FTA ALTERNATIVES ANALYSIS
DRAFT/FINAL ENVIRONMENTAL IMPACT STATEMENT

DANBURY BRANCH IMPROVEMENT PROGRAM TASK 5

ENVIRONMENTAL TECHNICAL MEMORANDUM

STATE PROJECT 302-008

SECTION 2: NOISE AND VIBRATION

JULY 2009

SECTION 2. NOISE AND VIBRATION

INTRODUCTION

This section describes the methodology used to characterize the existing noise and vibration environment along the proposed corridor. In addition, this section provides background on noise and vibration issues related to transit projects and a discussion of the criteria used to assess impact. A noise and vibration assessment was carried out in conformance with the procedures and criteria established in the Federal Transit Administration (FTA) guidance manual "Transit Noise and Vibration Impact Assessment" (Final Report No. FTA-VA-90-1003-06, May 2006).

Regulatory Context

Noise and vibration impact for this project is based on the criteria as defined in the U.S. FTA guidance manual Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06, May 2006). The criteria contained in this document are applicable for National Environmental Policy (NEPA) documentation.

Noise and Vibration Fundamentals and Descriptors

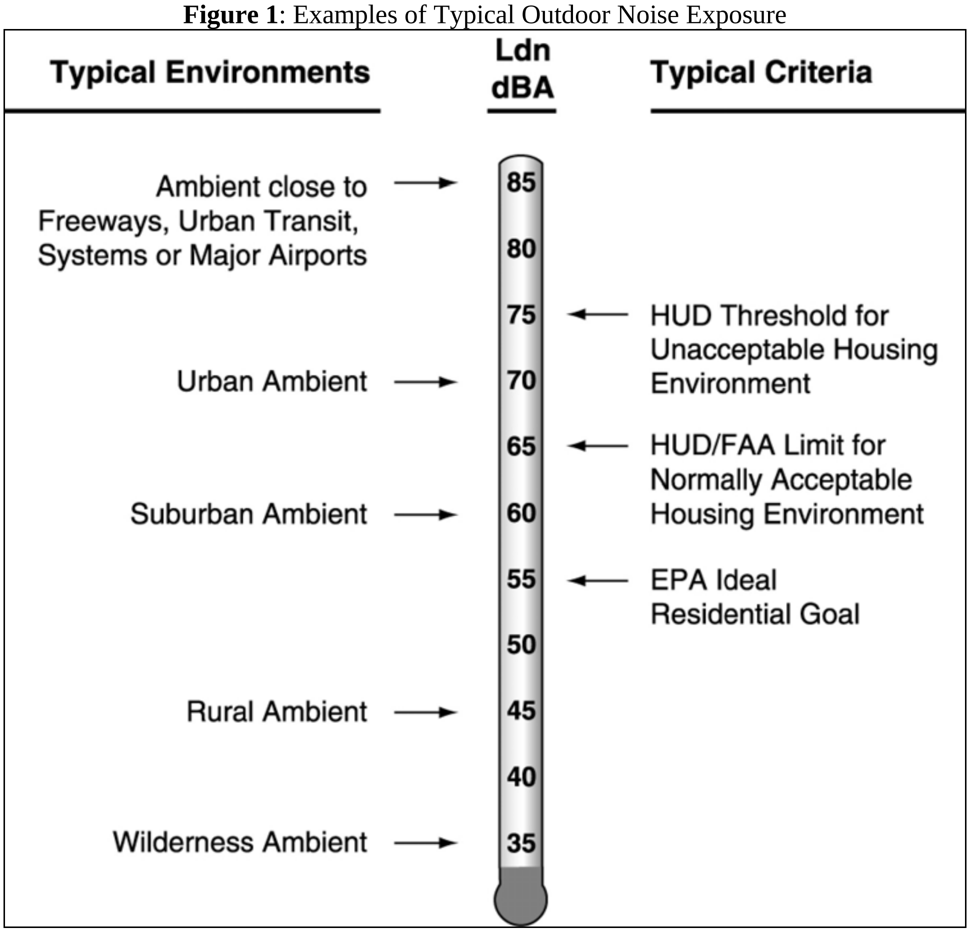
<u>Noise</u>

Noise is typically defined as unwanted or undesirable sound, where sound is characterized by small air pressure fluctuations above and below the atmospheric pressure. The basic parameters of environmental noise that affect human subjective response are (1) intensity or level, (2) frequency content and (3) variation with time. The first parameter is determined by how greatly the sound pressure fluctuates above and below the atmospheric pressure, and is expressed on a compressed scale in units of decibels. By using this scale, the range of normally encountered sound can be expressed by values between 0 and 120 decibels. On a relative basis, a 3-decibel change in sound level generally represents a barely-noticeable change outside the laboratory, whereas a 10-decibel change in sound level would typically be perceived as a doubling (or halving) in the loudness of a sound.

The second parameter, the frequency content of noise, is related to the tone or pitch of the sound, and is expressed based on the rate of the air pressure fluctuation in terms of cycles per second (called Hertz and abbreviated as Hz). The human ear can detect a wide range of frequencies from about 20 Hz to 17,000 Hz. However, because the sensitivity of human hearing varies with frequency, the A-weighting system is commonly used when measuring environmental noise to provide a single number descriptor that correlates with human subjective response. Sound levels measured using this weighting system are called "A-weighted" sound levels, and are expressed in decibel notation as "dBA." The A-weighted sound level is widely accepted by acousticians as a proper unit for describing environmental noise.

Because environmental noise fluctuates from moment to moment, it is common practice to condense all of this information into a single number, called the "equivalent" sound level (Leq). Leq can be thought of as the steady sound level that represents the same sound energy as the varying sound levels over a specified time period (typically 1 hour or 24 hours). Often the Leq values over a 24-hour period are used to calculate cumulative noise exposure in terms of the Day-Night Sound Level (Ldn). Ldn is the A-weighted Leq for a 24-hour period with an added 10-decibel penalty imposed on noise that occurs during the nighttime hours (between 10 P.M. and 7 A.M.). Many surveys have shown that Ldn is well correlated with human annoyance, and therefore this descriptor is widely used for environmental noise impact assessments. Figure 1 provides examples of typical noise environments and criteria in terms of Ldn. While the extremes of Ldn are shown to range from 35 dBA in a wilderness environment to 85 dBA in noisy urban environments, Ldn is generally found to range between 55 dBA and 75 dBA in most communities. As shown in Figure 1 in terms of U.S. Federal agency criteria, this spans the range between the goal identified by the EPA for an “ideal” residential environment and the threshold for an unacceptable residential environment according to HUD.

Figure 1: Examples of Typical Outdoor Noise Exposure



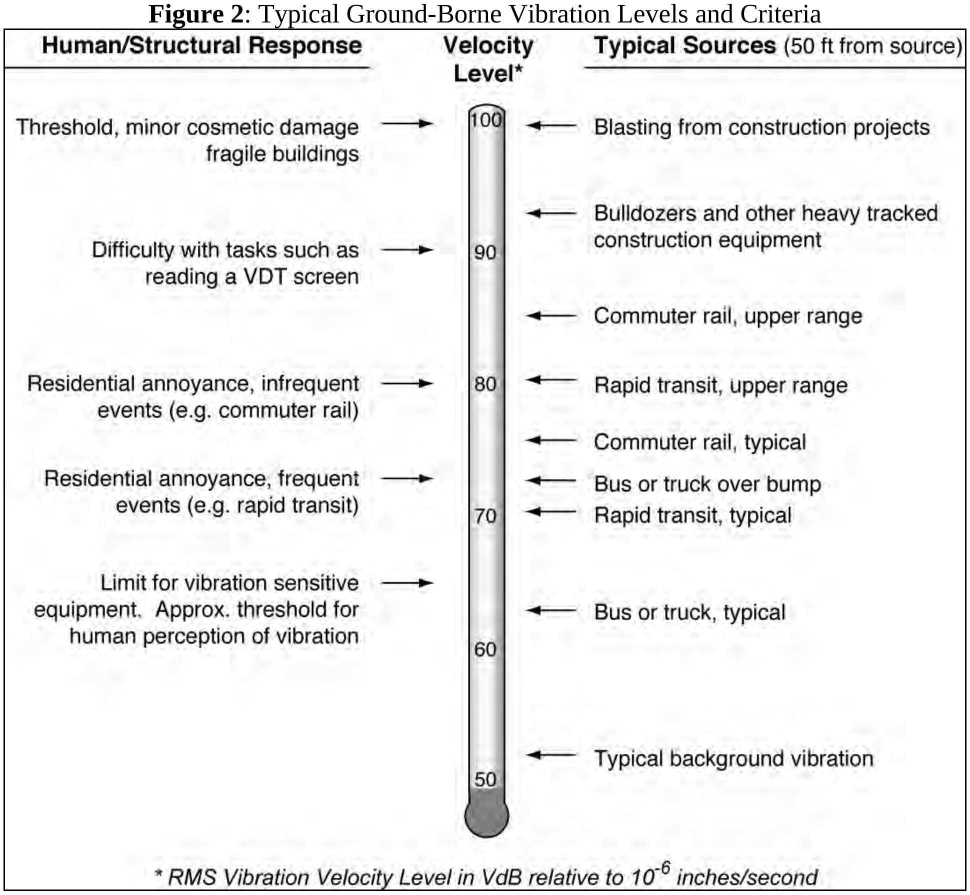
Vibration

Ground-borne vibration is the oscillatory motion of the ground about some equilibrium position that can be described in terms of displacement, velocity or acceleration. Human sensitivity to vibration typically corresponds to the amplitude of vibration velocity within the low-frequency range of most concern for environmental vibration (roughly 5-100 Hz); therefore velocity is the preferred measure for evaluating the potential for ground-borne vibration impact from transit projects.

The most common measure used to quantify vibration amplitude is the peak particle velocity (PPV), defined as the maximum instantaneous peak of the vibratory motion. PPV is typically used in monitoring blasting and other types of construction-generated vibration, since it is related to the stresses experienced by building components. Although PPV is appropriate for evaluating building damage, it is less suitable for evaluating human response, which is better related to the average vibration amplitude. Thus, ground-borne vibration from transit operations is typically characterized in terms of the "smoothed" root mean square (rms) vibration velocity level, in decibels (VdB), with a reference quantity of one micro-inch per second. VdB is used in place of dB to avoid confusing vibration decibels with sound decibels.

Figure 2 illustrates typical ground-borne vibration levels for common sources as well as criteria for human and structural response to ground-borne vibration. As shown, the range of interest is from approximately 50 to 100 VdB, from imperceptible background vibration to the threshold of building damage. Although the approximate threshold of human perception to vibration is 65 VdB, annoyance is usually not significant unless the vibration level exceeds 70 VdB.

Figure 2: Typical Ground-Borne Vibration Levels and Criteria



Methods, Coordination, and Data Sources

This section summarizes the models used to predict future noise and vibration levels for potential sources of community impact related to the project. These sources include commuter rail operations and construction activities. The projection models for these sources are described below.

The information required for the analysis of noise and vibration impact for the proposed project was obtained from URS and Connecticut Department of Transportation (ConnDOT) staff.

Commuter Rail Noise

The FTA's noise impact assessment procedure involves five key steps:

1) Identify noise-sensitive land use. Noise-sensitive land use along the project corridor was initially identified based on preliminary alignment drawings and GIS mapping. Confirmation of noise-sensitive land use occurred during visual surveys conducted during the noise measurement program.

2) Characterize the existing noise environment. Existing ambient noise levels were characterized through direct measurements at selected sites along the proposed alignment. The measurement sites were located in noise-sensitive areas and were selected to represent a range of existing noise conditions along the corridor.

3) Predict future noise from transit operations. Future transit noise was projected based on data from the FTA guidance manual. Commuter rail operations, track alignments, and location of sensitive land use were included in the projections of noise at individual or clusters of noise-sensitive land uses.

4) Assess impact based on the criteria discussed above. The projections determined the Leq and Ldn values at each cluster and noise impact was assessed according to the appropriate FTA criteria, depending on the land use category.

5) Recommend mitigation measures where required and appropriate. Mitigation measures can include noise barriers, sound insulation and other means to reduce noise from transit operations.

Commuter Rail Vibration

The FTA's general vibration impact assessment procedure involves four key steps:

1) Identify vibration-sensitive land use. Vibration-sensitive land use along the project corridor was initially identified based on preliminary alignment drawings and GIS mapping. Confirmation of vibration-sensitive land use occurred during visual surveys conducted during the noise measurement program.

2) Predict vibration levels from transit operations. Commuter rail vibration was projected based on data from the FTA guidance manual. Commuter rail operations, track alignments, and location of sensitive land use were included in the projections of vibration at individual or clusters of vibration-sensitive land uses.

3) Assess impact based on the criteria discussed above. The projections determined the vibration levels at each cluster and vibration impact was assessed according to the appropriate FTA criteria, depending on the land use category.

4) Recommend mitigation measures where required and appropriate. Mitigation can include ballast mats, special fasteners, and other means of reducing vibration levels.

Construction Noise

Construction noise varies greatly depending on the construction process, type and condition of equipment used, and layout of the construction site. Many of these factors are traditionally left to the contractor's discretion, which makes it difficult to accurately estimate levels of construction noise. Overall, construction noise levels are governed primarily by the noisiest pieces of equipment. For most construction equipment, the engine, which is usually diesel, is the dominant noise source. This is particularly true of engines without sufficient muffling. For special activities such as impact pile driving and pavement breaking, noise generated by the actual process dominates.

Projecting construction noise requires a construction scenario of the equipment likely to be used and the average utilization factors or duty cycles (i.e., the percentage of time during operating hours that the equipment operates under full power during each phase). Using the typical sound emission characteristics, it is then possible to estimate Leq or Ldn at various distances from the construction site. The noise impact assessment for a construction site is based on:

1) An estimate of the type of equipment that will be used during each phase of the construction and the average daily duty cycle for each category of equipment,

2) Typical noise emission levels for each category of equipment, and

3) An estimate of noise attenuation as a function of distance from the construction site.

Construction noise estimates are always approximate because of the lack of specific information available at the time of the environmental assessment. Decisions about the procedures and equipment to be used are made by the contractor. Project designers usually try to minimize constraints on how the construction will be performed and what equipment will be used so that contractors can perform construction in the most cost effective manner.

Based on a typical construction scenario for ballast-and-tie track construction, an eight-hour Leq of 88 dBA should be expected at a distance of 50 feet from the geometric center of the work site. With at-grade track construction, the duration of the activities at a specific location along the alignment will be relatively limited, usually a matter of several weeks. As a result, even when there may be noise impacts, the limited duration of the construction can mean that mitigation is not cost effective.

TRANSIT NOISE AND VIBRATION CRITERIA

Noise Impact Criteria

Noise impact for this project is based on the criteria as defined in the FTA guidance manual. The FTA noise impact criteria are founded on well-documented research on community reaction to noise and are based on change in noise exposure using a sliding scale. Although more transit noise is allowed in neighborhoods with high levels of existing noise, smaller increases in total noise exposure are allowed with increasing levels of existing noise.

The FTA Noise Impact Criteria group noise sensitive land uses into the following three categories:

Category 1: Tracts of land where quiet is an essential element in their intended purpose. This category 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.

Category 2: Residences and buildings where people normally sleep. This category includes homes, hospitals and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.

Category 3: Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds and recreational facilities can also be considered to be in this category. Certain historical sites and parks are also included.

Ldn is used to characterize noise exposure for residential areas (Category 2). For other noise sensitive land uses, such as outdoor amphitheaters and school buildings (Categories 1 and 3), the maximum one-hour Leq during the facility's operating period is used.

There are two levels of impact included in the FTA criteria. The interpretation of these two levels of impact is summarized below:

Severe Impact: Project-generated noise in the severe impact range can be expected to cause a significant percentage of people to be highly annoyed by the new noise and represents the most compelling need for mitigation. Noise mitigation will normally be specified for severe impact areas unless there are truly extenuating circumstances which prevent it.

Moderate Impact: In this range of noise impact, the change in the cumulative noise level is noticeable to most people but may not be sufficient to cause strong, adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation. These factors include the existing level, the predicted level of increase over existing noise levels, the types and numbers of noise-sensitive land uses affected, the noise sensitivity of the properties, the effectiveness of the mitigation measures, community views and the cost of mitigating noise to more acceptable levels.

The noise impact criteria are summarized in graphical form in Figure 3. The figure shows the existing noise exposure and the additional noise exposure from a transit project that would cause either moderate or severe impact. The vertical axis along the left is used for Category 1 and 2 land uses while the vertical axis along the right is used for Category 3 land uses. The future noise exposure would be the combination of the existing noise exposure and the additional noise exposure caused by the transit project. Figure 4 shows the same criteria in terms of the increase in cumulative noise that can occur in the overall noise environment before impact occurs.

Figure 3: FTA Project Noise Impact Criteria

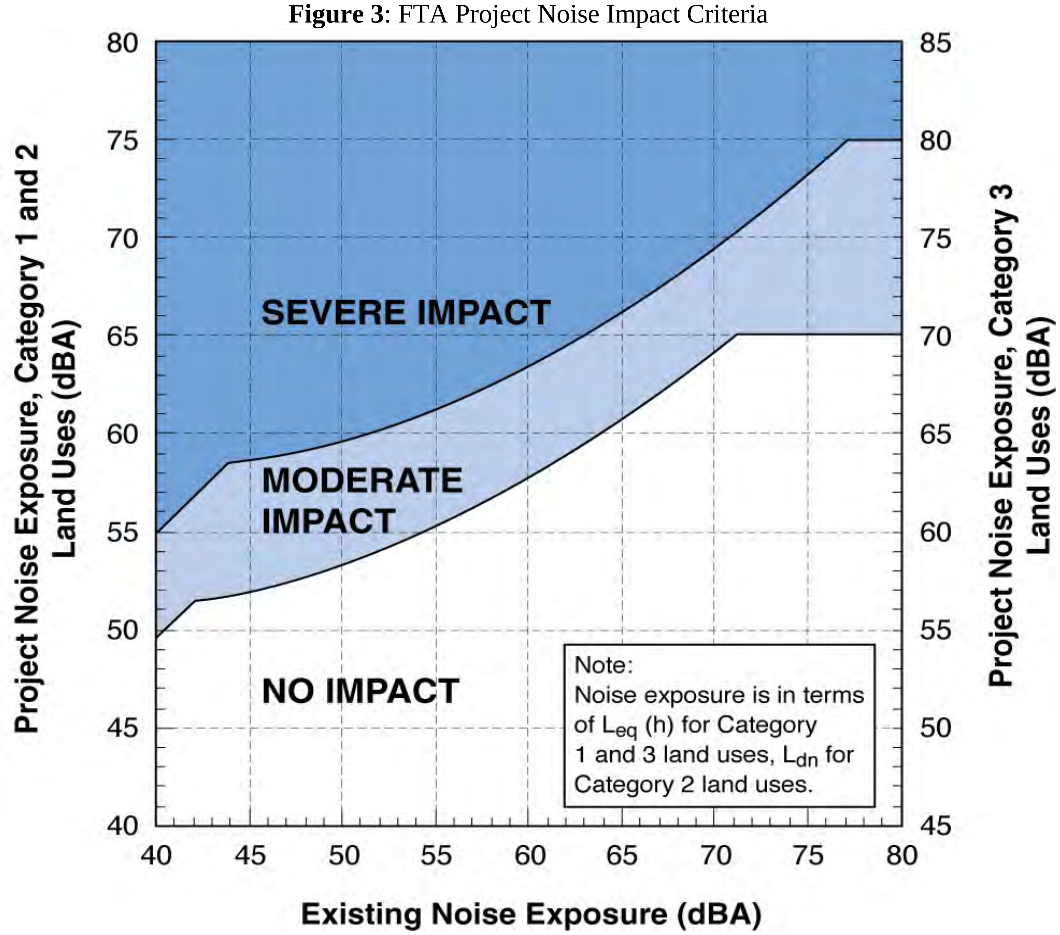
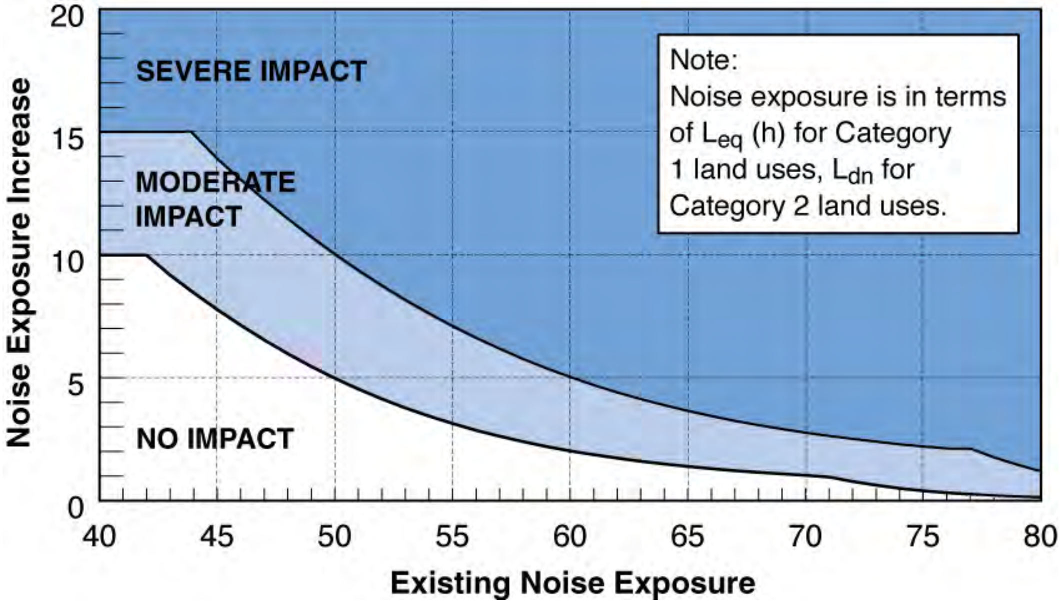


Figure 4: Increase in Cumulative Noise Exposure Allowed by FTA Criteria



Vibration Impact Criteria

The FTA ground-borne vibration impact criteria are based on land use and operational frequency, as shown in Table 1 and are given in terms of the maximum RMS vibration level for an event. There are some buildings, such as concert halls, recording studios and theaters that can be very sensitive to vibration but do not fit into any of the three categories listed in Table 1. Due to the sensitivity of these buildings, they usually warrant special attention during the environmental assessment of a transit project. Table 2 gives criteria for acceptable levels of ground-borne vibration for various types of special buildings.

It should be noted that Table 1 and Table 2 include separate FTA criteria for ground-borne noise, which is the "rumble" that can be radiated from the motion of room surfaces in buildings due to ground-borne vibration. Although expressed in dBA, which emphasizes the more audible middle and high frequencies, the criteria are set significantly lower than for airborne noise to account for the annoying low-frequency character of ground-borne noise. Because airborne noise often masks ground-borne noise for above ground (i.e. at-grade or elevated) transit systems, ground-borne noise criteria are primarily applied to subway operations where airborne noise is not a factor. For above-grade transit systems, ground-borne noise criteria are applied only to buildings that have sensitive interior spaces that are well insulated from exterior noise.

In addition, the FTA vibration criteria provide a method to assess vibration impact in locations with existing train operations. The criteria are based on the number of existing and proposed train operations and on how much higher or lower the future projected vibration levels will be as compared with the existing levels.

Table 1: FTA Ground-Borne Vibration and Ground-Borne Noise Impact Criteria

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 micro-inch /sec)			Ground-Borne Noise Impact Levels (dB re 20 micro Pascals)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibrations would interfere with interior functions.	65 VdB[4]	65 VdB[4]	65 VdB[4]	N/A[4]	N/A[4]	N/A[4]
Category 2: Buildings where people sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

(1) "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
(2) "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
(3) "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
(4) This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
(5) Vibration-sensitive equipment is generally not sensitive to ground-borne noise.

Source: Federal Transit Administration, May 2006

Table 2: FTA Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for Special Buildings

Land Use Category	GBV Impact Levels (VdB re 1 micro-inch /sec)		GBN Impact Levels (dB re 20 micro Pascals)	
	Frequent Events[1]	Occasional or Infrequent Events[2]	Frequent Events[1]	Occasional or Infrequent Events[2]
Concert Halls	65 VdB	65 VdB	25 dBA	25 dBA
TV Studios	65 VdB	65 VdB	25 dBA	25 dBA
Recording Studios	65 VdB	65 VdB	25 dBA	25 dBA
Auditoriums	72 VdB	80 VdB	30 dBA	38 dBA
Theaters	72 VdB	80 VdB	35 dBA	43 dBA

(1) "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
(2) "Occasional or Infrequent Events" is defined as fewer than 70 vibration events per day. This category includes most commuter rail systems.
(3) If the building will rarely be occupied when the trains are operating, there is no need to consider impact. As an example, consider locating a commuter rail line next to a concert hall. If no commuter trains will operate after 7 pm, it should be rare that the trains interfere with the use of the hall.

Source: Federal Transit Administration, May 2006

Construction Noise Impact Criteria

Construction noise criteria are based on the guidelines provided in the FTA Guidance Manual. These criteria, summarized in Table 3 below, are based on land use and time of day and are given in terms of Leq for an eight-hour work shift.

Table 3: FTA Construction Noise Criteria

Land Use	**Noise Limit, 8-hour Leq (dBA)**	
	Daytime	**Nighttime**
Residential	80	70
Commercial	85	85
Industrial	90	90

Source: Federal Transit Administration, May 2006

It is important to note that ConnDOT has stricter construction noise criteria guidelines. According to ConnDOT's Construction Manual (April 2009), "the maximum allowable noise level on construction projects is 90 decibels on the "A" weighted scale at the nearest occupied building or residence" regardless of land use or time of day. The stricter standards put forth by ConnDOT take precedence over the guidelines recommended by the FTA.

EXISTING CONDITIONS

Noise

Land use along the project corridor that is sensitive to noise and vibration was identified through aerial photography and mapping, and a field survey of the corridor conducted by Harris Miller Miller & Hanson Inc. (HMMH) staff on March 16-17, 2009. Summary descriptions of the noise and vibration sensitive land use along the project corridor from south to north are as follows:

<u>South Norwalk Station to I-95, Norwalk</u>: The noise and vibration sensitive land use in this area includes numerous multi-family residential buildings and a park located directly adjacent to the alignment. The Norwalk Maritime Museum and some single-family residences are also located in this area and are shielded from the alignment by other buildings.

<u>I-95 to Wall Street, Norwalk</u>: The noise and vibration sensitive land use in this area includes a playground and the Stepping Stone Museum for Children adjacent to Matthew's Park. There are also some scattered single- and multi-family residential buildings adjacent to the alignment.

<u>Cross Street to New Canaan Avenue, Norwalk</u>: The noise and vibration sensitive land use in this area includes mostly single-family residences along both sides of the alignment on Wilton Avenue and Jefferson Street.

<u>Nearby Merritt Parkway, Norwalk</u>: The noise and vibration sensitive land use in this area consists of several multi-family residences mixed with commercial buildings along Main Avenue/Route 7.

Norwalk/Wilton town line to Wolfpit Road, Wilton: The noise and vibration sensitive land use in this area includes a hospital and several single-family residences located on Arrowhead Road and Wolfpit Road.

Wolfpit Road to Wilton Station, Wilton: The noise and vibration sensitive land use in this area includes multi-family residential buildings as well as a church and Schenck's Park near the Wilton town center and the Track Side Teen Center located north of Wilton Station.

Pimpewaug Road/Mather Street/Mill Road, Wilton: The noise and vibration sensitive land use in this area consists of mainly single-family residences directly adjacent to the alignment, as well as a recreational center, two schools, and a church.

Near Branchville Station, Redding/Wilton/Ridgefield: The noise and vibration sensitive land use in this area is mixed single-family residences mixed with commercial land uses on Route 7.

Simpaug Turnpike, Ridgefield/Redding: The noise and vibration sensitive land use along this section of the corridor consists of mainly single-family residences directly adjacent to the alignment as well as a park and a church.

Near Bethel Station, Bethel: The noise and vibration sensitive land use includes numerous single-family residences, as well as a cemetery and the Bethel Public Library. There are also several multi-family residential buildings which are partially shielded by commercial buildings.

South of Danbury Station, Danbury: The noise and vibration sensitive land use in this area includes numerous single- and multi-family residential buildings and an elementary school.

North of Danbury Station, Danbury: The noise and vibration sensitive land use in this area includes some single- and multi-family residential buildings on Chapelle Street, and single-family residences on Beaver Brook Road.

Stony Hill Road to Wisconier Road, Brookfield: The noise and vibration sensitive land use in this area consists mainly of single-family residences on both sides of the alignment.

Wisconier Road to Brookfield/New Milford town line, Brookfield: The noise and vibration sensitive land use in this area consists mainly of single-family residences to the east of the alignment.

Cross Road to Grove Street, New Milford: The noise and vibration sensitive land use in this area consists mainly of single-family residences and a park.

Near New Milford town center, New Milford: The noise and vibration sensitive land use in this area near the center of New Milford consists of single- and multi-family residential buildings along the alignment and a hotel on Bridge Street

Noise Measurements

A noise measurement program was conducted by HMMH staff between April 27 and May 1, 2009. Long-term (24-hour) measurements were conducted where feasible and used to calculate the A-weighted Ldn. Additional short-term (one-hour) measurements were conducted to supplement the long-term sites. Estimates of the Ldn at these locations were made using the methods described in the FTA guidance manual.

Specific measurement sites were selected that were representative of the existing ambient noise levels at other nearby noise sensitive locations along the corridor. Considerations taken into account in the selection of sites included the proximity to the existing railway line, major roadways, and other noise sources. At each site the measurement microphone was positioned to characterize the exposure at the site to the dominant noise sources in the area and positioned to avoid acoustic shielding by any landscaping or other obstructions along the path of the noise.

Table 4 summarizes the existing ambient noise measurements. The measurement locations and results are described below. Because the dominant noise sources along most of the corridor are the existing commuter rail and freight rail operations, the existing noise levels at these measurement locations will be used to determine the existing noise conditions at all noise-sensitive receptors along the project corridor.

Table 4: Summary of Existing Ambient Noise Measurements

Site	Measurement Location	Start of Measurement		Meas. Time (hrs)	Noise Exposure (dBA)	
		Date	Time		Ldn[1]	Leq
N-1	77 North Water Street, Norwalk	4/29/09	16:17	1	59	57
N-2	Matthew's Park, Norwalk	4/29/09	16:27	1	72	70
N-3	28 Wilton Ave., Norwalk	4/27/09	15:00	24	62	59
N-4	Merritt Station, Norwalk	4/28/09	15:08	1	72	69
N-5	51 Wolfpit Road, Wilton	4/27/09	16:00	24	57	53
N-6	Schenck's Island Park, Wilton	4/30/09	15:46	1	60	57
N-7	186 Mather Street, Wilton	4/27/09	17:00	24	63	58
N-8	96 Portland Avenue, Wilton	4/28/09	19:00	24	63	59
N-9	131 Simpaug Turnpike, Redding	4/28/09	18:00	24	56	54
N-10	5 Taylor Avenue, Bethel	4/28/09	13:00	24	67	59
N-11	63 Wildman Street, Danbury	4/30/09	11:54	1	66	67
N-12	51 Beaver Brook Road, Danbury	4/28/09	10:00	24	61	58
N-13	151 Pocono Road, Brookfield	4/29/09	11:00	24	51	48
N-14	16 Prospect Drive, Brookfield	4/29/09	13:00	24	57	47
N-15	30 Erickson Road, New Milford	4/30/09	10:00	24	62	49
N-16	42 S. Main Street, New Milford	4/30/09	11:00	24	74	49

(1) The Leq measurements at the one-hour measurement sites were used to estimate the Ldn using FTA methodology. This approach tends to be conservative and underestimate the existing noise levels, which can result in higher levels of noise impact for a project.

Source: Harris Miller Miller & Hanson Inc., 2009

Site N-1: 77 North Water Street, Norwalk. The measured one-hour Leq at this location was 57 dBA and the estimated Ldn was 59 dBA. The ambient noise levels were dominated by Metro-North train operations on the Danbury branch.

Site N-2: Matthew's Park, Norwalk. The measured one-hour Leq at this location was 70 dBA and the estimated Ldn was 72 dBA. The ambient noise levels were dominated by Metro-North train operations and grade-crossing horns at Science Road and Jennings Place.

Site N-3: 28 Wilton Avenue, Norwalk. The measured Ldn at this location was 62 dBA and the peak-hour Leq was 59 dBA. The ambient noise levels were dominated by Metro-North train operations and grade-crossing horns at Cross and Catherine Streets.

Site N-4: Merritt Station, Norwalk. The measured one-hour Leq at this location was 69 dBA and the estimated Ldn was 72 dBA. At this measurement location near the tracks the ambient noise levels were dominated by Metro-North train operations.

Site N-5: 51 Wolfpit Road, Wilton. The measured Ldn at this location was 57 dBA and the peak-hour Leq was 53 dBA. The ambient noise levels were dominated by Metro-North train operations.

Site N-6: Schenck's Island Park, Wilton. The measured one-hour Leq at this location was 57 dBA and the estimated Ldn was 60 dBA. The ambient noise levels were dominated by Metro-North train operations.

Site N-7: 186 Mather Street, Wilton. The measured Ldn at this location was 63 dBA and the peak-hour Leq was 59 dBA. The ambient noise levels were dominated by Metro-North train operations.

Site N-8: 96 Portland Avenue, Wilton. The measured Ldn at this location was 63 dBA and the peak-hour Leq was 58 dBA. The ambient noise levels were dominated by Metro-North train operations and grade-crossing horns at Branchville Road

Site N-9: 131 Simpaug Turnpike, Redding. The measured Ldn at this location was 56 dBA and the peak-hour Leq was 54 dBA. The ambient noise levels were dominated by Metro-North train operations.

Site N-10: 5 Taylor Avenue, Bethel. The measured Ldn at this location was 67 dBA and the peak-hour Leq was 59 dBA. The ambient noise levels were dominated by Metro-North train operations and horn noise at several nearby grade-crossings.

Site N-11: 63 Wildman Street, Danbury. The measured one-hour Leq at this location was 67 dBA and the estimated Ldn was 66 dBA. The ambient noise levels were dominated by Metro-North train operations and horn noise at several nearby grade-crossings.

Site N-12: 51 Beaver Brook Road, Danbury. The measured Ldn at this location was 61 dBA and the peak-hour Leq was 58 dBA. The ambient noise levels were dominated by local automobile traffic and daily freight train operations.

Site N-13: 151 Pocono Road, Brookfield. The measured Ldn at this location was 51 dBA and the peak-hour Leq was 48 dBA. The ambient noise levels were dominated by daily freight train operations.

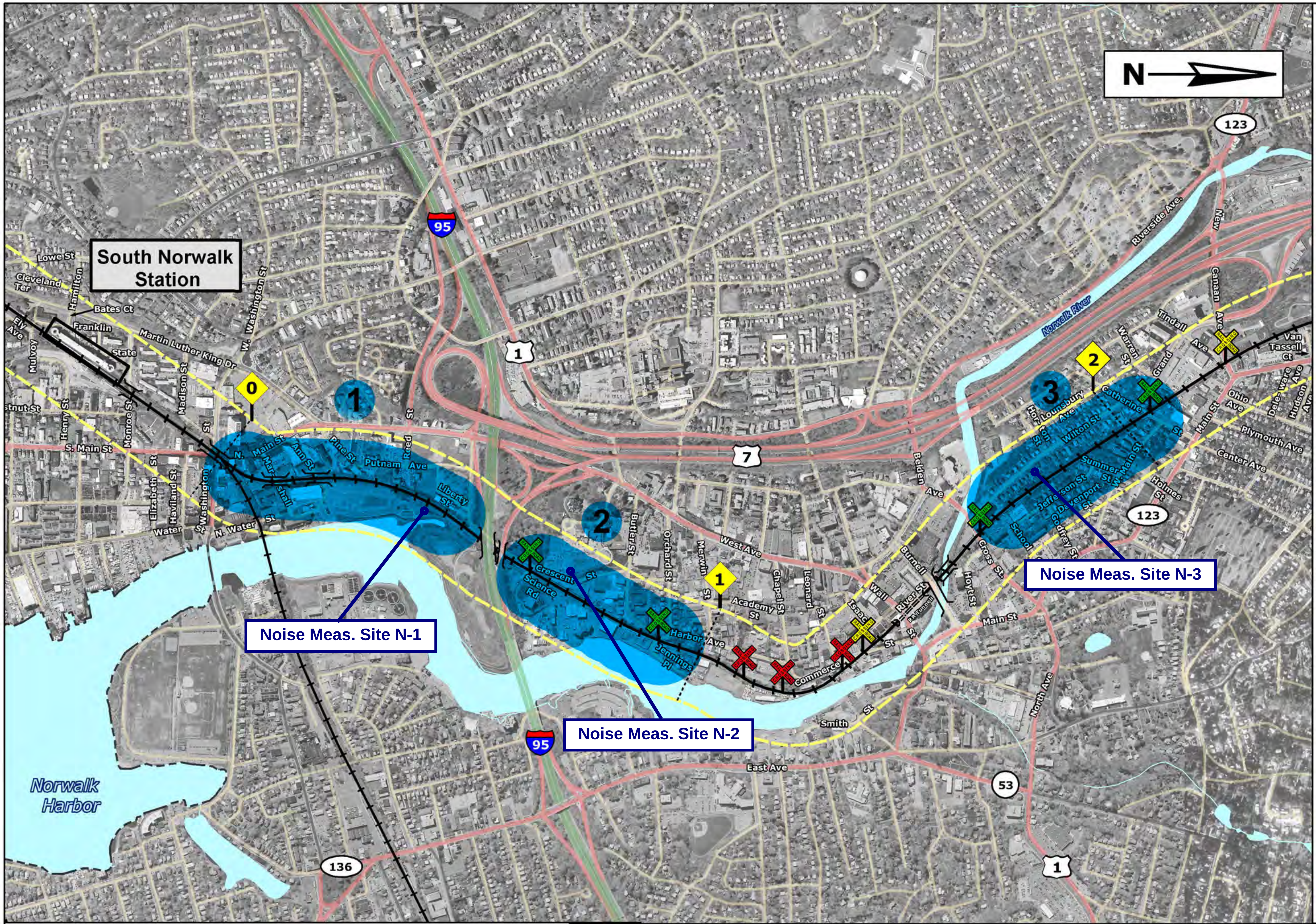
Site N-14: 16 Prospect Drive, Brookfield. The measured Ldn at this location was 57 dBA and the peak-hour Leq was 47 dBA. The ambient noise levels were dominated by daily freight train operations.

Site N-15: 30 Erickson Road, New Milford. The measured Ldn at this location was 62 dBA and the peak-hour Leq was 49 dBA. The ambient noise levels were dominated by daily freight train operations.

Site N-16: 42 South Main Street, New Milford. The measured Ldn at this location was 74 dBA and the peak-hour Leq was 49 dBA. The ambient noise levels were dominated by daily freight train operations and horn noise at several nearby grade-crossings.

Vibration

Existing sources of vibration along the project corridor include Metro-North commuter trains on the branch from Norwalk to Danbury and freight trains on the railway line from Danbury to New Milford. The existing future vibration levels from both commuter and freight operations will be estimated using the FTA general assessment methodology. Vibration measurements may be conducted during subsequent phases of the project to characterize the soil conditions along the corridor in order to refine the vibration projections at specific locations, as required.



Legend

- Railroad Track
- 1000 Foot Study Corridor
- Town Boundary
- Railroad Station
- Proposed Location of New Railroad Station
- Railroad Milepost Marker
- Railroad Crossing
- Private Railroad Crossing
- Interstate Highway
- US Highway
- State Road
- Local Road
- Rivers/Streams
- Lakes/Ponds

Data Sources:

Roads layer: CT DEP
RR Track: CT DEP
Town Boundary: CT DEP
Hydrography: CT DEP
RR Milepost Markers and Grade Crossings: Metro-North Track Charts

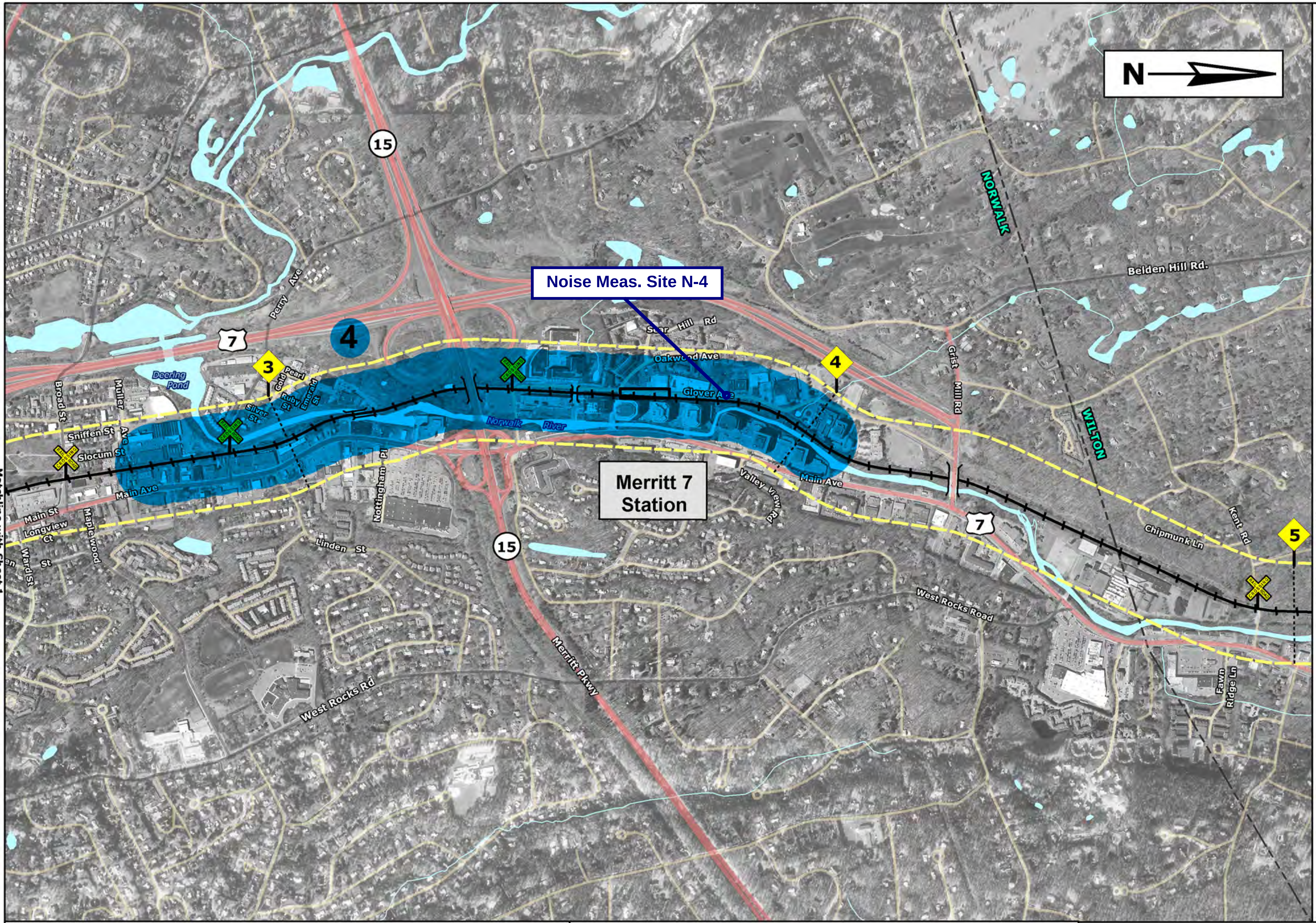
MAP SCALE

Feet

0 1,000 2,000

ONE INCH =1000 FEET

PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**	**STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION**	TOWN(S): NORWALK	PROJECT NO: 302-008
GIS MAPPING BY: URS CORPORATION DATE: 02/2009		MAP TITLE: ORTHOPHOTO BASE MAP	MAP NO:
			SHEET NO: 1 OF 14



Legend

- Railroad Track
- 1000 Foot Study Corridor
- Town Boundary
- Railroad Station
- Proposed Location of New Railroad Station
- Railroad Milepost Marker
- Railroad Crossing
- Private Railroad Crossing
- Interstate Highway
- US Highway
- State Road
- Local Road
- Rivers/Streams
- Lakes/Ponds

Data Sources:

Roads layer: CT DEP
RR Track: CT DEP
Town Boundary: CT DEP
Hydrography: CT DEP
RR Milepost Markers and Grade Crossings: Metro-North Track Charts

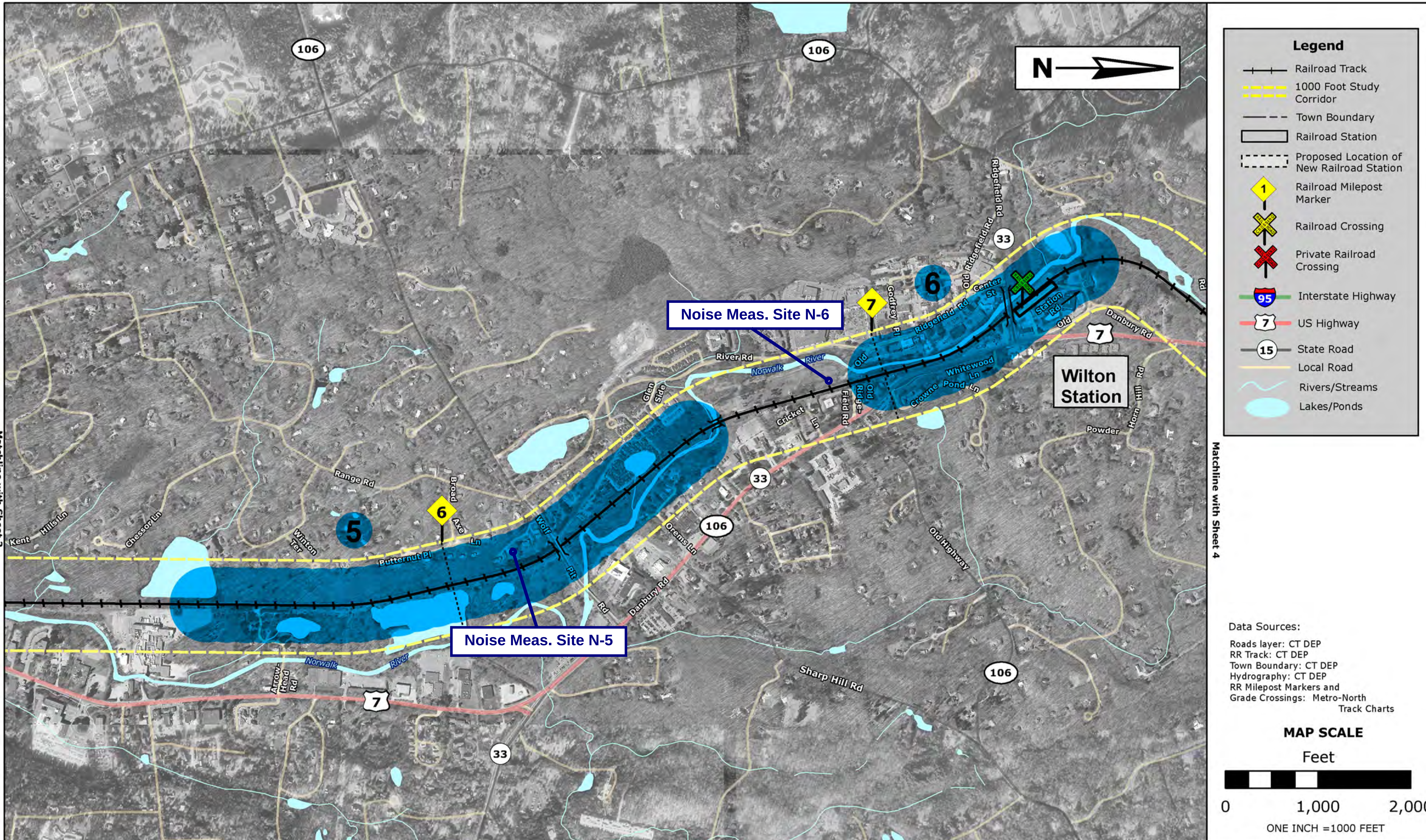
MAP SCALE

Feet

0 1,000 2,000

ONE INCH =1000 FEET

PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**	**STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION**	TOWN(S): NORWALK, WILTON	PROJECT NO: 302-008
GIS MAPPING BY: URS CORPORATION DATE: 02/2009		MAP TITLE: ORTHOPHOTO BASE MAP	MAP NO:
			SHEET NO: 2 OF 14



PROJECT TITLE:

DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT

GIS MAPPING BY: URS CORPORATION DATE: 02/2009

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION

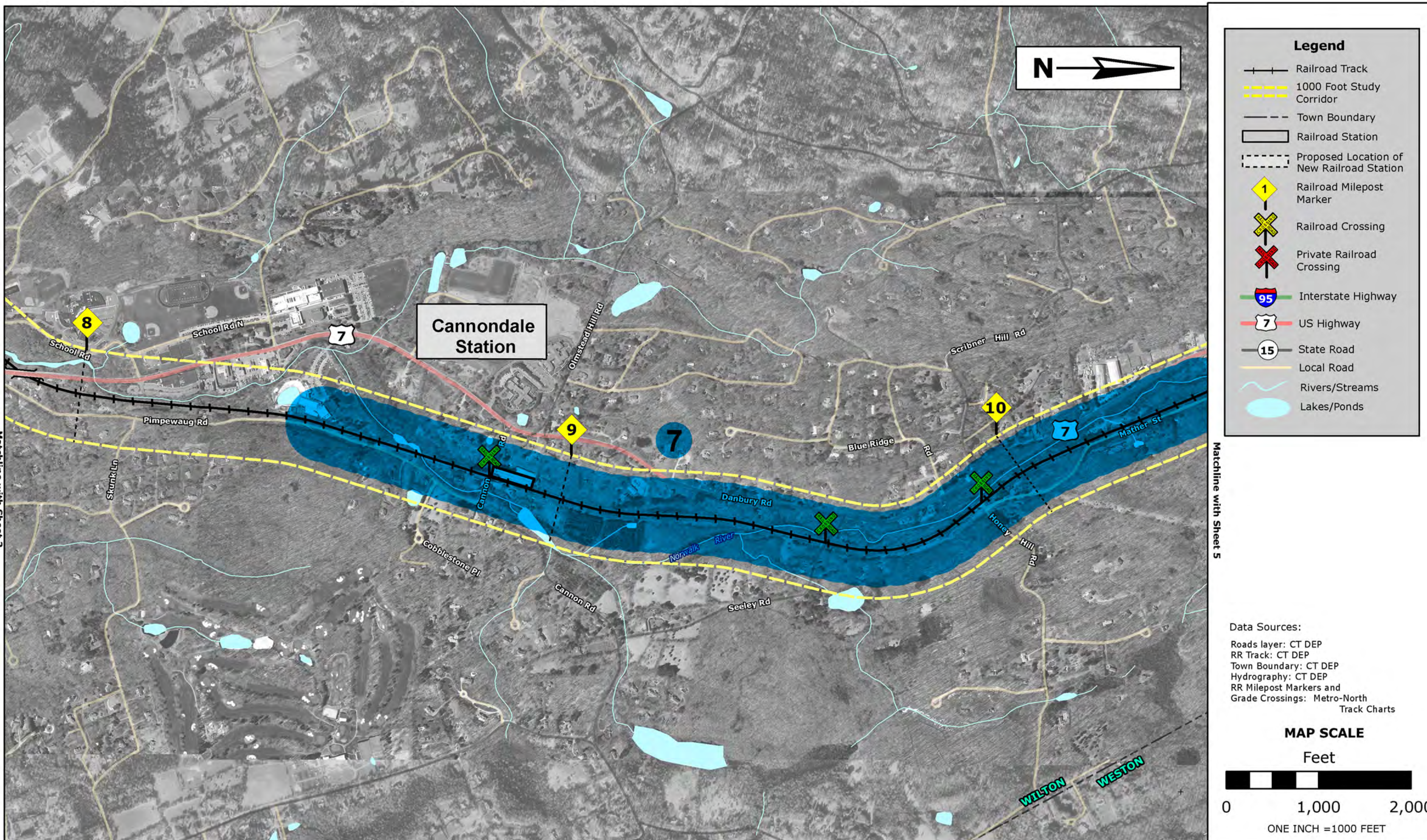
TOWN(S): WILTON

MAP TITLE: ORTHOPHOTO BASE MAP

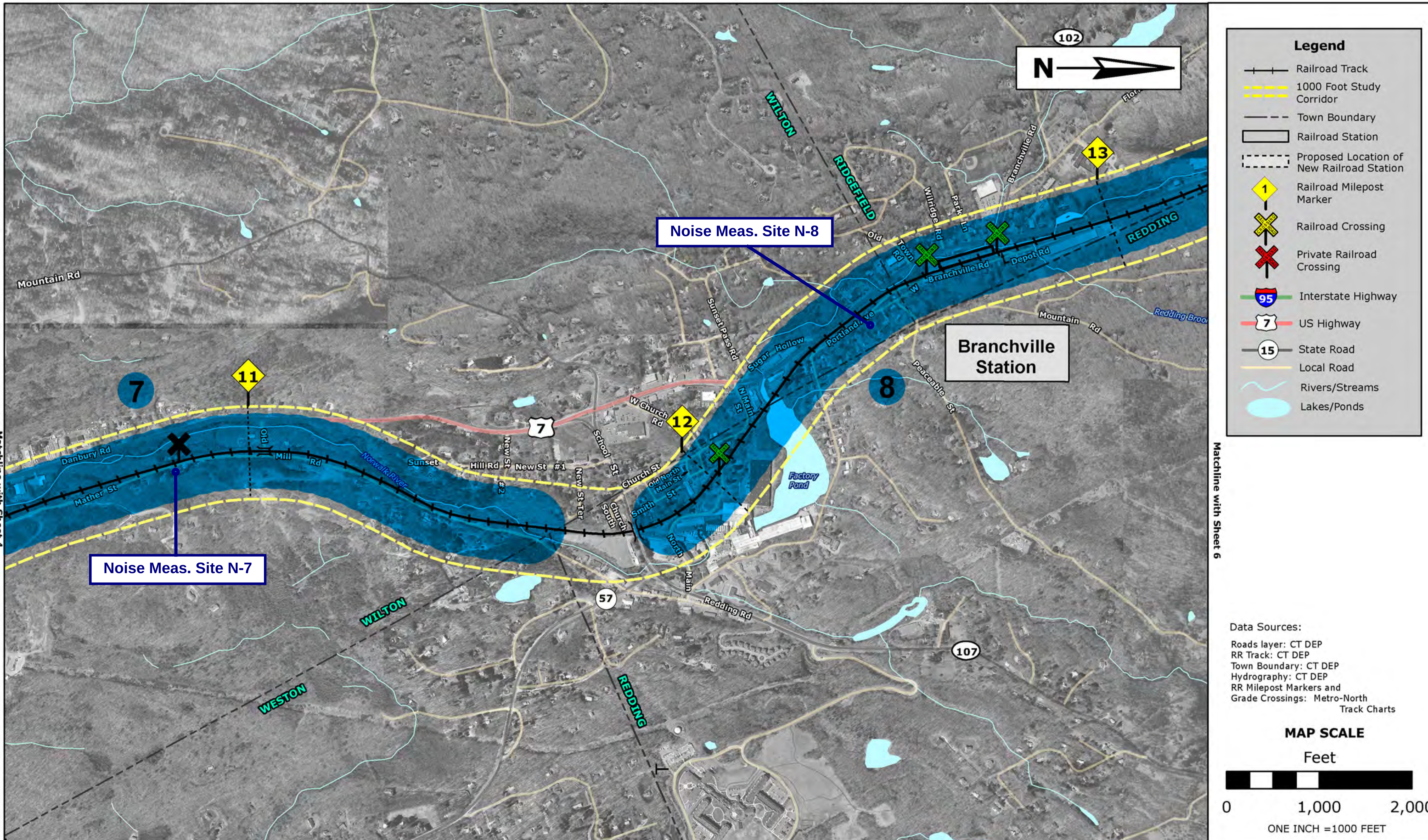
PROJECT NO: 302-008

MAP NO:

SHEET NO: 3 OF 14



PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**	**STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION**	TOWN(S): WILTON, WESTON	PROJECT NO: 302-008
GIS MAPPING BY: URS CORPORATION DATE: 02/2009		MAP TITLE: ORTHOPHOTO BASE MAP	MAP NO:
			SHEET NO: 4 OF 14



PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**

GIS MAPPING BY: URS CORPORATION DATE: 02/2009

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION

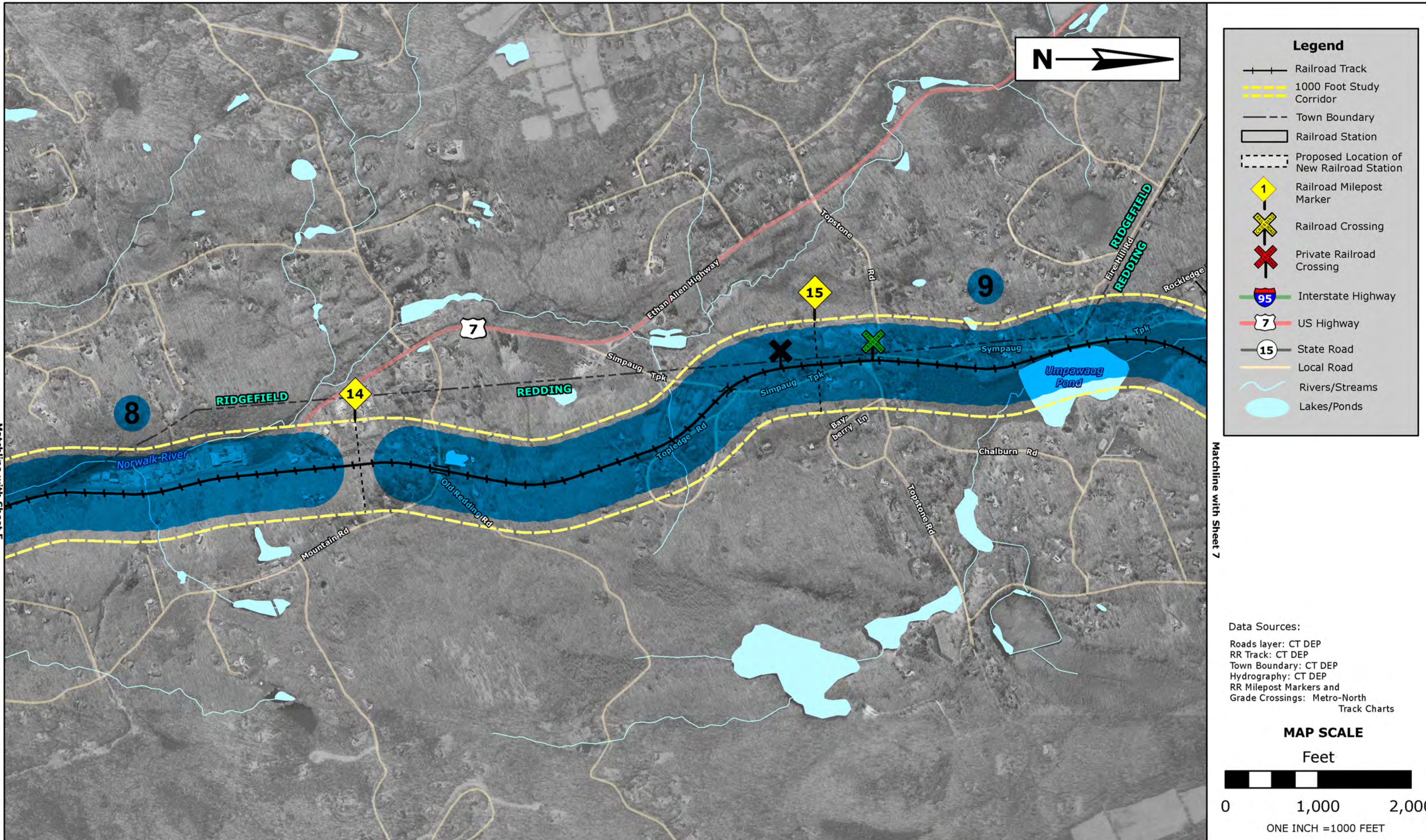
TOWN(S): WILTON, WESTON, RIDGEFIELD, REDDING

PROJECT NO: 302-008

MAP NO:

MAP TITLE: ORTHOPHOTO BASE MAP

SHEET NO: 5 OF 14



PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**

GIS MAPPING BY: URS CORPORATION DATE: 02/2009

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION

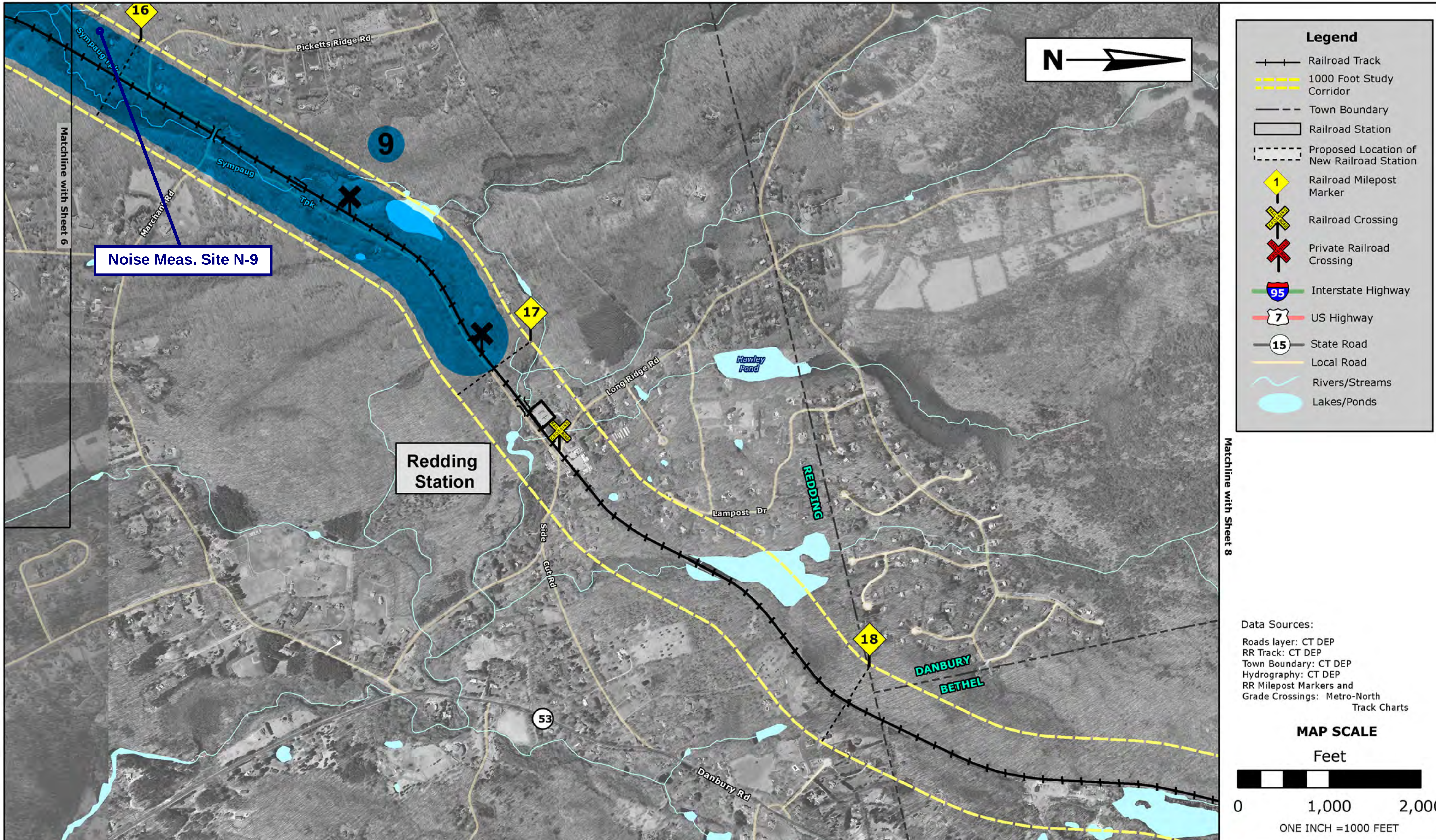
TOWN(S): RIDGEFIELD, REDDING

MAP TITLE: ORTHOPHOTO BASE MAP

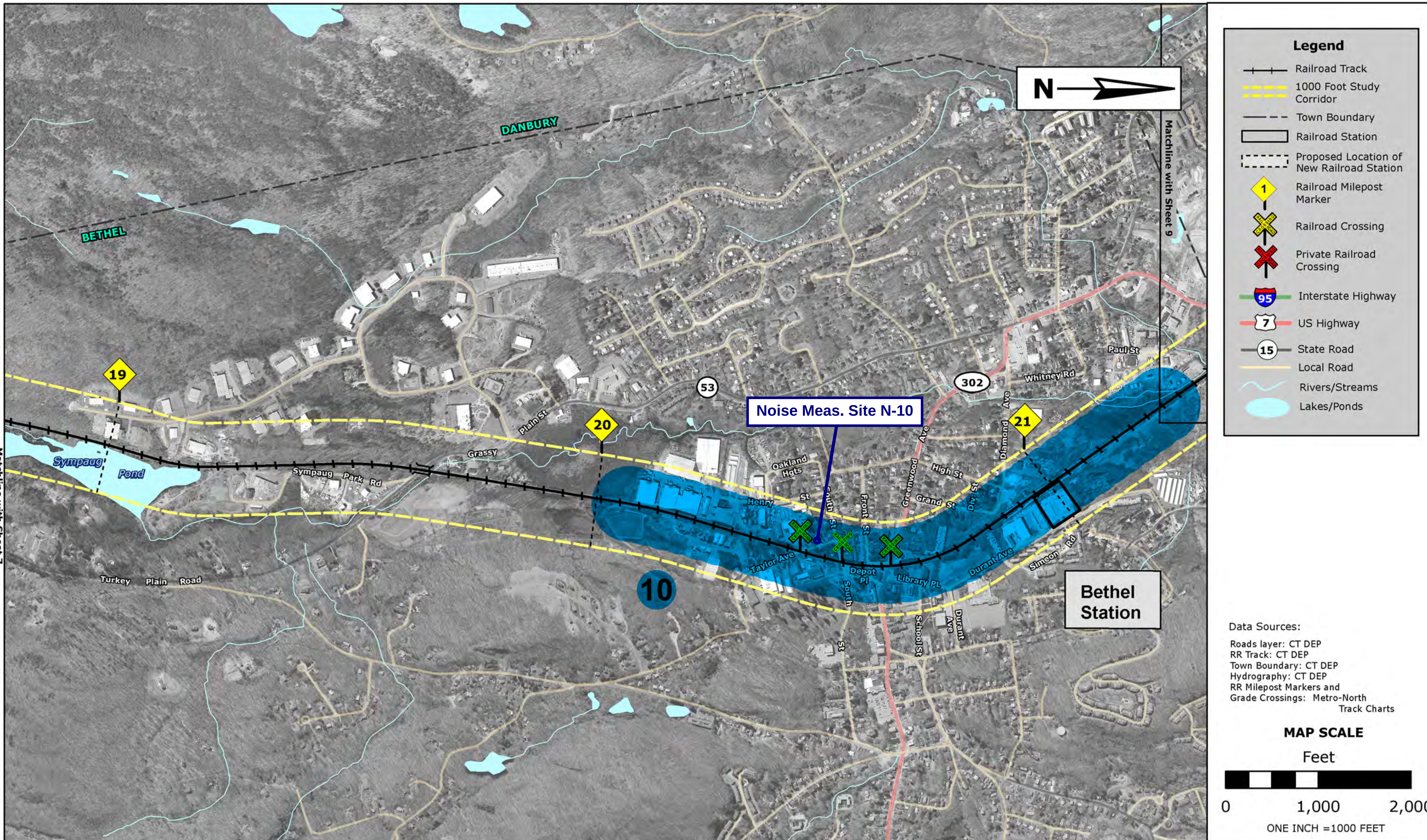
PROJECT NO: 302-008

MAP NO:

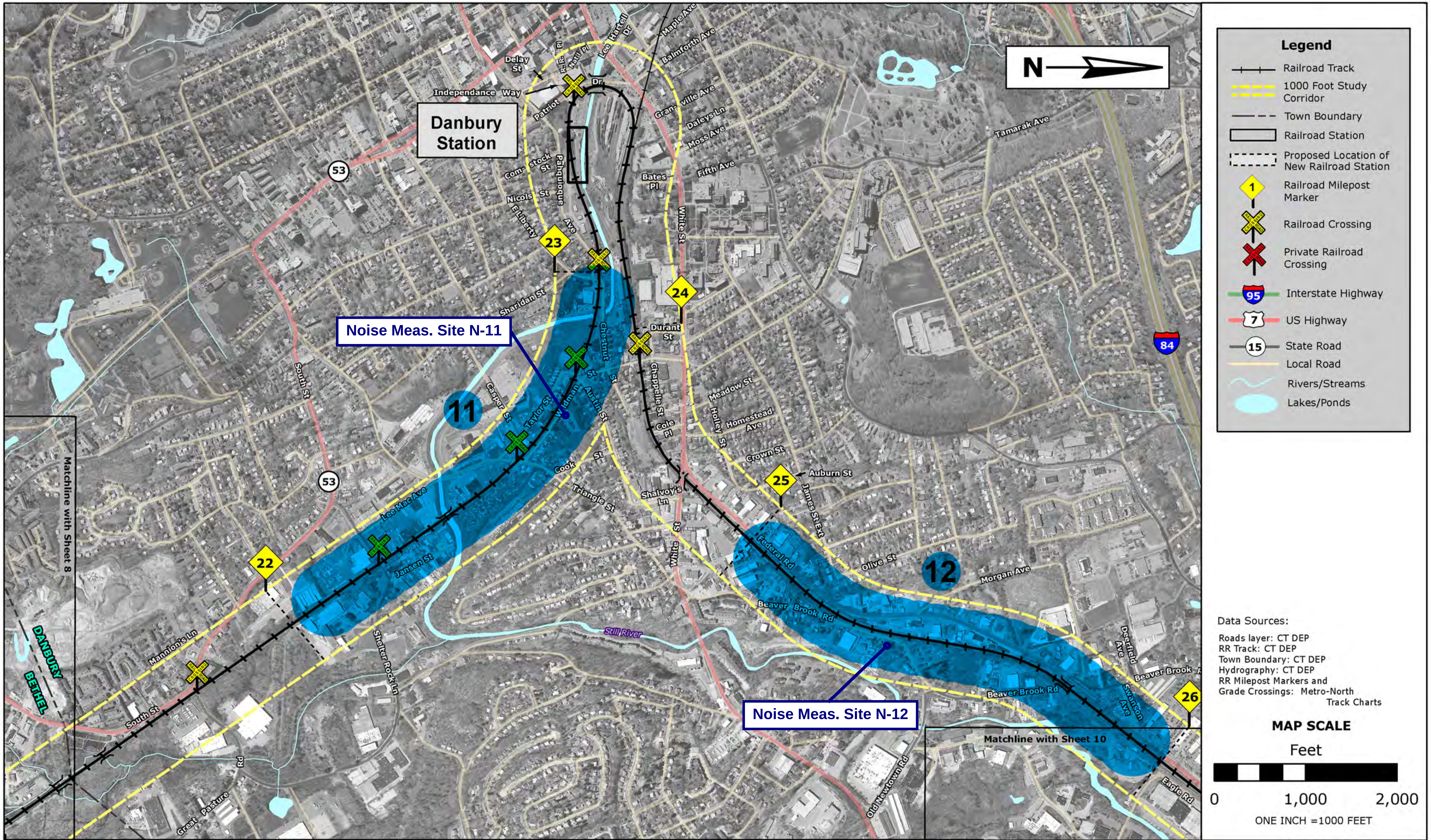
SHEET NO: 6 OF 14



PROJECT TITLE: DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT	STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION	TOWN(S): REDDING, BETHEL, DANBURY	PROJECT NO: 302-008
GIS MAPPING BY: URS CORPORATION DATE: 02/2009		MAP TITLE: ORTHOPHOTO BASE MAP	MAP NO:
			SHEET NO: 7 OF 14



PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**	**STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION**	TOWN(S): BETHEL, DANBURY	PROJECT NO: 302-008
GIS MAPPING BY: URS CORPORATION DATE: 02/2009		MAP TITLE: ORTHOPHOTO BASE MAP	MAP NO:
			SHEET NO: 8 OF 14



PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**

GIS MAPPING BY: URS CORPORATION DATE: 02/2009

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION

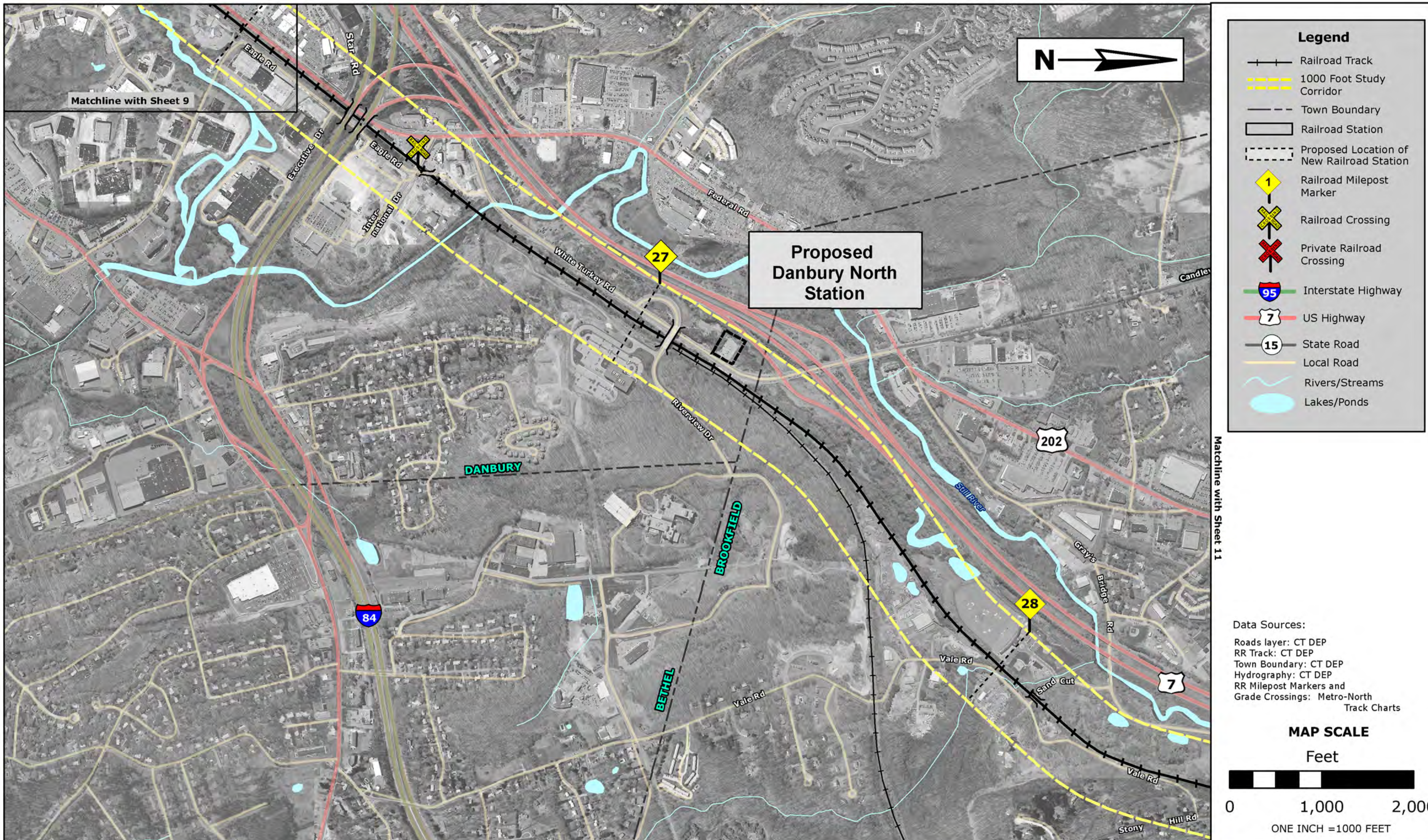
TOWN(S): DANBURY, BETHEL

MAP TITLE: ORTHOPHOTO BASE MAP

PROJECT NO: 302-008

MAP NO:

SHEET NO: 9 OF 14



PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**

GIS MAPPING BY: URS CORPORATION DATE: 02/2009

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION

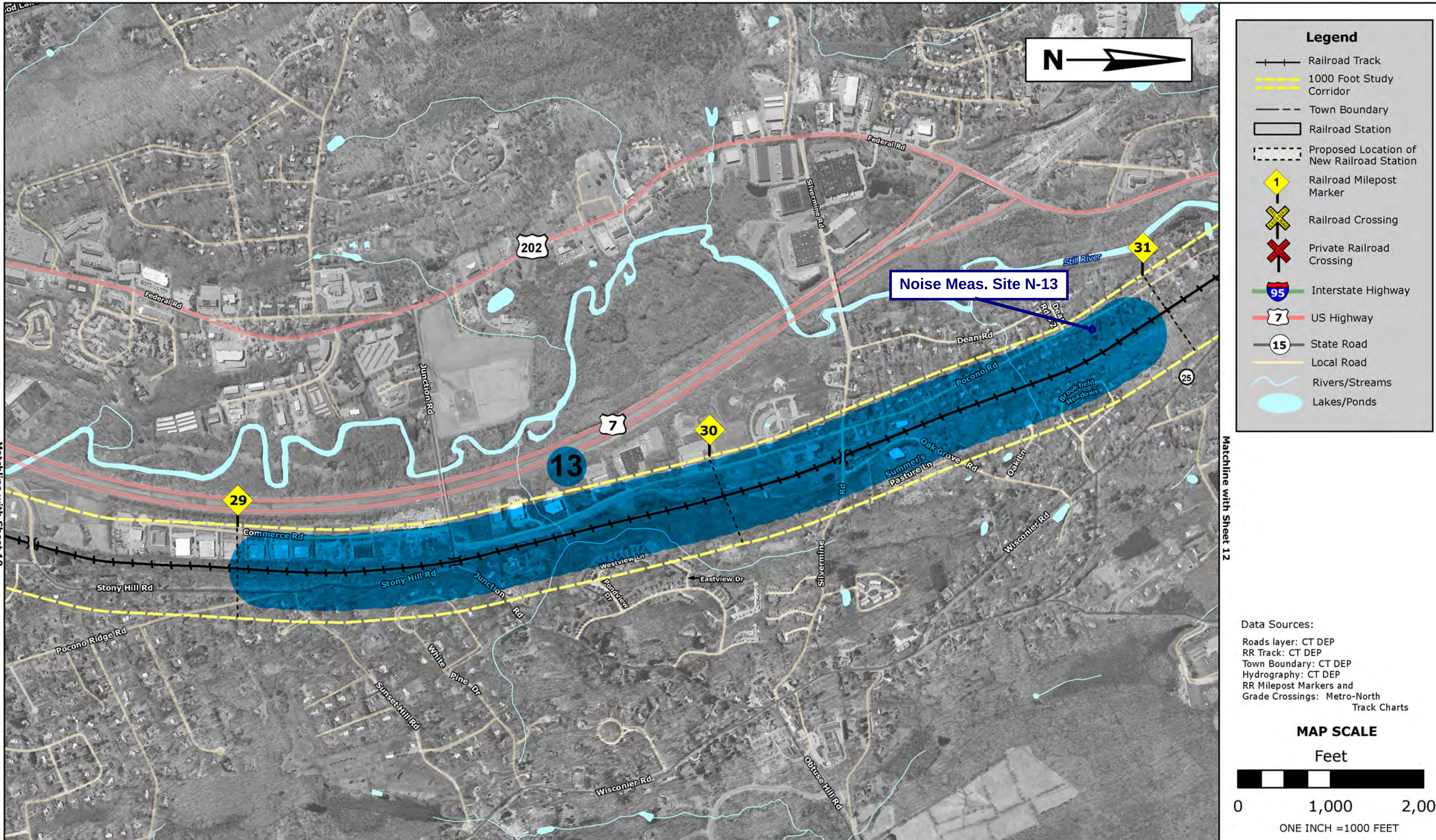
TOWN(S): DANBURY, BETHEL, BROOKFIELD

MAP TITLE: ORTHOPHOTO BASE MAP

PROJECT NO: 302-008

MAP NO:

SHEET NO: 10 OF 14



PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**

GIS MAPPING BY: URS CORPORATION DATE: 02/2009

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION

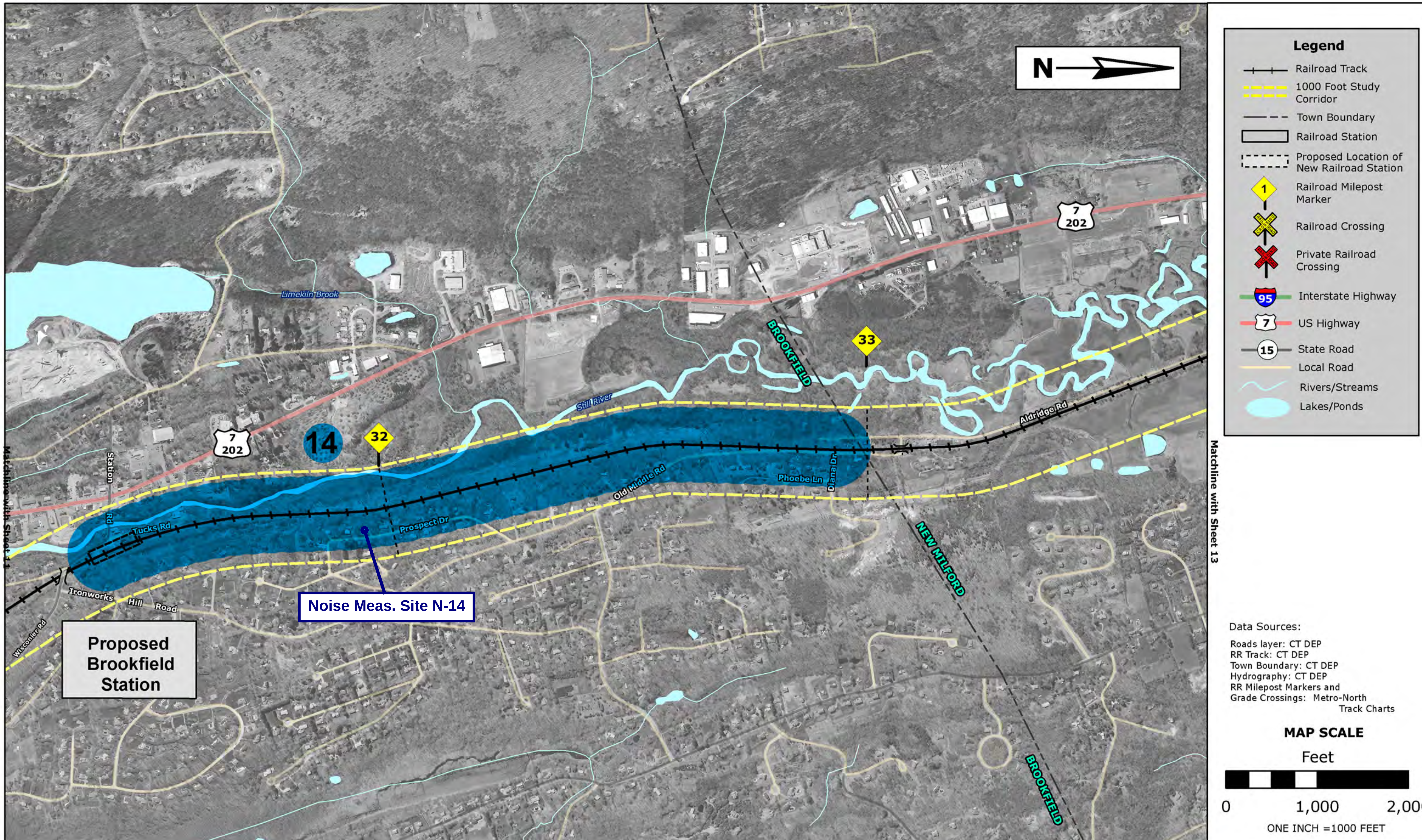
TOWN(S): BROOKFIELD

MAP TITLE: ORTHOPHOTO BASE MAP

PROJECT NO: 302-008

MAP NO:

SHEET NO: 11 OF 14



PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**

GIS MAPPING BY: URS CORPORATION   DATE: 02/2009

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION

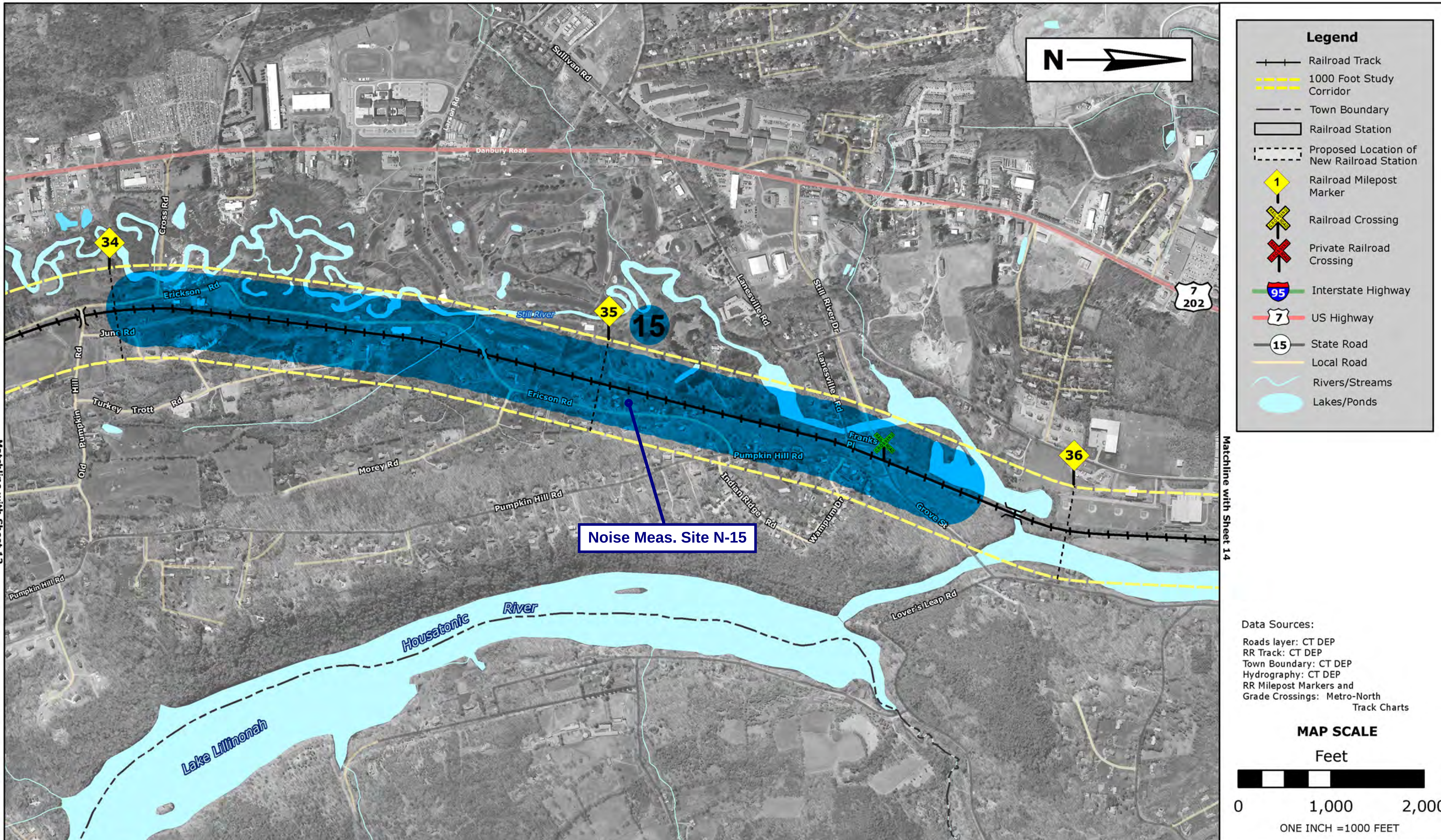
TOWN(S): BROOKFIELD, NEW MILFORD

PROJECT NO: 302-008

MAP NO:

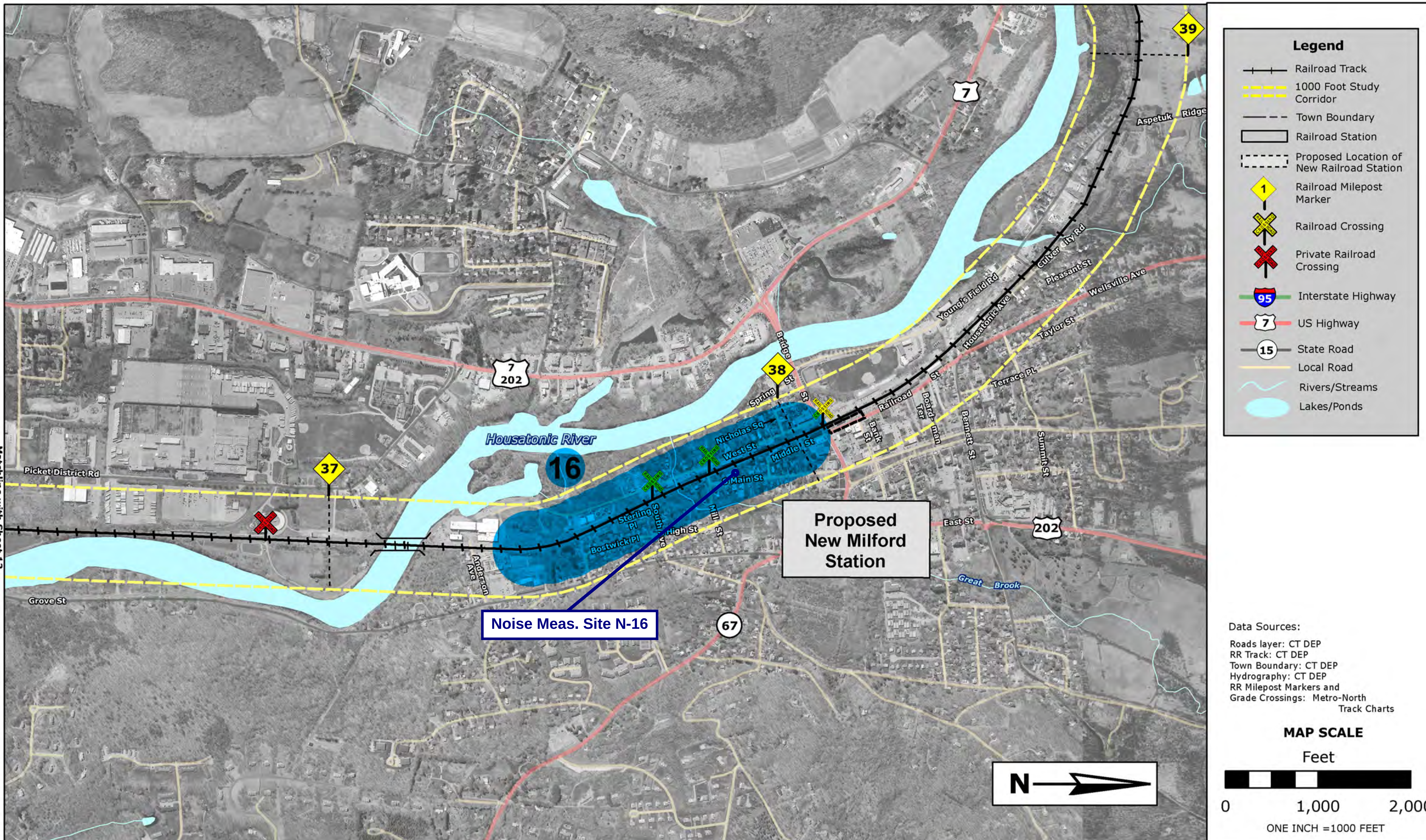
MAP TITLE: ORTHOPHOTO BASE MAP

SHEET NO: 12 OF 14



PROJECT TITLE: **DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT**	**STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION**
GIS MAPPING BY: URS CORPORATION DATE: 02/2009	

TOWN(S): NEW MILFORD	PROJECT NO: 302-008
MAP TITLE: ORTHOPHOTO BASE MAP	MAP NO:
	SHEET NO: 13 OF 14



PROJECT TITLE:

DANBURY BRANCH IMPROVEMENT PROGRAM & ELECTRIFICATION ENVIRONMENTAL IMPACT STATEMENT

GIS MAPPING BY: URS CORPORATION DATE: 02/2009

STATE OF CONNECTICUT DEPARTMENT OF TRANSPORTATION

TOWN(S): NEW MILFORD

MAP TITLE: ORTHOPHOTO BASE MAP

PROJECT NO: 302-008

MAP NO:

SHEET NO: 14 OF 14