL NOISE

The need to mitigate proposed Project operational noise depends on the magnitude of the impact. According to the FTA Manual, severe noise impacts are likely to result in a significant percentage of people being highly annoyed by Project-related noise. Noise mitigation would normally be specified for severe impact areas, unless there is no practical method of mitigating the impact.

Moderate noise impacts have the potential to result in complaints from the community. According to the FTA Manual, consideration of mitigation measures for moderate noise impacts should account for:

- Predicted increase over existing noise levels
- Types and number of noise-sensitive receptors affected
- Existing outdoor/indoor sound insulation
- Sources of both existing and projected noise levels
- Community views of the proposed Project
- Impact on transit operations and maintenance
- Noise reduction potential of the mitigation
- Cost of mitigating noise to more acceptable levels

NICTD reviewed potential mitigation measures based on these considerations.

5.2.2 MITIGATION FOR TRAIN HORN NOISE

Train horn use at highway-rail at-grade crossings is expected to contribute to three moderate noise impacts. Two of the moderate impacts would fall in the upper range of moderate impacts shown on **Figure 1-5** and warrant mitigation. To mitigate these impacts, NICTD intends to modify the horn noise level on SSL vehicles to a maximum of 100 dBA at 50 feet. This measure would eliminate the one lower range moderate impact in Gary, reduce the magnitude of the noise impact at the two upper range moderate impacts in Beverly Shores to a level less than significant, and further benefit other noise-sensitive receptors along the corridor.

Although the analysis indicates that the proposed Project would not result in a cumulative noise impact in Michigan City, NICTD continues to work with Michigan City and FRA to establish a quiet zone between Carroll and Sheridan Avenues.

5.2.3 MITIGATION MEASURES FOR OPERATIONAL VIBRATION

To mitigate the projected vibration impacts in the Town of Pines, Beverly Shores, and Michigan City, NICTD would consider installing crosstie pads, ballast mats, resilient rail fasteners, or other track support system modifications. These materials would be evaluated for effectiveness at impacted receptors and for durability in a shared freight corridor during the final design phase of the proposed Project. Final mitigation measure selection would be performed at that time.

Crosstie pads are highly elastic pads that are fitted to the base of a tie for providing vibration isolation. In addition to reducing disruptive vibrations, these types of pads offer other advantages including a possible reduction in maintenance expenses and lengthening the service life of the track structure. They also represent an economical alternative to ballast mats as a vibration isolating measure. A ballast mat has a top layer consisting of geotextile or fleece with high stretch and tear resistance. The resilient layer consists of micro-cellular polyurethane materials. Ballast mats would be placed between the ballast and sub-ballast layers of a typical track cross section. Ballast mats can also be placed on a layer of hot mix asphalt under the rail, ties, and ballast, which may be needed to stiffen up the subsurface layer. The reduction in GBV provided by a ballast mat is strongly dependent on the vibration frequency content and the design and support of the mat. Resilient rail fasteners are also used to provide vibration isolation between rails and ties, as well as on concrete slabs for direct fixation track. These fasteners include a soft, resilient element to provide greater vibration isolation than standard rail fasteners in the vertical direction. There are resilient rail fasteners available that can be used on high axle load systems such as locomotive hauled trains. Resilient rail fasteners are shown to be effective at frequencies above 40 Hertz.

6.0 CONCLUSIONS

6.1 NO BUILD ALTERNATIVE

Because the construction activities, track upgrades, and operational changes associated with the proposed Project would not occur under the No Build Alternative, neither noise impacts nor vibration impacts are anticipated with the No Build Alternative.

6.2 BUILD ALTERNATIVE

Construction activities associated with the proposed Project could result in temporary increases in noise and vibration. The increased noise and vibration would be short term and would occur at different places along the corridor during different phases of construction. NICTD would develop a construction noise and vibration management plan and a public outreach plan. NITCD would also coordinate with the various municipalities during construction and adhere to local ordinances.

Project operation is predicted to increase noise at sensitive receptors in the corridor based on FTA thresholds. This includes two potential upper range moderate noise impacts and one potential lower range moderate noise impact. The noise impacts are all attributable to train horn use at grade crossings. To mitigate these impacts, the horn level on the NICTD vehicles would be reduced to 100 dBA at 50 feet.

Vibration impacts could occur at two locations in Beverly Shores: one location in the Town of Pines, and five locations in Michigan City. NICTD would install crosstie pads, ballast mats, resilient rail fasteners, or other track support system modifications to mitigate these impacts. Details of those mitigation measures would be refined and finalized during the final design phase of the proposed Project.

7.0 REFERENCES

FTA. 2006. *Transit Noise and Vibration Impact Assessment.*

49 Code of Federal Regulations 222

Appendix A

Construction Noise Assessment

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Equipment	Qty.	Hours/day	Utilization	Horse-power	Kilowatts (KW)	SWL/unit	Total SWL	SPL (dBA) at distance (feet)			
								100	200	500	1,000
Clearing											
Off-Highway Trucks	4	6	50%	350	261	123	126	85	79	72	65
Rubber Tired Dozers	3	8	67%	255	190	122	125	84	78	70	64
Rubber Tired Loaders	2	6	50%	199	148	121	121	80	74	66	60
Tractors/Loaders/Backhoes	3	5	42%	97	72	118	119	78	72	64	58
Trenchers	2	4	33%	80	60	117	115	74	68	60	54
Combined Noise Level								**89**	**83**	**75**	**69**
Utility Relocation											
Cranes	1	6	50%	226	169	121	118	78	72	64	58
Dumper/Tender	2	4	33%	16	12	110	108	67	61	53	47
Off-Highway Trucks	2	6	50%	350	261	123	123	82	76	69	62
Rubber Tired Dozers	3	8	67%	255	190	122	125	84	78	70	64
Rubber Tired Loaders	2	6	50%	199	148	121	121	80	74	66	60
Tractors/Loaders/Backhoes	3	5	42%	97	72	118	119	78	72	64	58
Trenchers	2	6	50%	80	60	117	117	76	70	62	56
Welders	3	6	50%	46	34	114	116	75	69	61	55
Combined Noise Level								**89**	**83**	**75**	**69**
Earthwork											
Excavators	2	8	67%	162	121	120	121	80	74	66	60
Graders	1	8	67%	174	130	120	118	78	72	64	58
Off-Highway Trucks	4	8	67%	350	261	123	127	87	81	73	67
Off-Highway Trucks	1	4	33%	350	261	123	118	78	72	64	58

Equipment	Qty.	Hours/day	Utilization	Horse-power	KW	SWL/unit	Total SWL	SPL (dBA) at distance (feet)			
								100	200	500	1,000
Rollers	2	6	50%	80	60	117	117	100	200	500	1,000
Rubber Tired Dozers	1	8	67%	255	190	122	120	79	73	65	59
Rubber Tired Loaders	2	6	50%	199	148	121	121	80	74	66	60
Scrapers	2	8	67%	361	269	123	125	84	78	70	64
Signal Boards	3	8	67%	6	4	106	109	68	62	54	48
Tractors/Loaders/Backhoes	3	6	50%	97	72	118	119	79	73	65	59
							Combined Noise Level	**91**	**85**	**77**	**71**
Bridge Construction for Overpasses											
Cranes	1	7	58%	226	169	121	119	78	72	64	58
Excavators	2	8	67%	162	121	120	121	80	74	66	60
Forklifts	3	8	67%	89	66	117	120	80	74	66	60
Generator Sets	1	8	67%	84	63	117	115	75	69	61	55
Graders	1	8	67%	174	130	120	118	78	72	64	58
Pavers	2	8	67%	125	93	119	120	79	73	65	59
Paving Equipment	2	8	67%	130	97	119	120	79	73	65	59
Rollers	2	8	67%	80	60	117	118	77	71	63	57
Rubber Tired Dozers	1	8	67%	255	190	122	120	79	73	65	59
Scrapers	2	8	67%	361	269	123	125	84	78	70	64
Tractors/Loaders/Backhoes	2	8	67%	97	72	118	119	78	72	64	58
Welders	1	8	67%	46	34	114	113	72	66	58	52
							Combined Noise Level	**90**	**84**	**76**	**70**

Equipment	Qty.	Hours/day	Utilization	Horse-power	KW	SWL/unit	Total SWL	SPL (dBA) at distance (feet)			
								100	200	500	1,000
Retaining Walls											
Excavators	2	8	67%	162	121	120	121	80	74	66	60
Forklifts	3	8	67%	89	66	117	120	80	74	66	60
Generator Sets	1	8	67%	84	63	117	115	75	69	61	55
Graders	1	8	67%	174	130	120	118	78	72	64	58
Rubber Tired Dozers	1	8	67%	255	190	122	120	79	73	65	59
Rubber Tired Loaders	2	7	58%	199	148	121	121	81	75	67	61
Scrapers	2	8	67%	361	269	123	125	84	78	70	64
Tractors/Loaders/Backhoes	3	7	58%	97	72	118	120	79	73	65	59
Combined Noise Level								**89**	**83**	**75**	**69**
Signals											
Cranes	1	7	58%	226	169	121	119	78	72	64	58
Forklifts	3	8	67%	89	66	117	120	80	74	66	60
Generator Sets	1	8	67%	84	63	117	115	75	69	61	55
Tractors/Loaders/Backhoes	2	8	67%	97	72	118	119	78	72	64	58
Welders	1	8	67%	46	34	114	113	72	66	58	52
Combined Noise Level								**84**	**78**	**70**	**64**
Track Installation											
Air Compressors	1	6	50%	78	58	117	114	73	67	59	53
Cranes	1	7	58%	226	169	121	119	78	72	64	58
Forklifts	3	8	67%	89	66	117	120	80	74	66	60
Generator Sets	1	8	67%	84	63	117	115	75	69	61	55

Equipment	Qty.	Hours/day	Utilization	Horse-power	KW	SWL/unit	Total SWL	SPL (dBA) at distance (feet)			
								100	200	500	1,000
Track Laying Machine	1	8	67%	1500	1119	129	128	87	81	73	67
Track Tamper	1	8	67%	200	149	121	119	78	72	64	58
Track Stabilizer	1	8	67%	700	522	126	124	84	78	70	64
Tractors/Loaders/Backhoes	2	8	67%	97	72	118	119	78	72	64	58
Welders	1	8	67%	46	34	114	113	72	66	58	52
							Combined Noise Level	**90**	**84**	**76**	**70**
Signal Work											
Cranes	1	7	58%	226	169	121	119	78	72	64	58
Forklifts	3	8	67%	89	66	117	120	80	74	66	60
Generator Sets	1	8	67%	84	63	117	115	75	69	61	55
Tractors/Loaders/Backhoes	2	8	67%	97	72	118	119	78	72	64	58
Welders	1	8	67%	46	34	114	113	72	66	58	52
							Combined Noise Level	**84**	**78**	**70**	**64**
Install Track and Subballast											
Air Compressors	1	6	50%	78	58	117	114	73	67	59	53
Cranes	1	7	58%	226	169	121	119	78	72	64	58
Forklifts	3	8	67%	89	66	117	120	80	74	66	60
Generator Sets	1	8	67%	84	63	117	115	75	69	61	55
Track Laying Machine	1	8	67%	1500	1119	129	128	87	81	73	67
Track Tamper	1	8	67%	200	149	121	119	78	72	64	58
Track Stabilizer	1	8	67%	700	522	126	124	84	78	70	64
Ballast Regulator	1	8	67%	135	101	119	117	77	71	63	57

Equipment	Qty.	Hours/day	Utilization	Horse-power	KW	SWL/unit	Total SWL	SPL (dBA) at distance (feet)			
								100	200	500	1,000
Tractors/Loaders/Backhoes	2	8	67%	97	72	118	119	78	72	64	58
Welders	1	8	67%	46	34	114	113	72	66	58	52
							Combined Noise Level	**91**	**85**	**77**	**71**
Final Cut-over and Removal of Turnouts											
Cranes	1	7	58%	226	169	121	119	78	72	64	58
Forklifts	3	8	67%	89	66	117	120	80	74	66	60
Generator Sets	1	8	67%	84	63	117	115	75	69	61	55
Tractors/Loaders/Backhoes	3	7	58%	97	72	118	120	79	73	65	59
Welders	1	8	67%	46	34	114	113	72	66	58	52
							Combined Noise Level	**85**	**79**	**71**	**65**

Source: HDR

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Appendix B

Noise Contours

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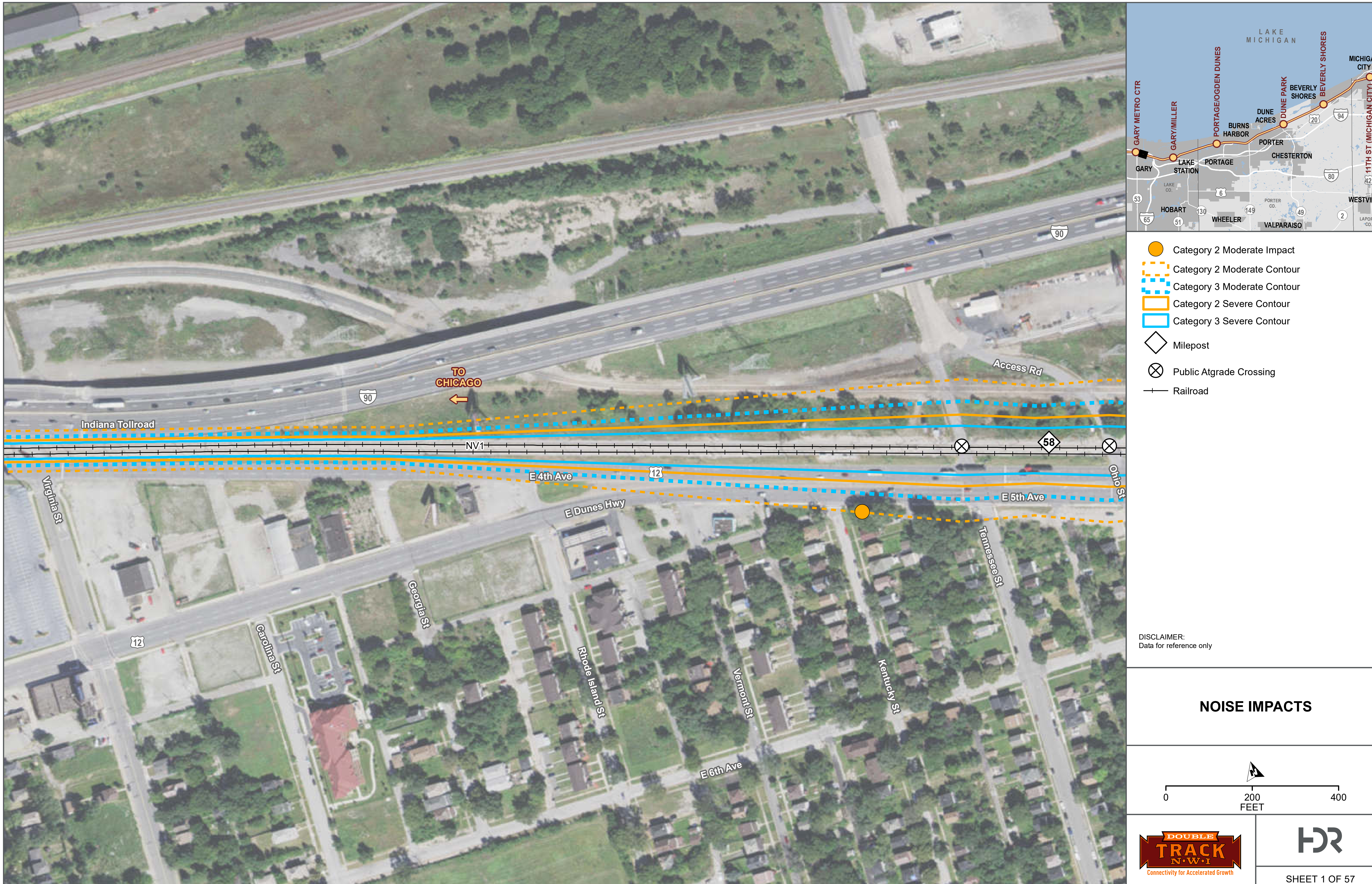


- Category 2 Moderate Impact
- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Milepost
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Measurement Site
- Milepost
- Crossover
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

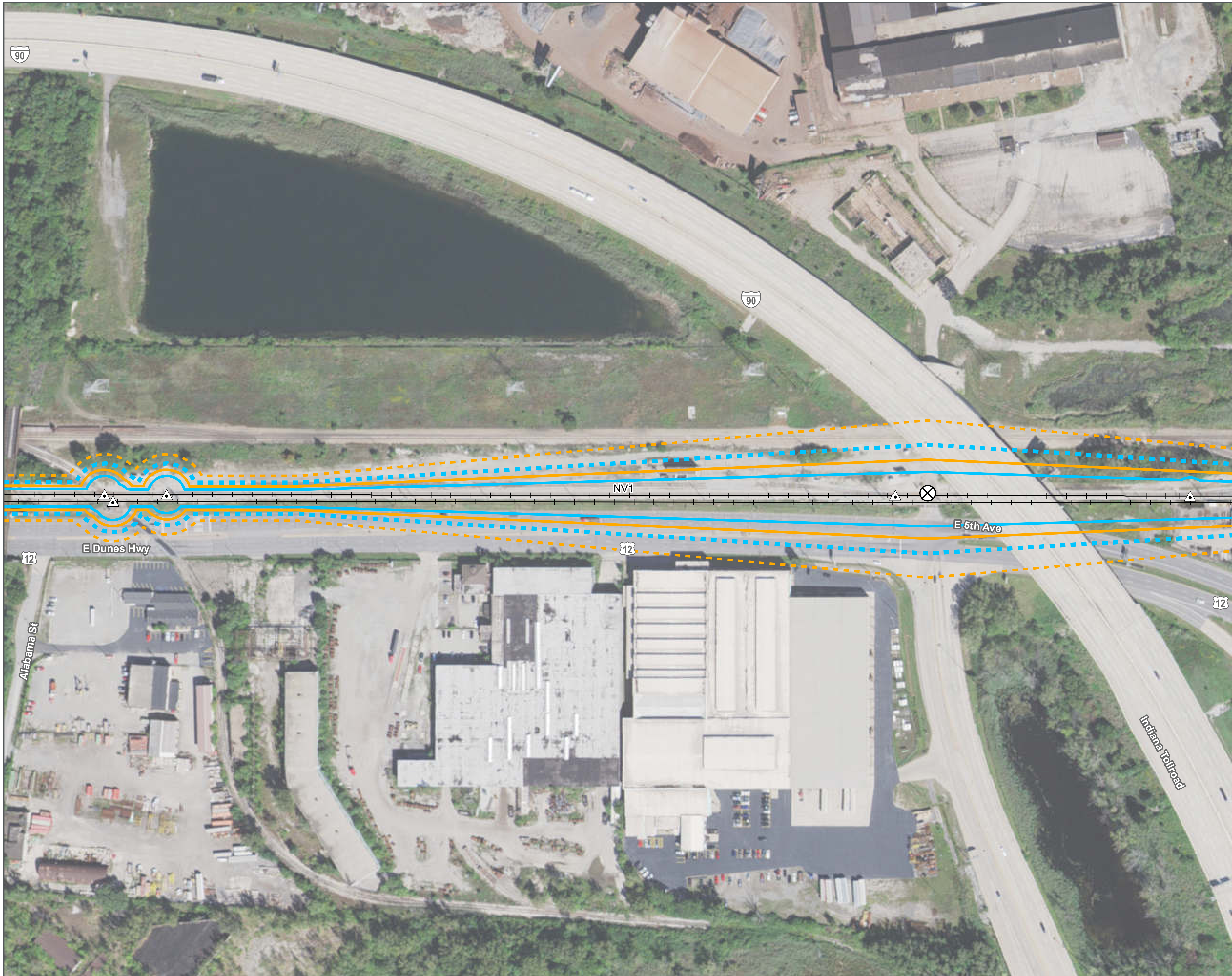
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 2 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Crossover
Public Atgrade Crossing
Railroad

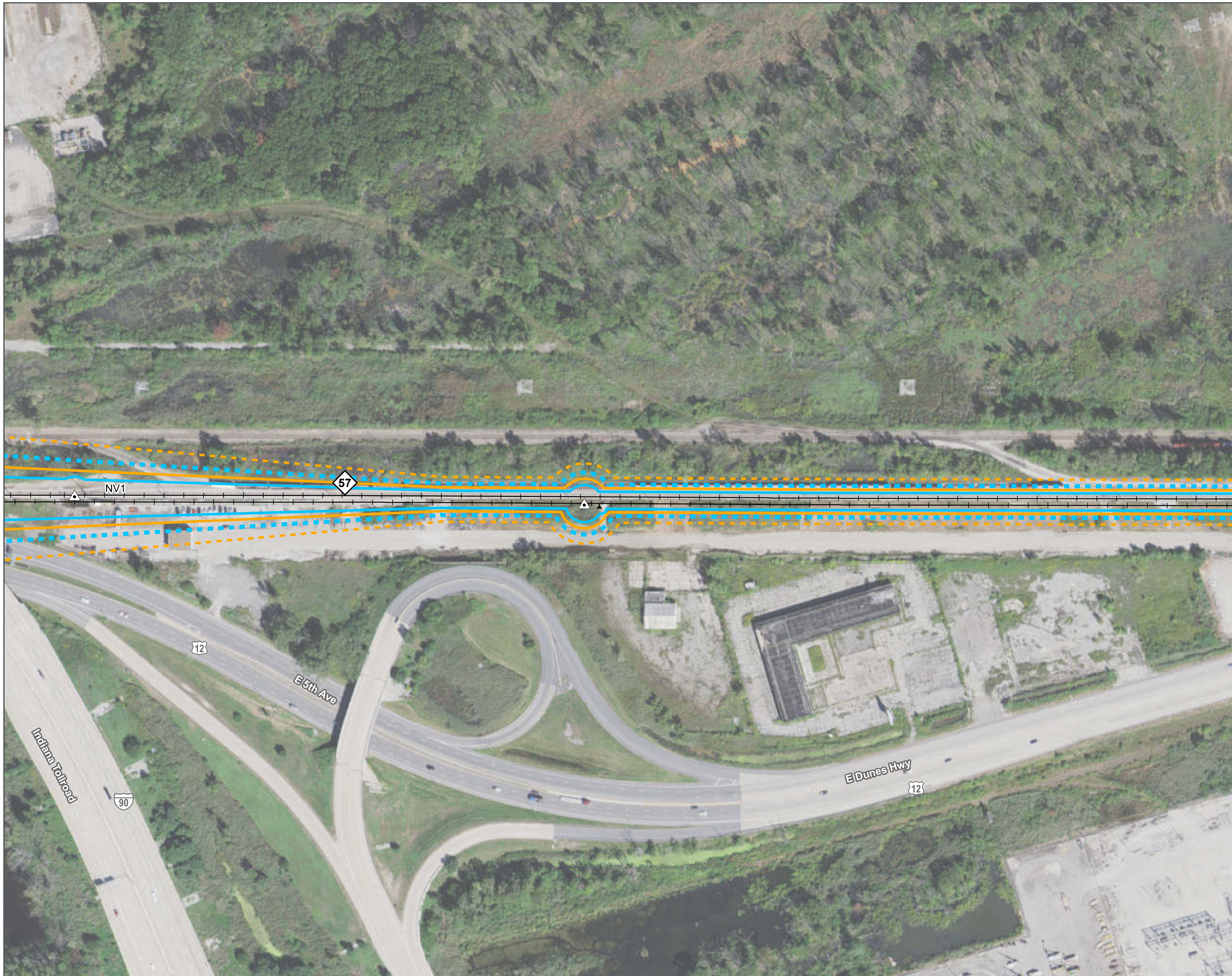
DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR



Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Crossover
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Crossover
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Milepost
- Crossover
- Railroad

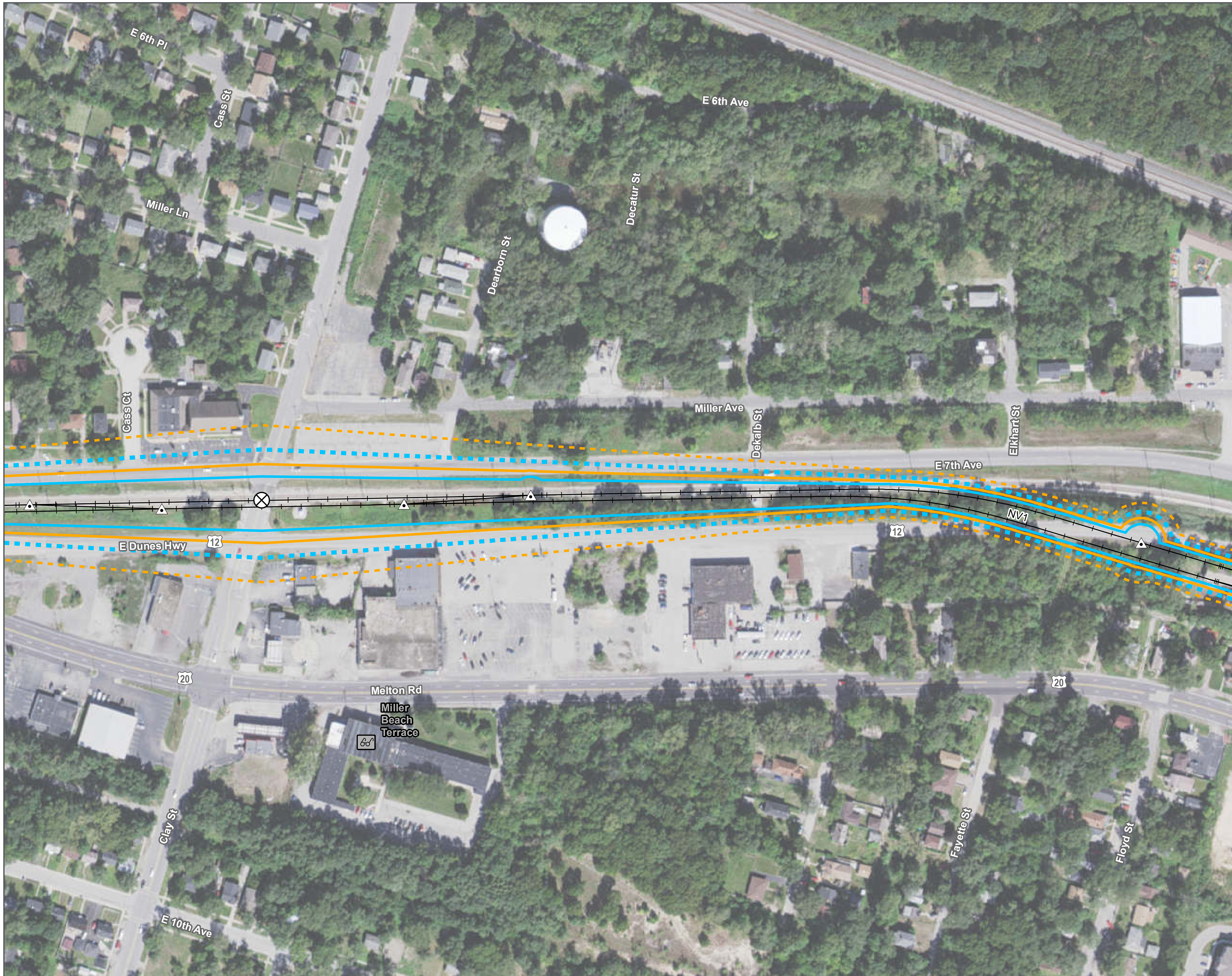
DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR



- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Assisted Living
- Crossover
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

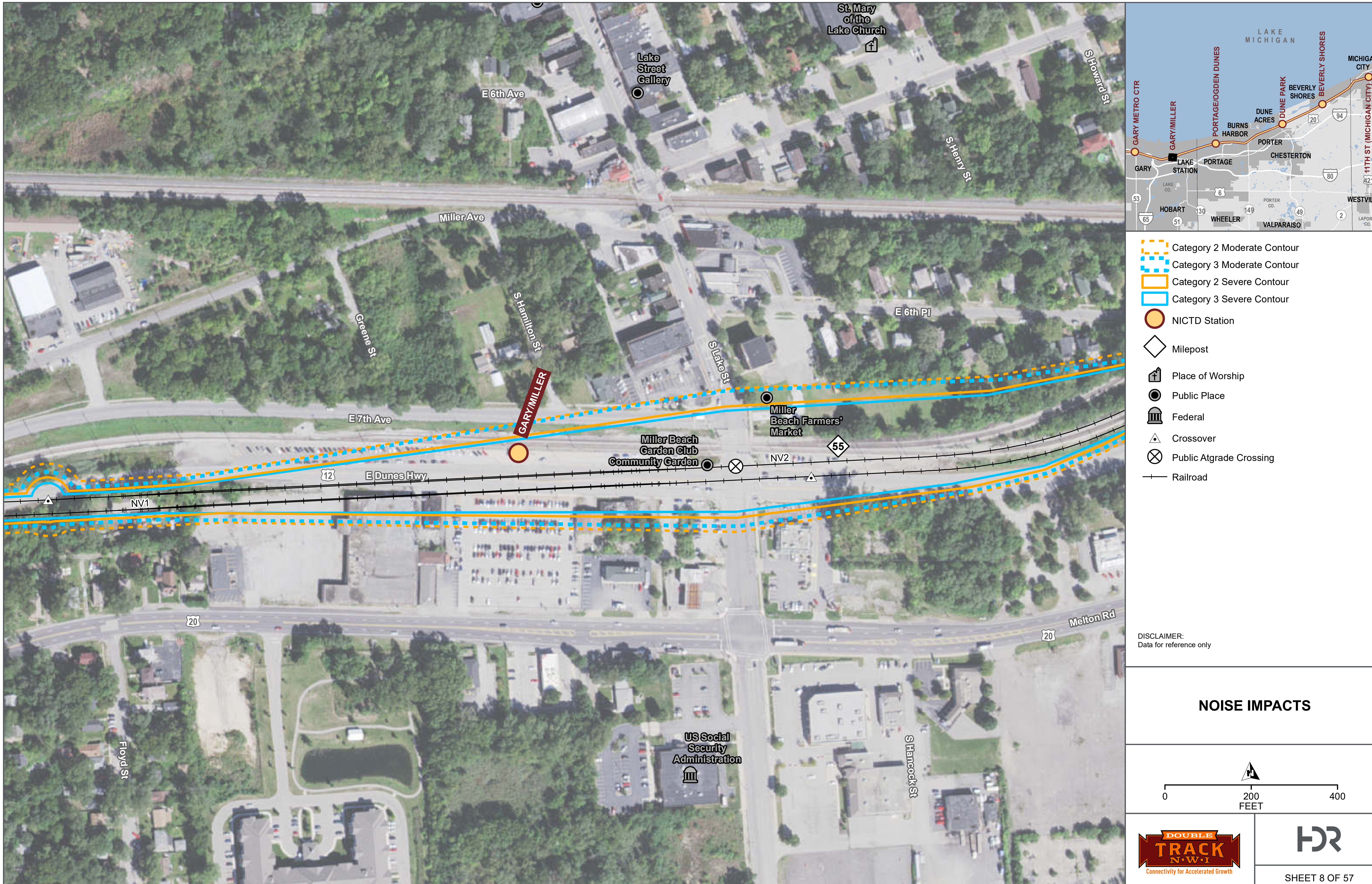
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

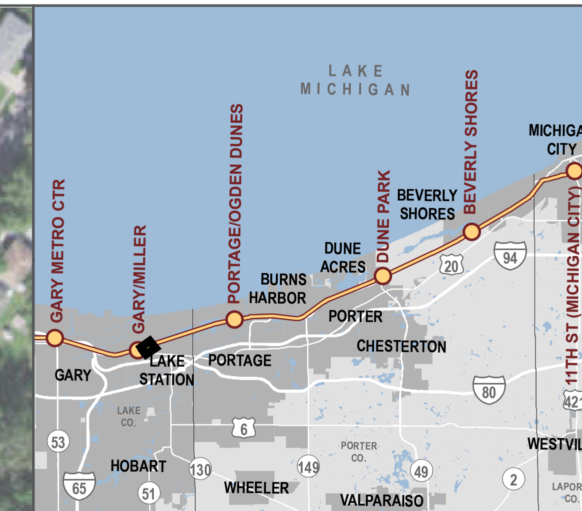
HDR

SHEET 7 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Place of Worship
Railroad

DISCLAIMER:
Data for reference only

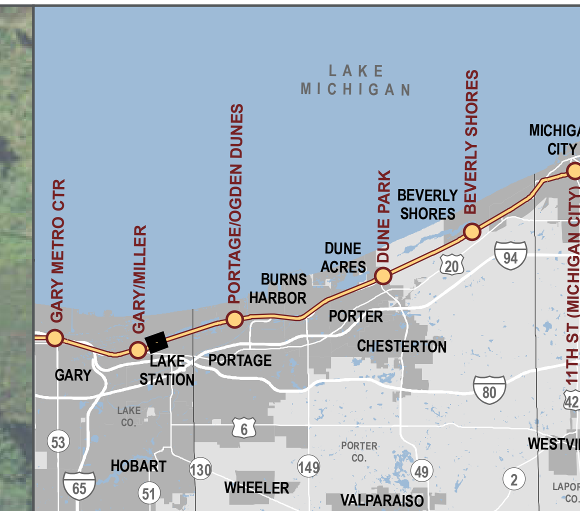
NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Moderate Contour

Category 3 Moderate Contour

Category 2 Severe Contour

Category 3 Severe Contour

Milepost

Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

SHEET 12 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

SHEET 13 OF 57

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

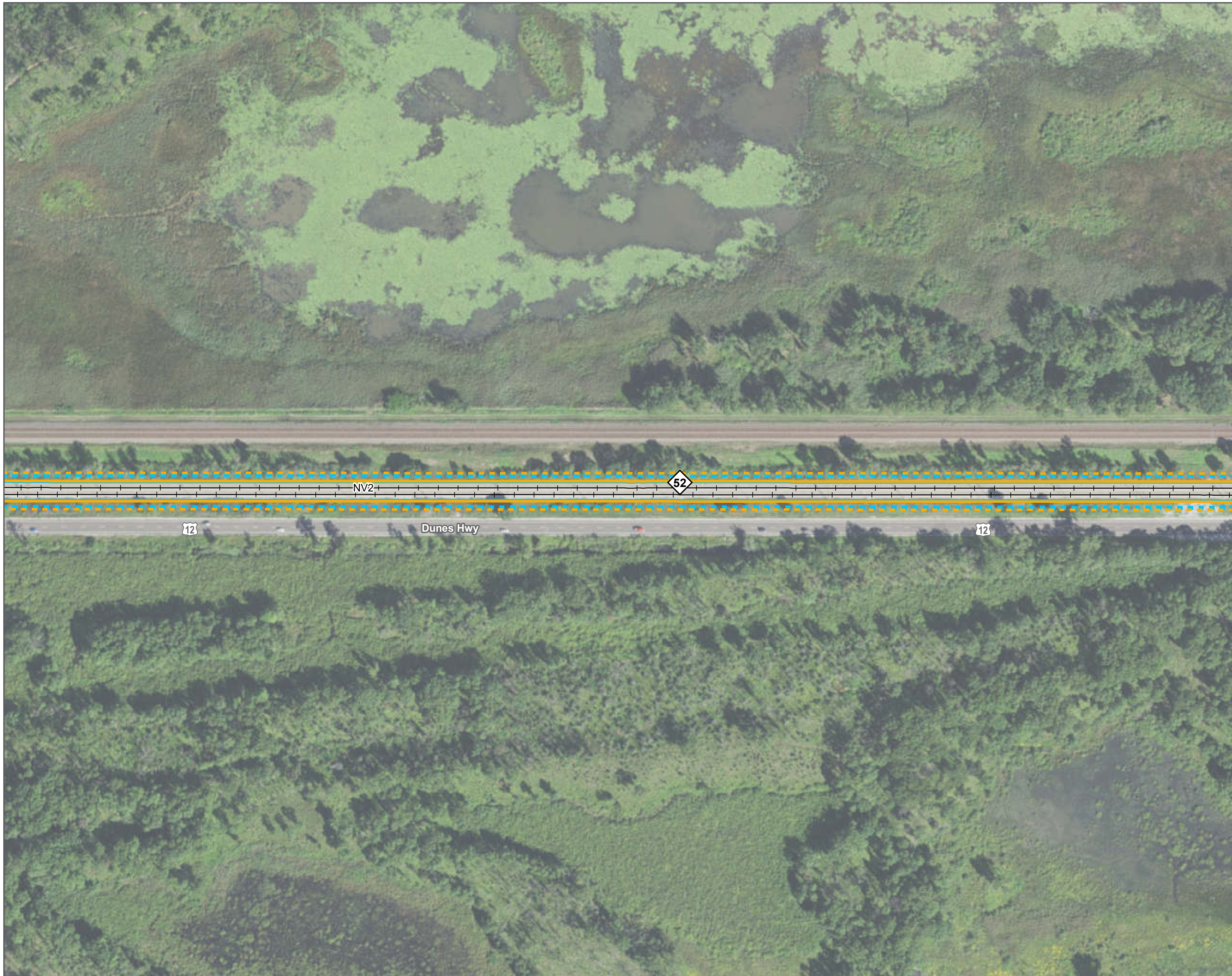
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 14 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Crossover
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

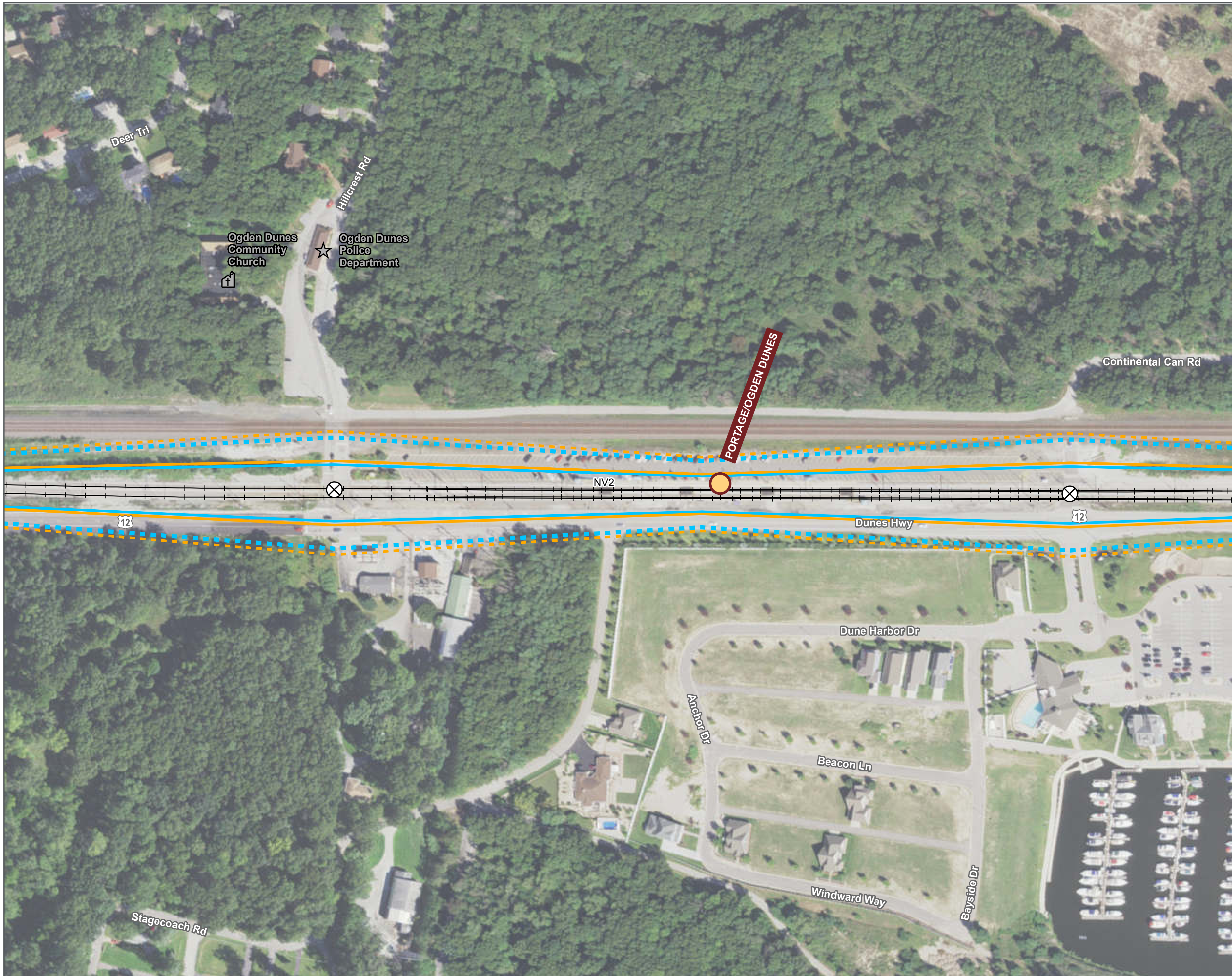
SHEET 16 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

DISCLAIMER:
Data for reference only

NOISE IMPACTS



- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- NICTD Station
- Place of Worship
- Police Department
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

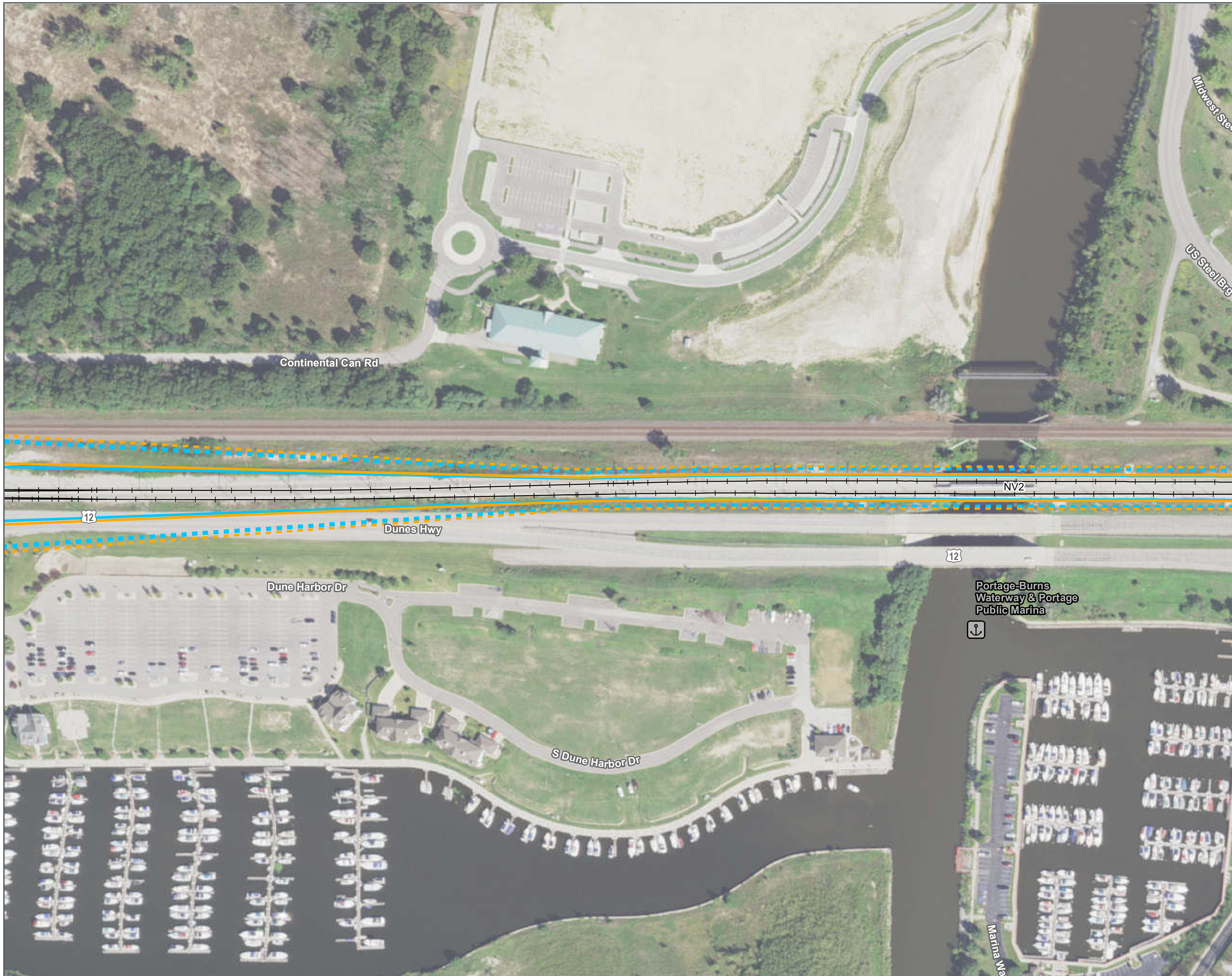
NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Marina
- Railroad

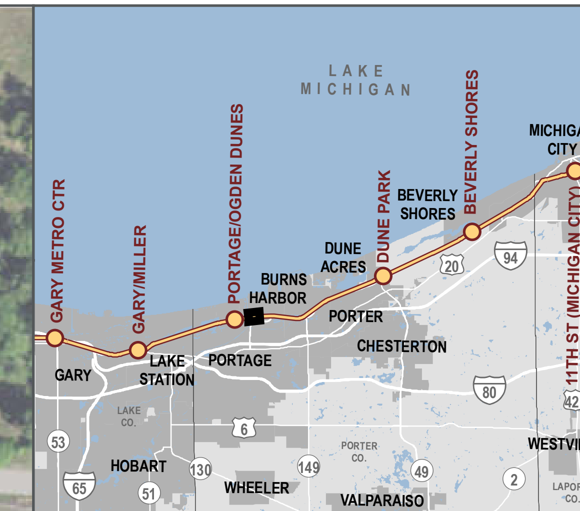
DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR



Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Crossover
Railroad

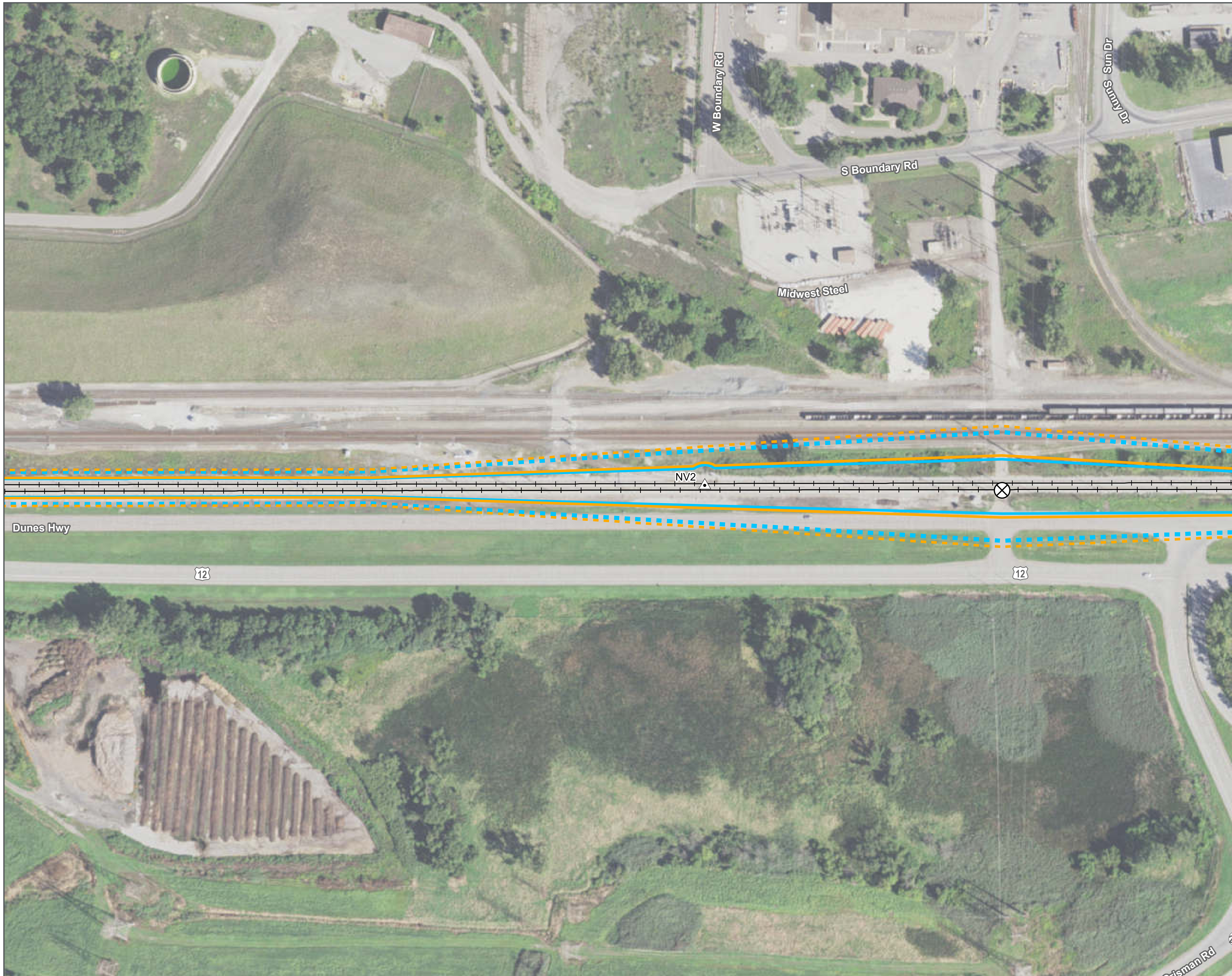
DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR



- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Crossover
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

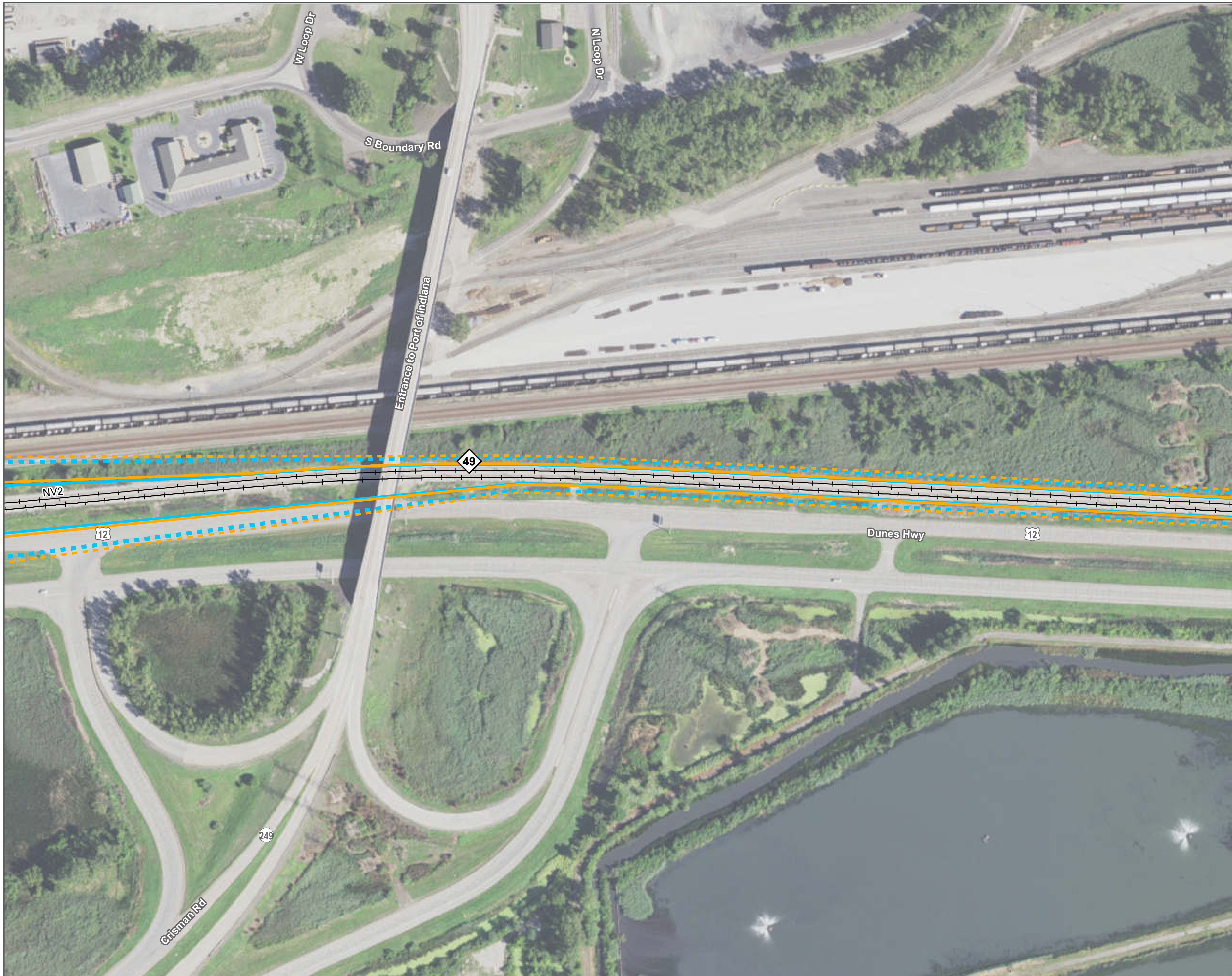
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 21 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Railroad

DISCLAIMER:
Data for reference only

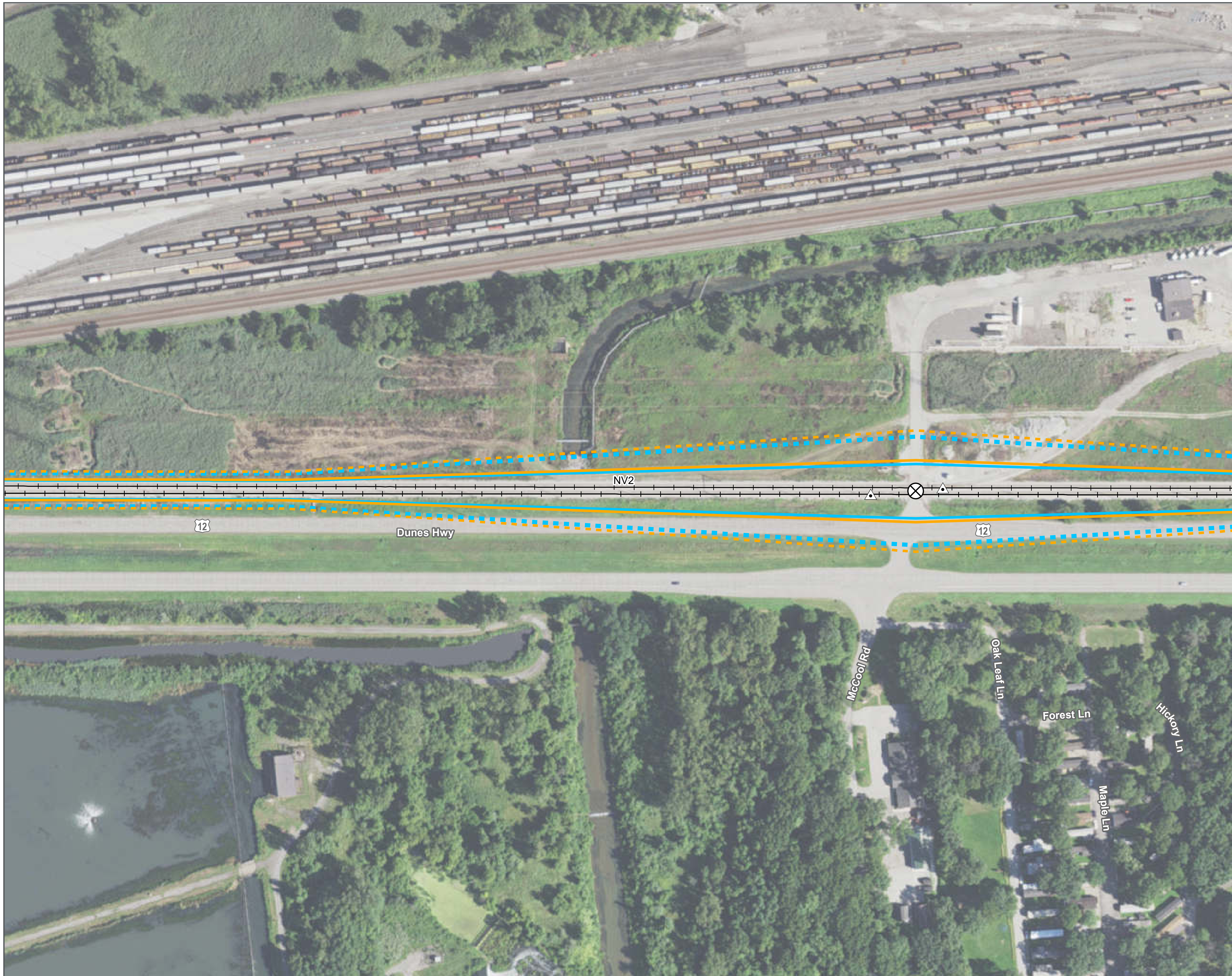
NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 22 OF 57



Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK NWI
Connectivity for Accelerated Growth

HDR

- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Milepost
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

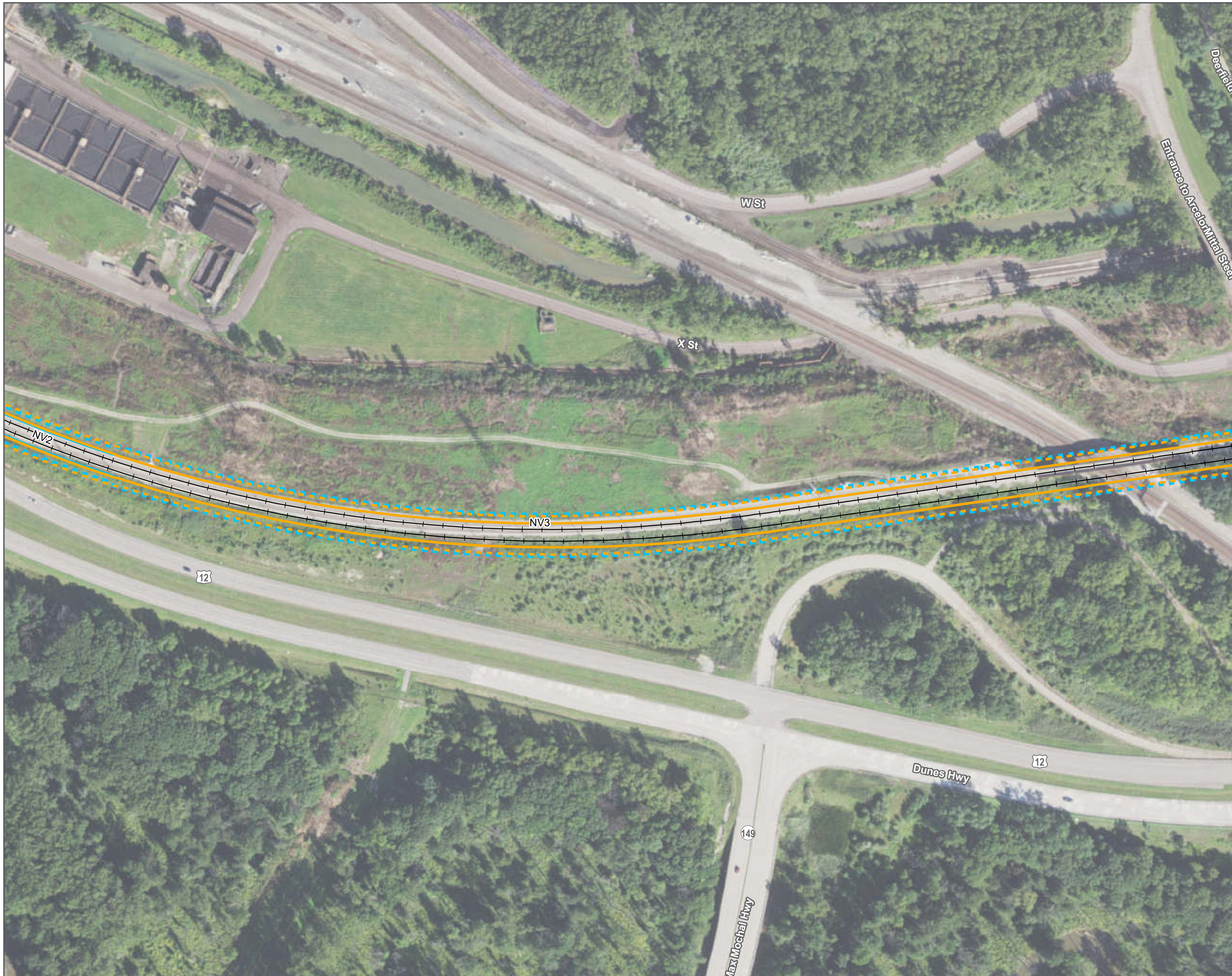
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 24 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Railroad

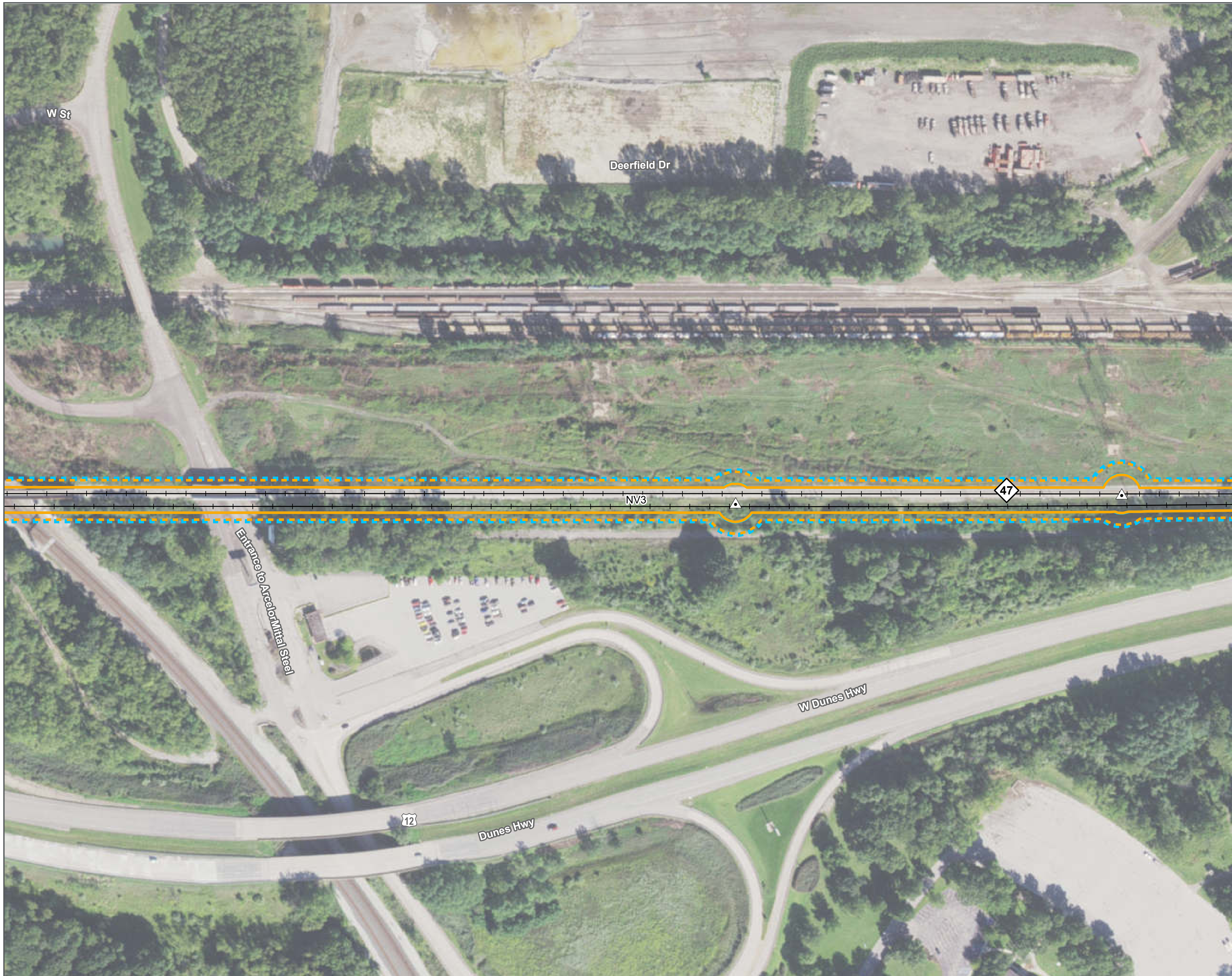
DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR



- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Milepost
- Crossover
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour

Category 3 Moderate Contour

Category 2 Severe Contour

Category 3 Severe Contour

Crossover

Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

SHEET 27 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 28 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Milepost
- Crossover
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Cemetery
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Crossover
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 32 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Measurement Site
NICTD Station
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Crossover
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 35 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Crossover
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour

Category 3 Moderate Contour

Category 2 Severe Contour

Category 3 Severe Contour

Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 37 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Milepost
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

SHEET 40 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

SHEET 42 OF 57

- Category 2 Moderate Contour
- Category 3 Moderate Contour
- Category 2 Severe Contour
- Category 3 Severe Contour
- Railroad

DISCLAIMER:
Data for reference only

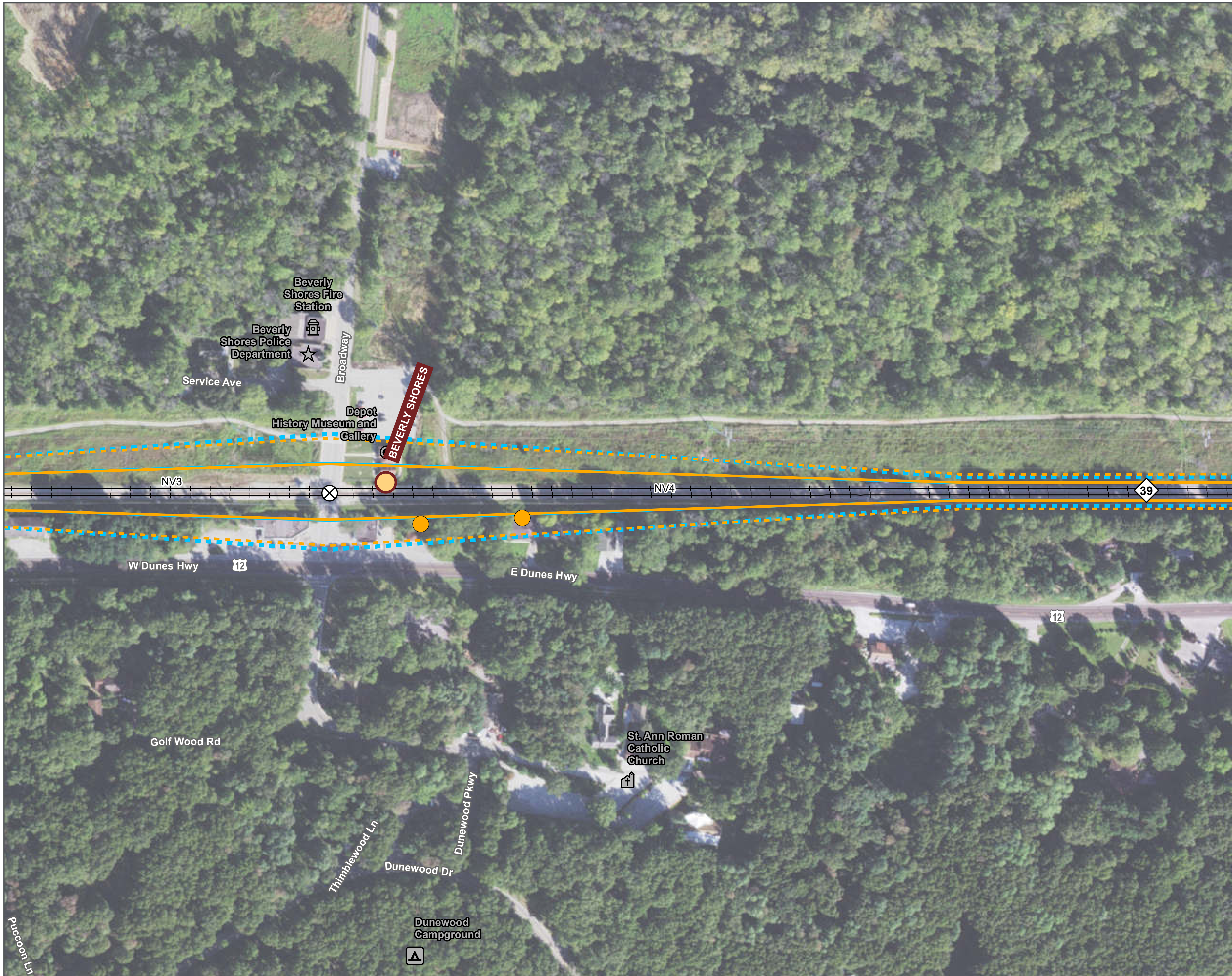
NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Moderate Impact
Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
NICTD Station
Milepost
Campground
Place of Worship
Public Place
Fire Station
Police Department
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

SHEET 44 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 45 OF 57

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Place of Worship
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

DISCLAIMER:
Data for reference only

NOISE IMPACTS

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 47 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Milepost
Railroad

DISCLAIMER:
Data for reference only

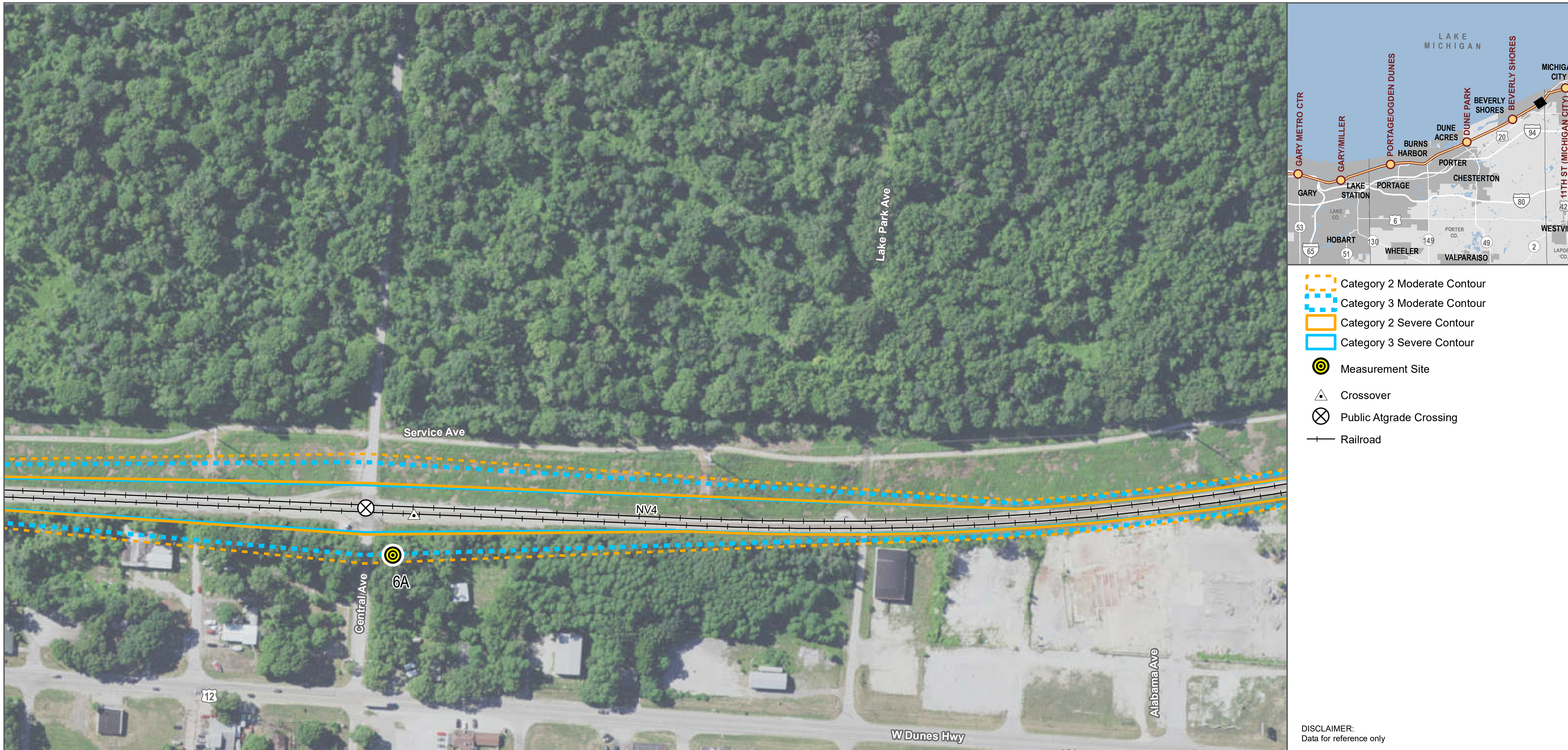
NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 49 OF 57



DISCLAIMER:
Data for reference only

NOISE IMPACTS

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

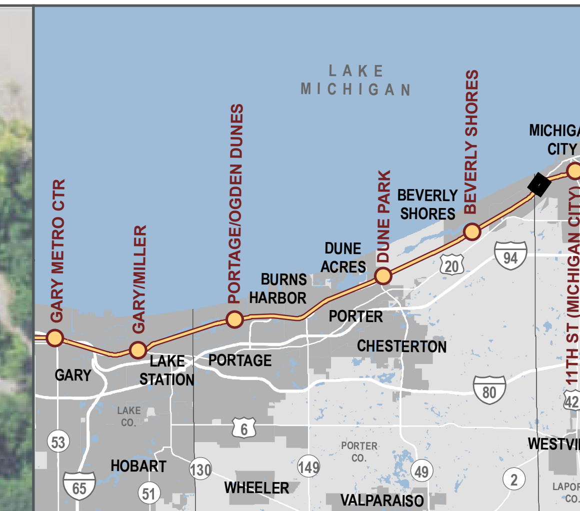
DISCLAIMER:
Data for reference only

NOISE IMPACTS

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Moderate Contour
Category 3 Moderate Contour
Category 2 Severe Contour
Category 3 Severe Contour
Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Place of Worship

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

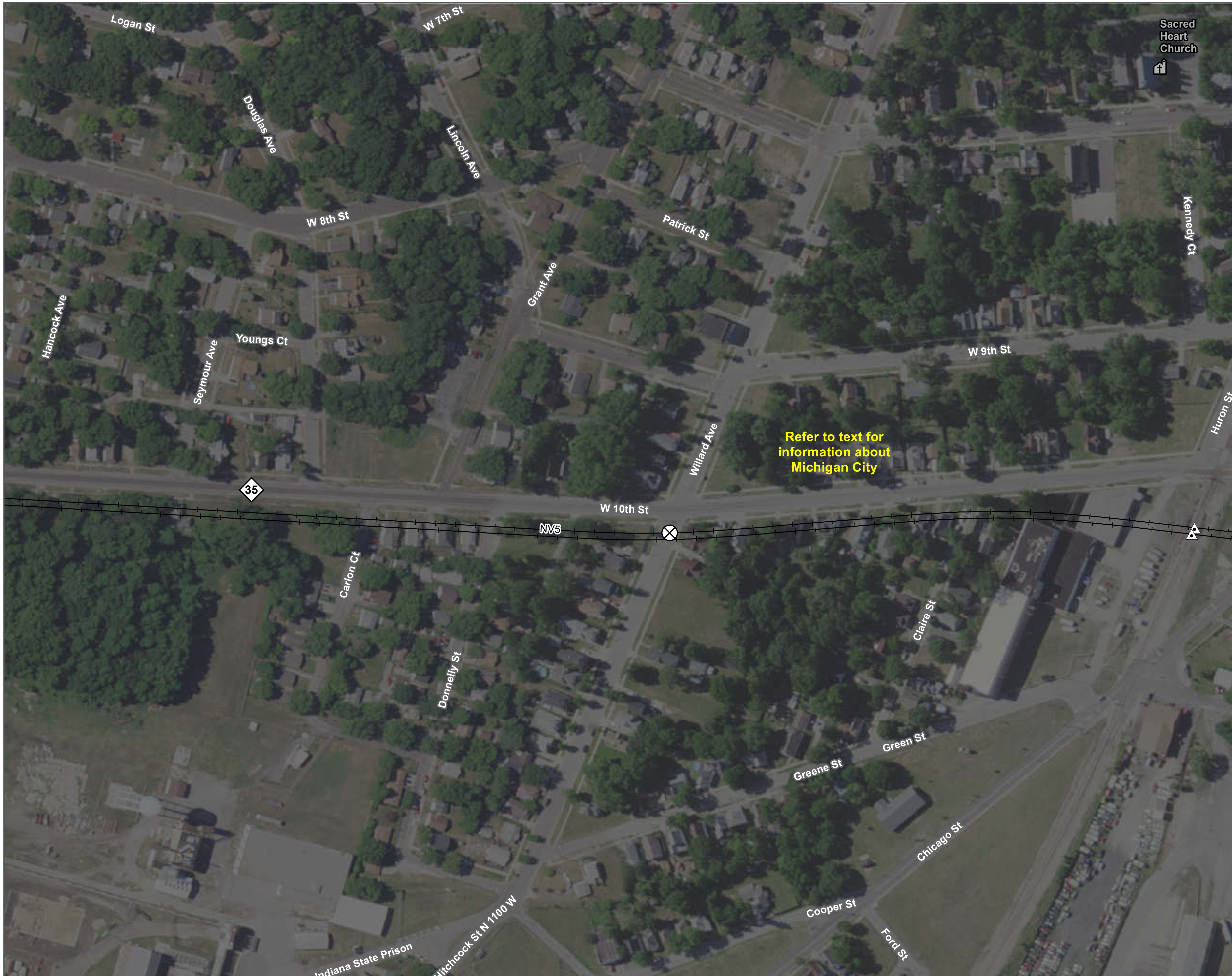
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 53 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Milepost

Place of Worship

Crossover

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

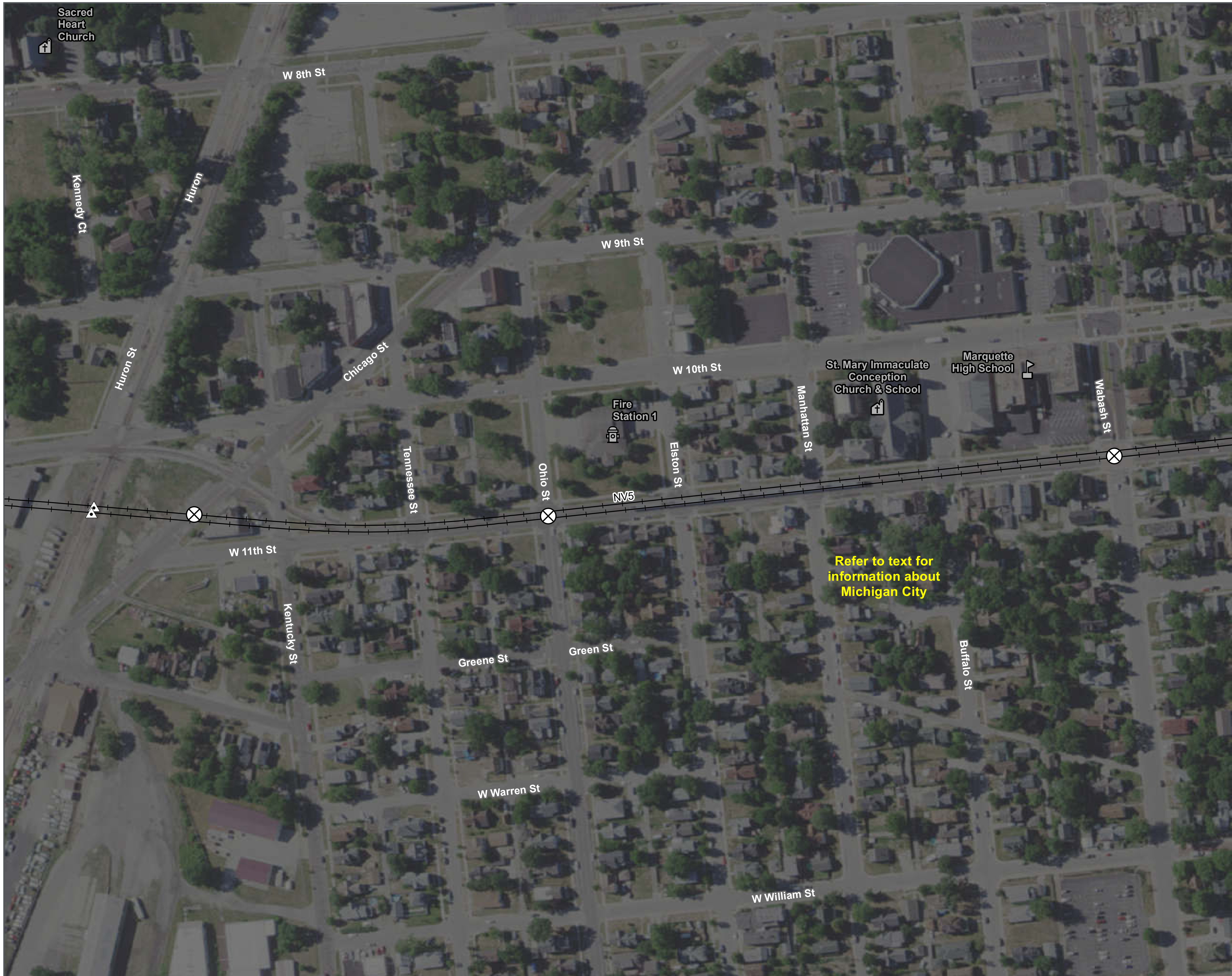
NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



- Place of Worship
- Fire Station
- School
- Crossover
- Public Atgrade Crossing
- Railroad

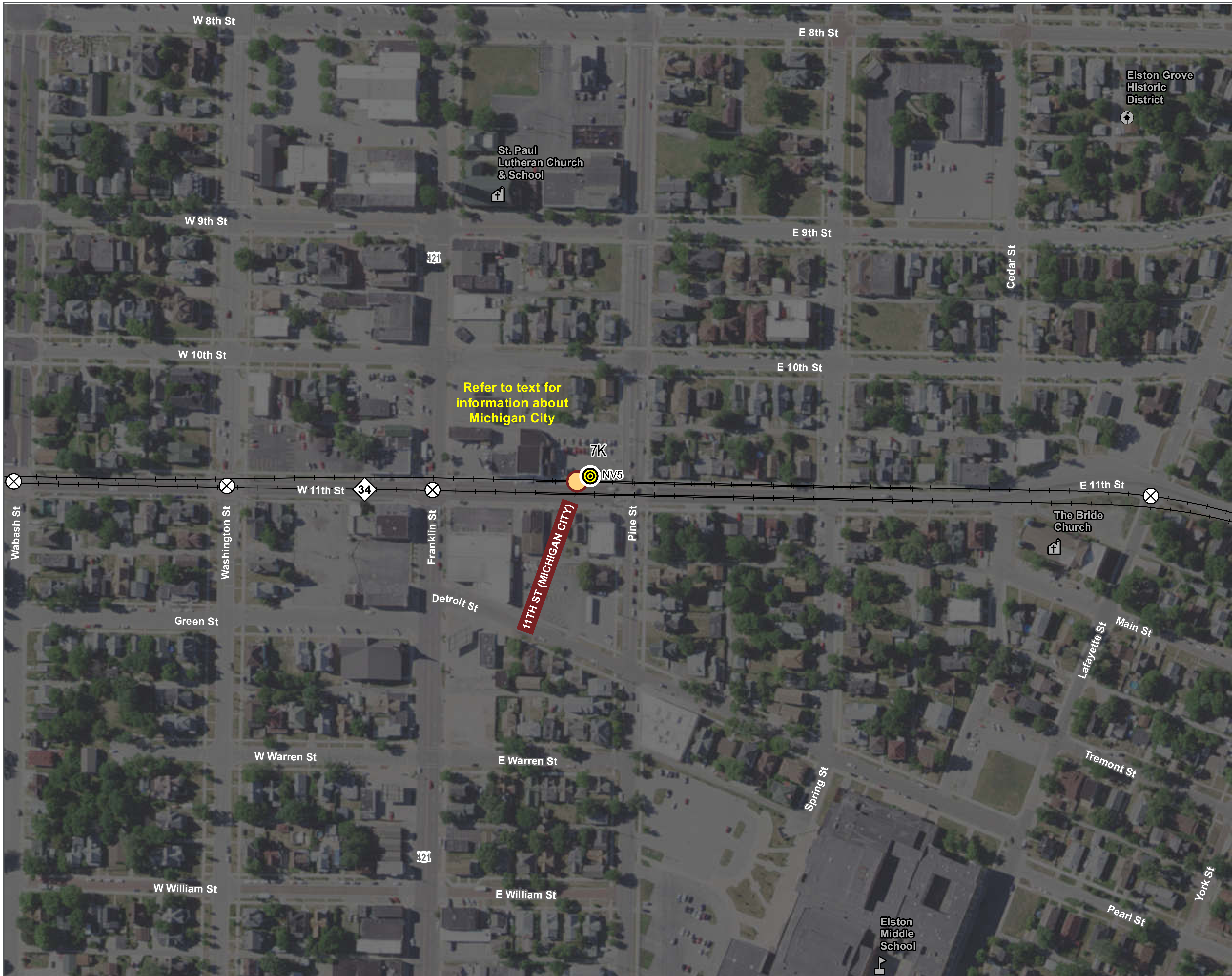
DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

SHEET 55 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



- Measurement Site
- NICTD Station
- Milepost
- Place of Worship
- Historic District
- School
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

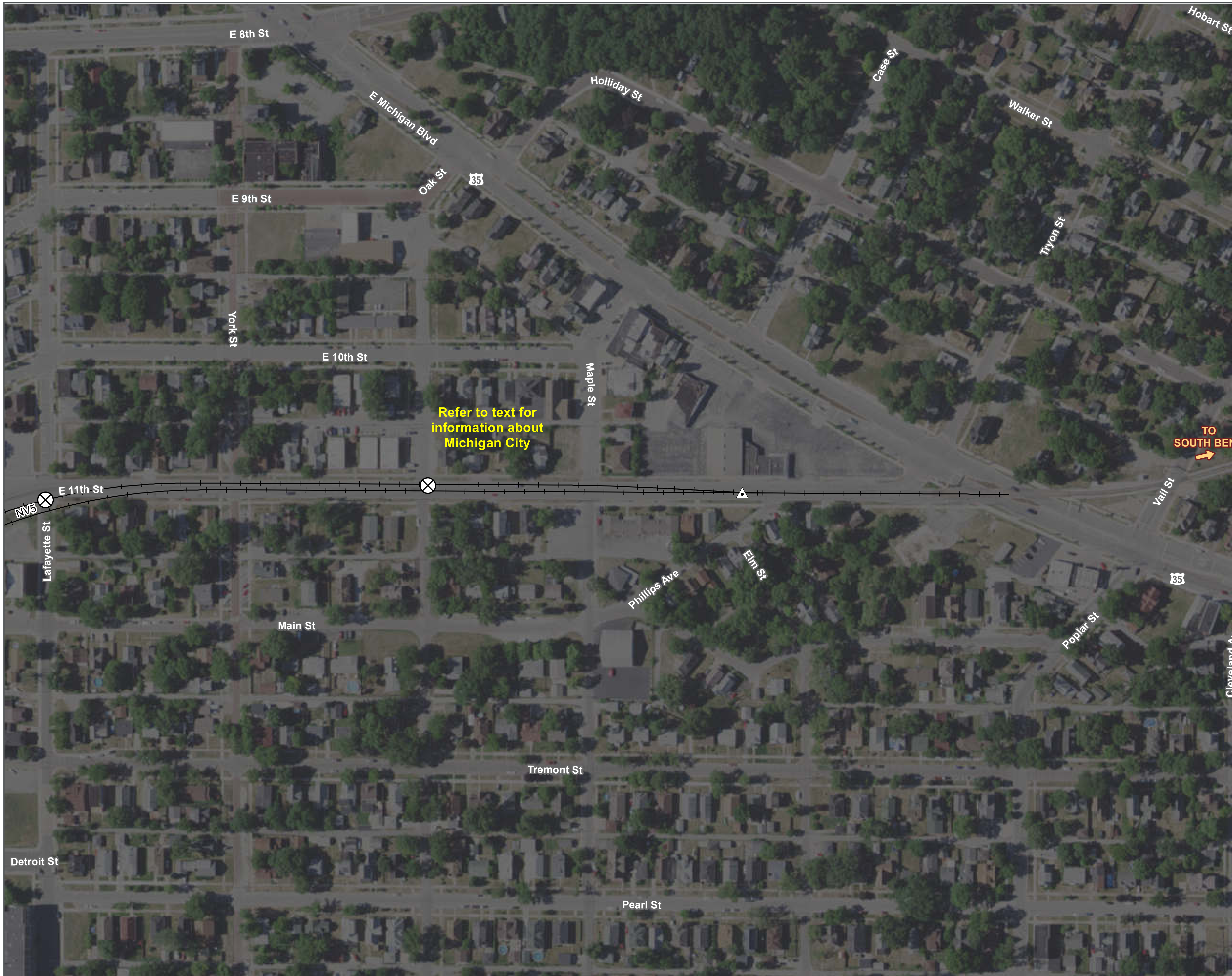
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 56 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

- Crossover
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

NOISE IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 57 OF 57

Appendix C

Vibration Contours

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Category 2 Vibration Contour
Category 3 Vibration Contour
Milepost
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Crossover

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

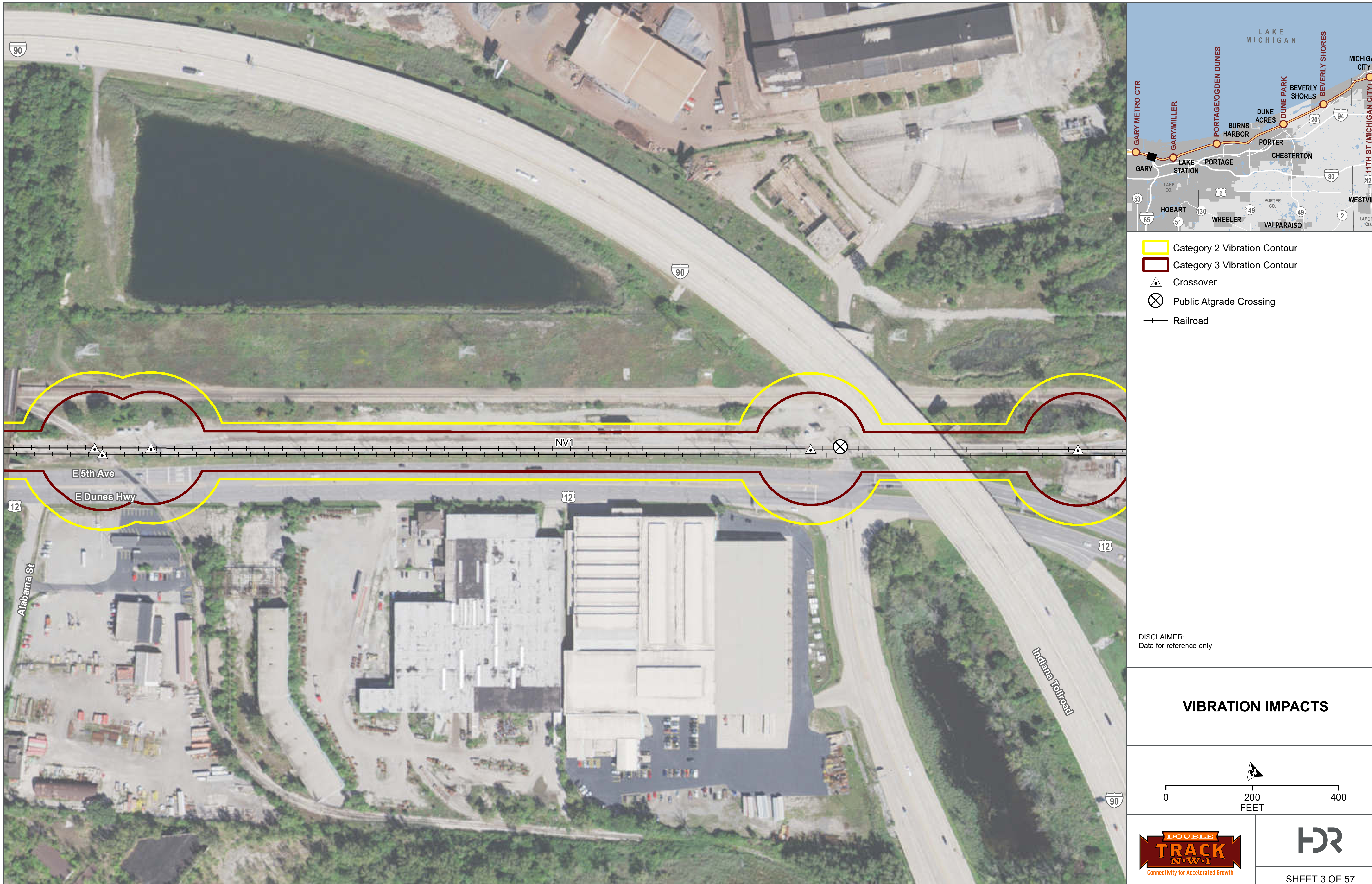
VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Vibration Contour
Category 3 Vibration Contour
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

- Category 2 Vibration Contour
- Category 3 Vibration Contour
- Milepost
- Crossover
- Railroad

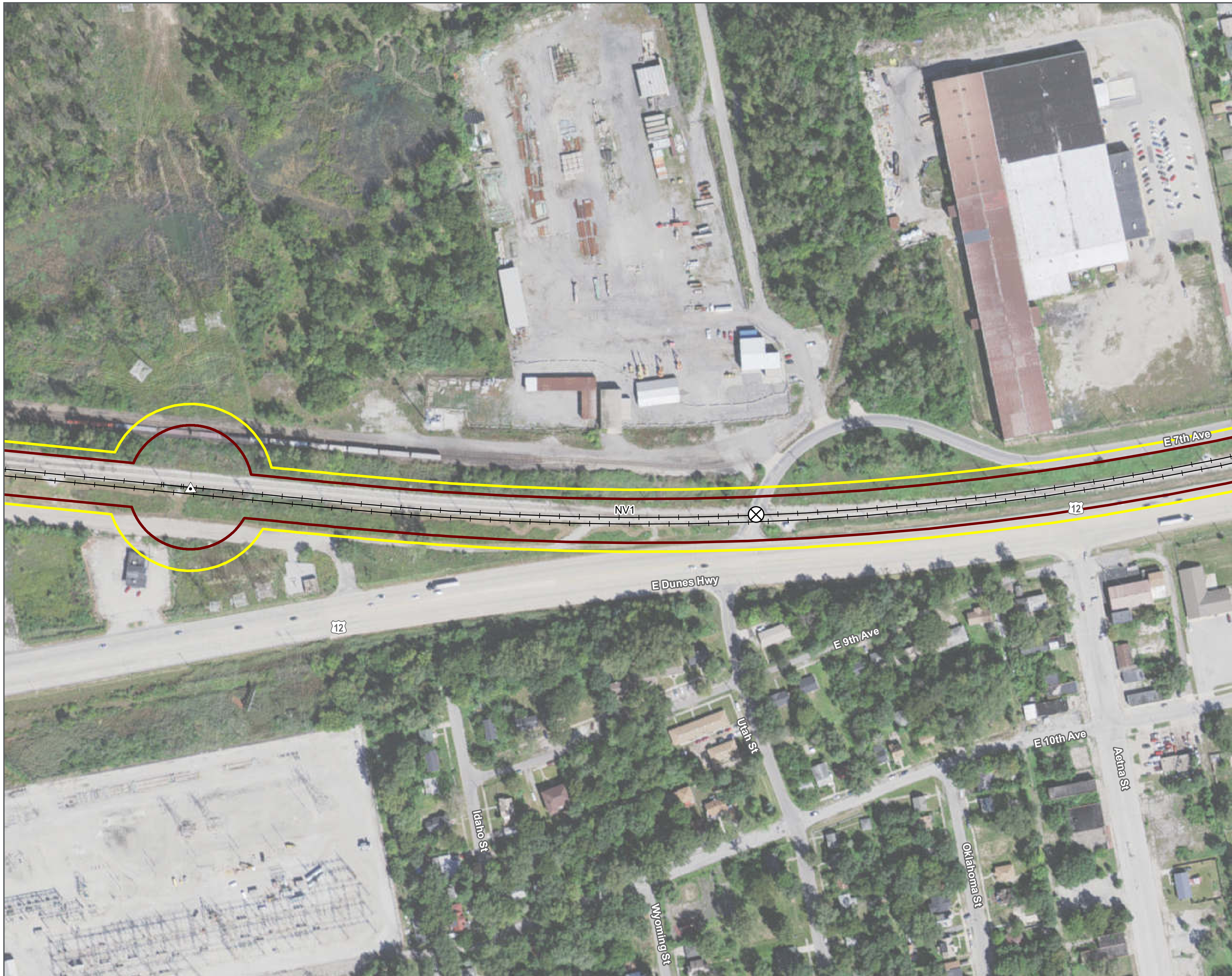
DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR



Category 2 Vibration Contour
Category 3 Vibration Contour
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

SHEET 5 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Crossover

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

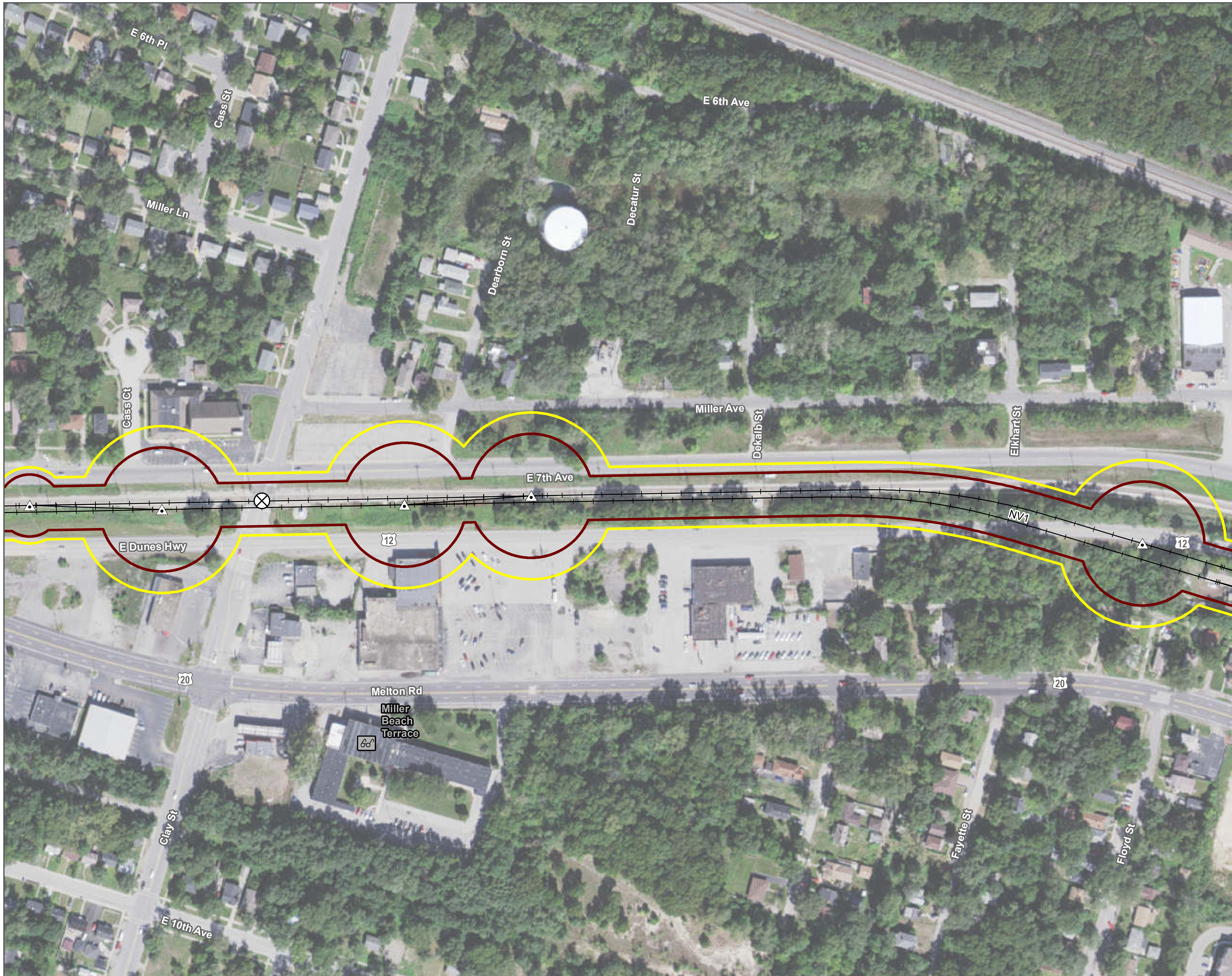
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 6 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Vibration Contour
Category 3 Vibration Contour
Assisted Living
Crossover
Public Atgrade Crossing
Railroad

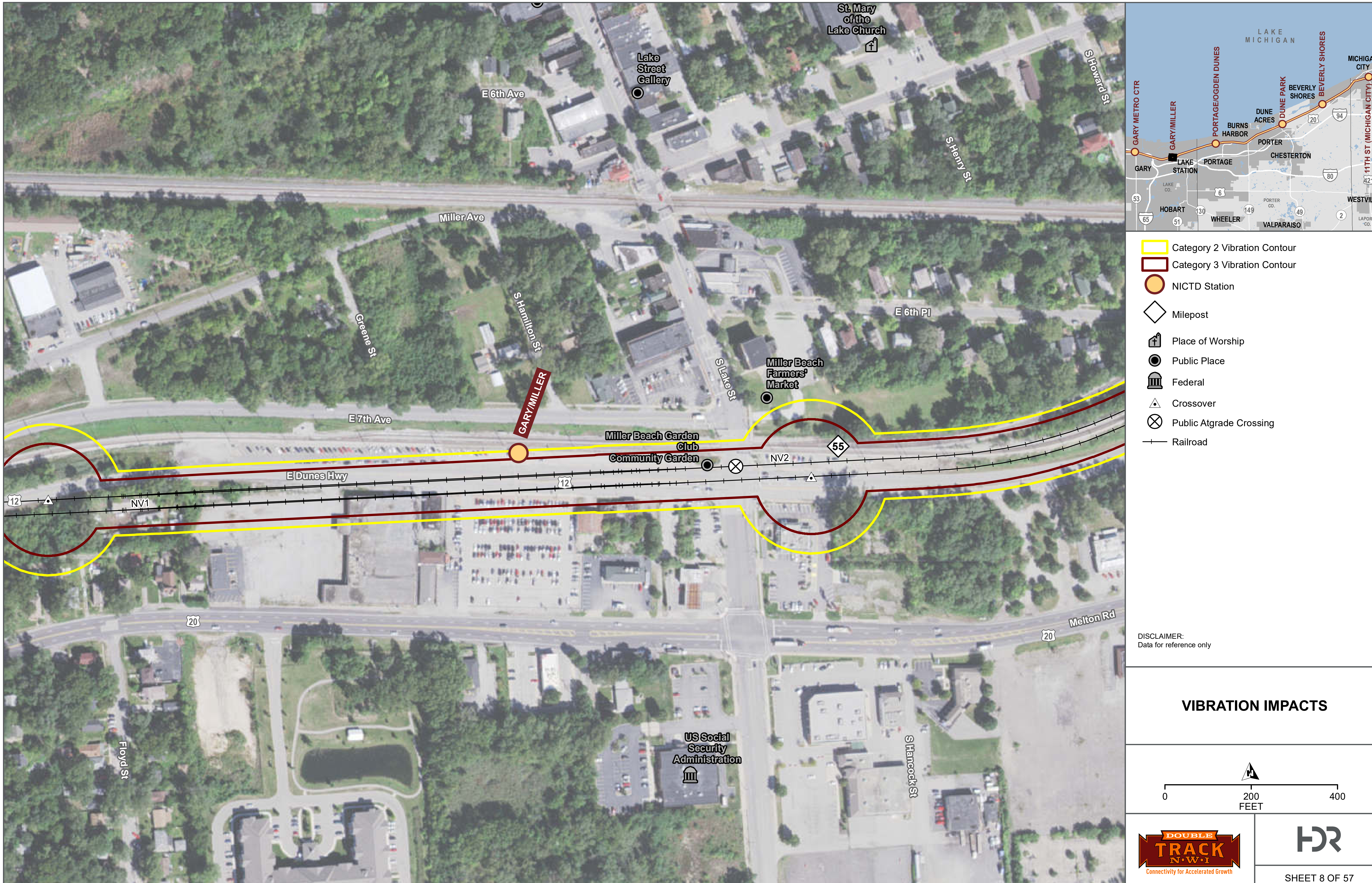
DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR



Category 2 Vibration Contour

Category 3 Vibration Contour

NICTD Station

Milepost

Place of Worship

Public Place

Federal

Crossover

Public Atgrade Crossing

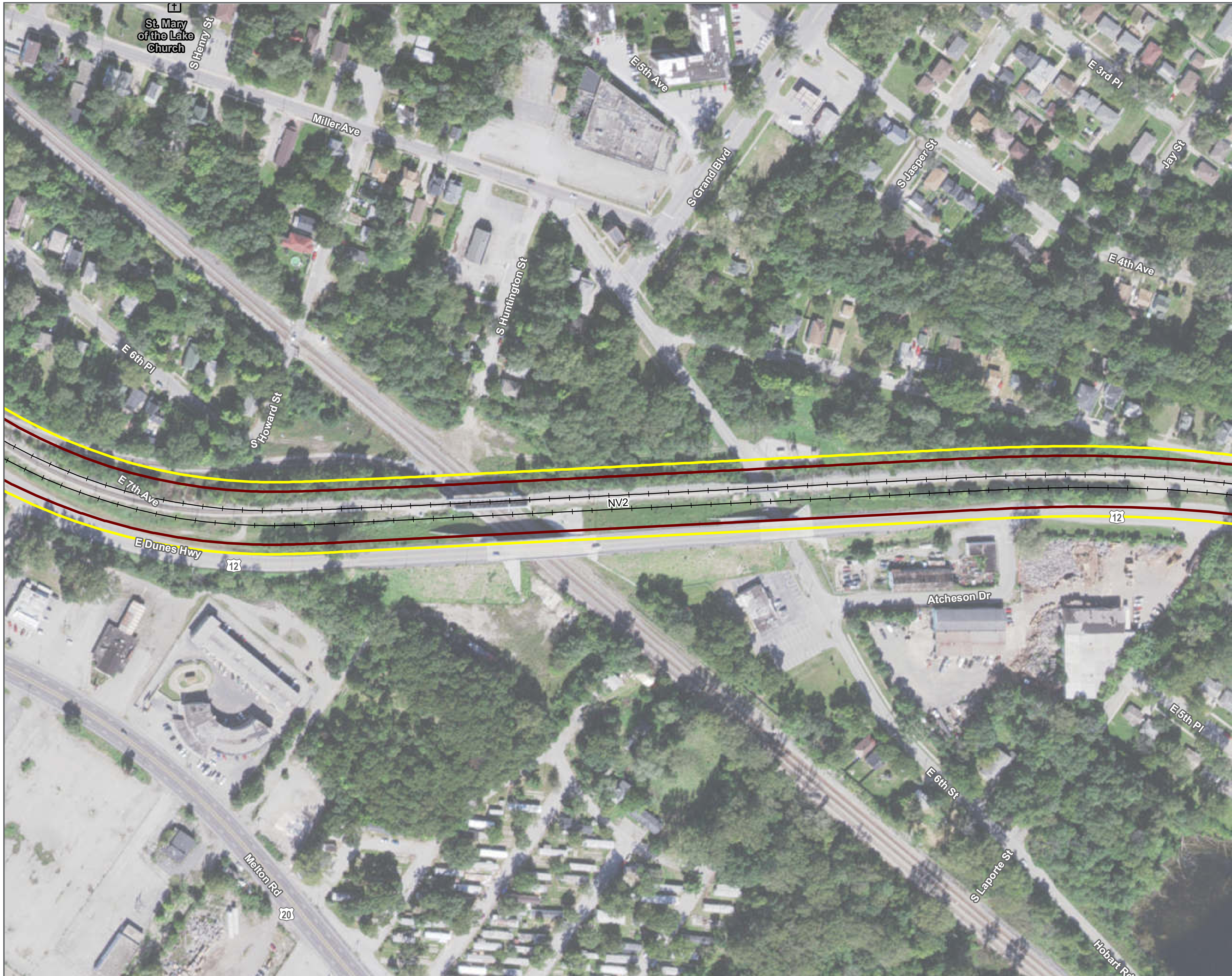
Railroad

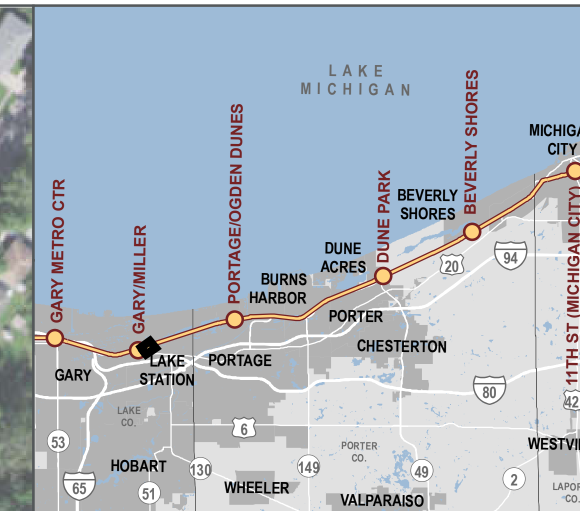
DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

DOUBLE TRACK N·W·I Connectivity for Accelerated Growth

HDR





Category 2 Vibration Contour
Category 3 Vibration Contour
Place of Worship
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

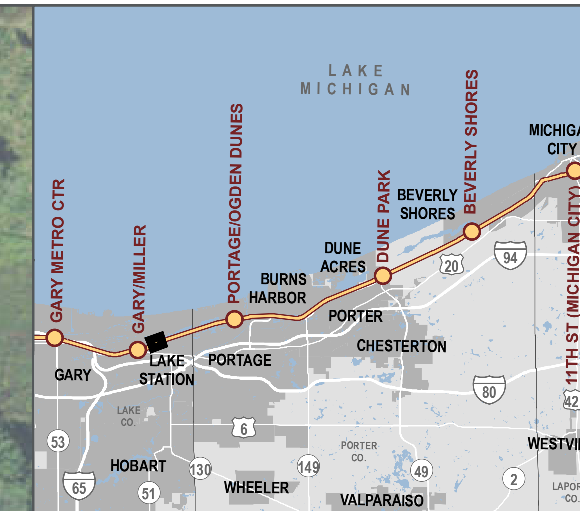
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 9 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 10 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 11 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour
Category 3 Vibration Contour
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 12 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 13 OF 57

Category 2 Vibration Contour

Category 3 Vibration Contour

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 15 OF 57

Category 2 Vibration Contour

Category 3 Vibration Contour

Crossover

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour
Category 3 Vibration Contour
Milepost
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

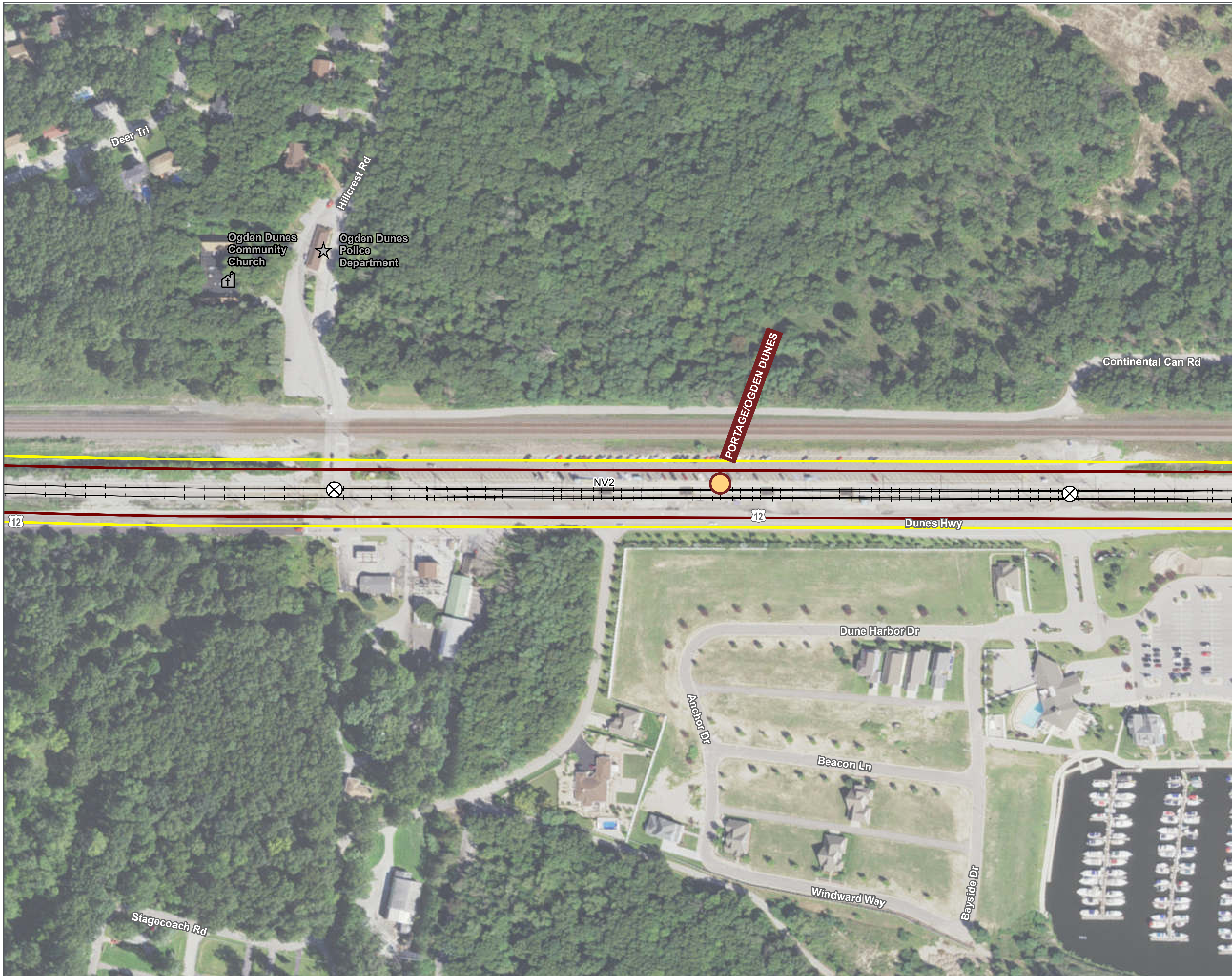
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 17 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Vibration Contour
Category 3 Vibration Contour
NICTD Station
Place of Worship
Police Department
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

SHEET 18 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Marina

Railroad

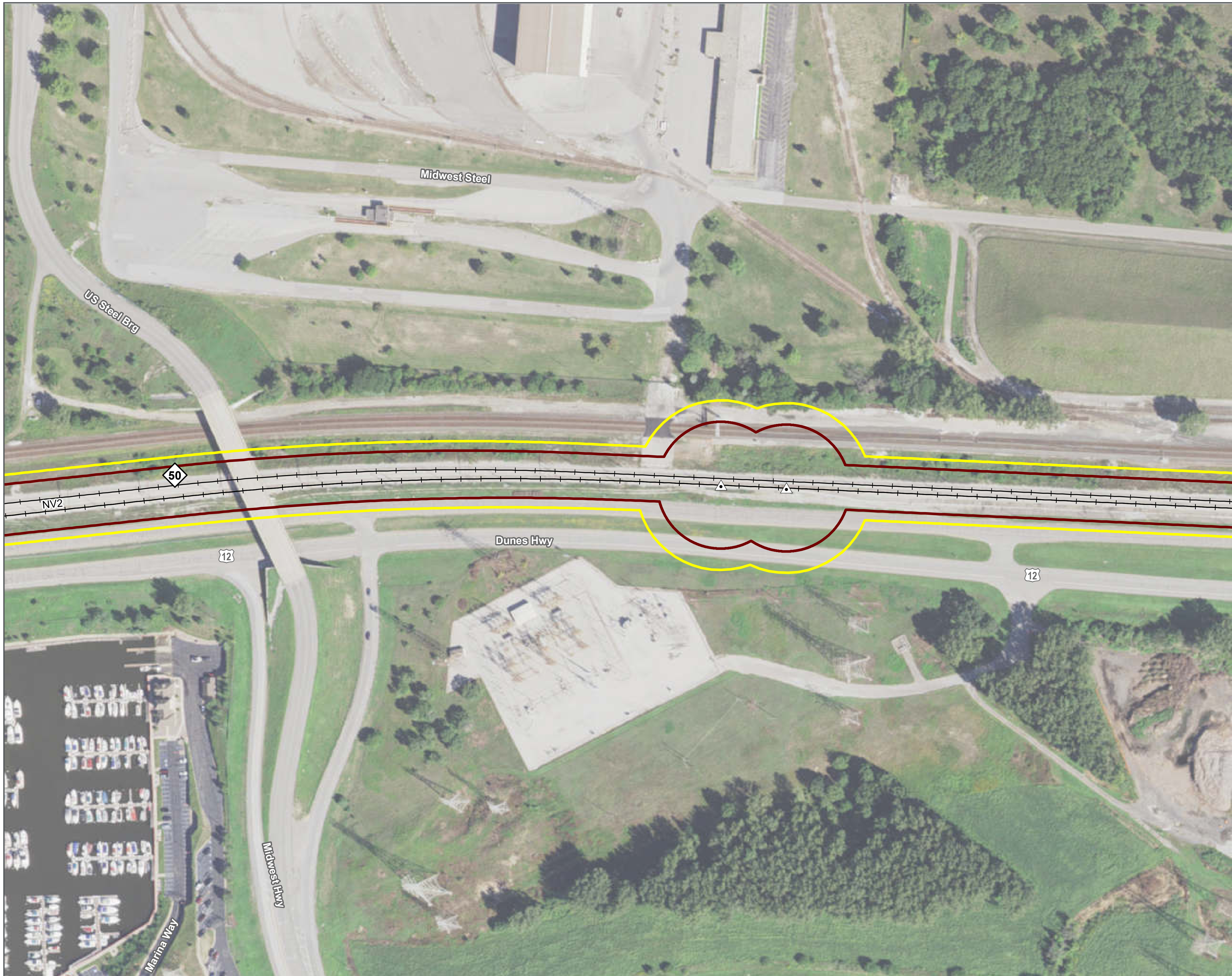
DISCLAIMER:
Data for reference only

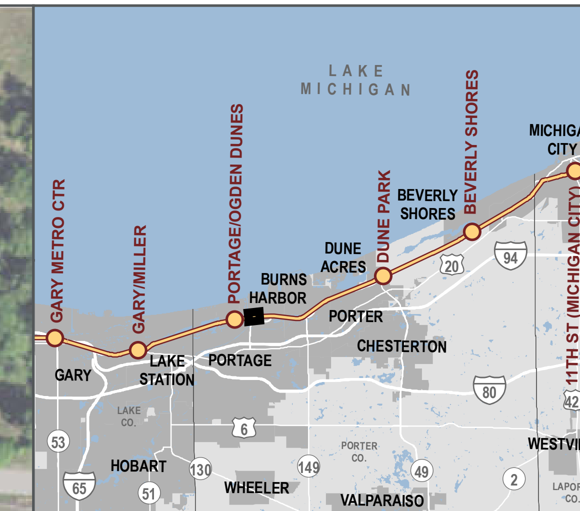
VIBRATION IMPACTS

0 200 400
FEET

SHEET 19 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY





Category 2 Vibration Contour
Category 3 Vibration Contour
Milepost
Crossover
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

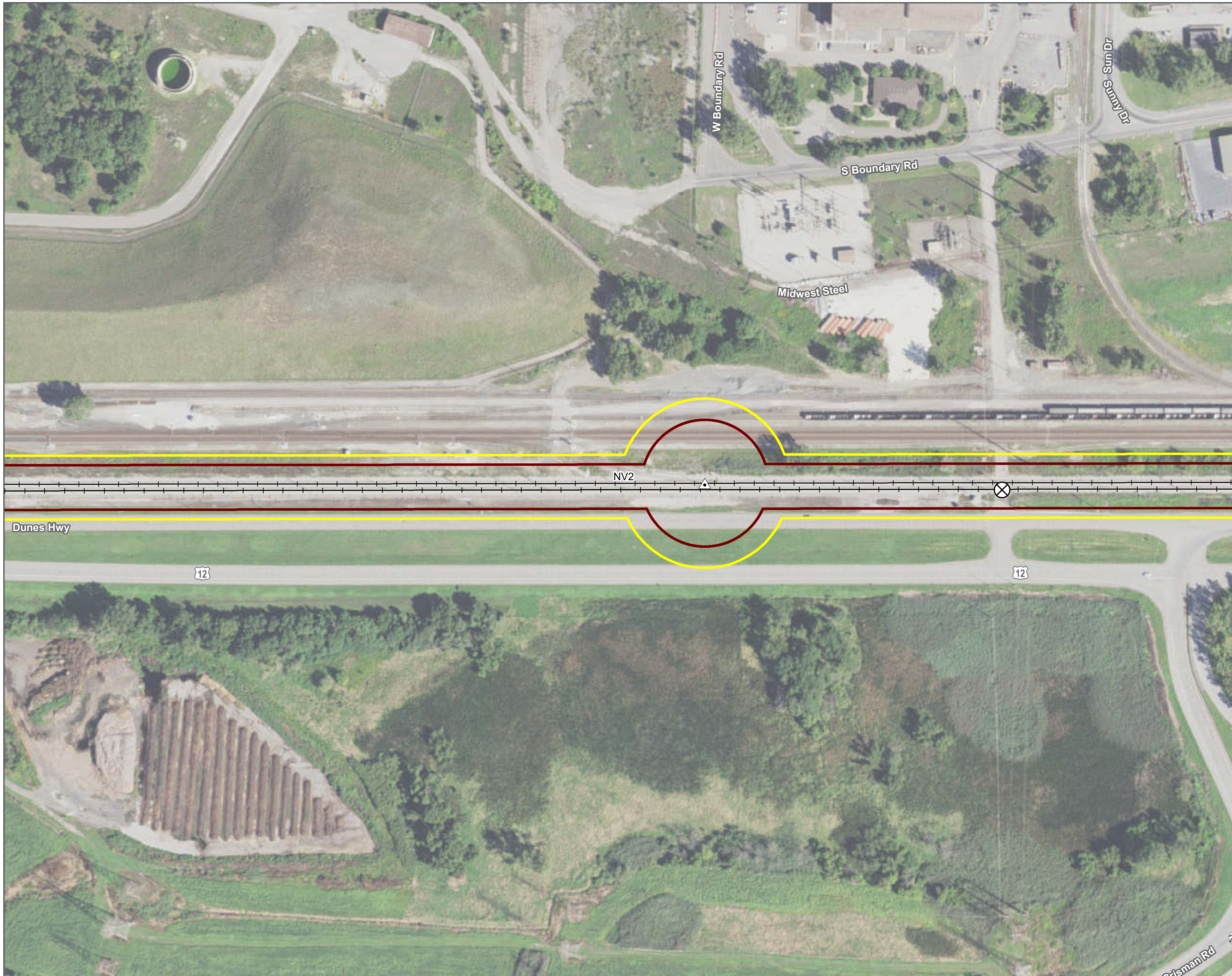
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 20 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Vibration Contour
Category 3 Vibration Contour
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 21 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

- Category 2 Vibration Contour
- Category 3 Vibration Contour
- Milepost
- Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

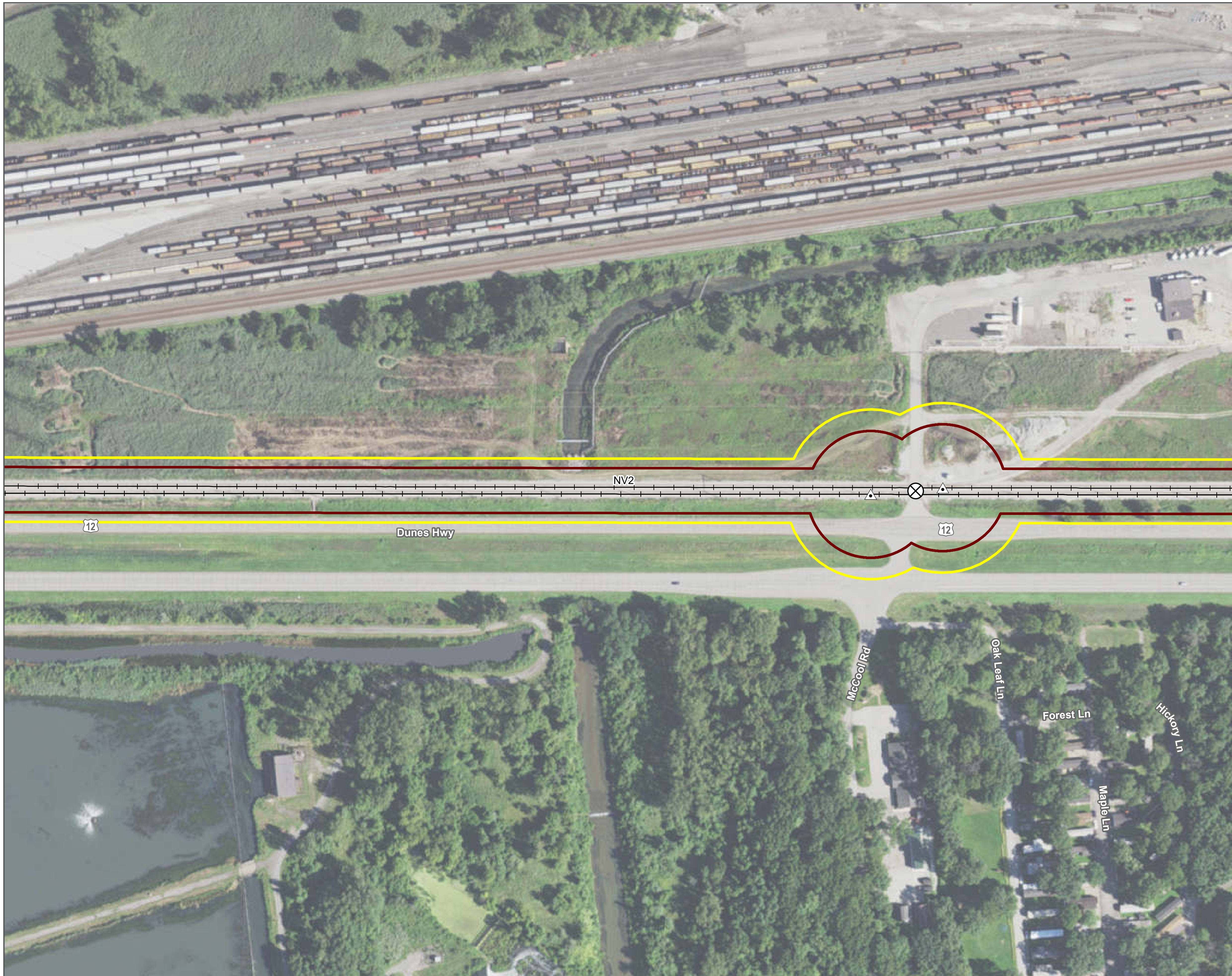
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 22 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Vibration Contour

Category 3 Vibration Contour

Crossover

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 23 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

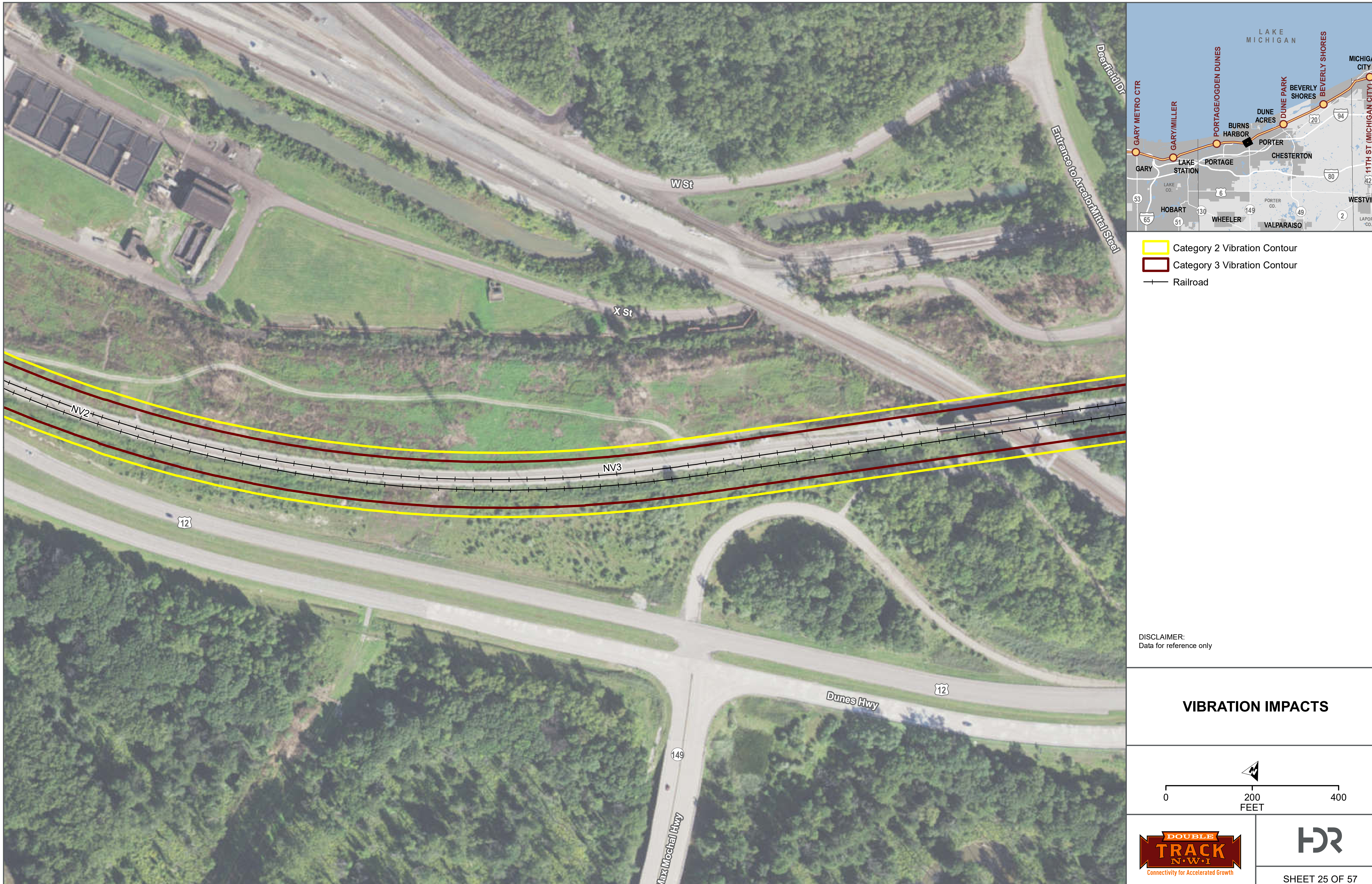
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 24 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Vibration Contour
Category 3 Vibration Contour
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

- Category 2 Vibration Contour
- Category 3 Vibration Contour
- Crossover
- Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

- Category 2 Vibration Contour
- Category 3 Vibration Contour
- Crossover
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour
Category 3 Vibration Contour
Milepost
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 29 OF 57

- Category 2 Vibration Contour
- Category 3 Vibration Contour
- Cemetery
- Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 — 200 — 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Vibration Contour
Category 3 Vibration Contour
Milepost
Crossover
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 31 OF 57

Category 2 Vibration Contour
Category 3 Vibration Contour
Crossover
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Crossover

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 33 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

NICTD Station

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

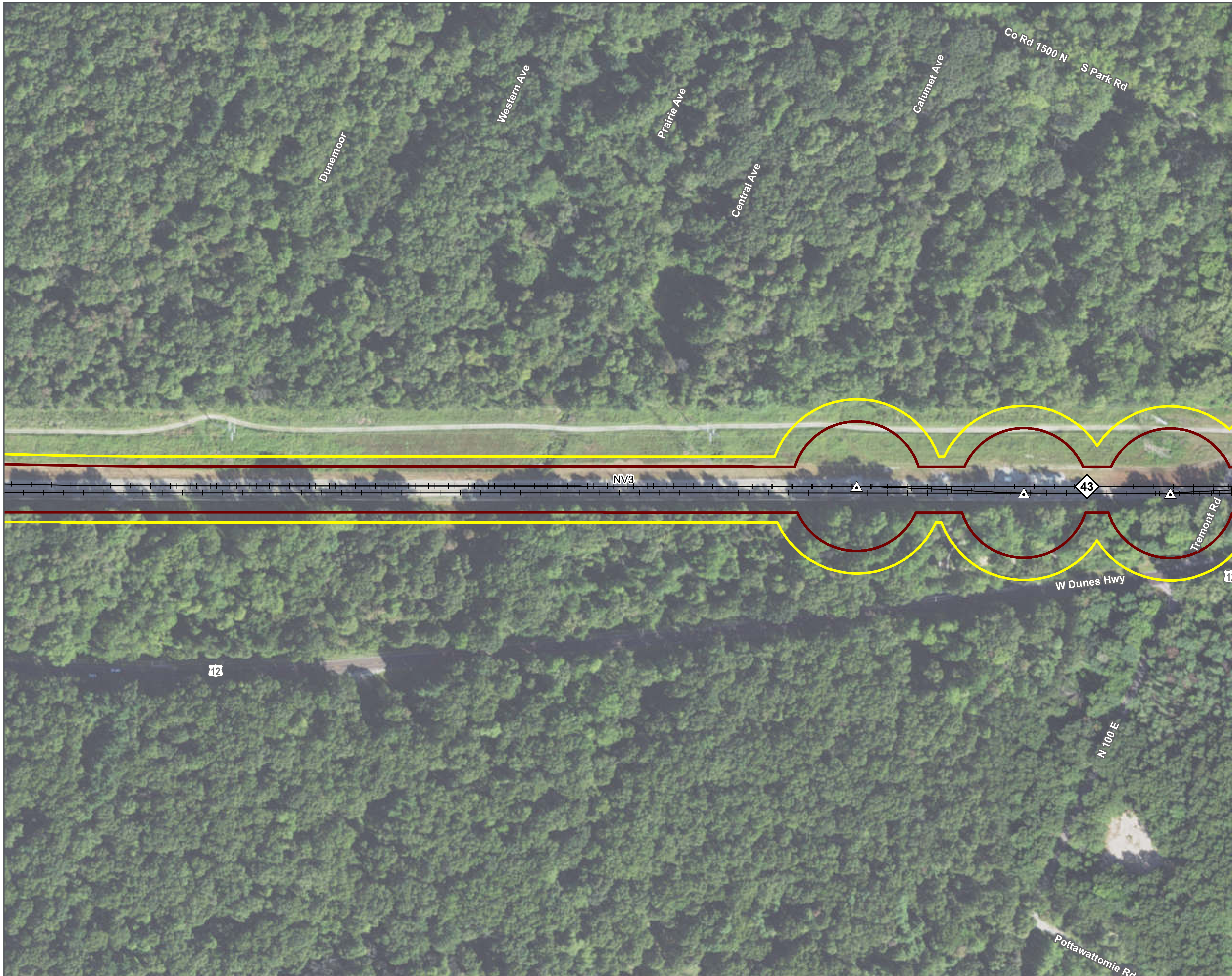
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 34 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Crossover

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 35 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour
Category 3 Vibration Contour
Crossover
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 36 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour
Category 3 Vibration Contour
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 37 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 38 OF 57

Category 2 Vibration Contour

Category 3 Vibration Contour

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Crossover

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 40 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour
Category 3 Vibration Contour
Milepost
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 42 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Railroad

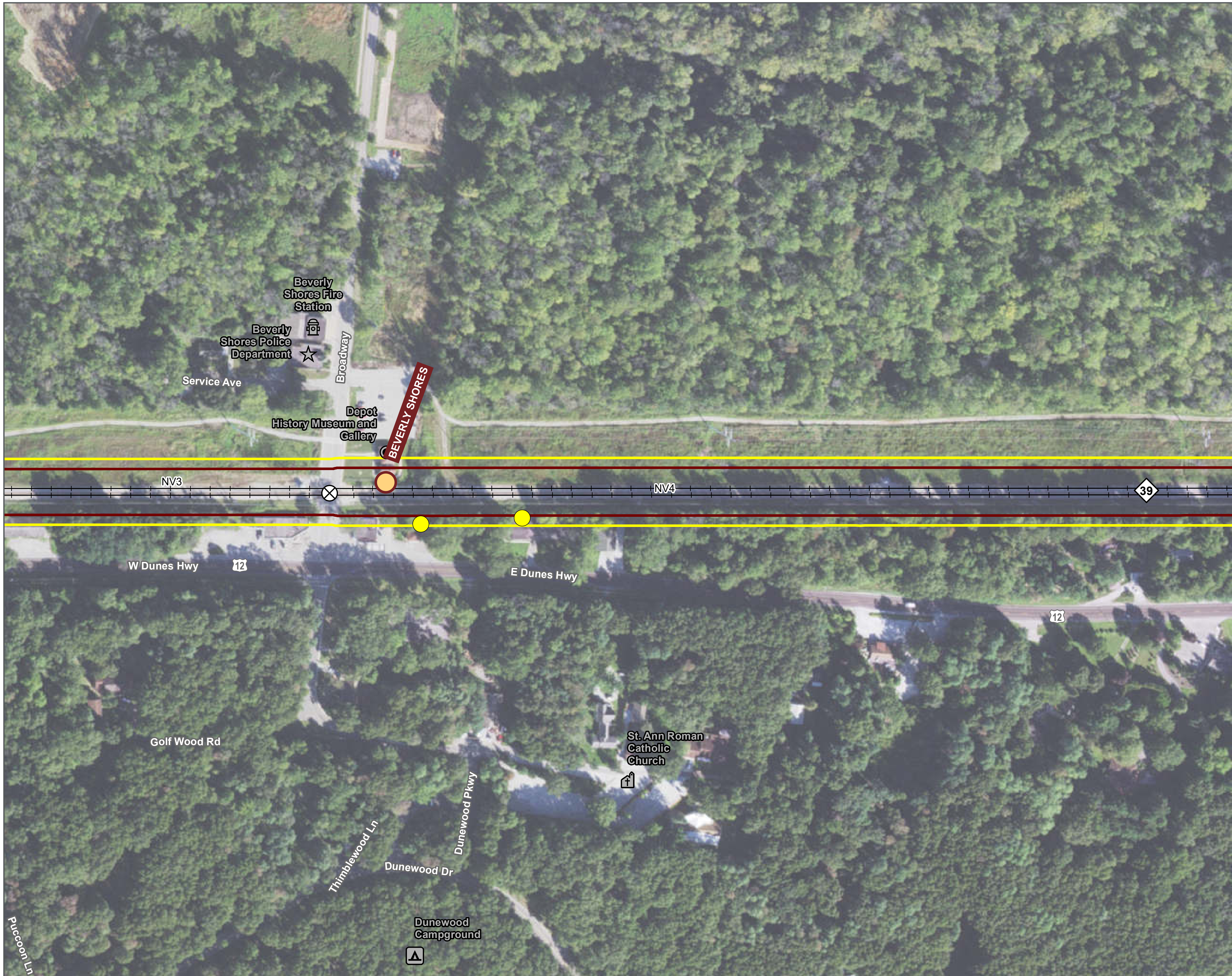
DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

SHEET 43 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



- Category 2 Vibration Impact
- Category 2 Vibration Contour
- Category 3 Vibration Contour
- NICTD Station
- Milepost
- Campground
- Place of Worship
- Public Place
- Fire Station
- Police Department
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK NWI
Connectivity for Accelerated Growth

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 45 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Impact
Category 2 Vibration Contour
Category 3 Vibration Contour
Place of Worship
Public Atgrade Crossing
Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 46 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Place of Worship

Crossover

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 47 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Vibration Contour

Category 3 Vibration Contour

Milepost

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

SHEET 49 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Category 2 Vibration Contour

Category 3 Vibration Contour

Crossover

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

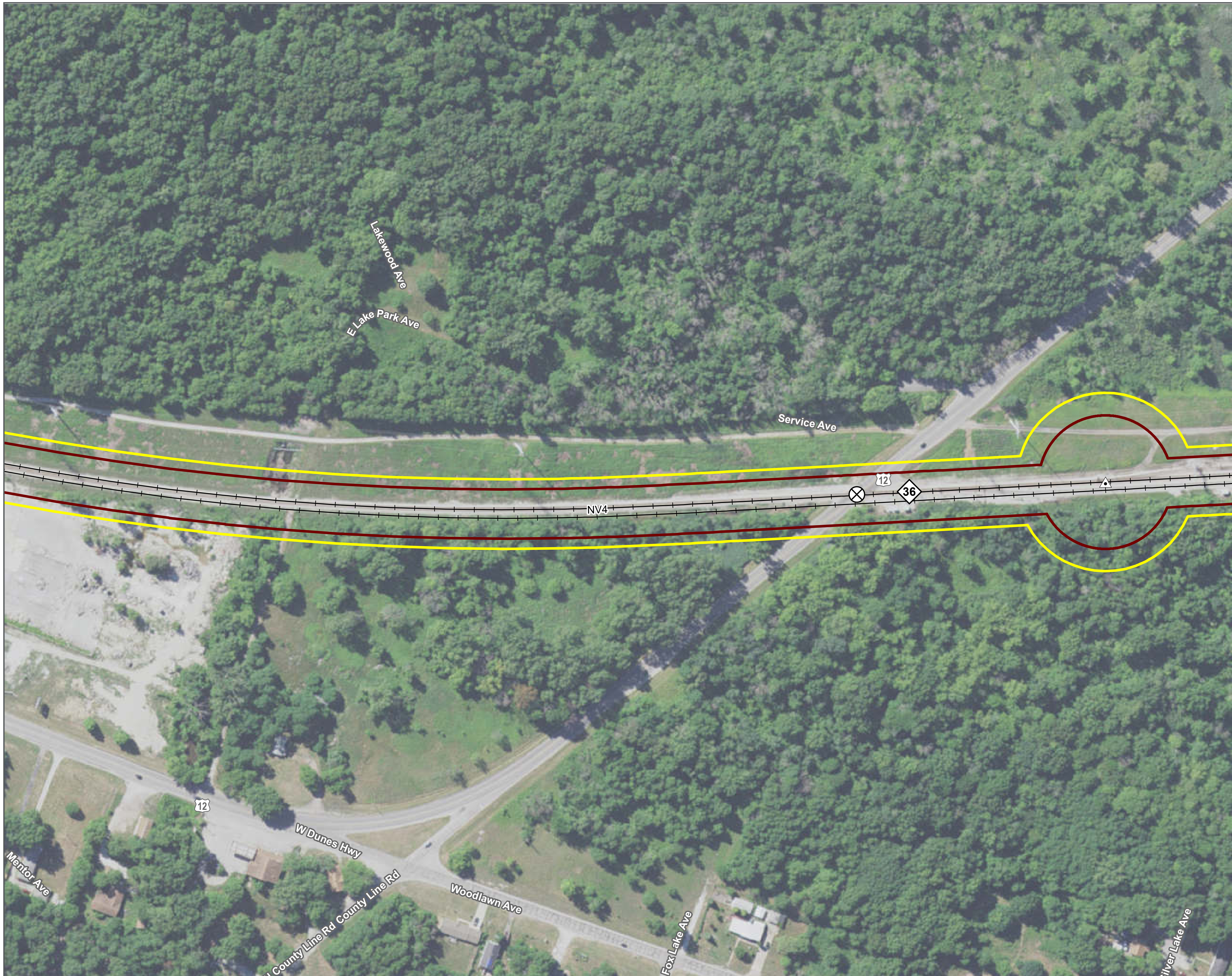
0 200 400
FEET

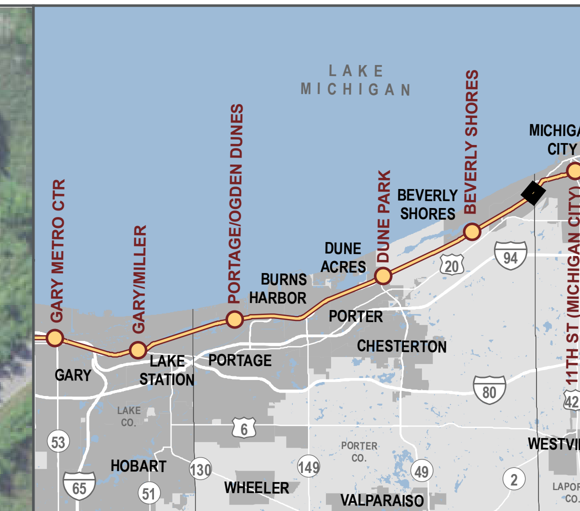
DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 50 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY





Category 2 Vibration Contour
Category 3 Vibration Contour
Milepost
Crossover
Public Atgrade Crossing
Railroad

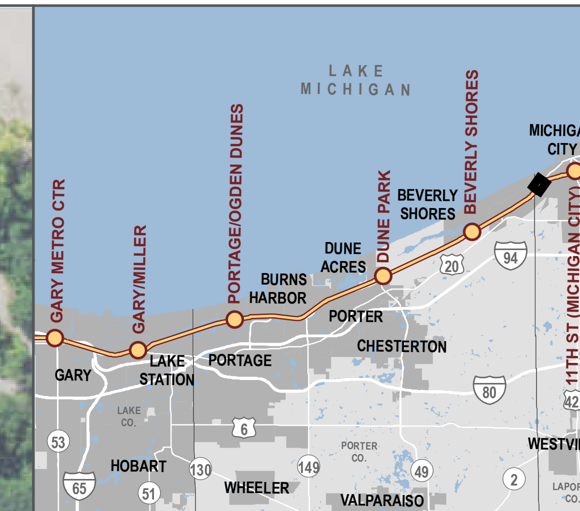
DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR



Category 2 Vibration Contour

Category 3 Vibration Contour

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

Category 2 Vibration Contour

Category 3 Vibration Contour

Place of Worship

Public Atgrade Crossing

Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 53 OF 57

- Category 2 Vibration Contour
- Category 3 Vibration Contour
- Milepost
- Place of Worship
- Crossover
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

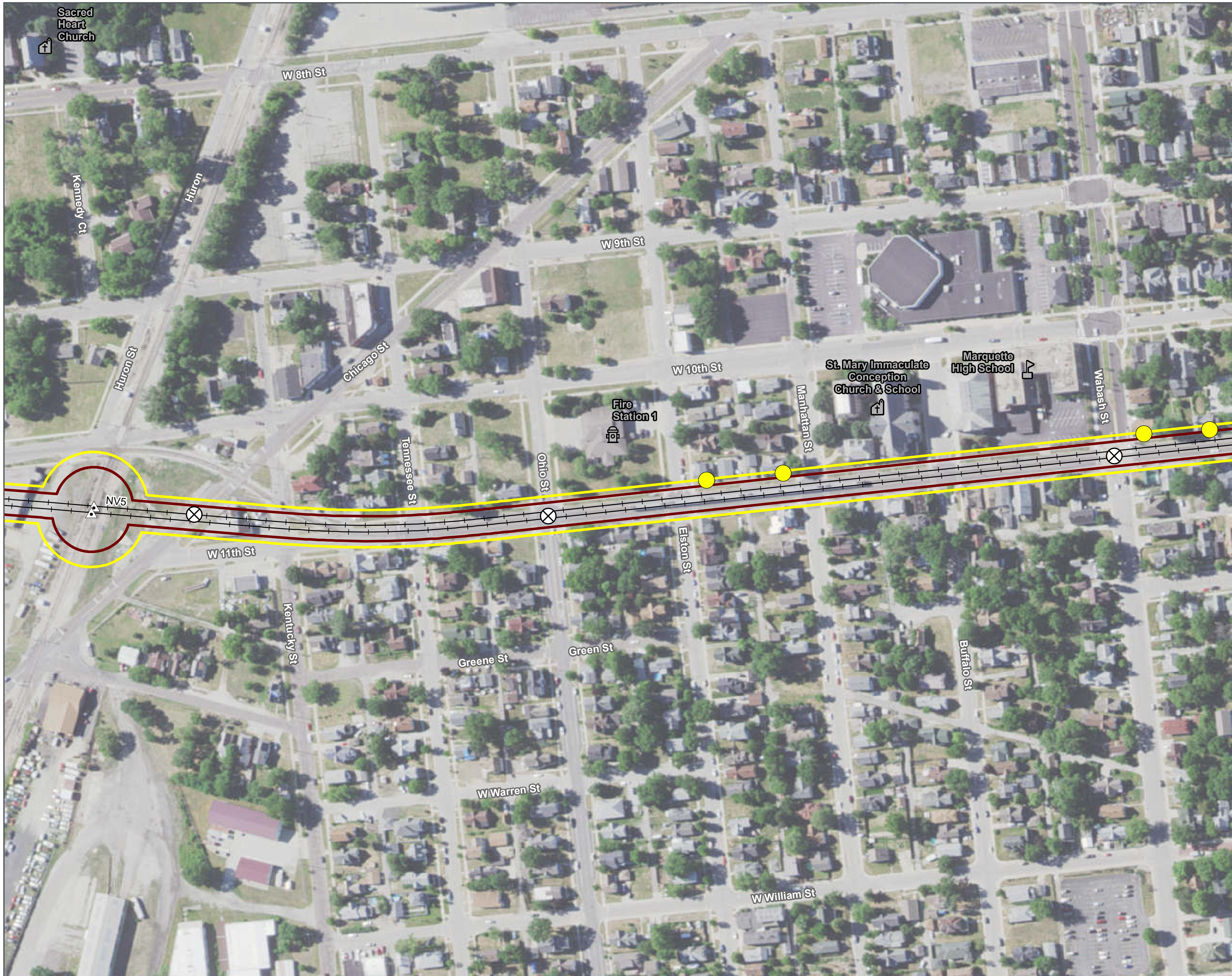
VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



- Category 2 Vibration Impact
- Category 2 Vibration Contour
- Category 3 Vibration Contour
- Place of Worship
- Fire Station
- School
- Crossover
- Public Atgrade Crossing
- Railroad

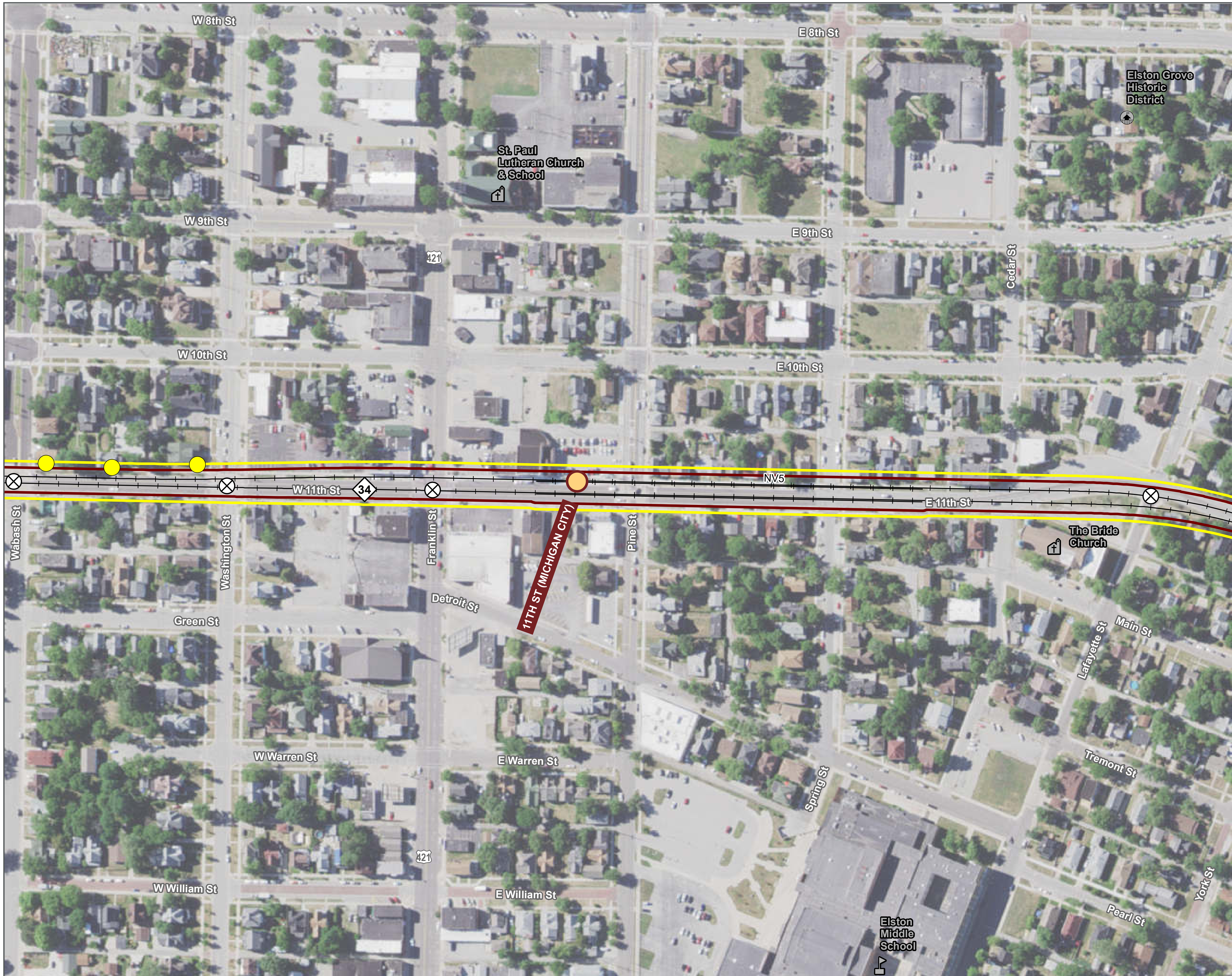
DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR



- Category 2 Vibration Impact
- Category 2 Vibration Contour
- Category 3 Vibration Contour
- NICTD Station
- Milepost
- Place of Worship
- Historic District
- School
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

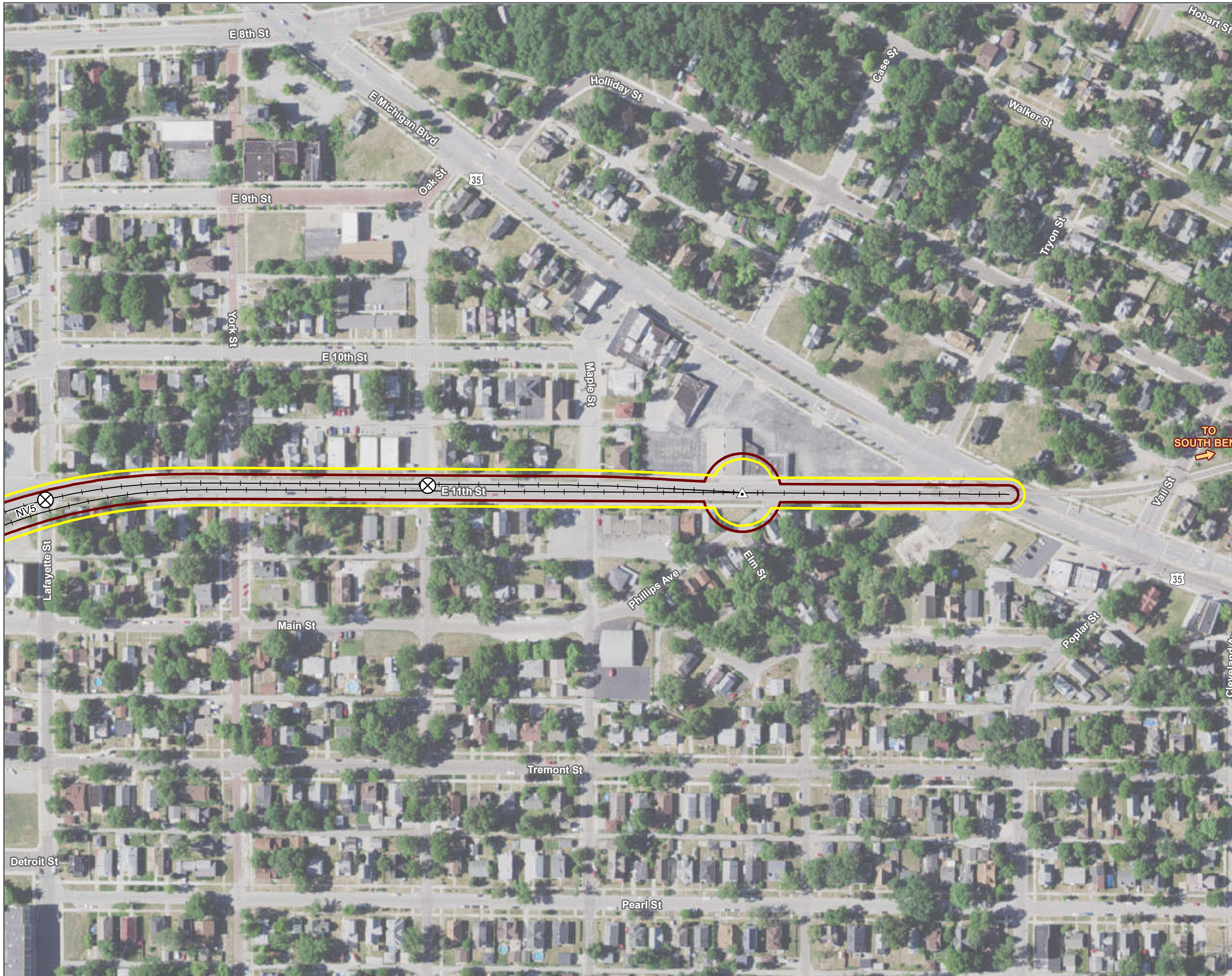
0 200 400
FEET

DOUBLE TRACK N·W·I
Connectivity for Accelerated Growth

HDR

SHEET 56 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



- Category 2 Vibration Contour
- Category 3 Vibration Contour
- Crossover
- Public Atgrade Crossing
- Railroad

DISCLAIMER:
Data for reference only

VIBRATION IMPACTS

0 200 400
FEET

SHEET 57 OF 57

BACKGROUND SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Appendix D

Cumulative Noise Analysis Results for Michigan City

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Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1084	85	0	0	66	-20
R_1085	79	0	1	60	-19
R_1086	84	0	1	65	-20
R_1087	85	0	0	65	-20
R_1088	85	0	0	65	-20
R_1089	84	0	0	65	-20
R_1090	84	0	1	64	-20
R_1091	84	0	0	65	-20
R_1128	72	1	2	53	-19
R_1129	73	1	2	54	-19
R_1130	75	0	2	56	-19
R_1131	77	0	2	58	-19
R_1139	72	1	3	53	-19
R_1140	73	1	2	54	-19
R_1141	75	0	2	55	-19
R_1142	76	0	2	57	-19
R_1144	72	1	3	53	-19
R_1145	72	1	3	53	-19
R_1146	72	1	2	53	-19
R_1147	74	1	2	54	-19
R_1148	75	0	2	56	-19
R_1149	76	0	2	57	-19
R_1158	72	1	3	53	-19
R_1159	72	1	3	53	-19
R_1160	85	0	0	66	-20
R_1886	87	0	0	67	-20
R_570	73	1	2	54	-19
R_571	73	1	2	54	-19

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_851	72	1	3	53	-19
R_863	85	0	0	69	-17
R_864	87	0	0	71	-16
R_865	83	0	1	71	-12
R_867	74	1	2	55	-19
R_868	74	1	2	60	-14
R_870	77	0	2	62	-15
R_869	81	0	1	70	-10
R_871	79	0	1	69	-11
R_872	77	0	2	65	-12
R_873	76	0	2	63	-13
R_874	76	0	2	62	-14
R_875	75	0	2	60	-15
R_876	72	1	3	53	-19
R_925	72	1	3	52	-19
R_926	72	1	3	52	-19
R_927	72	1	3	53	-19
R_962	75	0	2	56	-19
R_963	87	0	0	74	-13
R_964	85	0	0	71	-15
R_965	75	0	2	56	-19
R_966	86	0	0	67	-19
R_967	85	0	0	66	-19
R_968	75	0	2	56	-19
R_969	75	0	2	56	-19
R_970	76	0	2	56	-19
R_971	86	0	0	67	-19

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_972	85	0	0	65	-19
R_973	75	0	2	56	-19
R_974	84	0	1	65	-19
R_975	84	0	1	65	-19
R_976	75	0	2	56	-19
R_992	75	0	2	56	-19
R_993	85	0	0	66	-19
R_994	84	0	0	65	-19
R_995	79	0	1	60	-19
R_996	77	0	2	58	-19
R_997	75	0	2	56	-19
R_998	72	1	3	53	-19
R_999	72	1	3	53	-19
R_1000	72	1	3	53	-19
R_1001	72	1	3	53	-19
R_1002	72	1	3	53	-19
R_1003	75	0	2	56	-19
R_1004	76	0	2	57	-19
R_1005	75	0	2	57	-19
R_1006	75	0	2	57	-18
R_1007	72	1	3	54	-18
R_1008	72	1	3	53	-18
R_1009	72	1	3	53	-19
R_1010	72	1	3	53	-19
R_1011	72	1	3	53	-19
R_1012	72	1	3	53	-19
R_1083	85	0	0	65	-20
R_1113	74	1	2	55	-19

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1114	74	1	2	55	-19
R_1115	73	1	2	54	-18
R_1118	72	1	3	53	-19
R_1123	72	1	3	53	-19
R_1124	73	1	2	54	-19
R_1161	72	1	3	53	-19
R_1162	72	1	2	53	-19
R_1163	72	1	3	53	-19
R_1171	75	0	2	56	-19
R_1172	77	0	2	58	-19
R_1173	85	0	0	66	-20
R_1204	86	0	0	66	-20
R_1205	80	0	1	61	-19
R_1206	77	0	2	58	-19
R_1207	75	0	2	56	-19
R_1208	86	0	0	66	-20
R_1209	85	0	0	66	-19
R_1210	86	0	0	66	-20
R_1211	87	0	0	67	-20
R_1212	86	0	0	67	-20
R_1213	75	0	2	56	-19
R_1214	75	0	2	56	-19
R_1215	75	0	2	56	-19
R_1216	75	0	2	56	-19
R_1217	76	0	2	56	-19
R_1218	76	0	2	56	-19
R_1219	72	1	2	53	-19
R_1222	72	1	2	53	-19

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1223	72	1	2	53	-19
R_1224	72	1	2	53	-19
R_1225	72	1	2	53	-19
R_1226	72	1	2	53	-19
R_1227	72	1	3	53	-19
R_1236	72	1	2	53	-19
R_1237	73	1	2	54	-19
R_1238	75	0	2	55	-19
R_1239	85	0	0	66	-20
R_1240	86	0	0	66	-20
R_1241	80	0	1	60	-19
R_1242	85	0	0	65	-19
R_1243	86	0	0	66	-20
R_1244	86	0	0	66	-20
R_1245	86	0	0	66	-20
R_1246	78	0	2	59	-19
R_1247	76	0	2	57	-19
R_1248	73	1	2	54	-19
R_1262	80	0	1	61	-19
R_1263	77	0	2	58	-19
R_1264	75	0	2	56	-19
R_1265	72	1	2	53	-19
R_1275	72	1	3	52	-19
R_1276	72	1	2	53	-19
R_1277	73	1	2	54	-19
R_1278	75	0	2	56	-19
R_1279	76	0	2	57	-19
R_1280	79	0	2	60	-19

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1281	86	0	0	66	-20
R_1282	87	0	0	67	-20
R_1283	79	0	1	60	-19
R_1284	76	0	2	57	-19
R_1285	75	0	2	56	-19
R_1286	73	1	2	54	-19
R_1287	72	1	2	53	-19
R_1288	72	1	3	53	-19
R_1297	72	1	2	53	-19
R_1298	74	1	2	54	-19
R_1299	74	0	2	55	-19
R_1300	75	0	2	56	-19
R_1301	76	0	2	57	-19
R_1302	78	0	2	58	-19
R_1303	79	0	1	60	-19
R_1304	86	0	0	66	-20
R_1305	86	0	0	66	-20
R_1306	86	0	0	67	-20
R_1307	86	0	0	67	-20
R_1308	84	0	0	65	-19
R_1309	81	0	1	61	-19
R_1310	76	0	2	57	-19
R_1311	75	0	2	56	-19
R_1312	72	1	2	53	-19
R_1319	72	1	2	53	-19
R_1320	75	0	2	56	-19
R_1321	77	0	2	58	-19
R_1322	80	0	1	60	-19

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1330	80	0	1	61	-19
R_1331	77	0	2	58	-19
R_1332	75	0	2	56	-19
R_1333	72	1	2	53	-19
R_1334	72	1	3	53	-19
R_1342	72	1	3	53	-19
R_1343	72	1	2	53	-19
R_1344	75	0	2	56	-19
R_1345	77	0	2	58	-19
R_1346	80	0	1	61	-19
R_1351	86	0	0	65	-20
R_1352	82	0	1	63	-19
R_1353	78	0	2	59	-19
R_1354	76	0	2	57	-19
R_1355	75	0	2	56	-19
R_1356	79	0	1	60	-20
R_1357	77	0	2	58	-19
R_1358	75	0	2	56	-19
R_1359	72	1	2	53	-19
R_1368	71	1	3	54	-18
R_1369	71	1	3	54	-17
R_1370	71	1	3	54	-17
R_1371	75	0	2	57	-18
R_1406	75	0	2	58	-17
R_1407	74	1	2	56	-17
R_1408	75	0	2	57	-17
R_1409	74	1	2	57	-17
R_1410	73	1	2	55	-18

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change Modeled Future – Modeled Existing
		Moderate	Severe		
R_1411	71	1	3	53	-18
R_1413	71	1	3	54	-18
R_1422	71	1	3	53	-18
R_1423	73	1	2	55	-18
R_1424	79	0	1	65	-14
R_1428	71	1	3	53	-18
R_1429	72	1	3	54	-18
R_1430	73	1	2	55	-18
R_1431	74	1	2	57	-17
R_1432	75	0	2	59	-17
R_1433	77	0	2	61	-16
R_1458	71	1	3	53	-18
R_1459	72	1	3	54	-18
R_1460	73	1	2	55	-18
R_1461	74	1	2	56	-17
R_1462	74	0	2	57	-17
R_1463	75	0	2	59	-17
R_1464	78	0	2	62	-16
R_1465	76	0	2	59	-17
R_1466	74	1	2	57	-17
R_1467	73	1	2	56	-18
R_1468	73	1	2	55	-18
R_1469	71	1	3	54	-18
R_1470	71	1	3	53	-18
R_1473	71	1	3	53	-18
R_1474	72	1	2	55	-18
R_1475	73	1	2	55	-18
R_1476	74	1	2	56	-17

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1477	76	0	2	59	-17
R_1478	75	0	2	58	-17
R_1479	74	1	2	57	-17
R_1882	86	0	0	66	-20
R_1883	87	0	0	67	-20
R_1887	86	0	0	66	-20
R_1888	80	0	1	60	-19
R_1889	77	0	2	58	-19
R_1	83	0	1	61	-22
R_2	83	0	1	61	-22
R_3	82	0	1	60	-22
R_4	82	0	1	60	-22
R_5	83	0	1	60	-23
R_6	83	0	1	60	-23
R_7	84	0	1	61	-23
R_8	83	0	1	60	-23
R_9	83	0	1	60	-23
R_10	82	0	1	60	-23
R_11	84	0	1	61	-23
R_12	83	0	1	60	-23
R_13	76	0	2	56	-20
R_14	73	1	2	53	-20
R_22	73	1	2	53	-20
R_23	74	0	2	54	-20
R_24	75	0	2	54	-20
R_25	73	1	2	53	-20
R_31	76	0	2	55	-20
R_32	74	1	2	53	-20

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_33	76	0	2	55	-20
R_34	74	1	2	54	-20
R_35	73	1	2	53	-20
R_40	76	0	2	55	-20
R_41	74	1	2	54	-20
R_42	73	1	2	53	-20
R_49	75	0	2	55	-20
R_50	73	1	2	53	-20
R_58	73	1	2	53	-20
R_59	84	0	1	61	-23
R_60	84	0	0	61	-23
R_61	84	0	1	61	-23
R_62	83	0	1	60	-23
R_63	74	1	2	54	-20
R_65	73	1	2	53	-20
R_66	74	1	2	54	-20
R_950	72	1	3	53	-19
R_951	72	1	3	53	-19
R_952	72	1	3	53	-19
R_953	72	1	3	53	-19
R_954	72	1	3	53	-19
R_955	76	0	2	57	-19
R_956	76	0	2	57	-19
R_957	76	0	2	57	-19
R_958	76	0	2	58	-19
R_959	84	0	0	67	-17
R_960	85	0	0	67	-17
R_961	83	0	1	66	-18

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_977	76	0	2	57	-19
R_978	76	0	2	57	-19
R_979	76	0	2	58	-19
R_980	72	1	3	53	-19
R_981	72	1	3	53	-19
R_982	72	1	3	53	-19
R_983	72	1	3	53	-19
R_984	75	0	2	56	-19
R_985	83	0	1	66	-17
R_986	77	0	2	58	-19
R_987	81	0	1	63	-18
R_988	81	0	1	63	-18
R_989	84	0	1	67	-17
R_990	84	0	0	67	-17
R_991	84	0	1	67	-17
R_1014	85	0	0	65	-19
R_1015	86	0	0	67	-18
R_1016	85	0	0	67	-17
R_1017	85	0	0	67	-17
R_1018	75	0	2	56	-19
R_1019	75	0	2	56	-19
R_1020	75	0	2	56	-19
R_1021	76	0	2	57	-19
R_1022	75	0	2	56	-19
R_1023	77	0	2	58	-19
R_1024	72	1	3	53	-19
R_1025	72	1	2	53	-19
R_1026	72	1	3	53	-19

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1027	72	1	2	53	-19
R_1050	72	1	3	53	-19
R_1051	72	1	3	53	-19
R_1052	72	1	3	53	-19
R_1053	73	1	2	53	-19
R_1054	73	1	2	53	-19
R_1055	73	1	2	53	-19
R_1056	73	1	2	53	-19
R_1057	73	1	2	53	-19
R_1058	73	1	2	53	-19
R_1059	72	1	2	53	-19
R_1060	77	0	2	57	-20
R_1061	77	0	2	57	-20
R_1062	77	0	2	58	-19
R_1063	76	0	2	58	-18
R_1064	76	0	2	58	-18
R_1065	76	0	2	57	-18
R_1066	81	0	1	65	-16
R_1067	72	1	3	53	-19
R_1072	71	1	3	52	-19
R_1073	72	1	3	53	-19
R_1074	72	1	3	54	-19
R_1075	72	1	3	53	-19
R_1076	75	0	2	57	-18
R_1077	75	0	2	57	-18
R_1078	75	0	2	57	-18
R_1079	75	0	2	57	-18
R_1080	76	0	2	58	-18

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1081	76	0	2	58	-18
R_1082	75	0	2	57	-18
R_1092	75	0	2	56	-18
R_1093	75	0	2	57	-18
R_1094	72	1	3	53	-19
R_1095	72	1	3	53	-19
R_1096	72	1	3	53	-19
R_1097	72	1	3	53	-19
R_1098	72	1	3	53	-19
R_1174	76	0	2	58	-18
R_1175	76	0	2	58	-18
R_1176	76	0	2	58	-18
R_1183	72	1	3	53	-19
R_1190	72	1	3	53	-19
R_1191	72	1	3	53	-19
R_1192	72	1	2	53	-19
R_1193	72	1	3	53	-19
R_1194	72	1	3	53	-19
R_1195	76	0	2	58	-19
R_1196	75	0	2	57	-19
R_1197	77	0	2	59	-18
R_1198	75	0	2	57	-19
R_1199	75	0	2	56	-19
R_1200	77	0	2	59	-18
R_1201	85	0	0	69	-16
R_1202	87	0	0	71	-16
R_1203	80	0	1	61	-18
R_1255	74	0	2	56	-19

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1256	77	0	2	58	-18
R_1257	80	0	1	62	-18
R_1258	86	0	0	69	-16
R_1259	75	0	2	56	-19
R_1260	76	0	2	58	-19
R_1261	79	0	1	61	-18
R_1325	71	1	3	53	-19
R_1326	72	1	2	54	-19
R_1327	77	0	2	59	-18
R_1328	80	0	1	62	-18
R_1329	84	0	1	67	-17
R_1347	75	0	2	56	-18
R_1348	77	0	2	59	-18
R_1349	80	0	1	62	-18
R_1350	83	0	1	63	-20
R_1372	78	0	2	55	-23
R_1373	76	0	2	54	-22
R_1374	79	0	1	60	-20
R_1380	76	0	2	54	-22
R_1381	75	0	2	53	-22
R_1382	75	0	2	54	-21
R_1383	75	0	2	54	-21
R_1392	75	0	2	55	-20
R_1393	75	0	2	55	-20
R_1394	75	0	2	55	-20
R_1395	81	0	1	59	-22
R_1396	84	0	1	61	-23
R_1397	83	0	1	60	-23

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_1398	83	0	1	61	-23
R_1399	84	0	1	61	-23
R_1400	84	0	1	61	-23
R_1401	84	0	1	60	-23
R_1402	84	0	0	60	-24
R_1403	83	0	1	60	-24
R_1404	83	0	1	59	-24
R_1405	84	0	1	62	-22
R_1434	84	0	1	61	-23
R_1435	80	0	1	58	-22
R_1436	78	0	2	57	-21
R_1444	75	0	2	54	-20
R_1445	74	0	2	54	-20
R_1446	74	1	2	54	-20
R_1447	84	0	1	61	-23
R_1448	82	0	1	60	-23
R_1449	83	0	1	60	-23
R_1450	83	0	1	60	-23
R_1821	76	1	5	58	-18
R_1826	79	1	3	61	-18
R_1828	80	0	3	63	-18
R_1878	77	0	2	59	-18
R_1879	75	0	2	57	-18
R_1880	76	0	2	58	-18
R_1881	86	0	0	69	-17
R_1884	85	0	0	69	-17
R_1885	83	0	2	66	-17
R_566	73	1	2	54	-19

Receiver	Modeled Existing SSL and Freight Operations Noise Level	Noise Increase Criteria		Modeled Future SSL and Freight Operations Noise Level	Noise Level Change
		Moderate	Severe		Modeled Future – Modeled Existing
R_567	78	0	2	59	-19
R_568	76	0	2	57	-19
R_569	75	0	2	56	-19
R_854	72	1	3	53	-19
R_855	72	1	3	53	-19
R_858	74	1	2	55	-19
R_859	74	1	2	55	-19
R_860	75	0	2	56	-19
R_861	74	0	2	55	-19
R_862	87	0	0	68	-18
R_866	74	0	2	55	-19
R_1855	74	0	2	55	-19