Appendix C: Historic and Cultural Resources

C-1 Finding of Effects

DRAFT

FINDING DOCUMENTATION

SECTION 106 EFFECT FINDING

PIN: 8TZ1.00

SHPO PROJECT REVIEW NUMBER (11PR06692)

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT, WESTCHESTER AND ROCKLAND COUNTIES

1. PROJECT DESCRIPTION

OVERVIEW

The Tappan Zee Hudson River Crossing ("Project") is a federally funded project being undertaken by the Project Sponsors – New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA) –with the Federal Highway Administration (FHWA), serving as the federal lead agency under the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act. The purpose of the project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The project would address the structural, operational, mobility, safety, and security needs of the Tappan Zee Hudson River Crossing.

An Environmental Impact Statement (EIS) is being prepared that considers a Replacement Bridge Alternative. The existing and proposed replacement bridge are 3.1 miles in length, and the tie-in work in Rockland and Westchester Counties will be limited to the minimum work necessary to match existing highway geometry at the landings. The project limits would be approximately 4 miles in total, from the South Broadway Bridge in South Nyack (Rockland County) to the Broadway Bridge in Tarrytown (Westchester County). The Project will not require alteration of existing interchanges or other highway features beyond the project limits.

The Section 106 review process is being progressed in accordance with its implementing regulations (36 CFR Part 800), and in coordination with the EIS. The analyses presented in the EIS anticipate an Estimated Time of Completion between 2017 and 2019. Two alternatives will be evaluated in the EIS, the No Build Alternative and the Replacement Bridge Alternative. To provide flexibility in the future design of the replacement bridge, two options will be considered. Each alternative is briefly discussed below:

- No Build Alternative – The No Build Alternative would retain the existing Tappan Zee Bridge in its current configuration with ongoing maintenance, as practicable, to ensure its continued safe use by the traveling public. However, given the age of the bridge and its vulnerabilities in extreme events, it is possible that the crossing could be closed altogether at some point in the future. Although the No Build Alternative does not meet the project's purpose and need, NEPA requires it be evaluated in the EIS. The No Build Alternative also serves as the baseline condition against which the potential benefits and impacts of the Replacement Bridge Alternative are evaluated.
- Replacement Bridge Alternative – There are two options for the Replacement Bridge Alternative that would meet the structural and operational requirements of a new crossing. These options differ in two basic ways: 1) the distance between their piers (short vs. long); and 2) the potential number of levels of bridge operations (single vs. dual). These options—Short Span and Long Span—are described below.
    - The Replacement Bridge Alternative—Short Span Option would be two single-level structures separated by a 42-foot gap at their main spans. Under typical operation, each structure would have four traffic lanes and wide shoulders to facilitate emergency vehicle access. The north bridge structure would serve westbound traffic, and the south bridge structure would serve

eastbound traffic. A bicycle/pedestrian path would be provided on the north bridge structure. The north bridge structure would be 96 feet wide and the south bridge structure would be 87 feet wide.

The Short Span option would not preclude future transit service across the Tappan Zee Hudson River crossing.

- The Replacement Bridge Alternative—Long Span Option would be two new truss bridges with two levels each. The dual structures would be separated by a minimum gap of approximately 42 feet at the main span. The northernmost structure would be 96 feet wide. Under normal operations, it would support four westbound lanes and a shared-use (bicycle and pedestrian) path on the upper level. The southernmost structure would be 87 feet wide, and under normal operations, it would support four eastbound lanes. Both structures would include wide shoulders to facilitate emergency access.

  The Long Span option would not preclude future transit service across the Tappan Zee Hudson River crossing.

Both Replacement Bridge Alternative options propose the removal of the existing Tappan Zee Bridge upon completion of the new river crossings. The Tappan Zee crosses the Hudson River between the Village of South Nyack in Rockland County on the west and the Village of Tarrytown in Westchester County on the east. The Tappan Zee Bridge carries Interstate 87 (New York State Thruway) and Interstate 287 and provides the only interstate highway crossing of the Hudson River for the 48-mile stretch between the George Washington Bridge (Interstate 95) and the Newburgh-Beacon Bridge (Interstate 84). The existing and proposed replacement bridge under both Replacement Bridge Alternative options are 3.1 miles in length, and the tie-in work in Rockland and Westchester Counties will be limited to the minimum work necessary to match existing highway geometry at the landings. The project limits would be approximately 4 miles in total, from the South Broadway Bridge in South Nyack (Rockland County) to the Broadway Bridge in Tarrytown (Westchester County). The Project will not require alteration of existing interchanges or other highway features beyond the project limits. **Figures E-1 through E-10 in Attachment E: Plans, Profiles, Elevations, Sections for Replacement Bridge Alternative/Long and Short Span Options** depict the location of the Project and Replacement Bridge Alternative options.

AREA OF POTENTIAL EFFECT

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to delineate a project Area of Potential Effect (APE), which is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist" (36 CFR § 800.16[d]). The APE is influenced by the scale and nature of an undertaking. The APE has been developed in consultation with the lead federal agency, SHPO, and consulting parties based on proposed work activities and their potential to affect historic properties, including potential direct and indirect effects caused by the construction and operation of the proposed project. The project would involve the removal of the existing Tappan Zee Bridge and construction of a new Hudson River crossing. This would include the construction of new tie-ins to the Rockland and Westchester County Landings, new piers to support the new bridge structures in the Hudson River, reconstruction of the toll plaza in Tarrytown, reconstruction of the South Broadway Bridge in South Nyack in Rockland County, and construction of a new shared-use path.

In general, as defined by the Advisory Council on Historic Preservation, potential adverse effects on architectural resources can include both direct physical effects—demolition, alteration, or damage from construction—and indirect effects, such as the introduction of visual, audible, or atmospheric elements that may alter the characteristics of the historic property that qualify it for inclusion in the National Register in a manner that would diminish the integrity of the property's significant historic features. Potential archaeological resources may be affected by construction activities resulting in disturbance to the ground surface (including submerged ground surfaces) such as excavation, grading, pile-driving,

cutting and filling, dredging, and staging. Adverse effects may include reasonably forseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

The project has one APE; however, to facilitate the analysis of effects, the APE has been subdivided to indicate the area in which the proposed project could cause potential direct effects and the area in which the proposed project could cause indirect effects. The APE is discussed in greater detail below and depicted in **Figure 1, contained as part of Exhibit A of *Cultural Resources Methodology* in Attachment A**. SHPO has concurred with the definition of the APE in a letter dated October 27, 2011.

The portion of the project APE in which there is the potential for the proposed project to cause direct effects includes all locations that could potentially be subject to direct ground-disturbing activities. Project activities are anticipated to include demolition, excavation, pile-driving, cutting and filling, and staging. **Figure 1, contained as part of Exhibit A of *Cultural Resources Methodology* in Attachment A,** illustrates the portion of the APE in which direct effects are possible.

The direct effects portion of the APE encompasses areas directly affected by the construction and operation of the roadway, as follows:

- Rockland County: includes the existing right-of-way of Interstate 87/287 and areas where property would be acquired outside of the right-of-way between the Tappan Zee Bridge and Interchange 10 (Route 9W), including to construct the proposed shared use path, in South Nyack.
- Hudson River: includes the Tappan Zee Bridge and its existing right-of-way, the footprint of the proposed replacement bridge, and the staging/dredging areas at both the Westchester and Rockland landings.
- Westchester County: includes the existing right-of-way of Interstate 87/287 and an area where property would be acquired outside of the right-of-way between the Tappan Zee Bridge to Interchange 9 (Route 9) in Tarrytown.

The APE in which direct effects could occur consists of horizontal and vertical components. The horizontal extent is defined as the footprint of construction activity that would result in ground disturbance or other physical impacts to properties. The vertical extent varies along the 4-mile-long project area, depending on the type of construction activity, for both above-ground and below-ground components.

As discussed above, indirect effects may include the introduction of visual, audible, or atmospheric elements that alter the characteristics of the historic property that qualify it for inclusion in the National Register. The portion of the project APE in which indirect effects could occur is illustrated in **Figure 1, contained as part of Exhibit A of *Cultural Resources Methodology* in Attachment A**.

For work to Interstate 87/287, the APE extends 500 feet from either side of the existing centerline of Interstate 87/287 in order to account for both potential direct and indirect effects resulting from project construction and operation along Interstate 87/287. The APE is more expansive in the area that is within visual range of the Tappan Zee Bridge to encompass potential indirect effects associated with the replacement bridge. The APE for indirect effects extends approximately 1.5 miles south of the existing bridge and approximately 1.2 miles north of the existing bridge in both Rockland and Westchester Counties. The APE for indirect effects considers the topography and the surrounding built environment. It was defined abased on extensive surveys undertaken on both sides of the Hudson River, stretching from Rockland Lake State Park south to Sneden's Landing in Rockland County and from Ossining south to Dobbs Ferry in Westchester County, and visual simulations. The survey and simulations were used to determine the visibility of the existing bridge and to identify an appropriate area in which effects of a magnitude that could adversely affect the National Register eligibility of a historic property may occur. The existing Tappan Zee Bridge can be seen up to approximately five miles to the north and south along

the shorelines depending on weather conditions, but as distance and obstructions increase, the potential for adverse visual, audible, or atmospheric effects decreases.

The APE encapsulates areas that would have the most proximate and unobstructed views to the Project and areas where the replacement bridge could potentially adversely affect the character of setting of historic properties. In Rockland County, the APE includes almost the entire village of Grand View-on-Hudson south of the bridge and areas east of Piermont Avenue in South Nyack north to Memorial Park. Memorial Park projects into the Hudson River and serves as a natural topographic boundary. In Westchester County, the APE encompasses much of the area west of South Broadway in Tarrytown, including the Lyndhurst and Sunnyside National Historic Landmarks, to the Irvington village line. North of the bridge, the landscape is more densely built. Therefore, the APE has been delineated to encompass areas west of River Street/Division Street/Railroad Way up to and including the National Register-listed Tarrytown Lighthouse in Sleepy Hollow, located at the tip of Kingsland Point Park. Kingsland Point Park extends out into the water beyond the vacant General Motors Plant and also serves as a natural topographic boundary. Farther east, the topography and develop obstruct views.

The expanded APE in the area surrounding the Hudson provides sufficient coverage to the north, south, east, and west to account for areas from which the replacement structure may be visible and where potential adverse effects could occur. Beyond the APE, views of the bridge are generally diminished by distance, topography, vegetation and development, and the Replacement Bridge Alternative would not be anticipated to alter the character of setting of historic properties in these areas.

2. STEPS TAKEN TO IDENTIFY HISTORIC PROPERTIES

The methodology used for identifying historic properties in the project APE is described below and described in greater detail in *Cultural Resources Methodology,* included as **Attachment A** to this report.

ARCHAEOLOGICAL RESOURCES

Archaeological Investigations typically proceed in a multi-phase process generally consisting of Phase I (determining the presence of archaeological resources through documentary research and field testing), Phase II (determining their integrity, significance, and S/NR eligibility), and Phase III (planning to avoid or minimize affects or mitigating unavoidable impacts through performance of a data recovery or other form of mitigation). The need for the next phase is dependent upon the results of the preceding phase.

A Phase I Archaeological survey was conducted for the entire terrestrial portion of the APE for direct effects by AECOM Technical Services, Inc. in January 2012 (included as **Attachment C**). The Phase I report provides the results of the following efforts and analyses:

- An overview of the project site's environmental setting;
- The development of prehistoric and historic contexts for the general region including a summary of map documented structures;
- An analysis of various sources of background research in order to identify areas of archaeological potential within the APE;
- Subsurface testing (Phase IB) in the one small area of the terrestrial portion of the APE determined to be sensitive for archaeological resources and analysis of the recovered artifacts;
- Geoarchaeological assessment of submerged landforms beneath the Hudson River's river bottom; and
- Examination of remote sensing data in order to determine the potential for submerged historic resources or potential shipwrecks.

As part of the Phase I study for this project, research was conducted at the New York State Museum (NYSM) and SHPO to identify previously identified archaeological sites located within one mile of the

APE for potential direct effects and previously completed cultural resource surveys for areas in or adjacent to the APE for potential direct effects. In addition, cartographic research and a site walkover survey were conducted to evaluate historic and modern land use factors that may have resulted in ground disturbance and affected potential archaeological resource preservation. For example, areas for which grading and excavation occurred during construction of the Tappan Zee Bridge were determined not to possess archaeological potential. In compliance with applicable standards and guidelines for archaeological surveys, including those promulgated by the SHPO, New York Archaeological Council, and the Secretary of the Interior, Phase I-level field testing was subsequently undertaken in the one small area of the terrestrial portion of the APE determined to possess archaeological sensitivity. Through the excavation of a series of three test pits and analysis of the recovered mixture of historic and modern artifacts, this area of sensitivity was determined to contain no archaeological resources.

The research team obtained information on submerged historic resources, potential shipwrecks, and submerged landforms sensitive for archaeological resources that may be present within the underwater portions of the APE for potential direct effects. The potential for shipwrecks and historic resources was assessed through review of previously conducted surveys, including remote sensing data, such as sidescan sonar, and consultation with staff of the New York State Department of Environmental Conservation (NYSDEC), Columbia University's Lamont-Doherty Earth Observatory (LDEO), and SHPO. The potential for submerged landforms was assessed through background research and the examination of soil borings performed in the APE for potential direct effects. The identification and evaluation of submerged historic resources, potential shipwrecks, and submerged landforms sensitive for archaeological resources that could be affected by the project is ongoing.

As a result of completion of the Phase I survey and examination of the one identified area of archaeological sensitivity, which determined that the area has no archaeological resources, there are no identified archaeological resources within the terrestrial portions of the APE for direct effects. Two classes of potential archaeological resources were identified within the river portion of the APE: a submerged paleo landform that may have been occupied during the prehistoric period and possible historic resources, including shipwrecks, lying on the river bottom. Each class of resource is described below.

Submerged Paleo Landform

Geoarcheology Research Associates (GRA) conducted vibracore sediment sampling of the Hudson River bottom sediments in November 2008. The purpose of the geoarchaeological investigation was to determine the potential for submerged prehistoric archaeological sites to be present in the APE for direct effects. A total of four vibracore sediment samples extending up to 10 feet below the sediment-water interface were collected for this geoarchaeological survey. These sediments were analyzed to determine past environmental conditions that may have supported occupation of the area by prehistoric people. Samples recovered were analyzed for sediment type (e.g., sand, silt, clay, etc.) and presence of faunal material. Radiocarbon dating of samples provided dates within the stratigraphic column. Geotechnical data collected by other recent surveys in the vicinity of the Tappan Zee Bridge was also reviewed by GRA. This information was combined with data collected from GRA's survey, as well as information from previously identified archaeological sites in the area, to help identify environmental conditions during prehistoric times. The presence of oysters within the sediment columns was interpreted as an indication of a time period capable of supporting oyster harvesting by prehistoric peoples.

Based on these data, there is a possibility for the presence of deeply buried *in situ* marsh deposits and underlying river terraces (a submerged paleo landform) approximately 45 to 50 feet below sea level to the north of the bridge. These deposits may contain evidence of prehistoric activity dating to the beginning of the Early Archaic Period or the Paleo-Indian Period. The deposits and terraces occur in the vicinity of the causeway, in an area extending approximately 1,500 feet from the Nyack shore.

Additional tighter interval borings to be monitored by a geoarchaeologist are currently planned for early 2012 to delineate the extent of the landform within the APE and to determine if resources are present that are considered NR eligible. The boring program is currently planned to consist of ten pairs of borings performed in the area of sensitivity, with each pair positioned at an interval of approximately 250 feet and with the borings in each pair positioned approximately 50 feet apart. The portion of each of these borings located between approximately 30 and 50 feet below sea level will be examined, documented, and sampled for microscopic observation, flotation and radiocarbon dating, if appropriate samples are recovered.

Submerged Historic Resources and Potential Shipwrecks

SHPO maintains a database of previously identified shipwrecks located within New York State waters. A review of this database revealed that there were no previously identified shipwrecks currently on file with the SHPO within or immediately adjacent to the APE for direct effects. However, it was also noted that surveys conducted in the 1990s and 2000s may have identified shipwrecks that have not yet been entered into the SHPO database. A review of the surveys conducted in the 1990s and 2000s noted that ten shipwrecks/potential shipwrecks were identified in an area extending 2 miles north and approximately ½ mile south of the Tappan Zee Bridge. Only one of the potential shipwrecks was identified within or directly adjacent to the APE for direct effects; the rest of the potential shipwrecks are outside the APE. These survey reports, which focused on identifying the presence of remotely sensed anomalies (including shipwrecks) on the river bottom, did not provide information on the possible identity of these potential shipwrecks (e.g., ship name, type, period of use, time of loss, etc.).

A survey conducted by LDEO in 2006 identified a total of eight anomalies that may represent shipwreck sites. This survey utilized high resolution acoustic mapping and sediment deposition sampling of the Hudson River Crossing, along with previously collected data from the NYSDEC funded Hudson River Benthic Mapping Project (HRBMP) to identify these potential shipwrecks. One of these potential shipwrecks is located within the APE for direct effects. A side-scan sonar survey conducted by Alpine Ocean Seismic Survey, Inc. (AOSS) in 2009 recorded three anomalies identified as shipwrecks in the vicinity of the Tappan Zee Bridge. The location of one of these shipwrecks corresponds to a potential shipwreck identified in the LDEO survey report; another corresponds to the location of a wreck depicted on a NOAA chart. None of these potential shipwrecks are located within the APE for direct effects. Further information regarding the location of previously identified shipwrecks in the vicinity of the Tappan Zee Bridge was gathered through a review of historic and modern nautical charts prepared by NOAA. None of the shipwrecks recorded on the NOAA charts were located within the APE for direct effects.

In addition to shipwrecks, a small number of other potential archaeological resources were identified on the NOAA charts in the general vicinity of the Tappan Zee Bridge, including docks and ruins, which likely refer to the remains of former docks and/or piers. Features identified as ruins were typically located at the site of former landings, and none of them were identified within or adjacent to the APE for direct effects. Two docks/piers were visible on the western shore of the river in the footprint of or potentially just north of the existing Tappan Zee Bridge on the 1855, 1865, 1902, and 1911 NOAA nautical charts. These two piers appear to have been demolished for construction of the bridge in the 1950s, as they do not appear on maps post-dating its construction. The LDEO survey identified pier remains along the Hudson River shoreline, particularly along the western shore, which appeared to be associated with waterfront house lots. These dock/pier features are not recorded in the archaeological site files of the NYSHPO.

The following is a summary of additional, ongoing efforts to determine the presence or absence of additional submerged historic resources and potential shipwrecks beyond those discussed above in the APE for direct effects. The University of Massachusetts (UMASS) is currently reviewing all available remote sensing data (summarized above) for the APE for direct effects. This data consists of high

resolution single and multibeam sonar data. Criteria for the identification of anomalies in the data that are potential shipwrecks will be developed and applied in the analysis of this data. UMASS will prepare a report in compliance with applicable standards and guidelines detailing the methods and results of this review for submission to the SHPO. In addition, if appropriate, UMASS underwater archaeologists may undertake diving to visually examine any identified submerged historic resources and potential shipwrecks that may be affected by the project to determine their significance and NR eligibility. The scheduling of this examination is dependent upon other project actions.

ARCHITECTURAL RESOURCES

Once the APE was determined, a list of officially recognized architectural resources within the APE was compiled. Architectural resources identified include National Historic Landmarks (NHL) and properties listed on the State and National Registers (S/NR) or determined eligible for such listing. Among the previously recognized historic properties in the APE are Tappan Zee Bridge, which was determined eligible for the National Register (NR) in 2003, and three NHLs, Lyndhurst, Sunnyside, and the Old Croton Aqueduct which are located in Westchester County. Information on resources previously determined eligible for the S/NR were collected from SHPO's inventory of historic properties, housed in Waterford, New York. A list of potential historic resources within the APE was also compiled. These were identified based on field surveys of the APE conducted by architectural historians who meet NPS Professional Qualification Standards for Architectural History, codified under 36 CFR Part 61, at AECOM Technical Services, Inc and undertaken between 2005 and 2010. Additional research including consultation with municipal governments, historical societies, and visits to repositories in Albany, New York City, and Rockland and Westchester Counties was also undertaken. Properties in APE that were over 50 years old and appeared to meet one or more of the National Register criteria but which had not been previously evaluated were identified as potential historic resources. For each of these properties, New York State Building-Structure Inventory forms were completed to document recommendations for National Register eligibility. Consistent with Section 106 and procedures agreed upon by SHPO, FHWA, and NYSDOT, the NYSDOT Office of Environment submitted documentation for properties recommended S/NR eligible and requested SHPO concurrence. The SHPO concurred with the eligibility recommendations for building and structures in the Westchester and Rockland County portions of the APE on November 16, 2011. FHWA reviewed the documentation relating to architectural properties within the APE, as well as the response letter from the SHPO dated November 16, and concurred with the eligibility recommendations for identified architectural properties for the Project (see **Attachment F: Correspondence**).

3. EVALUATION OF PROJECT IMPACT ON IDENTIFIED HISTORIC PROPERTIES

ARCHAEOLOGICAL RESOURCES

As no archaeological resources have been identified on the terrestrial portions of the APE for direct effects, no archaeological resources will be affected in that portion of the APE. Due to the nature of this bridge replacement project, it was determined that there is no potential for indirect or cumulative effects to archaeological resources.

As described above, there is a possibility for the presence of deeply buried *in situ* marsh deposits and underlying river terraces approximately 45 to 50 feet below sea level to the north of the bridge. These deposits may contain evidence of prehistoric activity dating to the beginning of the Early Archaic Period or the Paleo-Indian Period. Subsurface disturbance of this landform, such as that posed by dredging, the driving of support piles, or construction of the replacement bridge could result in adverse effects on archaeological resources, if present.

Further analysis will be undertaken to determine whether submerged S/NR eligible resources are present in the river portion of the APE for direct effects. If submerged resources are identified and determined to be NR eligible, the project may have an adverse effect on those resources as a result of dredging and

construction of the replacement bridge. Consultation with SHPO, and any tribal nations and consulting parties as appropriate would be undertaken to identify measures to avoid, minimize or mitigate any potential adverse effects on eligible resources.

ARCHITECTURAL RESOURCES

Two architectural resources were identified within the portion of the APE in which direct effects could occur, both of which have been determined S/NR-eligible: the Tappan Zee Bridge and the South Nyack Historic District. There are eight architectural resources within the APE for indirect effects in Rockland County and 15 architectural resources within the APE for indirect effects in Westchester County. These resources are described below. These are listed in **Table 1** below and identified in **Figure B-1 through B-5 of Attachment B: Historic Properties Materials**.

Table 1
Architectural Resources within the APE

Ref No.[1]	Name	Location	NRHP Qualifying Characteristics	Effects – Long Span	Effects – Short Span
1	Tappan Zee Bridge (BIN 5516340)	Interstate I-87/287 over the Hudson River	NR Criteria A and C – transportation and engineering features	Demolition and removal	Demolition and removal
Rockland County					
2	South Nyack Historic District*	South Nyack	NR Critera A and C – historic and architectural significance	Demolition and removal of 2 contributing properties	Demolition and removal of 2 contributing properties
3	129 Piermont Avenue*	South Nyack	NR Criterion C – architectural significance	No Adverse Effect	No Adverse Effect
4	135 Piermont Avenue*	South Nyack	NR Criterion C – architectural significance	No Adverse Effect	No Adverse Effect
5	147 Piermont Avenue*	South Nyack	NR Criteria A and C- historic and architectural significance	No Adverse Effect	No Adverse Effect
6	2 Shadyside Avenue*	South Nyack	NR Criterion C – architectural significance	No Adverse Effect	No Adverse Effect
7	10 Ferris Lane*	Orangetown	NR Criterion C – design and Criterion Consideration B - Moved Properties	No Adverse Effect	No Adverse Effect
8	Wayside Chapel**	24 River Road, Grand-View-on-Hudson	NR Criterion C - architecture	No Adverse Effect	No Adverse Effect
9	River Road Historic District*	River Road, Grand-View-on-Hudson	NR Criteria A and C- historic and architectural significance	No Adverse Effect	No Adverse Effect
Westchester County					
10	Tarrytown Lighthouse***	Kingsland Point Park, Route 9, Sleepy Hollow	Maritime history, transportation and architecture	No Adverse Effect	No Adverse Effect
11	Tarrytown Sewage Treatment Plant*	Pierson Park, Tarrytown	NR Criteria A and C- historic and architectural significance	No Adverse Effect	No Adverse Effect
12	Tarrytown Railroad Station	1 Depot Plaza, Tarrytown	NR criteria A and C – transportation and architecture	No Adverse Effect	No Adverse Effect
13	Tappan Landing Historic District*	Tappan Landing Road & North Tappan Road Tarrytown	NR Criteria A and C- historic and architectural significance	No Adverse Effect	No Adverse Effect

Table 1 (cont'd)
Architectural Resources within the APE

Ref No.[1]	Name	Location	NRHP Qualifying Characteristics	Effects – Long Span	Effects – Short Span
14	Washington Irving Gardens*	300 South Broadway, Tarrytown	NR Criteria A and C-historic and architectural significance	No Adverse Effect	No Adverse Effect
15	Old Croton Aqueduct***	Route 9, Tarrytown	History, engineering, and architecture	No Adverse Effect	No Adverse Effect
16	99 White Plains Road*	Tarrytown	NR Criterion C – architectural significance	No Adverse Effect	No Adverse Effect
17	100 White Plains Road*	Tarrytown	NR Criterion C – architectural significance	No Adverse Effect	No Adverse Effect
18	Irving Historic District*	Van Wart & Paulding Avenues, Tarrytown	NR Criteria A and C-historic and architectural significance	No Adverse Effect	No Adverse Effect
19	Hope United Presbyterian Church*	500 South Broadway, Tarrytown	NR Criteria A and C-historic and architectural significance	No Adverse Effect	No Adverse Effect
20	Glenwolde Park Historic District*	Glenwolde Park, Water Street, and Willowbrook Avenue, Tarrytown	NR Criteria A and C-historic and architectural significance	No Adverse Effect	No Adverse Effect
21	Lyndhurst***	635 South Broadway, Tarrytown	Commerce and architecture	No Adverse Effect	No Adverse Effect
22	New County Park	Route 9, Tarrytown	NR Criterion C – architectural significance	No Adverse Effect	No Adverse Effect
23	Sunnyside***	1 West Sunnyside Lane, Tarrytown	Literature	No Adverse Effect	No Adverse Effect
24	South End Historic District*	West side of Route 9, Tarrytown	NR Criteria A and C-historic and architectural significance	No Adverse Effect	No Adverse Effect

Notes:
[1]Corresponds to **Figure B-1 in Appendix B: Historic Properties Materials**.
*Determined National Register of Historic Places-Eligible as part of this project
**Also a contributing resource within S/NR-eligible River Road Historic District, Grand View-on-Hudson, Rockland County
*** Categories of significance are as specified in the NR Nomination Form for the property
NHL: National Historic Landmark.
NR: National Registers of Historic Places.

Potential Direct Effects

There are two historic properties within the Direct APE: the Tappan Zee Bridge, which straddles Westchester and Rockland Counties, and the South Nyack Historic District in Rockland County. No architectural resources are located in the Westchester County portion of the Direct APE.

Tappan Zee Bridge

The Tappan Zee Bridge (NR-eligible) carries the New York State Thruway over the Hudson River from Rockland County to Westchester County (see **Figures B-1 in Attachment B and Figures E-1 and E-2 in Attachment E**). Following the creation of the New York State Thruway Authority (NYSTA) in 1950 and in connection with the establishment of the Federal Interstate Highway System in 1954, the Tappan Zee Bridge was constructed between 1952 and 1955. Captain Emil H. Praeger, U.S. Navy Retired (1882-1973), served as chief engineer for Madigan-Hyland, designers of the bridge. The Tappan Zee Bridge is the longest bridge in the state and one of the longest in the country. It also has the world's ninth longest cantilever span, at 1,212 feet. It was determined eligible for NR listing in 2003 under Criterion A for its significance in the area of transportation and Criterion C for its significance in the area of engineering (see October 27, 2003 SHPO Resource Evaluation in **Attachment F**). Character-defining features identified in the 2003 SHPO resource evaluation include the bridge's unique caisson support system, the length of its cantilever span, and the total bridge length.

Engineering studies prepared for the Tappan Zee Bridge/ I-287 Corridor Project included four options to retain and rehabilitate the existing bridge, but did not recommend rehabilitation as a reasonable alternative for further development. As documented in the *Alternatives Analysis for Rehabilitation and Replacement of the Tappan Zee Bridge Report* (March 2009), deciding factors included engineering performance and the need for substantial modifications to comply with structural integrity and seismic criteria. All rehabilitation options would involve replacement of the existing buoyant foundations, a contributing feature of the National Register eligible bridge, to meet requirements of the seismic criteria.

Although the earlier project was terminated in October 2011, FHWA and the New York State Department of Transportation (NYSDOT) have reviewed the 2009 alternatives analysis report, and determined the conclusions remain valid and pertinent to the TZHRC Project. Based upon review of this alternatives analysis, the SHPO concurred with the finding that rehabilitation of the National Register eligible Tappan Zee bridge is not a viable alternative (see correspondence from NYSDOT and SHPO dated November 18, 2011 in **Attachment F**).

The reuse of the existing Tappan Zee Bridge in tandem with the Replacement Bridge Alternative was also considered. Under the Reuse Alternative, FHWA, New York State Department of Transportation (NYSDOT), and NYSTA would seek a new owner for the existing Tappan Zee Bridge once the Replacement Bridge Alternative is operational. The new owner would be responsible for the future use of the bridge in accordance with federal, state, and local laws, permits, and approvals and would be responsible for the maintenance of the structure. Reuse of the Tappan Zee is not prudent or feasible as upland access would be precluded without an alternative upland right-of-way, retention of the bridge would be considered an obstruction to navigation, and the cost to rehabilitate the existing structure for an alternative use and its continued maintenance would be very high.

Moving the bridge to an alternative location was also considered but would be very difficult. The Tappan Zee Bridge is more than 3 miles long with 198 piers, and the removal and relocation of the bridge intact would be infeasible. Disassembly and reassembly of the structure would also be extremely difficult given the location, length, and age of the Tappan Zee Bridge. Furthermore, the removal of the bridge would likely alter or demolish its causeway foundations, buoyant foundations, and cofferdams, which are contributing elements to the historic integrity of the bridge.

The Replacement Bridge Alternative advanced in the EIS proposes the demolition and removal of the National Register eligible Tappan Zee Bridge, an adverse effect under 36 CFR Part 800.5(a)(1). As summarized above, an analysis of alternatives did not identify a feasible and prudent alternative that would retain the existing bridge without causing adverse effects to the historic structure.

South Nyack Historic District

The NR-eligible South Nyack Historic District is located within the Village of South Nyack in Rockland County. The historic district is characterized by large, Second Empire estates, Queen Anne-style residences, and modest residences built in the Tudor, Colonial Revival, and Craftsman styles. The district encompasses residences on Piermont, Clinton, Cornelison, Gesner, Glen Byron, Mansfield, Smith, and Washington Avenues; Gurnee and Prall Places; South Broadway; Tappan Zee Terrace; and Voorhis Point. The district includes 130 contributing resources and 34 noncontributing resources. It is NR-eligible under Criterion A because of the important role that the community, located along the Hudson River, played in the residential and industrial development of Rockland County and the Nyacks from the early-19th century to the mid-20th century. It is also eligible under Criterion C because it is a cohesive assembly of predominantly residential structures built between 1830 and 1935.

Two contributing properties in the South Nyack Historic District are located within the APE for direct effects: 21 Cornelison Avenue and 78 Smith Avenue (see **Figures B-1 and B-2 in Attachment B and Figures E-7 and E-8 in Attachment E**). The residence at 21 Cornelison is a four-square, hip-roofed

structure built in the early 20th century. The residence at 78 Smith Avenue is a Colonial Revival-style building constructed ca. 1910.

Under the Replacement Bridge Alternative, the South Broadway Bridge over Interstate 87/287 must be lengthened to allow for a northward shift in the highway alignment to meet the new abutments of the Replacement Bridge Alternative as well as to provide for the new shared-use path immediately north of the highway lanes (see **Figures E-7 and E-8 in Attachment E**). NYSDOT and NYSTA would acquire property east of South Broadway to stage the bridge's construction. The structure would be erected at that location and lifted in place when complete. In this manner, NYSDOT and NYSTA could avoid an 18- to 24-month closure of South Broadway. The 21 Cornelison Avenue and 78 Smith Avenue properties would be acquired for this purpose. The structures would be removed, and the properties would be permanently incorporated into the Interstate 87/287 and future South Broadway right-of-way. The property at 21 Cornelison Avenue would be the future location of the shared-use path, the realigned South Broadway Bridge, and landscaped buffer space. The property at 78 Smith Avenue would be the future location of the Replacement Bridge Alternative's shared-use path, a retaining wall, and landscaped buffer space.

Alternatives have been considered to avoid the adverse effects on these structures: the Southerly Alignment in Rockland County Alternative (Replace Tappan Zee Bridge but No South Broadway Bridge Replacement), the Replacement of the South Broadway Bridge at the Same Location Alternative, and the Reconstruction of the South Broadway Bridge to the West Alternative. Under the Southerly Alignment Alternative, Interstate 87/287 would maintain its existing alignment west of and beneath the South Broadway Bridge and would then shift northward to meet the replacement bridge abutments. The Alternative would avoid an adverse effect on the South Nyack Historic District. However, the Alternative would result in substandard roadway features, permanent speed restrictions on Interstate 87/287, and poor connectivity to the shared-use path, and therefore, it is not considered a prudent alternative.

The Replacement of the South Broadway Bridge at the Same Location Alternative would avoid demolition of the 21 Cornelison Avenue property. However, the northward shift of the Interstate 87/287 right-of-way, including the shared-use path and a noise wall, would move the transportation infrastructure much closer to the house on this property and would violate legal light and air requirements for residential structures. NYSDOT and NYSTA could acquire the property and maintain the structure, but it may not be legally inhabitable due to light and air considerations. The removal of the building at 78 Smith Avenue could not be avoided under this alternative; therefore, the Alternative would have an adverse effect on the South Nyack Historic District.

Furthermore, the Replacement of the South Broadway Bridge at the Same Location Alternative would lengthen the South Broadway Bridge at its current location within its existing right-of-way. During the 12-month or longer reconstruction of South Broadway, the bridge would be closed to traffic over Interstate 87/287, and vehicles would be diverted to either Route 9W or Piermont and River Roads (potentially impacting the River Road Historic District). This diversion would inconvenience motorists and increase travel times, vehicle emissions, and noise. It would also substantially impair emergency response for the Village of South Nyack. The modified grade of the new on-line bridge would also require a new 10-foot-tall retaining wall in front of the South Nyack Village Hall, causing an adverse effect on this structure which is also a contributing resource in the South Nyack Historic District. Therefore, the Replacement of the South Broadway Bridge at the Same Location Alternative is not prudent, as it would result in severe social, economic, and environmental impacts, and would not avoid an adverse effect to the South Nyack Historic District.

A third alternative was considered, which is to reconstruct the South Broadway Bridge west of its current alignment. This would avoid the adverse effect on 21 Cornelison Avenue but the property at 78 Smith Avenue would still need to be incorporated into the NYSTA right-of-way and therefore the adverse effect to this property would not be avoided. This alternative would impact the eastbound ramp located at the foot of South Broadway on the north side of Interstate 87/287, requiring its reconfiguration and taking of

additional properties within the South Nyack Historic District, or its permanent closure, which would substantially inhibit traffic flow and access in eastern Rockland County. It would also require the closure of South Broadway for a year during construction, thereby diverting traffic to Route 9W or River Road (potentially impacting the River Road Historic District and impairing emergency response for the Village of South Nyack), and require additional property taking at Elizabeth Place Park. Therefore, this alternative would not avoid all adverse effects on the South Nyack Historic District and could result in the need to acquire additional historic properties to avoid the adverse effect on 78 Smith Avenue.

The removal of the two residences at 21 Cornelison Avenue and 78 Smith Avenue under both the Short Span and Long Span Options would constitute an adverse effect on the South Nyack Historic District.

Measures to Avoid and Minimize Effects

In addition to the properties located in the APE for direct effects that could be directly affected by the project, other historic resources are located outside of the APE for direct effects but in close proximity to possible project construction. In order to avoid accidental damage to adjacent resources as a result of construction activities associated with both the Short Span and Long Span Options, all appropriate resources would be included in a Construction Protection Plan (CPP). The CPP would be prepared in consultation with SHPO, ACHP, consulting parties, and the property owners. The CPP would identify the architectural resources to be included in the plan. It would set forth the specific measures to be used and specifications that would be applied to protect these architectural resources during the construction period. Architectural resources to be included are expected to include properties in the South Nyack Historic District, the River Road Historic District, and 10 Ferris Lane in Rockland County and properties in the Irving Historic District in Westchester County (these properties are described in greater detail below).

Potential Indirect Effects

Twenty-three architectural resources are located within the APE for indirect effects (see **Figure B-1 in Attachment B**). No adverse indirect effects have been identified on architectural resources, as described in greater detail below.

10 Ferris Lane

10 Ferris Lane is located on the east side of Ferris Lane in the Town of Orangetown, immediately south of the Village of South Nyack border and west of the Village of Grand View-on-Hudson in Rockland County. The property is located on a rise approximately 50 feet from the edge of Interstate 87/287 and is screened from Interstate 87/287 by vegetation. The residence on this property was constructed ca. 1870 on a residential section of Broadway, and moved to its current location in the early 20th century. The house has an L-shaped plan with intersecting front gable and side gable sections and is covered in clapboard siding. The east façade has a full-length wooden porch with a central gable-front dormer with multi-pane windows above the porch on the second floor. The north façade has a bay window and decorative embellishment of the gable. A detached frame garage, sheathed in weatherboard, is located north of the residence. The residence at 10 Ferris Lane was determined eligible for listing on the NR under Criteria Consideration B as a moved property, and under Criterion C because it is an example of a turn-of-the-century Queen Anne-style residence.

In the vicinity of Ferris Lane, the proposed Interstate 87/287 roadway under the Long Span Option would be approximately 30 feet higher than existing, with the new roadway located about 10 feet higher than Ferris Lane, rather than in a cut (see **Figure E-8 in Attachment E**). As described above, 10 Ferris Lane was moved to its existing location in the early 20th century. Since the 1950s, the property's setting has included Interstate 87/287, which has extended in front of the property in a cut and with a substantial vegetative buffer to the south. Though separated by the tree buffer located both in the right-of-way and on the historic property itself, the higher roadway (and removal of the vegetation in the highway's right-of-way) would alter the setting of the property. The change would be one in which the historic property is

located at a higher elevation and with the highway beneath it to one in which the highway would extend above the elevation of the roadway on which the house is situated.

Under the Short Span Option, the height of the Interstate 87/287 roadway would increase by approximately 5 feet at the eastern end of the property (see **Figure E-7 in Attachment E**). Proposed mitigation for noise impacts may result in the construction of an approximately 20-foot-tall noise is proposed along the south side of the Interstate 87/287 right-of-way. Under this design option, the noise wall would be introduced as a new element in the setting of the property.

Determined National Register eligible under Criteria Consideration B as a moved property, and Criterion C as an example of a turn-of-the-century Queen Anne-style residence, the setting of 10 Ferris Lane has been compromised by relocation of the structure and by I-87/287, introduced as an intrusion in the property's setting in the 1950s. While the proposed elevation of the highway and removal of vegetation under the Long Span Option, or introduction of a noise wall under the Short Span Option, represent a change in existing conditions, these changes would not alter contributing elements that qualify the property for inclusion in the National Register, and would not adversely affect the property.

River Road Historic District

The River Road Historic District (determined NR-eligible as part of this project) is located in the Village of Grand View-on-Hudson in the Town of Orangetown in Rockland County. The River Road Historic extends approximately 1.5 miles from the Tappan Zee Bridge to the south along both sides of River Road. River Road is a coastal route that overlooks the Hudson River. The west side of the road consists of steep and heavily vegetated slopes, while the east side slopes to the Hudson River. The district consists of a variety of historical resources, including residences, piers, boathouses, bottling plants, and stone quarries. Overall, the district includes 75 contributing resources and 48 non-contributing resources that attained historic and architectural significance between 1732 and 1945. One of the contributing resources—Wayside Chapel at 24 River Road—has been listed on the NR and is significant under Criterion C as a rare example of mid-19th century Picturesque inspired ecclesiastic architecture in the Village of Grand View-on-Hudson. 18 other properties were previously determined eligible for listing on the NR. The residences that flank the east and west sides of River Road date from as early as the 18th century to as late as the 20th century and include a wide range of styles, from Queen Anne, Italianate, Spanish, to the Revival styles of Dutch Colonial and Colonial. As suggested by the village name, the topographical setting provides a panoramic view of the Hudson River to the east. The district was determined eligible under Criterion A because of the role the community played in the development of the area, and under Criterion C because it is a cohesive assembly of predominantly residential structures that overlooks the Hudson River.

The north end of the district lies adjacent to I-87/287 and the approach to the existing Tappan Zee Bridge. Under the Replacement Bridge Alternative, the proposed alignment would continue in proximity to the northern terminus but avoid direct impacts to the district. Under the Short Span Option, the road deck height would increase in elevation by 4-7 feet compared to the existing approach, and under the Long Span Option, the height would increase by approximately 30 feet (see **Figures E-7 and E-8 in Attachment E**).

On the west side of River Road, the parcel closest to the proposed change contains two residential properties, accessed by Bight Lane. The property at 1 River Road, a non-contributing residence within the district boundary, and 3 River Road, a contributing resource set back at the rear of this parcel of land. The structure at 3 River Road, an 18th century Dutch Colonial-style residence, originally stood along the Hudson River, and has been moved twice in its history, most recently in 1953 in association with construction of the existing bridge. Though still near the Hudson River, relocation of the property has resulted in changes in elevation and spatial relationships relative to the Hudson River and other historic properties.

Resources on the east side of River Road are situated in close proximity to the river, and the project would not change this relationship. The Wayside Chapel at 24 River Road (also individually NR listed) and the neighboring residence at 22 River Road, a property contributing to the significance of the River Road Historic District, are located in a cove south of the western bridge approach. Both the Short Span and Long Span Options would introduce a larger bridge structure into the immediate context of the Wayside Chapel and 22 River Road (see **Figure G-2 in Appendix G: Visual Simulations**). However, the setting of these resources already includes the existing bridge approach structure. Under both replacement options the new approach structure, though a taller and thicker structure under the both design options, would be located at a greater distance from these two contributing resources.

The project would not alter the characteristics that qualify the River Road Historic District for inclusion in the National Register, and would have no adverse effects on the district. The Replacement Bridge Alternative does not require the acquisition, removal or demolition of land or contributing resources within the district boundaries. Adjacent to the north end of the district, a proposed change in elevation of up to 30 feet under the Long Span Option and also increased elevation, though to a lesser degree, under the Short Span Option, would represent a change from existing conditions, but would not diminish the integrity of setting for the district as a whole (see **Figure G-1 in Appendix G: Visual Simulations**). Post-dating the district's period of significance, the existing Tappan Zee Bridge and its western approach have been visual elements of the Hudson River viewshed since 1955. When viewed as a single entity, and within the scale of its total expanse, the district would not incur adverse effects to its setting due to the prominence of the existing Tappan Zee Bridge as an element within the viewshed (see **Figures G-1 through G-4 in Appendix G: Visual Simulations**).

South Nyack Historic District

As described above under "Potential Direct Effects," the removal of two contributing properties within the South Nyack Historic District would constitute a direct effect on the South Nyack Historic District. The Tappan Zee Bridge, though visible from the eastern end of the Historic District, does not relate to or contribute to the characteristics that qualify the South Nyack Historic District for inclusion in the National Register. Therefore, the Replacement Bridge Alternative would not diminish the integrity of location, setting, or association of these resources.

Other Architectural Resources

The Replacement Bridge Alternative would not adversely alter the context or setting of other architectural resources in the APE. The Tappan Zee Bridge does not relate or contribute to the characteristics that qualify any of the architectural resources for inclusion in the National Register. These resources have co-existed since the 1950s with Interstate 87/287 and the Tappan Zee Bridge, which at the time introduced new visual and audible elements into the built context of the APE. As such, the project, to be constructed in an alignment close to the existing, would not constitute an adverse visual, atmospheric, or audible effect for these properties or otherwise alter the characteristics that quality these properties for the NR. The project's potential to affect these other architectural resources in the APE for indirect effects is analyzed below.

129 Piermont Avenue

129 Piermont Avenue (determined NR-eligible as part of this project) is located in the Village of South Nyack in Rockland County. The property is located over 4,000 feet north of the Tappan Zee Bridge, which is visible from the property. The structure, constructed in the early 19th century, is a vernacular worker's residence with a small lawn, brick driveway, flagstone path, and mature trees. This structure was determined eligible for listing on the NR under Criterion C as an example of a 19th-century vernacular worker's house.

The Tappan Zee Bridge is visible from the residence at 129 Piermont Avenue. However, the replacement of the bridge would not substantially change the setting of the structure nor would it diminish the integrity of its historic features. The project would have no adverse indirect effects on this historic resource.

135 Piermont Avenue

135 Piermont Avenue (determined NR-eligible as part of this project) is located in the Village of South Nyack in Rockland County. This resource is located over 4,000 feet north of the Tappan Zee Bridge, which is visible from the rear of the property. 135 Piermont Avenue includes a Second Empire-style, 2½-story residence constructed in the 1870s and a 20th-century multi-purpose frame garage/boathouse. The residence at 135 Piermont Avenue is eligible for listing on the NR under Criterion C, as it is an example of a 19th-century Second Empire residence.

The Tappan Zee Bridge is visible from the residence at 135 Piermont Avenue. However, the replacement of the bridge would not substantially change the setting of the structure nor would it diminish the integrity of its historic features. The project would have no adverse indirect effects on this historic resource.

147 Piermont Avenue

147 Piermont Avenue (determined NR-eligible as part of this project) is located in the Village of South Nyack in Rockland County. This resource is located over 4,000 feet north of the Tappan Zee Bridge, which is visible from the rear of the property. 147 Piermont Avenue includes a 2½-story, T-plan, Queen Anne-style residence constructed between the 1880s and 1890s. The residence at 147 Piermont Avenue was determined eligible for listing on the NR under Criterion A because of its association with William Voorhis, a prominent resident of South Nyack during the 19th century who developed lots along Piermont Avenue and had a role in the local shipbuilding industry. The structure also is eligible under Criterion C as an example of a 19th-century eclectic Queen Anne-style residence.

The Tappan Zee Bridge is visible from the residence at 147 Piermont Avenue. However, the replacement of the bridge would not substantially change the setting of the structure nor would it diminish the integrity of its historic features. The project would have no adverse indirect effects on this historic resource.

2 Shadyside Avenue

2 Shadyside Avenue (determined NR-eligible as part of this project) is located south of the intersection of Hillside Avenue (US Route 9 West) and Shadyside Avenue in the Village of South Nyack in Rockland County. The majority of the property is situated within the APE for indirect effects and is approximately 450 feet west of Interstate 87/287. In this area, Interstate 87/287 is located in a cut and screened from the resource by topography, mature vegetation, and residential development. The residence is a 2½-story, T-plan, frame building that rests atop a stone-and-concrete foundation built in the Gothic Revival style. 2 Shadyside Avenue was determined eligible for listing on the NR under Criterion C for its architectural significance, as a good example of a mid-to-late 19th-century residence with Gothic Revival features.

As noted, Interstate 87/287 is situated in a cut in the vicinity of 2 Shadyside Avenue, and is screened from the property by topography, mature vegetation, and residential development. No indirect adverse effects on 2 Shadyside Avenue are anticipated to result from the project.

The Tarrytown Lighthouse

The Tarrytown Lighthouse (S/NR-listed) is located in the Hudson River, south of Kingsland Point Park in the Town of Sleepy Hollow in Westchester County. The lighthouse is approximately 5,000 feet north of the Tappan Zee Bridge and visible from the bridge. The bridge is also visible behind the lighthouse in views south from Kingsland Point Park. The lighthouse was constructed from 1882 to 1883. As the only lighthouse in Westchester County, the structure marked a dangerous area when commerce on the Hudson River was at its peak. The lighthouse is a five-story, steel conical tower with a cellar and lantern deck. Painted white with a black lantern room and a red pier, the tower has eight portholes and eight additional windows. Today, the Tarrytown Lighthouse is the only conical steel lighthouse to be constructed with living quarters and a family station in the lower Hudson region.

The Lighthouse has clear views to the Tappan Zee Bridge and the Hudson River. The Lighthouse is also clearly visible from the Tappan Zee Bridge and from points north of the bridge. The setting of the Lighthouse would change somewhat under both bridge replacement options (see **Figure G-5 of**

Attachment G: Visual Simulations). The replacement bridge would differ in design from the existing Tappan Zee Bridge. However, because the existing bridge does not relate or contribute to the character-defining features of the Lighthouse the change in bridge design would not adversely affect the context of the Tarrytown Lighthouse. Therefore, no adverse indirect effects on the Tarrytown Lighthouse would result from the project.

Tarrytown Sewage Treatment Plant

The Tarrytown Sewage Treatment Plant (determined NR-eligible as part of this project) is located in Pierson Park, on the south side of West Main Street, in the Village of Tarrytown in Westchester County. Constructed in 1940, it currently functions as office space for the Tarrytown Recreation Department. The plant is located approximately 2,500 feet north of Tappan Zee Bridge, and the bridge and is fully visible from the plant. There are two remaining buildings on the plant property. The Administration building is a 1½-story brick building with Colonial Revival-style influences. The structure is capped by a slate-clad hipped roof with a projecting cross gable. The brick Digester building comprises north and south cylindrical digester tanks, connected by a hyphen. The Tarrytown Sewage Treatment Plant was determined eligible for listing on the NR under Criterion A for its associations with development of sewage treatment in Westchester County, and an increasing awareness of the impact of pollution on the Hudson River. It is also significant as a sewer treatment plant partially funded by the PWA during the Great Depression. It is also eligible under Criterion C because it retains integrity as an example of a small-scale, Depression-era, Colonial Revival-style sewage treatment plant constructed in 1940.

The replacement bridge under either option would not constitute an adverse effect on the property, as it would not diminish the integrity of the character-defining features of the resource.

Tarrytown Railroad Station

The Tarrytown Railroad Station (NR-eligible) is located at 1 Depot Plaza in the Village of Tarrytown in Westchester County. In addition to its S/NR eligibility, the train station is designated a local landmark by the Village of Tarrytown. This single-story stone structure was built in 1890 for the Hudson Rail Line and currently is in use by Metro-North Railroad (MNR) as a commuter rail line to New York City. The building was designed in the Richardsonian Romanesque style by Shepley, Rutan, & Coolidge, the firm who succeeded H. H. Richardson after his death in 1886. Richardson had begun a design commission in 1881 for the Boston & Albany Railroad that included the design of over 30 stations. The Tarrytown Railroad Station is located approximately ½ mile north of the bridge. The Tappan Zee Bridge is visible from the train platforms and commuter parking lots. The Building-Structure Inventory form prepared for the station and SHPO's correspondence regarding eligibility does not identify under which National Register criteria the station is eligible.

The project would not block or compromise views that are important to the historic context of the railroad station. The replacement of the river crossing would not affect the character-defining features of the structure. Therefore, the project would have no adverse indirect effect on the Tarrytown Railroad Station.

Tappan Landing Historic District

The Tappan Landing Historic District (determined NR-eligible as part of this project) is located in the Tappan Landing neighborhood in the Village of Tarrytown in Westchester County. The portion of the historic district along the west side of Tappan Landing Road and North Tappan Road is within the APE and is located approximately 450 feet north of Interstate 87/287 and the Tappan Zee Bridge toll plaza. Both roads are curvilinear cul-de-sacs set atop sloping land with clear views of the MNR Hudson Line, the Hudson River, and the Tappan Zee Bridge. The district consists of single family residences constructed during the early 1940s, and includes 20 contributing and 11 non-contributing resources within the APE. These structures represent a wide variety of mid-20th century domestic architectural styles including Colonial Revival, Dutch Colonial Revival, and vernacular saltbox-type cottages. The Tappan Landing Historic District is determined eligible for listing on the National Register under Criterion A because it clearly represents a mid-20th century residential enclave in Tarrytown, and under Criterion C

because it constitutes an architecturally cohesive community of small Colonial Revival-style residences designed to shelter both families and automobiles. The layout of Tappan Landing accentuates the natural beauty of the hillside into which it was constructed while the curvilinear dead-end roads provide glimpses of the Hudson River.

Under the replacement bridge options, the replacement bridge would be located in closer proximity than the existing bridge; however, the setting of the historic district would not be substantially altered. Therefore, the project would have no adverse effect on the Tappan Landing Historic District.

Washington Irving Gardens

Washington Irving Gardens (determined NR-eligible as part of this project) is an apartment complex located at 300 South Broadway (Route 9) in the Village of Tarrytown in Westchester County. Erected in 1929, Washington Irving Gardens was one of the first garden apartments to be constructed in Tarrytown. It exemplified the hallmarks of garden apartment construction including ample landscaping, design that emphasized sunlight and ventilation and close proximity to transit. The apartment building is a brick, six-story, U-plan building in the Colonial style on a four acre lot landscaped with mature trees and shrubs. The building was determined eligible for listing on the NR under Criterion A as a representation of the evolution of garden apartment architecture in Tarrytown in the 1920s and under Criterion C as an example of the Colonial Revival style applied to garden apartment buildings.

Washington Irving Gardens is fully visible from Route 9, but screened from the bridge toll plaza and Interstate 87/287 by residential and commercial development. The proposed project would not diminish the integrity of the resource's setting or otherwise adversely affect the historic character of the property. Therefore, the replacement of the bridge and other infrastructure improvements would have no adverse effect on Washington Irving Gardens.

Old Croton Aqueduct

The Old Croton Aqueduct (SR and NR-listed, NHL) extends north-south through the APE, near Route 9 in Tarrytown in Westchester County. The Croton Aqueduct was constructed in 1837-1842 as an enclosed conduit to carry water from the Croton River (at the New Croton Dam) to New York City. The Aqueduct originally extended 41 miles and includes a number of above grade contributing features including the High Bridge in Manhattan; the Overseer's House and Barn in Dobbs Ferry; and culverts, ventilator shafts, and waste weirs along the length of it. The Aqueduct was taken out of service in the 1960s, and almost the entire southern portion of the Aqueduct in Manhattan south of the High Bridge has been removed. A 26-mile section of the Aqueduct in Westchester County is in use as Old Croton Aqueduct State Park, a linear recreational trail. Two ventilator shafts, numbered Ventilators 16 and 17 on the NR form, are located within the APE. The ventilators are hollow stone cylinders, 10 to 14 feet high, situated above grade and used to regulate air pressure and allow for access into the conduit. Ventilator 16 is located just north of Route 9. Ventilator 17 is located near the estates of Sunnyside and Lyndhurst, on the west side of Route 9 in the southernmost portion of the APE. The Old Croton Aqueduct is considered significant in the areas of Engineering and Urban Planning.

The project would not result in any indirect adverse effects on the below grade aqueduct, not affect the historic character or context of the above ground elements and the above grade recreational trail. Therefore, there would not be any adverse effect to the.

99 White Plains Road

99 White Plains Road (determined NR-eligible as part of this project) is located in the Village of Tarrytown in Westchester County. This resource was formerly known as both 105 White Plains Road and the Goebel Collectors Club. The property abuts the APE for indirect effects and is located approximately 550 feet north of Interstate 87/287. The property is screened by development from Interstate 87/287, which is in a cut. 99 White Plains Road is a brick, two-story, rectangular-plan, Colonial Revival-style building atop a stone foundation. Once a residence, the structure was converted to commercial use in the 1970s. A hipped roof sheathed in slate and metal tops the structure and the roofline is emphasized by a

denticulated cornice. The façade has many embellishments including copper collector boxes with decorative designs, stone belt course, full-height, hipped-roof projecting bays accented by brick quoins, lintels, and a full-height, recessed entry bay set within a stone surround and capped by a denticulated pediment. The former Goebel Collectors Club is a designated a local landmark in the Village of Tarrytown. The structure at 99 White Plains Road is determined eligible for listing on the NR under Criterion C for its architectural significance as an excellent example of a Colonial Revival-style building in Tarrytown.

The structure at 99 White Plains Road is fully visible from grade-level White Plains Road, but is screened by development from Interstate 87/287 which is in a cut. The project would not result in adverse effects to 99 White Plains Road.

100 White Plains Road

100 White Plains Road (determined NR-eligible as part of this project) is located on a large lot dominated by a modern office building in the Village of Tarrytown in Westchester County. This structure is located 400 feet north of Interstate 87/287, and is screened by development and a noise barrier from Interstate 87/287, which is located in a cut. 100 White Plains Road is a two-story, rectangular-plan, Neoclassical-style building constructed circa 1910. Formerly a residence, it has since been converted into an office building. The west, or principal, façade is embellished with Classical detailing. A portico with a denticulated cornice is centered above the principal entry, which consists of wood double doors set within a broken-scroll pediment with supporting pilasters, multi-light transom, and side-lights with circular glass panes. A random-course ashlar masonry stone wall flanks a portion of the northern edge of the property along White Plains Road. The structure at 100 White Plains Road was determined eligible for listing on the NR under Criterion C for its architectural significance as an example of a well-preserved, Neoclassical-style building in Tarrytown. The historic setting of this resource has been compromised by the construction of a modern office building adjacent to the structure; therefore, the NR boundary includes only the building footprint of 100 White Plains Road and the stone wall.

The residence at 100 White Plains Road is fully visible from grade-level White Plains Road, but screened by development and a noise barrier from Interstate 87/287 which is in a cut. The project would not result in adverse effects to 100 White Plains Road.

Irving Historic District

The Irving Historic District (determined NR-eligible as part of this project) is located in the Village of Tarrytown in Westchester County. The historic district consists of Van Wart and Paulding Avenues and is bound on the south by the Kraft and General Motor properties, on the east by South Broadway Route 9), and on the west by the MNR Hudson Line and the Hudson River. The district is located approximately 200 feet south of the Tappan Zee Bridge toll plaza and Interstate 87/287, and is screened from the toll plaza by a noise barrier. Resources in the western end of the district have views toward the railroad right-of-way and the Tappan Zee Bridge. The district consists of a mixed-class community of single- and multi-family residences predominantly constructed during the early 19th and the mid-20th centuries and one intact estate (88 Paulding Avenue). A variety of domestic architectural styles are represented including Greek Revival, Gothic Revival, Colonial Revival, and Italianate. The district includes 19 contributing resources and 5 non-contributing resources. The historic district is determined eligible for listing on the NR under Criterion A as a representation of a mixed-class community from the early 19th to mid-20th century, and under Criterion C because it includes a variety of intact 19th to mid-20th-century residences constructed in a variety of architectural styles. Overall, the historic district visually communicates the history of Irving as a working-class community, surrounded by estate development.

As noted, the Historic District is screened from the toll plaza by an existing noise barrier and vegetation. Therefore, the proposed reconfiguration of the toll plaza is not expected to visually or contextually affect the Historic District. Although some properties within the Irving Historic District have views of the existing Tappan Zee Bridge, the proposed replacement of the bridge would not adversely affect these

resources. The Tappan Zee Bridge does not relate or contribute to the characteristics that qualify the historic district for inclusion in the National Register. The project would be constructed within the existing right-of-way, and as such would not alter the setting of this resource, which overlooks the Hudson River, abutting the Interstate 87/287 right-of-way to the north with intervening vegetation and a noise barrier. Therefore, the project would not have an adverse effect on this resource.

Hope United Presbyterian Church

The Hope United Presbyterian Church (First Korean Methodist Church of New York) (determined NR-eligible as part of this project) is located at 500 South Broadway in the Village of Tarrytown in Westchester County. It is located approximately 500 feet south of Interstate 87/287, but is screened from Interstate 87/287 by residential development and noise barriers. The property consists of the church, attached brick social hall, and a modern frame shed. The church is an L-shaped, 1½-story, Tudor Revival-style structure, built in 1931 and constructed of brick in common bond. Situated southeast of the church is a one-and-a-half story L-plan, Tudor Revival social hall. It is attached to the church by a one-story brick hyphen with a front-gabled slate-covered roof. The property was determined eligible under Criterion C as an example of a Tudor Revival-style ecclesiastical building and social hall in Tarrytown.

As noted, Interstate 87/287 is situated in a shallow cut in the vicinity of the Hope United Presbyterian Church. The church is screened from Interstate 87/287 by residential development and intermittent noise barriers that flank Interstate 87/287 to the south. Therefore, the project would not have an adverse effect on this resource.

Glenwolde Park Historic District

The Glenwolde Park Historic District (determined NR-eligible as part of this project) is located in the Village of Tarrytown in Westchester County. The district is located on the east side of South Broadway (Route 9) south of Sheldon Avenue, approximately 500 feet south of Interstate 87/287. It is screened from Interstate 87/287, which is situated in a shallow cut, by residential development and noise barriers. Similar to many middle class suburbs in the area, Glenwolde Park was developed on the grounds of a mid-19th century estate which was subdivided in response to the expansion of the local economy and increase in housing demand that occurred in the early-20th century. The district consists of detached, early-20th century, single-family residences representing both Tudor Revival and Colonial Revival styles along Glenwolde Park and two units of Tudor Revival-style townhouses located on the west side of Walter Street. The residences are mostly frame buildings with wood clapboard, brick, or stucco cladding. The district contains 10 contributing resources, a contributing road network, and 2 non-contributing resources. The Glenwolde Park Historic District is determined eligible for the NR under Criterion A, as a representation of an early phase in the suburbanization of Westchester County, and under Criterion C because it includes highly intact examples of Tudor Revival and Colonial Revival-style residences.

Because the Glenwolde Park Historic District is located approximately 500 feet south of the highway and is also screened from it by residential development and noise barriers, the project would not result in an adverse effect to the Hope United Presbyterian Church or the Glenwolde Park Historic District.

Lyndhurst

Lyndhurst (NHL, State/National Register-listed), also known as the Jay Gould Estate, is located at 635 South Broadway between Route 9 and the Hudson River in Tarrytown in Westchester County. In addition to being designated a NHL and listed on the State/National Register, Lyndhurst is also designated by the Village of Tarrytown as a local landmark. Lyndhurst is an 80-acre estate located approximately 4,000 feet south of the Tappan Zee Bridge. Designed in 1838 by Alexander Jackson Davis, Lyndhurst became one of Davis' first designs in the Hudson River Gothic style. The original brick and Ossining marble house, now the southern end of the structure, was built for William Paulding, a former Mayor of New York. Davis returned from 1864 to 1865 to enlarge the house for George Merritt, a New York City merchant. After the house was enlarged, Merritt drained 20 acres of the property and constructed a 400-foot-long, U-shaped iron-and-glass greenhouse. This structure burned down in 1880. In 1881, a new greenhouse was

constructed by Lord and Burnham for the new owner Jay Gould (1836–1893). The property also consists of a gardener's cottage and gatehouse at the entrances to the two driveways, a stable and children's playhouse to the southeast of the house, the Laundry/Guest Cottage to the north, the Northwest Cottage, and the Bowling Alley building.

Lyndhurst has views of the Hudson River and the Tappan Zee Bridge. The replacement of the bridge would introduce a Hudson River crossing of a different design into the views from this resource (see **Figure G-6 in Appendix G: Visual Simulations**). However, the replacement bridge would not change aspects of Lyndhurst's setting that contribute to its historic significance nor would it diminish the integrity of the property's significant historic features. Therefore, the project would have no adverse indirect effect on Lyndhurst.

New County Park

New County Park (NR-eligible) is a 37-acre parcel of land situated along the west side of Route 9 between the estates of Sunnyside and Lyndhurst in the Village of Tarrytown, Town of Greenburgh in Westchester County. New County Park appears to have once been three separate estates. Each estate had main houses, outbuildings, and significant landscapes with views of the Hudson River. Although research is currently incomplete, one of the estates was owned by relatives of Washington Irving. Another of the estates, Willowbrook, was reportedly owned by Ambrose C. Kingsland, who served as mayor of New York City and initiated the legislation that led to the creation of Central Park. George Merritt of Lyndhurst also owned some of the property, and all of it once belonged to Anna Gould, who also occupied Lyndhurst. None of the buildings remain on the property. The landscape of these estates—designed by George Merritt—does remain, however, and includes curvilinear roads, specimen trees, rolling lawns, ponds, and retaining walls. The New County Park was determined NR-eligible eligible under Criterion C as it embodies the distinctive characteristics of 19th and 20th century estate development in Tarrytown. New County Park was also determined NR-eligible as part of the South End Historic District (see description below).

The proposed replacement bridge would not alter the setting or historic characteristics of this resource. Views from this location would continue to include the Hudson River and more distant views of the Hudson River crossing, though of a different design. The project would have no adverse indirect effect on the park.

Sunnyside

Sunnyside (NHL, State/National Register-listed), the home of Washington Irving (1783–1859), is located at 1 West Sunnyside Lane along Route 9 in Tarrytown in Westchester County. In addition to being designated a NHL and listed on the State/National Register, Sunnyside is also designated by the Village of Tarrytown as a local landmark. Sunnyside is a 40-acre estate located approximately 1.5 miles south of the Tappan Zee Bridge. Sunnyside (formerly Van Tassel cottage) was originally constructed during the second half of the 17th century. Washington Irving acquired the property in 1835. Irving hired George Harvey, a Boston architect, to modify the Dutch cottage. The gable roof was heightened and covered with red tile. A projected porch was added and all of the gables were crowstepped to imitate the Dutch style. In 1847, Irving made a final addition to his house when he constructed a three-story stone and stuccoed tower at the northeast corner. Irving also created a picturesque landscape with wandering paths, groves and vistas to the Hudson River. After Irving's death, the house remained in his family and retained few changes except for the addition onto the north of the house in 1896. The house was purchased in 1945 by John D. Rockefeller, who helped fund Sleepy Hollow Restorations, the current property owner. Restorations that have occurred include the removal of the 1896 addition and the reconstruction of the kitchen yard.

As described in reference to Lyndhurst, above, the proposed replacement of the bridge crossing would introduce a new element into the view from Sunnyside. However, the replacement bridge would not change aspects of Sunnyside's setting that contribute to its historic significance nor would it diminish the

integrity of the property's significant historic features. Therefore, no adverse indirect effects to Sunnyside would result from the project.

South End Historic District

The South End Historic District (determined NR-eligible as part of this project) is located in the Village of Tarrytown in Westchester County. The historic district is located on the west side of South Broadway (Route 9) and ranges from approximately 3,000 feet to 1½ miles south of the Tappan Zee Bridge and Interstate 87/287. It is situated east of the MNR Hudson Line right-of-way. This area was originally designated a local historic district by the Village of Tarrytown Historic Review Board in 1980. The district includes multiple estates, including Lyndhurst, Sunnyside, and the estates known as Belvedere and Shadowbrook. The Old Croton Aqueduct tunnel extends north-south through the historic district but was not identified as a contributing resource to the district established in 1980. The South End Historic District includes the stone walls along Route 9/South Broadway which are designated as local landmarks by the Village of Tarrytown.

The replacement of the river crossing would change the historic features of the historic district or adversely affect its setting. Therefore, the project would have no adverse effect on the South End Historic District.

4. BASIS FOR RECOMMENDED PROJECT FINDING

FHWA, NYSDOT and NYSTA, in consultation with the SHPO, have applied the Criteria of Adverse Effect (36 CFR 800.5(a)(1)) to identified historic properties within the APE, and find the Project will have an Adverse Effect under the Replacement Bridge Alternative, Long Span and Short Span Options, due to the proposed removal and demolition of the existing Tappan Zee Bridge, and proposed acquisition and removal of two contributing resources within the South Nyack Historic District. The full extent of the Project's effects will be determined following steps to complete the identification of potential submerged archaeological resources within the Hudson River portion of the APE. A Memorandum of Agreement will be developed to resolve adverse effects, as agreed upon through consultation, and to complete steps required to take into account potential effects to as yet unidentified archaeological resources in the Hudson River portion of the APE.

Measures to Avoid or Minimize Effects

In order to avoid inadvertent construction-period effects to historic properties in the immediate vicinity of proposed project construction, a Construction Protection Plan (CPP) is proposed, to be developed in consultation with the SHPO, ACHP, Consulting Parties, and property owners.

Measures to Mitigate Adverse Effects

Measures to mitigate the Project's adverse effects will be included in a Draft Memorandum of Agreement (MOA), to be developed in consultation among the SHPO, FHWA, ACHP, NYSTA, NYSDOT, and Consulting Parties. Potential mitigation measures include: documentation of the Tappan Zee Bridge following Historic American Engineering Record (HAER) standards; production of educational materials interpreting the history and significance of the Tappan Zee Bridge for use by local libraries, historical societies, and educational institutions; and interpretive signage along the proposed shared-use path.

Proposed measures to mitigate adverse effects on the South Nyack Historic District in Rockland County may include: planting vegetation along existing and proposed noise barriers along the western edge of the district;completing Historic American Building Survey (HABS) recordation to document the two contributing resources that would be removed; installation of signage interpreting the history and architecture of the South Nyack Historic District within the District or along the shared-use path that would be constructed along the western edge of the Historic District as part of the project.

5. PUBLIC INVOLVEMENT

To date, NYSDOT has solicited public input concerning the project's effect on historic properties as follows:

- FHWA, NYSDOT, and NYSTA extended invitations to the Tribal Historic Preservation Officers or representatives of federally-recognized Native American tribes with an interest in the geographical area of the Project location. Invitations to participate in Section 106 consultation were also extended to local preservation groups, local planning agencies, and property owners of individually NR eligible and listed properties in the APE.
- A public notice, in English and Spanish, was published in newspapers and on the project website to invite interested members of the public to participate as Section 106 Consulting Parties.
- A Section 106 information table and sign-up location was provided at the October 2011 Environmental Impact Statement (EIS) public scoping meetings held in Tarrytown (Westchester County) and in West Nyack (Rockland County). The scoping presentation also directed interested parties to contact NYSDOT and directed the public to the Section 106 information table and sign-up location.
- 20 individuals and organizations requested Consulting Party status and were approved by FHWA.

  The first of two proposed Section 106 Consulting Parties meetings was held on December 16, 2011.

6. ATTACHMENTS

A. Methodology

- Cultural Resources Methodology
- Exhibit A: Area of Potential Effect (APE) Materials
  - Memorandum on Proposed APE, October 14, 2011
  - Map of Direct and Indirect Areas of Potential Effect

B. Historic Properties Materials

- Figure B-1: Map of Historical Properties within APE
- Figure B-2: North Rockland Map of Historic Properties within APE
- Figure B-3: South Rockland Map of Historic Properties within APE
- Figure B-4: North Westchester Map of Historic Properties within APE
- Figure B-5: South Westchester Map of Historic Properties within APE
- Resource Evaluation (NY SHPO) – Tappan Zee Bridge, October 27, 2003

C. Phase I Archaeological Survey Report

D. Public Involvement and Consulting Party Participation

- List of Section 106 Consulting Parties
- December 16, 2011 Consultation Meeting Agenda and Sign-in Sheet

E. Plans, Profiles, Elevations, Sections for Replacement Bridge Alternative / Long and Short Options

- Figure E-1: Project Location
- Figure E-2: Existing Bridge Plan, Profile, and Photographs
- Figure E-3: Replacement Bridge Alternative
- Figure E-4: Short Span Option – Indicative Plan and Elevation
- Figure E-5: Long Span Option – Indicative Plan and Elevation
- Figure E-6: Approach Spans Options

- Figure E-7: Short Span Option – Rockland County
- Figure E-8: Long Span Option – Rockland County
- Figure E-9: Westchester Landing
- Figure E-10: Main Span Options

F. Correspondence

- Letter of October 17, 2011 from NYSDOT to State Historic Preservation Officer (SHPO), APE Transmittal
- Letters of October 21, 2011 from FHWA to Native American Tribes
- Letter of October 27, 2011 from SHPO to NYSDOT, Concurrence Re Establishment of APE
- Letter of November 8, 2011 from NYSDOT to SHPO, Transmittal of Documentation Package – Architectural Properties
- Letter of November 16, 2011 from SHPO to NYSDOT, Concurrence Re Eligibility Recommendations
- Letter of November 17, 2011 from NYSDOT to FHWA, Section 106 Review / Architectural Properties
- Letter of November 18, 2011 from NYSDOT to SHPO, Section 106 – Replacement Bridge Alternative
- Letter of November 18, 2011 from SHPO to NYSDOT, Concurrence Re Rehabilitation
- Letter of December 21, 2011 from FHWA to NYSDOT, Section 106 Review / Architectural Properties – Concurrence with eligibility recommendations and identified architectural properties within the APE

G. Visual Simulations

- Figure G-1: 3 River Road at Bight Lane, Grand View-on Hudson, Rockland County, contributing resource in NR-eligible River Road Historic District
- Figure G-2: 24 River Road, Grand View-on-Hudson, Rockland County, NR – listed and contributing resource in NR-eligible River Road Historic District.
- Figure G-3: 31 River Road, Grand View-on Hudson, Rockland County, contributing resource in NR-eligible River Road Historic District
- Figure G-4: 74 River Road, Grand View-on Hudson, Rockland County, contributing resource in NR-eligible River Road Historic District
- Figure G-5: Tarrytown Lighthouse, NR-listed, Sleepy Hollow, Westchester County
- Figure G-6: Lyndhurst, NHL, NR-listed, Tarrytown, Westchester County

7. REFERENCES CITED

Alternatives Analysis for Rehabilitation and Replacement of the Tappan Zee Bridge Report, prepared by ARUP, March 2009

Historic Resources Inventory Forms, prepared by AECOM, 2005-2010

Tappan Zee Hudson River Crossing Project, Phase I Archaeological Survey Report, prepared by AKRF, Inc. and AECOM, January 2012

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT
SECTION 106 EFFECT FINDING

ATTACHMENT A:

CULTURAL RESOURCES METHODOLOGY

Methodology
Exhibit A: Area of Potential Effect (APE) Materials

- **Memorandum on Proposed APE, October 14, 2011**
- **Map of Direct and Indirect Areas of Potential Effect**

1-1 INTRODUCTION

The Tappan Zee Hudson River Crossing (the "project") is being undertaken by the Project Sponsors—New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA)—with the Federal Highway Administration (FHWA) serving as the federal lead agency under the National Environmental Policy Act (NEPA). The purpose of the project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The project would address the structural, operational, mobility, safety, and security needs of the Tappan Zee Hudson River Crossing.

FHWA has determined that the project constitutes an undertaking under Section 106 of the National Historic Preservation Act (NHPA) of 1966, established by the Advisory Council on Historic Preservation (ACHP). FHWA is responsible for compliance with Section 106 for this project, and the Project Sponsors, in cooperation with FHWA, will prepare all required analyses.

Implementing regulations for Section 106 require that lead federal agencies take into account the direct, indirect, and cumulative effects of their actions on any historic properties, constituting National Historic Landmarks, National Register-listed, and/or National Register-eligible resources within the area of potential effect (APE) defined for an undertaking.

In accordance with Section 106, Project Sponsors and FHWA will coordinate with the New York State Office of Parks, Recreation and Historic Preservation (NYSHPO) to identify National Historic Landmarks, National Register-listed, and National Register-eligible properties within the APE. In addition, the agencies will coordinate with NYSHPO to determine whether potential cultural resources identified within the APE as part of this project are eligible for listing in the National Register.

If FHWA determines that National Historic Landmarks, National Register-listed, and/or National Register-eligible historic resources would be adversely affected as a result of the undertaking and these effects cannot be avoided, the Project Sponsors and FHWA would collaborate with consulting parties to develop and implement measures to minimize and/or mitigate such effects. Consulting parties generally include NYSHPO, Native American tribes, local governments, individuals and organizations with a demonstrated interest in the undertaking, and the general public.

The agencies identified as participants in the Section 106 process for this project include:

- Project Sponsors (NYSDOT and NYSTA).

- Lead Agency (FHWA).
- Review Agency/Consulting Party (NYSHPO).

The ACHP, which provides guidance and advice concerning the operation of the Section 106 process, may choose to participate in the Section 106 process under the following circumstances:

- An undertaking has substantial impacts on important historic properties.
- An undertaking presents important questions of policy or interpretation.
- An undertaking has the potential for presenting procedural problems, including, but not limited to, disputes among or about consulting parties which ACHP's involvement could help resolve.
- An undertaking presents issues of concern to Native American tribes (36 CFR Part 800, Appendix A).

1-2 DEFINITION OF AREA OF POTENTIAL EFFECT

Section 106 of NHPA requires Federal agencies to take into account the potential effects of their actions on historic properties. A required step in the Section 106 process is determining the Area of Potential Effect (APE) which is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist" (36 CFR §800.16[d]). The APE is influenced by the scale and nature of an undertaking.

The APE has been developed based on proposed work activities and their potential to affect historic properties, including potential direct and indirect effects.

In general, potential effects on historic properties can include both direct physical effects—demolition, alteration, or damage from construction—and indirect effects, such as the isolation of a property from its surrounding environment, or the introduction of visual, audible, or atmospheric (e.g., pollutants) elements that are out of character with a property or that alter its historic setting and context (e.g., contextual effects). Development of the APE for Indirect Effects included field visits to determine locations where prominent views of the existing Tappan Zee Bridge and Hudson River exist and could be obstructed or altered by a replacement bridge.

Adverse effects can occur if a project would cause a change in the quality of a property that qualifies it for inclusion in the National Register of Historic Places.

The APEs for Direct Effects and for Indirect Effects are described in "**Tappan Zee Hudson River Crossing Project, Proposed Area of Potential Effect (APE),"** a Memorandum dated October 14, 2011 and appended as Exhibit A to this document.

1-3 IDENTIFICATION OF HISTORIC PROPERTIES

Identification of historic properties will be undertaken in accordance with Section 106 of the NHPA and NYSDOT/NYSHPO procedures for implementing Section 106. In addition, surveys will be conducted pursuant to the standards of the NYS Education Department (SED) *Cultural Resources Survey Program Work Scope Specifications for Cultural Resource Investigations on NYSDOT Projects* (March 2004).

The SED specifications are designed to assist NYSDOT in meeting its cultural resources compliance needs under Section 106 of the NHPA of 1966 (as amended) for federally sponsored projects and Section 14.09 of Parks, Recreation and Historic Preservation Law of 1980 for state sponsored projects. The March 2004 revised work scope specifications are a result of negotiations between SED, NYSDOT, and the NYSHPO, including those revisions made in January 2001. In January 2001, new Section 106 procedures were established between NYSDOT, NYSHPO, and FHWA based on revised regulations that went into effect in January 2001. As a result, NYSDOT assumed the responsibility for making National Register eligibility recommendations through the SED Cultural Resources Survey Program. The eligibility determinations were previously made by NYSHPO. The new procedures specify review and concurrence by NYSHPO and FHWA with the recommendations presented in the survey reports. The FHWA retains legal responsibility for all Section 106 findings and determinations.

1-3-1 HISTORIC RESOURCES

Historic resources are defined as buildings, structures, sites, objects, and districts that are over 50 years old, possess integrity, and meet the criteria of eligibility for listing in the NR as defined by the National Park Service (NPS).

Project Sponsors, in cooperation with FHWA, have prepared a historic resources survey to identify historic properties and conduct screening according to the standards of Section 106 and the NYS Education Department *Cultural Resources Survey Program Work Scope Specifications for Cultural Resource Investigations on NYSDOT Projects* (March 2004). Research has been conducted at NYSHPO and repositories in Rockland and Westchester Counties to obtain information on previously identified historic resources within the historic resources APE. Field surveys have also been undertaken within the APE to identify potentially National Register-eligible resources.

Four categories of resources have been identified within the historic resources APE. These include:

- National Historic Landmarks (NHLs).
- State and National Register-listed resources (S/NRHP- Listed).
- State and National Register-eligible (S/NRHP-Eligible) resources, including the Tappan Zee Bridge.
- Recommended S/NRHPs - historic resources identified during ongoing field survey and screening that appear to meet the criteria for listing in the NR will be documented on NYSHPO Historic Structure Inventory Forms, submitted to NYSHPO for NR eligibility determinations, and provided to the Consulting Parties.

1-3-1-1 BACKGROUND RESEARCH CONDUCTED TO IDENTIFY HISTORIC RESOURCES

Background research has been conducted at government agencies and public repositories. State and local government agencies were contacted to determine the extent of historic resources in the historic APE. Table 1 provides a list of the types of data gathered from these agencies.

Table 1
Historic Architectural Resources Data on File at State and Local Agencies

Type of Resource	Description
National Historic Landmarks	Buildings, structures, sites, objects, or districts that possess national significance as designated by the National Park Service (NPS). All NHLs are also S/NRHP-listed resources.
S/NRHP-Listed Resources	Buildings, structures, sites, objects, or districts that possess national, state, or local significance and are listed in the S/NRHP, maintained by NYSHPO and NPS.
S/NRHP-Eligible Resources	Same as above, with the exception that NYSHPO has determined resources to be eligible for S/NRHP listing but the resource has not yet been listed.
Locally Designated Landmarks and Historic Districts	Buildings, structures, sites, objects, or districts protected by municipal historic preservation regulations, but not evaluated for designation and/or S/NRHP eligibility by NYSHPO.
Locally Surveyed Historic Architectural Resources	Buildings, structures, sites objects, or districts surveyed by municipalities or preservation organizations, but not evaluated for designation and/or S/NRHP eligibility by local preservation agencies or NYSHPO.

NYSHPO maintains a repository of historic architectural resources information and documentation. Data gathering was conducted at NYSHPO for the following categories of resources:

- NHLs.
- S/NRHP-listed resources.
- S/NRHP-eligible resources.

NHL and S/NRHP nomination forms were obtained for resources in the proposed Indirect APE. For S/NRHP-eligible resources in the proposed APE, the online NYSHPO State Historic Preservation Information Network (SPHINX) database, which is organized by minor civil division (MCD), was consulted for the municipalities in the proposed APE in Rockland and Westchester Counties.

The municipal governments within the proposed historic architectural APE were consulted to determine the extent of their municipal historic preservation regulations, if any. Where applicable, data was obtained on protected historic architectural resources in the proposed APE. Local historical societies, local libraries, municipal historians, and historic preservation organizations were also consulted to gather data on historic architectural resources in the proposed APE.

Research was conducted at several repositories to compile a historic context that focuses on broad themes such as settlement patterns, economic development, development of regional transportation systems, and major events of historic importance. The context enables architectural historians to understand the historic built environment of the Lower Hudson River Valley and the proposed APE as it has changed over time, and provides baseline information to guide survey field work. To compile this context, secondary source research was conducted at a number of repositories, including, but not limited to, Historical Society, Inc. Serving Sleepy Hollow

& Tarrytown, Tarrytown, NY; New York Public Library, New York, NY; Nyack Library, Nyack, NY; State University of New York, Purchase, NY; Warner Library, Tarrytown, NY; Westchester County Archives, Elmsford, NY; and the West Nyack Free Library, West Nyack, NY.

1-3-1-2 HISTORIC RESOURCES SURVEY

A historic architectural resources survey was conducted within the Direct and Indirect APEs in accordance with relevant federal guidelines described above. It was undertaken by architectural historians who meet NPS Professional Qualification Standards for Architectural History, codified under 36 CFR Part 61. The purpose of the survey was to identify significant historic architectural resources over 50 years old within the APEs, and to recommend resources as S/NRHP eligible if they meet the NPS Criteria for Historic Significance and retain integrity.

The survey process consisted of both field work and research. Site visits were made to all historic architectural resources within the APEs, including buildings, structures, sites, objects and districts. Resources were photographed, field notes were prepared, and interviews were conducted with individuals knowledgeable about historic architectural resources within the proposed APE.

Locally designated landmarks and historic districts were identified. Each locally designated landmark within the APE was visited by an architectural historian and evaluated for potential S/NRHP eligibility. Unevaluated historic architectural resources over 50 years old were also identified in the proposed APE. Each resource was evaluated to determine whether it met the criteria for listing in the S/NRHP.

Each potential historic resource within the APE was analyzed according to the themes or patterns of development identified in the historic context. If the potential resource possessed physical or associative characteristics that significantly related it to the historic context and also possessed sufficient integrity to be an intact representative of its property type, it may be considered architecturally significant according to the National Register criteria.

Following the identification of historic architectural resources that appeared to qualify for listing in the S/NRHP within the proposed APE, research was conducted at multiple repositories in Albany, New York City, and Rockland and Westchester Counties as noted above. Information gathered at the repositories has been analyzed and incorporated into both NYSHPO Historic Resource Inventory Forms and Historic and Natural Districts Inventory Forms. A map showing the locations of all historic resources, including S/NRHP recommended historic resources, as well as the Historic Resource Inventory Forms prepared for these properties, will be submitted to NYSHPO and the Consulting Parties.

Properties in the proposed APE that do not appear to qualify for listing in the S/NRHP were also documented during the survey. These included resources over 50 years old that have been altered and generally lack integrity, or are common examples of their type. Information on these properties would be available to NYSHPO if so requested.

1-3-2 ARCHAEOLOGICAL RESOURCES

Archaeological resources are included in the National Park Service's definition of historic resources as buildings, objects, structures, sites, and districts that are over 50

years old, possess integrity, and meet the criteria of eligibility for listing in the National Register. Archaeological resources may date to the prehistoric or historic period and may be located in terrestrial or submerged environments.

Identification of archaeological resources will be undertaken in accordance with Section 106 of the NHPA and NYSDOT/NYSHPO procedures for implementing Section 106. In addition, archaeological assessments and surveys will be conducted pursuant to the standards of the NYS Education Department (SED) *Cultural Resources Survey Program Work Scope Specifications for Cultural Resource Investigations on NYSDOT Projects* (March 2004). The identification of potential shipwrecks within the Hudson River will be undertaken in accordance with the Abandoned Shipwreck Act of 1987 and the corresponding Abandoned Shipwreck Act Guidelines, National Park Service, Federal Register, Vol. 55, no. 3, December 4, 1990.

Archaeological resources are potentially affected by direct impacts from construction activity resulting in disturbance to the ground surface (including submerged ground surfaces) such as excavation, grading, pile-driving, cutting and filling, dredging, as well as staging.

Archaeological investigations typically proceed in a multi-phase process generally consisting of Phase I - determining the presence of archaeological resources, Phase II - determining their integrity, significance, and State or National Register eligibility, and Phase III - mitigating unavoidable impacts through performance of a data recovery or other form of mitigation. The need for the next phase is dependent upon the results of the preceding phase.

Research on previously identified archaeological sites on file at the New York State Museum (NYSM) and NYSHPO located at least one mile to the north and south of the APE for Direct Effects has been completed. Previously identified sites within one-half mile north and south of the APE for Direct Effects have been plotted onto project maps, as these sites share the most relevant geographic and topographic conditions with the corridor. Within the terrestrial portions of the APE, extensive subsurface ground disturbance has been documented through cartographic research and by means of targeted reconnaissance walkover surveys that have been conducted to evaluate historic and modern land use factors that may affect potential archaeological resource preservation. Archival research and historic and modern cartographic research have contributed to the evaluation of the potential for encountering intact archaeological resources within the APE at locations that appear to be undisturbed by historic or modern activities.

Phase I investigations are conducted when a review process has determined that a proposed project will not affect any known or previously identified sites, but is located in an area where insufficient survey has been conducted, and where there is a moderate to high probability that previously unrecorded sites may occur. The goals of the Phase I work need to be flexible to reflect the size of the proposed project and stage of project planning, and can be undertaken in two sub-phases, Phase IA and Phase IB, when appropriate (NYAC 1994). In such cases, the Phase IA survey consists of background documentary and cartographic research, a site disturbance characterization, and a sensitivity assessment, and the Phase IB survey consists of field investigation.

Phase IB testing has already been completed in the only area of the terrestrial portion of the APE determined to possess archaeological potential. No significant resources were identified and no further work will be required in that area. There are two potential archaeological issues within the Hudson River itself:

1. Approximately 1,500 feet of the APE, extending from the Rockland County coastline along the path of the proposed replacement bridge to the east is considered sensitive for the presence of a submerged paleo landform dating to the early prehistoric period. The landform is associated with a peat deposit identified by the geotechnical staff of Mueser Rutledge Consulting Engineers (2007) at a depth of approximately 45 to 50 feet below mean sea level. The sensitivity of the landform has been confirmed by an initial geoarchaeological survey conducted by GRA, Inc. in 2010.

2. Preliminary analysis of multi-beam sonar and other remote sensing data collected several years ago has identified a potential shipwreck on the Hudson River bottom. In addition, based on the identification of this and other potential shipwrecks in the general vicinity, the alignment is considered sensitive for additional ship remains.

An investigation will be completed in the coming months to determine the presence or absence of archaeological resources within the Hudson River portion of the APE. The investigation of the Hudson River will consist of two components.

1-3-2-1 GEOARCHAEOLOGICAL INVESTIGATION

1. A geoarchaeologist will monitor the performance of geotechnical borings in the location sensitive for the submerged paleo landform. The portion of each boring of concern will extend from approximately 40 to 60 feet below sea level.

2. The borings will be visually examined and documented through standard nomenclature and photography by the geoarchaeologist. The geoarchaeologist will also collect any observed anthropogenic deposits and soil samples.

3. The soil samples will be subjected to appropriate laboratory analyses. Findings will be summarized and any artifacts, fauna or flora specimens will be recorded, cataloged, photographed, and analyzed.

4. The significance and potential S/NRHP eligibility of any identified resources will be evaluated in consultation with NYSHPO. No additional testing or mitigation will be proposed given the inaccessibility of the potential resource.

1-3-2-2 POTENTIAL SHIPWRECK/HISTORIC RESOURCE EVALUATION

1. Information about known shipwreck sites and historic resources in the project vicinity has already been obtained by researchers and additional materials will be collected from archival and on-line sources. These may include the site inventories of the NYSHPO, the NYSM, local city and regional public libraries, shipwreck databases (including, but not limited to, the Northern Shipwrecks database, the automated wreck and obstruction information system, and the U.S. Navy's computer based shipwreck database) and other repositories of archaeological and historical site data. The effort will include a thorough review of the archaeological literature and reports, appropriate town records, early USGS topographic quadrangles and other appropriate historic maps.

2. A qualified maritime archaeologist will review all previously collected remote sensing data covering the project corridor. This data consists of multi and single-beam sonar data, sub-bottom profiling, side-scan sonar, and various soil sampling and is currently housed at a number of locations including the New York State Department of Environmental Conservation, Lamont Doherty Earth Observatory, and consultants to the above. This analysis will be completed in consultation with the appropriate involved agencies and NYSHPO.

3. If deemed necessary, a visual inspection of any targets identified through remote sensing data analysis that may be shipwrecks or other submerged, historic resources will be ground truthed by divers. One target has already been identified as a potential shipwreck and requires verification.

4. The significance and potential S/NRHP eligibility of any identified resources will be evaluated in consultation with the appropriate involved agencies and NYSHPO. Recommendations will be made for any additional survey if required.

1-4 EVALUATION OF EFFECTS

Section 106 requires that Project Sponsors, in cooperation with FHWA, assess the direct and indirect effects of feasible alternatives on historic resources. The Criteria of Adverse Effects in Table 2 will be applied by Project Sponsors, in cooperation with FHWA, to determine whether historic resources would be adversely affected by the proposed project alternatives. For those historic resources that would be adversely affected by the preferred alternative, avoidance of adverse effects will be explored by Project Sponsors and FHWA.

Table 2
Criteria of Adverse Effects

Criteria of an Adverse Effect
"An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of an historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative." *Source: (36 CFR 800.5[a][1]).*
Examples of Adverse Effects
Adverse effects on historic properties include, but are not limited to: 1. Physical destruction of or damage to all or part of the property; 2. Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (36 CFR Part 68) and applicable guidelines; 3. Removal of the property from its historic location; 4. Change of the character of the property's use or physical features within the property's setting that contribute to its historic significance; 5. Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features; 6. Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; 7. Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance." *Source: (36 CFR 800.5[a][2]).*

1-5 MITIGATION

Project Sponsors, in cooperation with FHWA, will consult with NYSHPO, the Consulting Parties, and ACHP as appropriate to develop mitigation measures for adverse effects. Mitigation measures will be set forth in a Section 106 Agreement to be executed among the Project Sponsors, FHWA, NYSHPO, ACHP as appropriate, and any involved Consulting Parties.

Exhibit A

Tappan Zee Hudson River Crossing Project
Proposed Area of Potential Effect (APE)
October 14, 2011

I General Project Description

The Tappan Zee Hudson River Crossing ("Project") is being undertaken by the Project Sponsors – New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA) –with the Federal Highway Administration (FHWA), serving as the federal lead agency under the National Environmental Policy Act (NEPA). The purpose of the project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The project would address the structural, operational, mobility, safety, and security needs of the Tappan Zee Hudson River Crossing.

The Environmental Impact Statement (EIS) will consider a Replacement Bridge Alternative. The existing and proposed replacement bridge are 3.1 miles in length, and the tie-in work in Rockland and Westchester Counties will be limited to the minimum work necessary to match existing highway geometry at the landings. The project limits would be approximately 4 miles in total, from the South Broadway Bridge in South Nyack (Rockland County) to the Broadway Bridge in Tarrytown (Westchester County). The Project will not require alteration of existing interchanges or other highway features beyond the project limits.

An EIS will be prepared in accordance with NEPA. The analyses anticipate an Estimated Time of Completion between 2017 and 2019. Two alternatives will be evaluated in the EIS, the No Build Alternative and the Replacement Bridge Alternative. To provide flexibility in the future design of the replacement bridge, two options will be considered. Each alternative is briefly discussed below:

- No Build Alternative – The No Build Alternative would retain the existing Tappan Zee Bridge in its current configuration with ongoing maintenance, as practicable, to ensure its continued safe use by the traveling public. However, given the age of the bridge and its vulnerabilities in extreme events, it is possible that the crossing could be closed altogether at some point in the future. Although the No Build Alternative does not meet the project's purpose and need, NEPA requires it be evaluated in the EIS. The No Build Alternative also serves as the baseline condition against which the potential benefits and impacts of the Replacement Bridge Alternative are evaluated.
- Replacement Bridge Alternative – There are two options for the Replacement Bridge Alternative that would meet the structural and operational requirements of a new crossing. These options differ in two basic ways: 1) the distance between their piers (short vs. long); and 2) the potential number of levels of bridge operations (single vs. dual). These options—Short Span and Long Span—are described below.
    - The Replacement Bridge Alternative—Short Span Option would be two single-level structures separated by a 42-foot gap at their main spans. Under typical operation, each structure would have four traffic lanes and wide shoulders to facilitate emergency vehicle access. The north bridge structure would serve westbound traffic, and the south bridge structure would serve eastbound traffic. A bicycle/pedestrian path would be

provided on the north bridge structure. The north bridge structure would be 96 feet wide and the south bridge structure would be 82 feet wide.

The Short Span option would not preclude future transit service across the Tappan Zee Hudson River crossing.

- The Replacement Bridge Alternative—Long Span Option would be two new truss bridges with two levels each. The dual structures would be separated by a minimum gap of approximately 42 feet at the main span. The northernmost structure would be 96 feet wide. Under normal operations, it would support four westbound lanes and a shared-use (bicycle and pedestrian) path on the upper level. The southernmost structure would be 82 feet wide, and under normal operations, it would support four eastbound lanes. Both structures would include wide shoulders to facilitate emergency access.

  The Long Span option would not preclude future transit service across the Tappan Zee Hudson River crossing.

Both Replacement Bridge Alternative options would result in removal of the existing Tappan Zee Bridge upon completion of the new river crossings.

II Development of the Area of Potential Effect

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the potential effects of their actions on historic properties. A required step in the Section 106 process is determining the Area of Potential Effect (APE) which is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist" (36 CFR § 800.16[d]). The APE is influenced by the scale and nature of an undertaking.

The APE has been developed based on proposed work activities and their potential to affect historic properties, including potential direct and indirect effects, based on information available at this time.

In general, potential effects on historic properties can include both direct physical effects—demolition, alteration, or damage from construction—and indirect effects, such as the isolation of a property from its surrounding environment, or the introduction of visual, audible, or atmospheric (e.g., pollutants) elements that are out of character with a property or that alter its historic setting and context (e.g., contextual effects). Adverse effects can occur if a project would cause a change in the quality of a property that qualifies it for inclusion in the National Register of Historic Places.

The proposed direct and indirect APEs are discussed in greater detail below and are depicted in Figure 1.

III APE for Direct Effects

As discussed above, direct effects may include physical damage or destruction of a resource or to its setting. The proposed APE for Direct Effects includes all locations that could potentially be subject to direct ground disturbing activities. Project activities are anticipated to include demolition, excavation, pile-driving, geological borings, cutting and filling, as well as staging. Figure 1 presents the proposed APE for Direct Effects.

The proposed APE for Direct Effects has been designed to encompass areas directly affected by the construction and operation of the roadway, as follows:

- Rockland County – includes the existing right-of-way (ROW) of the Thruway between the Tappan Zee Bridge and the South Nyack Bridge in South Nyack.

- Hudson River – includes the Tappan Zee Bridge and its existing ROW, the footprint of the proposed replacement bridge, and the staging/dredging areas at both the Westchester and Rockland landings.

- Westchester County – includes the existing ROW of the Thruway between the Tappan Zee Bridge to the Broadway Bridge in Tarrytown.

The proposed APE for Direct Effects consists of horizontal and vertical components. The horizontal extent of the APE is defined as the footprint of construction activity that would result in ground disturbance or other physical impacts to properties. The vertical extent of the APE varies along the 4 mile project area, depending on the type of construction activity, for both above-ground and below-ground components.

IV APE for Indirect Effects

As discussed above, indirect effects may include isolation of a property from its surrounding environment, or the introduction of visual, audible, or atmospheric (e.g., pollutants) elements that are out of character with a property or that alter its historic setting and context. The APE for Indirect Effects was developed to encompass any potential indirect effects resulting from proposed Project construction activities, such as noise, vibration, and changes in visual qualities and setting. Figure 1 presents the proposed APE for Indirect Effects.

For work to the Thruway, the proposed APE for Indirect Effects extends 500 feet from the either side of the existing centerline of the Thruway. The proposed APE for Indirect Effects is more expansive in the area that is within visual range of the Tappan Zee Bridge to encompass potential visual and audible impacts associated with construction of the replacement bridge. The APE takes into consideration topography and the surrounding built environment. The following points explain the expansion of the APE in the area surrounding the river:

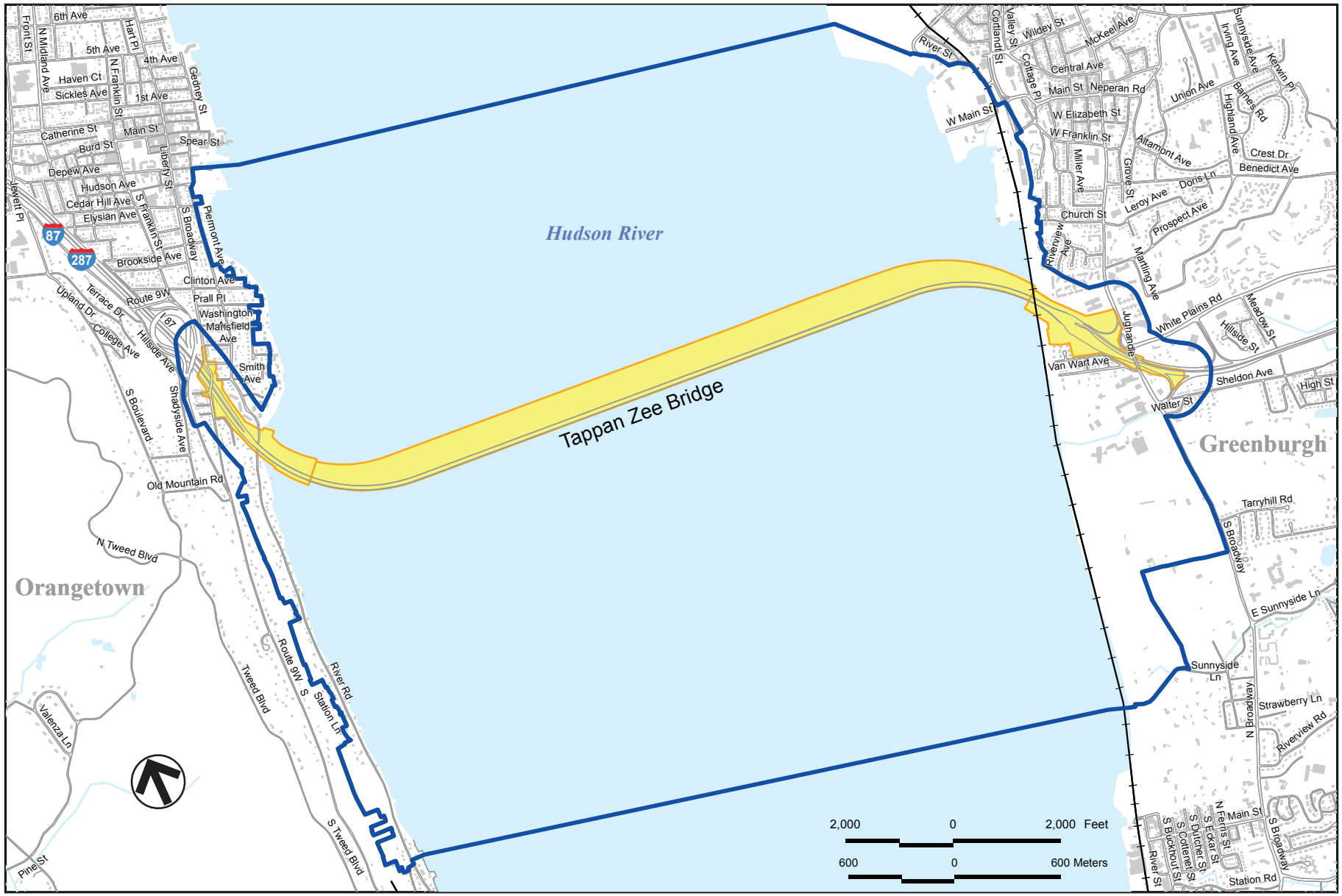
The proposed expanded APE for Indirect Effects associated with the replacement of the Tappan Zee Bridge incorporates areas from which the existing Tappan Zee Bridge and Hudson River are clearly or partially visible, and where the replacement bridge, proposed north of the existing bridge, has the potential to cause indirect alterations in the character or setting of historic properties in these areas. It is anticipated that the replacement bridge would be constructed slightly north of the existing bridge, and would tie into the existing Thruway alignment in Rockland and Westchester Counties. The APE also provides sufficient coverage to the north, south, east, and west to account for areas from which the replacement structure may be visible.

V Project Design Changes and the APE

Any changes in project design or scope that may occur as the Project moves forward may require that the APEs be updated and/or revised accordingly. For example, as construction

staging areas (in addition to those already anticipated adjacent to the landings of the Tappan Zee Bridge on the east and west shores of the Hudson River) are identified in the future, the APEs would be modified as appropriate in consultation with NYSHPO to incorporate these locations.

10.14.11



Direct Effect Area of Potential Effect (APE)

Indirect Effect Area of Potential Effect (APE)

Figure 1

TAPPAN ZEE HUDSON RIVER CROSSING

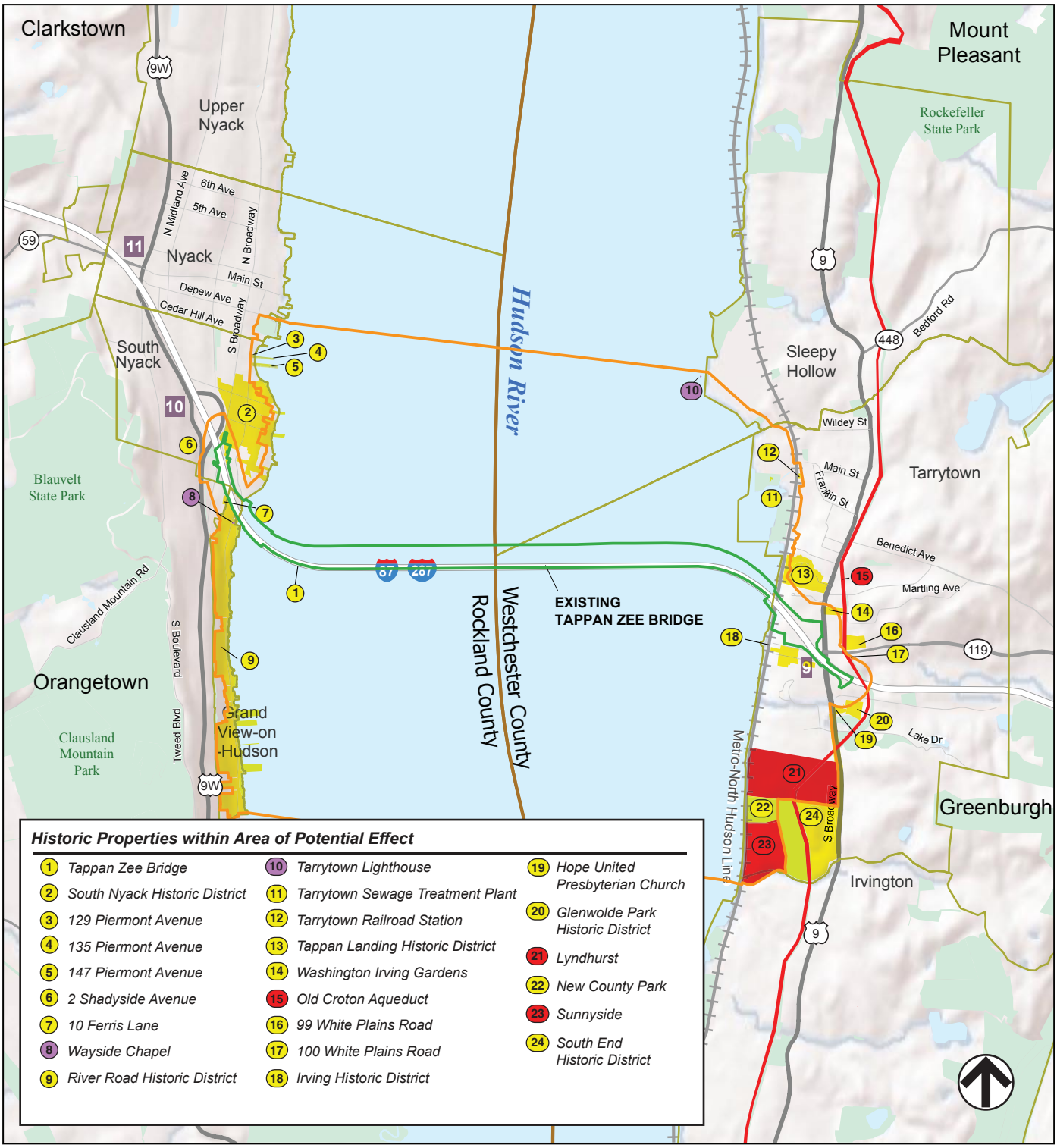
Direct and Indirect Effects APEs

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT
SECTION 106 EFFECT FINDING

ATTACHMENT B:

HISTORIC PROPERTIES MATERIALS

1.17.12



14 Interchange Number

87 Interstate Highway

9W U.S. Highway

59 State Highway

Historic Properties

Direct Effect Area of Potential Effect (APE)

Indirect Effect Area of Potential Effect (APE)

NHL

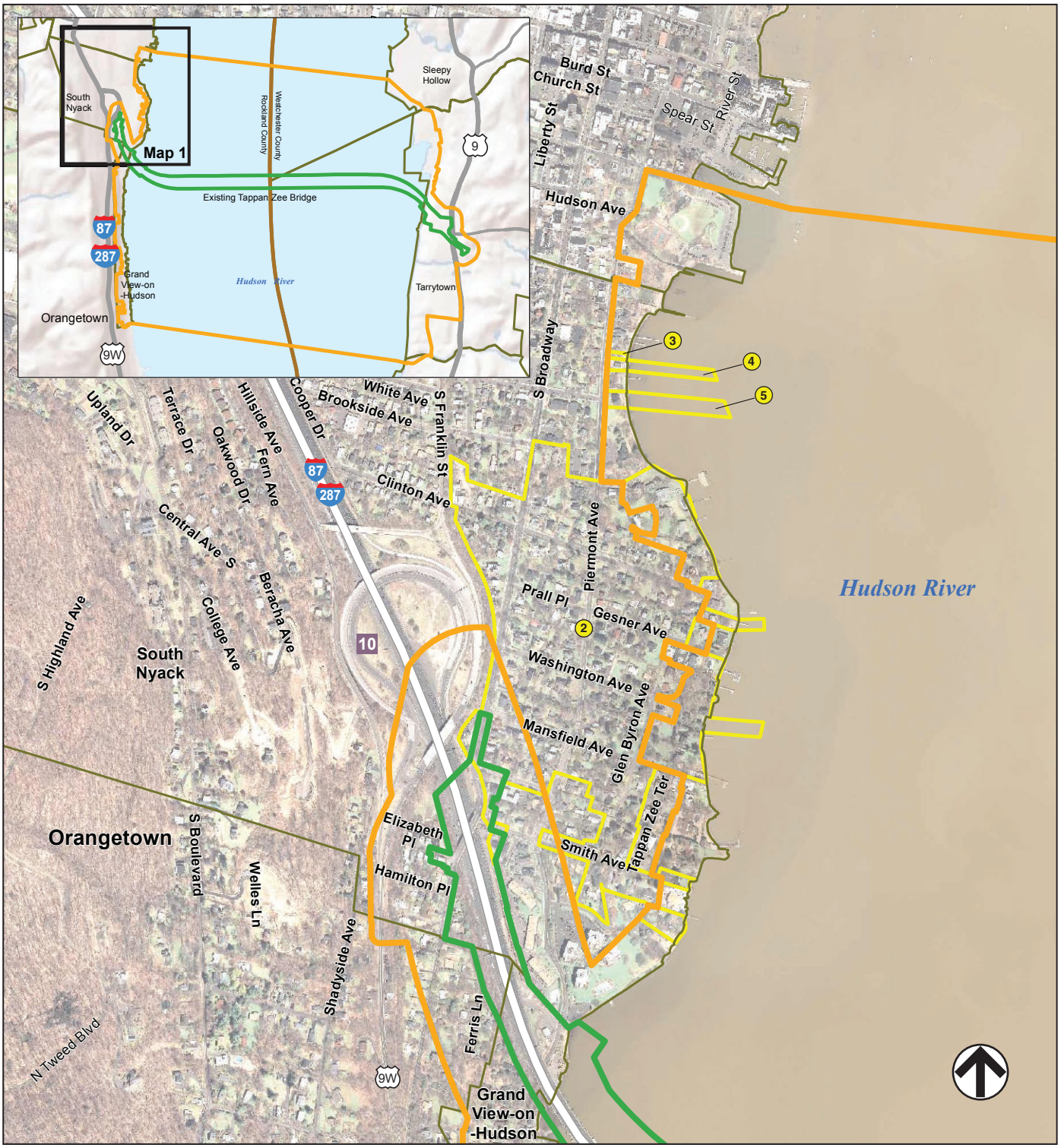
S/NRHP Listed

S/NRHP Eligible

TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

Figure B-1
Architectural Resources in APE

1.17.12



Direct Effect Area of Potential Effect (APE)

Indirect Effect Area of Potential Effect (APE)

S/NRHP Eligible

Historic Properties within Area of Potential Effect – Map 1

2 *South Nyack Historic District*

3 *129 Piermont Avenue*

4 *135 Piermont Avenue*

5 *147 Piermont Avenue*

0 1500 FEET

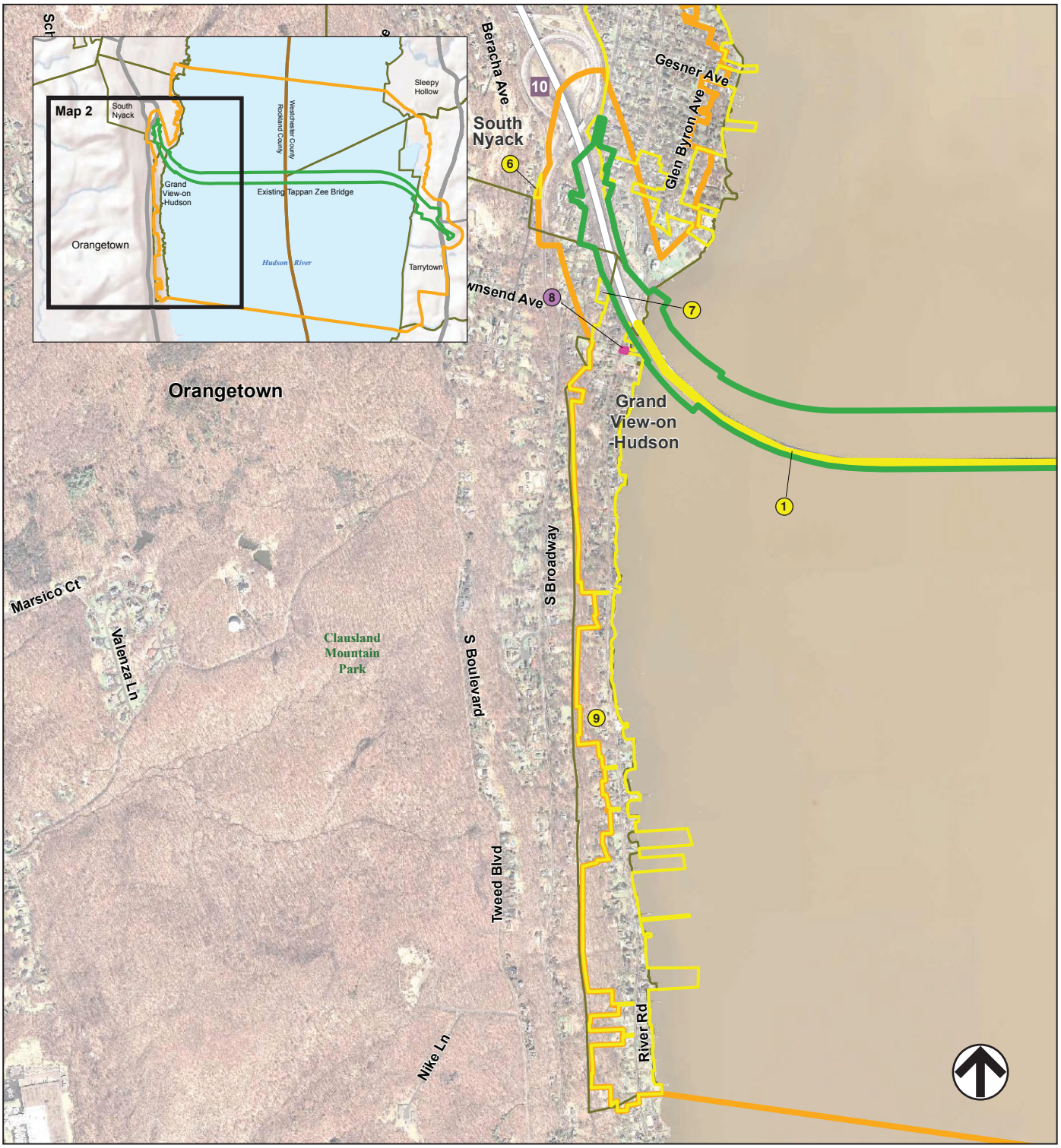
SCALE

Figure B-2

Architectural Resources in APE: Detail of Rockland County North

TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

1.17.12



- Direct Effect Area of Potential Effect (APE)
- Indirect Effect Area of Potential Effect (APE)
- S/NRHP Listed
- S/NRHP Eligible

Historic Properties within Area of Potential Effect – Map 2

1. *Tappan Zee Bridge*
6. *2 Shadyside Avenue*
7. *10 Ferris Lane*
8. *Wayside Chapel*
9. *River Road Historic District*

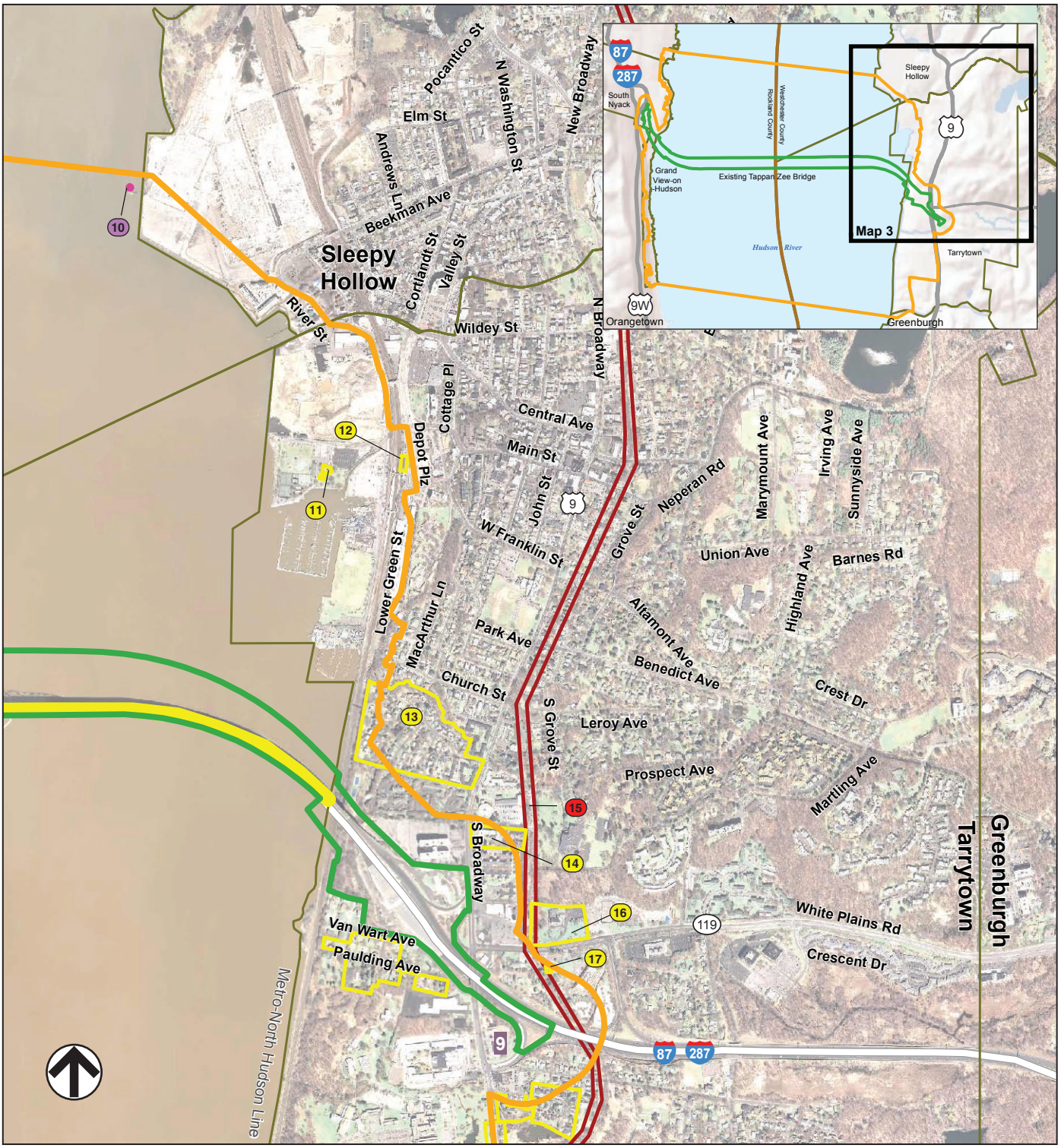
0 2000 FEET
SCALE

Figure B-3

Architectural Resources in APE: Detail of Rockland County South

TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

1.17.12



Direct Effect Area of Potential Effect (APE)

Indirect Effect Area of Potential Effect (APE)

NHL

S/NRHP Listed

S/NRHP Eligible

Historic Properties within Area of Potential Effect – Map 3

10 *Tarrytown Lighthouse*

11 *Tarrytown Sewage Treatment Plant*

12 *Tarrytown Railroad Station*

13 *Tappan Landing Historic District*

14 *Washington Irving Gardens*

15 *Old Croton Aqueduct*

16 *99 White Plains Road*

17 *100 White Plains Road*

0 2000 FEET

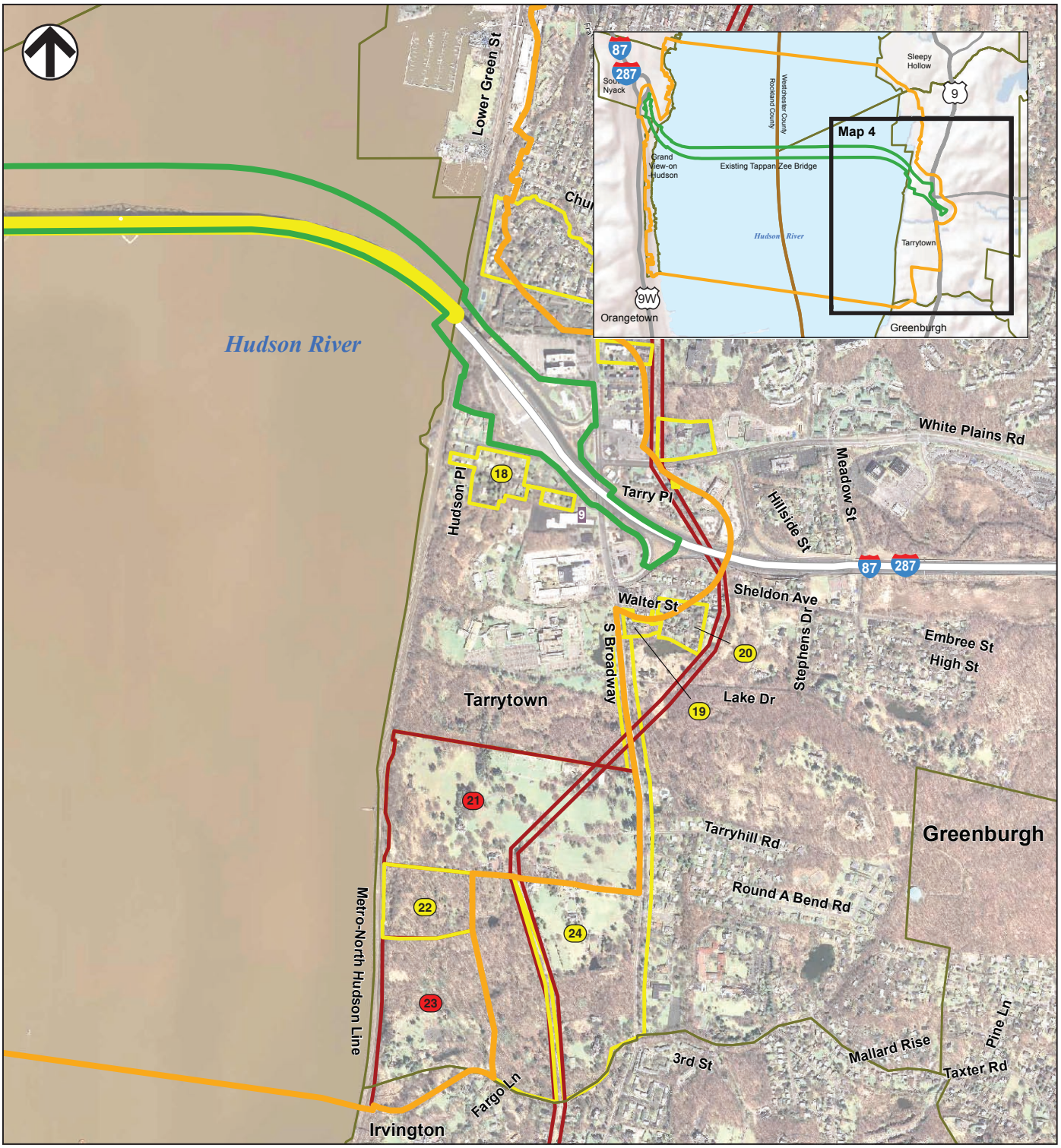
SCALE

Figure B-4

Architectural Resources in APE: Detail of Westchester County North

TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

1.17.12



Direct Effect Area of Potential Effect (APE)

Indirect Effect Area of Potential Effect (APE)

NHL

S/NRHP Listed

S/NRHP Eligible

Historic Properties within Area of Potential Effect – Map 4

18 *Irving Historic District*

19 *Hope United Presbyterian Church*

20 *Glenwolde Park Historic District*

21 *Lyndhurst*

22 *New County Park*

23 *Sunnyside*

24 *South End Historic District*

0 2000 FEET

SCALE

Figure B-5

Architectural Resources in APE: Detail of Westchester County South

TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

DEIS appendices - App. E - Sec. 106 consultations
Sec. 106 correspondence

New York State Office of Parks, Recreation and Historic Preservation
Historic Preservation Field Services Bureau
Peebles Island, PO Box 189, Waterford, New York 12188-0189 518-237-8643

NEW YORK STATE
Bernadette Castro
Commissioner

October 30, 2003

Christopher A. Waite
Executive Project Manager
Tappan Zee Bridge/I-287 Environmental Review
New York State Thruway Authority
200 Southern Boulevard
Albany, NY 12209

Re: FHWA/FTA/NR/NYSTA
Tappan Zee Bridge/I-287 Corridor Project,
Rockland and Westchester Counties
03R00385

Dear Mr. Waite:

Thank you for sending the materials about the history of the Tappan Zee Bridge. We are commenting in accordance with Section 106 of the National Historic Preservation Act of 1966 and the relevant implementing regulations. .

It is the SHPO's opinion that the Tappan Zee Bridge is eligible for listing on the State and National Registers of Historic Places. Please see the attached "Resource Evaluation."

We look forward to continuing consultation on the project. It is my understanding that our director, Ruth Pierpont, and head of our technical unit, Julian Adams, will continue to be the principal contacts here regarding our role in the project. If you have any questions, please call me at (518) 237-8643, extension 3264.

Sincerely,

Peter Shaver

Peter D. Shaver
Historic Preservation
Progam Analyst

RECEIVED
NOV 04 2003
Tappan Zee Bridge / I-287
Environmental Review Process

RESOURCE EVALUATION

Date:	October 27, 2003	Staff:	Peter Shaver
Property:	Tappan Zee Bridge	MCD:	Tarrytown, Grand View
Address:	NYS Thruway	County:	Westchester, Rockland
Project Ref. No.:	**03PR00385**	USN:	08748.000028, 11950.000388

I. ☐ Property is individually listed on SR/NR :

Name of listing :

☐ Property is a contributing component of a SR/NR district:

Name of District:

II. ☑ Property meets eligibility criteria

☐ Property contributes to a district which appears to meet eligibility criteria.

Pre SRB: ☐ Post SRB: ☐ SRB Date

Criteria for inclusion in the National Register.

A ☑ **Associated** with events that have made a significant contribution to the broad patterns of our history;

B ☐ **Associated** with the lives of persons significant in our past;

C ☑ Embodies the distinctive characteristics of a type, period or method of construction; or represents the work of a master; or possess high artistic values; or represents a significant and distinguishable entity whose component may lack individual distinction;

D ☐ **Have** yielded, or may be likely to yield information important in prehistory or history.

STATEMENT OF SIGNIFICANCE:

Based on the information provided, it is the opinion of the State Historic Preservation Office that the Tappan Zee Bridge is significant in the areas of transportation and engineering as one of the state's most important bridges. Built between 1952 and 1955, the 3.2-mile long highway bridge has a unique caisson system supporting the piers and deck. It is the longest bridge in the state and one of the longest in the country, as well as having the world's ninth longest cantilever span, at 1,212 feet. The bridge is an essential component of the NYS Thruway system, with 135,000 vehicles crossing the bridge daily to and from the New York Metropolitan area. The bridge has received minor modifications since 1955, including the replacement of the concrete deck.

If you have any questions concerning this Determination of Eligibility, please call Peter Shaver at 518-237-8643, ext 3264

RECEIVED

NOV 04 2003

Tappan Zee Bridge / I-287
Environmental Review Process

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT
SECTION 106 EFFECT FINDING

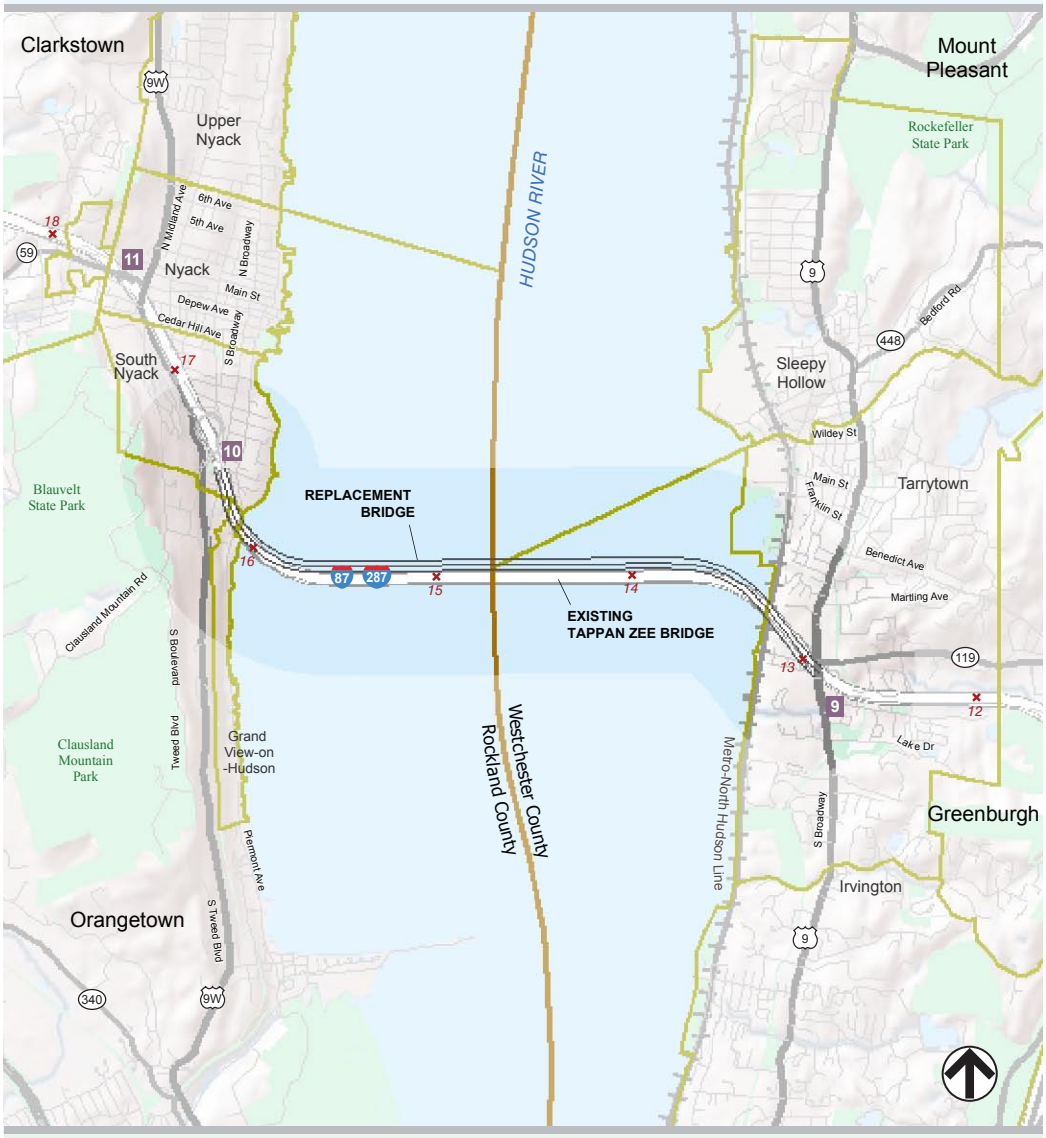
ATTACHMENT C:

PHASE 1A ARCHAEOLOGICAL SURVEY REPORT

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT

Phase I Archaeological Survey Report

Rockland and Westchester Counties, New York



Federal Lead Agency: Federal Highway Administration

Joint Lead Agencies: New York State Department of Transportation and New York State Thruway Authority

January 2012

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT
PHASE I ARCHAEOLOGICAL SURVEY REPORT

Note on this report

This Phase I Archaeological Survey report is a redaction of the Phase I report prepared in March 2011 by AECOM Technical Services, Inc., for the Tappan Zee Bridge / I-287 Corridor Project, the predecessor to the current project. The AECOM Phase I report covered a 30-mile corridor extending from I-87/I-287 interchange in Rockland County to the I-95/I-287 intersection in Westchester County and included a number of transit alternatives. The AECOM Phase I report was prepared for the following project sponsors: NYSDOT, NYSTA, Metropolitan Transportation Authority/Metro-North Railroad, FHWA, and the Federal Transit Administration. In October 2011 the Tappan Zee Bridge / I-287 Corridor Project was formally rescinded and a new Notice of Intent was published for the current Tappan Zee Hudson River Crossing Project, which consists of a bridge replacement project with a greatly reduced study area. This Phase I Archaeological Survey Report contains those portions of the March 2011 AECOM report that apply to the Tappan Zee Hudson River Crossing Project. In addition, this report retains references specific to the rescinded Tappan Zee I-287 Corridor Project that are not relevant to the current analysis. As a result, any such references to the project description, scope, alignment, or impacts, as well as project area boundaries on the included figures, have been superseded by documentation for the current project, included in the body of the Draft Environmental Impact Statement (DEIS). Please see Chapter 10 of the DEIS for a description of efforts to identify and assess effects on archaeological resources within the area of potential effects for the current project.

Project Location:	Rockland and Westchester Counties, New York
Federal Lead Agency:	Federal Highway Administration
Federal Lead Agency Contact:	John Burns
Joint Lead Agencies	New York State Department of Transportation New York State Thruway Authority
Preparers:	AKRF, Inc. 440 Park Avenue South New York, NY 10016
	AECOM Technical Services, Inc. One World Financial Center 200 Liberty Street New York, NY 10281
Submission Date	January 2012

MANAGEMENT SUMMARY

A. DOT PIN #8TZ1.03.101

B. DOT Project Type and funding: Not known

C. Cultural resource survey type: Phase I archaeological survey

D. LOCATION INFORMATION
Route I-287 from S. Nyack in Rockland County to Tarrytown in Westchester County.
Minor Civil Divisions:

Rockland County	Town of Orangetown, Village of South Nyack (MCD/CCD 55211)
	Town of Orangetown, Village of Grand View-on-Hudson (MCD/CCD 55211)
Westchester County	Town of Greenburgh, Village of Tarrytown (MCD/CCD 30367)

E. SURVEY AREA
Length: 4 miles
Width: 500 feet

F. USGS 7.5 Minute Quadrangle Maps:
PARK RIDGE (NY & NJ), NYACK (NY), & WHITE PLAINS (NY)

G. SENSITIVITY ASSESSMENT
Prehistoric (high, medium, low): Moderate—submerged Rockland County shoreline
Historic (high, medium, low): High—submerged historic resources and potential shipwreck in Hudson River

H. ARCHAEOLOGICAL SURVEY METHODOLOGY
Number of shovel test pits: 3
Number of units: N/A
Surface survey (yes/no): Yes

I. RESULTS OF ARCHAEOLOGICAL SURVEY
Number of prehistoric sites identified: One possible submerged paleo landform
Number of historic sites identified: Potential submerged historic resources and one potential shipwreck
Number of sites recommended for investigation: Two

K. AUTHOR/INSTITUTION:
Nancy A. Stehling, RPA, AECOM Technical Services, Inc.
Michele L. Besson, AECOM Technical Services, Inc.
A. Michael Pappalardo, AKRF, Inc.

L. DATE: January 2012

M. SPONSOR : NYSDOT, NYSTA, FHWA

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1. Introduction

In March 2011, AECOM Technical Services, Inc. prepared a Phase I Archaeological Survey Report for the 30-mile long Tappan Zee Bridge / I-287 Corridor Project for the following project sponsors: New York State Department of Transportation (NYSDOT), New York State Thruway Authority (NYSTA), Federal Highway Administration (FHWA), Metropolitan Transportation Authority/Metro-North Railroad, and the Federal Transit Administration. In October 2011 the Tappan Zee Bridge / I-287 Corridor Project was formally rescinded and a new Notice of Intent was published for the current Tappan Zee Hudson River Crossing Project. The present Phase I Archaeological Survey Report contains those portions of the March 2011 AECOM report that are related to the current project. Please note that occasional references to the predecessor project remain throughout the current report, including depictions of project area boundaries on the included figures. Discontinuities in section numbering reflect the removal of report sections unrelated to the new Project.

1.1 General Project Description

The Tappan Zee Hudson River Crossing ("Project") is being undertaken by the Project Sponsors – NYSDOT and NYSTA –with the FHWA serving as the federal lead agency under the National Environmental Policy Act (NEPA). The purpose of the project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The project would address the structural, operational, mobility, safety, and security needs of the Tappan Zee Hudson River Crossing.

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An EIS will be prepared in accordance with NEPA. The analyses anticipate an Estimated Time of Completion between 2017 and 2019. Two alternatives will be evaluated in the EIS, the No Build Alternative and the Replacement Bridge Alternative. To provide flexibility in the future design of the replacement bridge, two options will be considered. Each alternative is briefly discussed below:

- No Build Alternative – The No Build Alternative would retain the existing Tappan Zee Bridge in its current configuration with ongoing maintenance, as practicable, to ensure its continued safe use by the traveling public. However, given the age of the bridge and its vulnerabilities in extreme events, it is possible that the crossing could be closed altogether at some point in the future. Although the No Build Alternative does not meet the project's purpose and need, NEPA requires it be evaluated in the EIS. The No Build Alternative also serves as the baseline condition against which the potential benefits and impacts of the Replacement Bridge Alternative are evaluated.

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The Short Span option would not preclude future transit service across the Tappan Zee Hudson River crossing.

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The Long Span option would not preclude future transit service across the Tappan Zee Hudson River crossing.

Both Replacement Bridge Alternative options would result in removal of the existing Tappan Zee Bridge upon completion of the new river crossings.

1.2 Development of the Area of Potential Effect

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the potential effects of their actions on historic properties. A required step in the Section 106 process is determining the Area of Potential Effect (APE) which is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist" (36 CFR § 800.16[d]). The APE is influenced by the scale and nature of an undertaking.

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The proposed direct and indirect APEs are discussed in greater detail below and are depicted in Figure 1.

1.3 Direct and Indirect Areas of Potential Effects

1.3.1 Direct Effects

As discussed above, direct effects may include physical damage or destruction of a resource or to its setting. The proposed APE for Direct Effects includes all locations that could potentially be subject to direct ground disturbing activities. Project activities are anticipated to include demolition, excavation,

pile-driving, geological borings, cutting and filling, as well as staging. Figure 1 presents the proposed APE for Direct Effects.

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- Hudson River – includes the Tappan Zee Bridge and its existing ROW, the footprint of the proposed replacement bridge, and the staging/dredging areas at both the Westchester and Rockland landings.

- Westchester County – includes the existing ROW of the Thruway between the Tappan Zee Bridge and the Broadway Bridge in Tarrytown.

The proposed APE for Direct Effects consists of horizontal and vertical components. The horizontal extent of the APE is defined as the footprint of construction activity that would result in ground disturbance or other physical impacts to properties. The vertical extent of the APE varies along the 4 mile project area, depending on the type of construction activity, for both above-ground and below-ground components.

Due to the nature of this bridge replacement project, it was determined that no potential for indirect or cumulative effects to archaeological resources exists.

1.4 Regulatory Framework

1.4.1 Federal and State Laws

Several federal and state laws, executive orders (EOs), and regulations require that cultural resources (archaeological and historic architectural) either listed or eligible for listing in the National and/or State Register be identified, evaluated, and considered during federally funded, licensed, permitted, or approved undertakings and those undertakings subject to state or local regulations administered pursuant to delegation or approval by a federal agency. Federal and state statutes and regulations concerning protection of cultural resources that are applicable to this project are as follows:

- National Historic Preservation Act (NHPA).
- EO 11593, Protection and Enhancement of the Cultural Environment.
- Archaeological Resources Protection Act (ARPA).
- Native American Graves Protection and Repatriation Act (NAGPRA).
- National Environmental Policy Act (NEPA).
- New York State Environmental Quality Review Act (SEQRA).
- New York State Historic Preservation Act (NYSHPA).

Because the FHWA and FTA are the joint lead agencies for the Tappan Zee Bridge/I-287 Corridor Project with joint sponsorship from NYSDOT, NYSTA, and the Metro-North Railroad, Section 106 of the NHPA is the most relevant federal regulation.

Section 106 of the NHPA of 1966, as amended (16 USC 470 et seq.), provides that federal agencies take into account the effects of their actions on any district, site, building, structure, or object listed in, or eligible for inclusion in, the National Register of Historic Places. Implementing regulations for Section 106, established by the Advisory Council on Historic Preservation (ACHP), are contained in 36 CFR Part 800, Protection of Historic Properties. Participants in the Section 106 process include the following:

- Federal agencies sponsoring the undertaking.
- Advisory Council on Historic Preservation (ACHP).
- Consulting parties, including:
  - State historic preservation officers (SHPOs)
  - Native American tribes.
  - Tribal historic preservation officers (THPOs).
  - Representatives of local governments.
  - Applicants for federal assistance, permits, licenses, or other approvals.

- Additional consulting parties including individuals and organizations with a demonstrated interest in the undertaking.

Section 106 also requires agency officials to seek and consider the views of the public on their undertakings. According to the regulations, solicitation of public input should occur "in a manner that reflects the nature and complexity of the undertaking and its effects on historic properties." For the Tappan Zee Bridge/I-287 Corridor Project, the lead federal agencies and project sponsors have determined that the Section 106 public involvement process will occur in tandem with the NEPA public involvement process.

On the state legislative level, New York's State Environmental Quality Review Act (SEQRA) requires all state and local government agencies to consider environmental impacts equally with social and economic factors during discretionary decision making. The involved agencies must assess the environmental significance of all actions they have discretion to approve, fund, or directly undertake (dec.state.ny.us, 2007).

1.4.2 County Historic Preservation Regulations

1.4.2.1 Rockland County

Rockland County became a Certified Local Government (CLG) under the NHPA in 2002 and established the Rockland County Historic Preservation Board. The board acts as an advisory body to the county executive, county legislature, commissioner of planning, other county agencies, towns and villages, and individual property owners. The board provides advice on historic preservation issues and initiates, supports, and/or participates in the nomination of properties to the National and/or State Register.

The Historic Preservation Board received funding through the CLG Matching Grants Program to conduct a county-owned property survey and to establish a survey and inventory program.

During 2003, the board, under the auspices of the Rockland County Department of Planning, completed a survey of county-owned historic property that resulted in the identification of multiple archaeological and historic architectural properties that may be National Register eligible. No archaeological resources were located within the APE for the current survey.

1.4.2.2 Westchester County

Westchester County Department of Planning employs a historic preservation planner but the county has not sought qualification as a CLG under the NHPA. The planning department works with a citizen-based Historic Preservation Advisory Committee to oversee the nomination of properties to the Westchester County Inventory of Historic Places and the State and/or National Register of Historic Places. The historic preservation planner monitors, for the NYSHPO, design and construction of county capital projects and participates in Section 106 review of projects, such as the Tappan Zee Bridge/I-287 Corridor Project, that may have the potential to impact cultural resources within Westchester County.

1.5 Archaeological Investigation Standards

Archaeological investigations in New York State are generally conducted through a three-step process. The New York Archaeological Council (NYAC) has prepared a document entitled *Standards for Cultural Resource Investigations and the Curation of Archaeological Collections in New York State* (NYAC 1994). The New York State Historic Preservation Office (NYSHPO) adopted these standards in 1995. The National Park Service (NPS) reviewed the NYAC Standards and found them to be consistent with the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (36 CFR Part 800).

The Phase I archaeological investigation for the Tappan Zee Bridge/I-287 Corridor Project has been conducted in accordance with the standards of the *NYS Education Department (SED) Cultural Resources Survey Program Work Scope Specifications for Cultural Resource Investigations on NYSDOT Projects* (March 2004). The SED work scope specifications employ the NYAC Standards for archaeological +investigations.

The SED specifications are designed to assist NYSDOT in meeting its cultural resources compliance needs under Section 106 of the NHPA of 1966 (as amended) for federally sponsored projects and Section 14.09 of Parks, Recreation and Historic Preservation Law of 1980 for state sponsored projects. The March 2004 revised work scope specifications are a result of negotiations between SED, NYSDOT, and the NYSHPO, including those revisions made in January 2001.

In January 2001, New Section 106 procedures were established between NYSDOT, SHPO, and FHWA based on revised regulations that went into effect in January 2001. As a result, NYSDOT assumed the responsibility for making National Register eligibility recommendations through the SED Cultural Resources Survey Program. The eligibility determinations were previously made by NYSHPO. The new procedures specify review and concurrence by NYSHPO and FHWA with the recommendations presented in the survey reports. The FHWA retains legal responsibility for all Section 106 findings and determinations.

The following section outlines the NYAC standards adopted by the SED work plan for completing Phase I archaeological surveys for Department of Transportation projects within New York State.

1.5.1 Phase I Survey

The principal goals of Phase I surveys (prior to 1994, often referred to as Stage I surveys) are:

- To identify archaeologically sensitive areas as well as cultural/sacred areas that may be affected by a proposed project.
- To locate all prehistoric and historic archaeological resources that may exist within the proposed project area.

The goals of the Phase I work need to be flexible to reflect the size of the proposed project and stage of project planning, and can be undertaken in two sub-phases, Phase IA and Phase IB, when appropriate (NYAC 1994). In such cases, the Phase IA survey consists of background documentary and cartographic research and a sensitivity assessment, and the Phase IB survey consists of field investigation.

This report presents the results of the Phase IA and Phase IB archaeological surveys conducted for the Tappan Zee Bridge/I-287 corridor project.

1.5.1.1 Phase IA Survey

Phase IA investigations are intended to gather data on the environmental conditions and physical setting of the project's area of potential effect (APE) and surrounding area and region, as well as its cultural setting through background research and a reconnaissance walkover survey. The interrelationship between the physical and cultural setting provides the basis for the sensitivity assessment of an APE. Information gathered should include data on the geomorphology and soils of the project area, the prehistoric and historic context, previously identified archaeological sites, previously conducted archaeological surveys, and areas of prior ground disturbance. The Phase IA documentary and cartographic research provides the rationale for the sensitivity evaluation and selection of an appropriate Phase IB field strategy.

Phase IA background research includes a preliminary review of manuscripts, maps, atlases, historical documents, unpublished notes, previous surveys, state and local archaeological site inventories, and published material relevant to the project area, both to locate possible sites and to provide the basis for developing the prehistoric and historic contexts for the project area (NYAC 1994).

An integral part of a Phase IA investigation is a reconnaissance walkover survey to note existing conditions in the APE. The field visit to the APE should be undertaken to determine the possibility that prior ground disturbance may have destroyed previously identified sites and potential site locations, as well as to note potential site locations that seem to be undisturbed and may contain intact resources (NYAC 1994). Often, a "windshield survey" is the first step of a reconnaissance survey, particularly when access to portions of the APE must be granted by private landowners. In such instances, notification letters are sent out to the individual landowners informing them of the timing and tasks involved in the archaeological walkover survey.

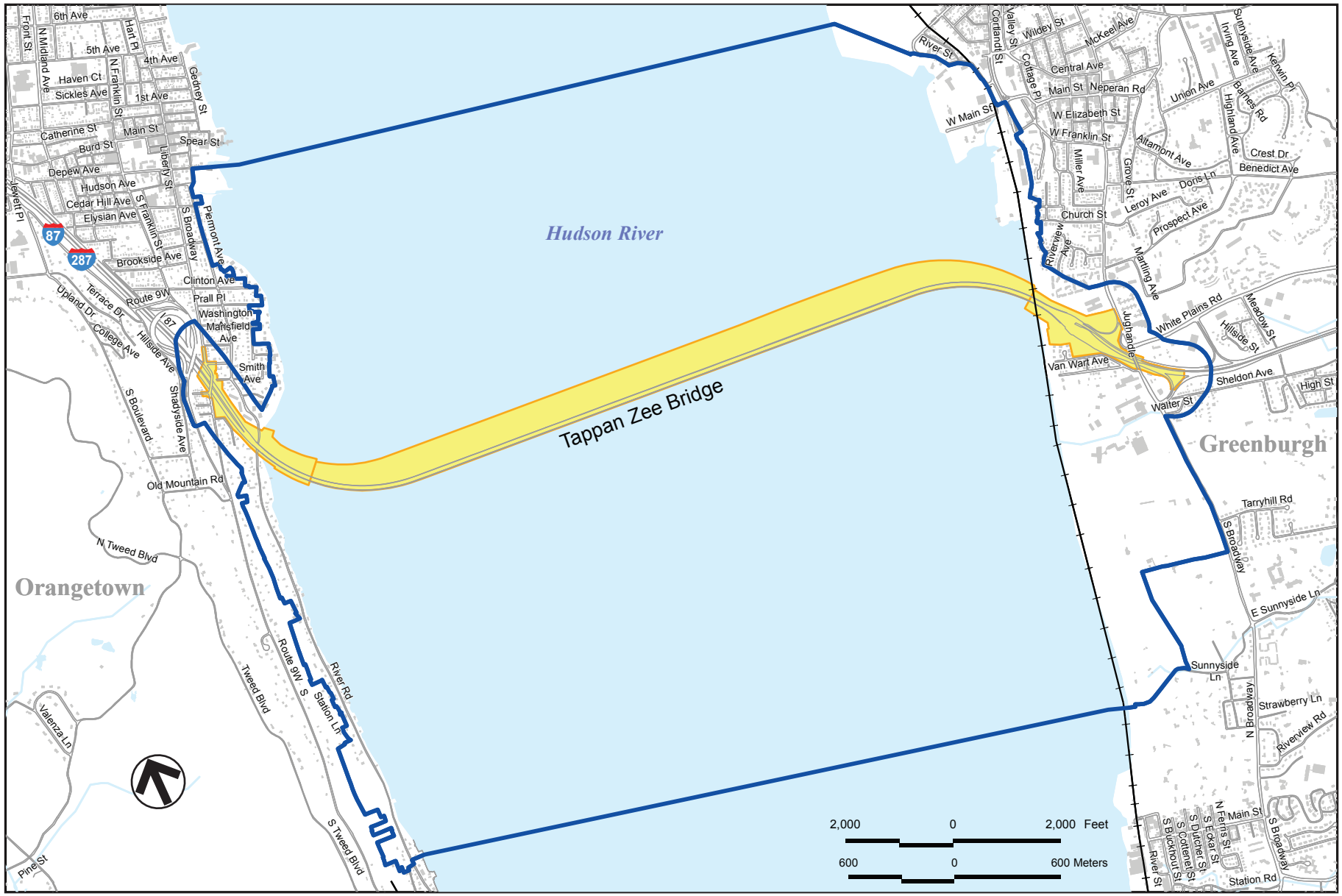
1.5.1.2 Phase IB Survey

Phase IB surveys consist of appropriate field investigation, which may be in the form of subsurface shovel testing, systematic surface survey, and/or remote-sensing studies to determine the presence or absence of archaeological resources. Subsurface testing is most often the major component of this level of investigation and is required except in those cases in which the presence or absence of resources can be determined by direct observation through a surface survey, by the examination of specific documented references, or by the detailed documentation of prior disturbance of such a degree that all traces of intact archaeological resources have been erased (NYAC 1994).

Phase IB field investigation verifies site locations suggested by the Phase IA research and locates previously unknown archaeological sites. The areas targeted for Phase IB testing are selected on the basis of the research completed for the Phase IA sensitivity evaluation and include all probable locations of project construction, staging areas, or any other areas of potential impact that have not been subjected to extensive prior disturbance. Detailed evaluation of identified resources is not carried out at this level of investigation, but the precise locations of identified resources with respect to the proposed project area must be clearly established.

If potentially eligible National Register archaeological resources are identified through the Phase IB survey, a Phase II survey to assess the integrity of the site toward a determination of National Register eligibility would be recommended.

1.10.12



Direct Effect Area of Potential Effect (APE)

Indirect Effect Area of Potential Effect (APE)

Figure 1

Direct and Indirect Effects APEs

See note on cover regarding report continuity
and references to rescinded project

1.7 Phase I Staff

The principal investigator and primary author for the Phase I archaeological survey, Nancy A. Stehling meets the Secretary of the Interior's Professional Qualification Standards for Archaeologists (36 CFR Part 61, Appendix A).

Several AECOM staff members were involved in the Phase IA tasks. The windshield survey of the project corridor was conducted by A. Michael Pappalardo, Michele L. Besson and Nancy A. Stehling. Nancy Stehling and Michele Besson conducted the cartographic, documentary, and archival research and developed the sensitivity assessment for the ROW portions of the Corridor and the Phase I area of potential effect. Alexander H. Joffe developed the prehistoric and historic context sections for the baseline report. Michele Besson and Matt Goodwin conducted numerous archaeological site file searches at Peebles Island, New York. George Myers, Jr. conducted supplemental site file research at Peebles Island. Nancy Stehling and Michele Besson conducted the reconnaissance walkovers of potential areas of archaeological sensitivity.

Phase IB fieldwork was also conducted by AECOM staff. Nancy Stehling was principal investigator and Michele Besson was field supervisor. The field crew consisted of Matt Goodwin, George Myers, Jr., Brian Brownworth, Andrew Martin, and Lucy Rubino.

Artifact processing, cataloguing, and analyses were undertaken at the AECOM archaeology laboratory following field work. Historic artifacts were analyzed by Nancy Stehling; Matt Goodwin conducted the prehistoric lithic analysis.

The Phase I report was prepared by several AECOM staff. Michele Besson and George Myers, Jr. were responsible for compiling and entering all Phase IB excavation data into tables that appear as appendices to this report. Various sections of the report were written by Nancy Stehling, principal author, Michele Besson, co-author, Matt Goodwin, contributing author, and Alexander Joffee, contributing author. Graphics were prepared by Jim Labate, Sherry Felix, Xiaojing Wei, and Robert Sachnin. Artifact photography was conducted by Matt Goodwin. (Note: Technical review and final edits to this report by Alan Tabachnick.)

1.8 Repositories of Project Information

All project research materials and photographs are being stored temporarily in the World Financial Center offices of AECOM Technical Services, Inc. in New York City.

2 Environmental Setting

2.1 Geology and Surface Waters

The 30-mile long I-287 project corridor traverses numerous landforms and water bodies. The topography of the area is a result of glacial activity.

The Rockland County portion of the corridor passes through the Triassic Lowland landform region. This region is characterized by rolling hills with north to south trending valleys, which are underlain by shales, soft sandstones, and hard lavas.

The Ramapo Mountains, part of the Hudson Hills or Highlands, bound the region to the northwest, and are composed of marbles and quartzites. Towards the eastern end of the county, the corridor traverses the imposing façade of a rock/topographic feature composed of lava traprocks and known as the Palisades sill (part of the Triassic Lowlands). The Thruway crosses the Palisades in an approximately 1.5-mile long cut, after which it descends to the southeast and into the Hudson River Valley.

The sedimentary bedrock of the Triassic Lowland extends into and underlies the western and central portions of the Hudson River. The river was carved through the basalt sill of the Palisades, creating the impressive cliffs that overlook the river (Thompson 1980:42). Geological data from recent studies note an ancient, buried channel of the pre-glacial Hudson River within the sandstone redbeds near the western shore of the river (Mueser Rutledge 2008).

The Westchester County portion of the corridor passes through the Manhattan Hills subregion of the New England Upland region. The subregion is relatively low in elevation and is underlain by gneisses, marbles, and schists which are folded into a series of predominantly northeast to southwest trending ridges and valleys.

A number of water bodies, following the north-south trending valleys of the region, cross through the I-287 corridor. The larger water bodies include, from west to east, the Ramapo River, the Mahwah River, the Saddle River, Pascack Brook, and the Hackensack River, as well as a number of smaller tributaries of these waters. Some of the more notable tributaries in the project corridor include Pine Brook in the vicinity of Chestnut Ridge Road and Nauraushaun Brook, west of the Palisades Interstate Parkway.
The Hudson River, an estuary of the Atlantic Ocean, is the major water body passing through the project corridor. Beginning several hundred miles north of the Tappan Zee Bridge at Lake Tear in the Cloud in the Adirondack Mountains, the river extends along a generally north-south oriented course, emptying into New York Bay approximately 27 miles south of the Tappan Zee Bridge.

The water bodies in Westchester County also tend to follow the generally north-south trending valleys that cross the county. From west to east, the major water bodies passing through the I-287 corridor include the Saw Mill River, Sprain Brook, Bronx River, Mamaroneck River, Hutchinson River, and Blind Brook. Smaller tributaries of the Hudson River in the vicinity of the project corridor include Sheldon Brook, an east-west oriented stream located south of the Thruway. The Long Island Sound, an estuary of the Atlantic Ocean, is located approximately 0.5-miles east of the project corridor.

2.2 Soils

Soils across the project corridor are largely the result of glacial till deposition over steep terrain. Glacial scouring left bare rock surfaces in some areas, as evident in the Hudson Highlands at the western end of the I-287 project corridor. Glacial activity also interrupted pre-existing drainage patterns, causing poor drainage across portions of the corridor. Overall, the soils occurring in both Rockland County and Westchester County are characterized as by extreme acidic conditions, shallow profiles, rockiness, and drainage problems (Thompson 1980:108).

A variety of soil types are present, ranging from those occurring in upland areas; along lower, rolling terrain such as in the vicinity of Central Nyack; on glacial till plains; and along glacial outwash plains and river terraces such as the Bronx River. Stratified alluvial deposits and organic material are also found along stream corridors. In addition to naturally deposited materials, human activity has led to disturbed soil conditions found across portions of the corridor, due to cutting, filling, and redeposition activities related to modern development.

2.3 Flora and Fauna

The project corridor is in a climate zone characterized by mild, wet winters and warm, humid summers. These climatic conditions, coupled with the poor soil conditions mentioned above, make the area unsuitable for long-term agricultural activity.

The project corridor crosses two major vegetation zones (Thompson 1980). The Oak-Northern Hardwood Zone covers the western half of Rockland County and the central portion of Westchester County. The type of vegetation present across different sections of this transitional zone is heavily influenced by the direction of slope a landform is on. Brighter light conditions along south and southwest facing slopes support stands of oak or a mix of oak, hickory and other trees. North and northeast facing slopes support trees found in northern vegetation zones.

The Oak Zone occurs on both sides of the Hudson River and along the eastern portion of the I-287 corridor, towards the Long Island Sound. Sheltered by the Catskill Mountains, and at a lower altitude and latitude, this zone is within the warmest parts of New York State. This zone supports several oak species and other trees, such as tulip poplar, which are suited to the warm climate and thin soils.

Land clearing and urban development activities over the last century have led to an increase in scrubby vegetation across both of these vegetation zones. Pioneering species such as red maple, aspen, fire cherry, hickory, and locusts sprout out of abandoned fields, along with red cedars, which prefer thin, rocky soils underlain by limestone.

The vegetation in Rockland and Westchester counties supports a variety of wildlife. Deer, coyote, skunk, groundhog, opossum, squirrel, chipmunk, mole, mouse, rat, otter and beaver are all found in the vicinity of the project corridor. Bird species in the area include crows, woodpeckers, finches, jays, cardinals, sparrows, and turkeys; raptors such as vultures, hawks and eagles; and waterfowl such as ducks, grebes, and geese.

Indigenous fish species to the Hudson River include anadromous species such as salmon, shad, and sturgeon; catadromous species such as eels; and freshwater species, such as bass and pike. Historically, sturgeon was so common in the Hudson River and exploited in such quantity that they became known as

“Albany beef” (Brumbach 1986). These numbers declined over the historic period so much that the once populous sturgeon are now listed as an endangered species. Shellfish are also present in local waters, such as the Hudson River and the Long Island Sound.

3 Background Research: Prehistoric and Historic Contexts

Archaeological resources are the material remains of past prehistoric and historic activity. Their value is dependent upon an understanding of the cultural context in which they were deposited and post-depositional processes that may have impacted their degree of preservation. In order to present an assessment of the range of resources that may be present in the current project corridor and the likelihood of their being intact, a Phase I archaeological survey has been completed. The elements of the Phase IA background research help establish an appropriate context against which to consider the significance of any potential and/or archaeological resources identified during the Phase IB testing.

This chapter summarizes the regional prehistoric cultural sequence and chronology that has been developed through archaeological research and excavation, focusing on Rockland and Westchester Counties. Following the prehistoric context, the historic context section summarizes the history of settlement, development, industrialization, urbanization, and suburbanization of the Lower Hudson Valley region, of which the project-area portions of Rockland and Westchester Counties are a part.

3.1 Prehistoric Period

3.1.1 Cultural Sequence and Chronology

The basic prehistoric cultural sequence and chronology for New York State remains that of Ritchie (1994 [originally published 1965, revised 1969, 1980]), and modified by Funk (1976), Snow (1995a) and others. It follows the overall sequence for eastern North America and is presented in Table 3-1.

Table 3-1

Cultural Sequence and Chronology

Cultural Period	Time Period	Geological Age
Paleo-Indian	11,000-9,000 BP (9,000-7,000 BC)	Late Pleistocene
Early Archaic	9,000-7,000 BP (7,000-5,000 BC)	Holocene
Middle Archaic	7,000-5,000 BP (5,000-3,000 BC)	
Late Archaic	5,000-3,000 BP (3,000-1,000 BC)	
Early Woodland	3,000-2,000 BP (1,000-0 BC)	
Middle Woodland	2,000-1,000 BP (AD 1-1000)	
Late Woodland	1,000-500 BP (AD 1000-1524)	
Contact	500 BP-Present (AD 1524-Present)	

This cultural sequence and typology was generated primarily for western and southern New York, and its applicability to the unusual estuarine environments of the Lower Hudson River and southeastern New York is uncertain. Given the paucity of excavated data from the Lower Hudson River Valley, at present the generalized sequence and chronology represents the state of the knowledge.

3.1.2 Paleoenvironment

The complex Early Holocene topography and resource base that were the settings for human occupation of the Hudson River Valley are primarily glacial in origin (Dineen 1996). At the glacial maximum, the Atlantic coastal plain extended between 50 and 68 miles south of the present shore of Long Island and sea level was nearly 300 feet lower than today. Among the landscape effects were the scouring of uplands of topsoil and the deposit of debris in valleys and on slopes.

In New York State, the retreat of the Laurentide ice sheet at the end of the Wisconsin glaciation produced significant landscape modification, and meltwaters created a number of proglacial lakes. These included Lake Hudson, which filled the valley south of the Hudson Highlands ca 15,000 years before present (BP), and Lake Albany, which occupied the valley north of the highlands to the area of Troy by ca 13,000 BP. By ca 12,000 BP the dams retaining these lakes were breached, allowing them to drain, incising a deep gorge, and permitting rebound of the land mass and the rise of sea levels (Salwen 1975; Schuldenrein 1995; Dineen 1996).

The Hudson River estuary migrated northward, while tributary valleys were flooded and terraces created. Alluvial material then began to accumulate, but soils in the Lower Hudson River Valley are much thinner than those on Long Island, where several glacial moraines and repeated episodes of marine transgression deposited many hundreds of feet of material (Newman 1977).

By 9,000 BP, rising sea levels at the rate of some 20 feet per millennium caused massive erosion and submergence along the Northeast coast, flooding Long Island Sound and isolating Long Island and other offshore islands such as Martha's Vineyard from the mainland (Dunford 1999). Especially productive estuarine environments would have been created by rising sea levels, but freshwater resources would have been reduced somewhat by forcing of freshwater aquifers. By 5,000 BP the rate of sea level rise began to decrease, and by 2,000 BP it had slowed to approximately 4 in per century.

The Holocene topography and resource bases of Westchester and Rockland Counties are thus extremely dynamic, characterized by changing balances of freshwater and saltwater-brackish estuaries along the Hudson River, New York Bay, and Long Island Sound. During the early Holocene epoch, the uplands likely experienced larger shifts from deciduous to mixed hardwood/coniferous forests, followed by shorter-term fluctuations from the Middle through the Late Holocene Epoch (Maenza-Gmelch 1996; McWeeney 1999).

3.1.3 Late Pleistocene, Paleo-Indian Hunters

Uncertainty remains about the timing and route of Paleo-Indian colonization of North America in general (Anderson and Gillam 2000), and the first human occupation of New York State is equally problematic. Humans entered upstate New York and the Hudson River Valley for the first time ca 12,000 to 11,000 BP. Ritchie (1980) reports isolated finds of fluted points characteristic of the Clovis tradition in the Albany area, but offers few details. Data on Paleo-Indian fluted points indicate only one example in Rockland County and two in Westchester County. Levine's more extensive (1989) publication regarding Paleo-Indian fluted points from surface collections in the Upper Hudson River Valley is similarly vague regarding the nature of findspots and their environmental settings. Most appear to have been collected from plow zones and indicate temporary habitation, such as hunting camps.

Relatively few Paleo-Indian sites have been excavated in New York State and northern New Jersey. Those that have been excavated include the following:

- The Plenge site in Warren County, New Jersey (Kraft 1973).
- The West Athens Hill and Kings Road sites in Greene County, New York (Ritchie 1973; Weinman and Weinman 1969).
- The Davis site in Essex County, New York (Ritchie 1980).
- The Dutchess Quarry Cave in western Orange County, New York (Funk et al. 1969).
- The Port Mobil Site on Staten Island, New York (Ritchie 1994).

Excavated sites in New York and northern New Jersey are consistently small and indicative of extremely short-term utilization. Of particular interest to the Lower Hudson River is the Port Mobil site, located above the Arthur Kill on Staten Island. Though badly disturbed, the location of the site indicates a strong estuarine orientation, and the lithic materials derive from both eastern New York and eastern Pennsylvanian sources (Ritchie 1994).

The material culture of the Paleo-Indian period consists largely of projectile points, with smaller numbers of knives, scrapers, flakes, choppers, and pounding tools. These assemblages indicate heavy dependence on hunting, probably of large game, and possibly exploitation of flint resources. The location of the Port Mobil site, however, suggests at least seasonal exploitation of estuarine resources. The rare occurrence of Hudson River flints (e.g., Normanskill chert) at the southeastern Pennsylvania Paleo-Indian Shoop site (Witthoft 1952) suggests that long-distance exchange of chipped stone may have taken place.

The small numbers of artifacts reported for New York State as a whole in recent studies of North American fluted points supports the reconstruction of only sporadic Paleo-Indian movement through the Hudson River Valley (Anderson and Faught 1998; Morrow and Morrow 1999). Funk and Wellman (1984) suggest that ecological factors, namely the predominance of post-glacial coniferous forests with relatively scarce resources, account for the scarcity of Paleo-Indian and Early-Middle Archaic sites in New York State, although this view is being increasingly challenged by new evidence from throughout the Northeast. Given the paucity of excavated sites and faunal assemblages, it remains unclear whether Paleo-Indian groups were generalized hunter-gatherers or specialized hunters pursuing species such as caribou (Abel and Fuerst 1999).

The poor preservation of small Paleo-Indian sites makes it difficult to accurately assess the importance of the period. Evidence from Paleo-Indian sites in Connecticut also suggests that the margins of paleo-lakes would have been especially productive areas for hunters (Curran and Dincauze 1977), but riverbank sites would tend to have been severely eroded and the ad hoc tool components washed downriver, where they are unrecognized. The collection emphasis on projectile points also skews discussions of subsistence toward fauna and away from floral resources (Moeller n.d.). The larger Hudson River estuary would have been highly productive with respect to Paleo-Indian sites, but factors such as rising sea levels throughout the Holocene Epoch make the region not conducive to site preservation.

3.1.4 Holocene, Archaic Hunter-Gatherers

The Early and Middle Archaic Periods had long been interpreted as representing a low point in human occupation in the Northeast, but, as with the Paleo-Indian period, surface collections have begun to fill in

the gap (Levine 1989). Part of the explanation for the increasing density of human occupation of upper New York State may involve the gradual transition from relatively resource-poor coniferous forests to hardwood forests during the course of the Archaic Period (Salwen 1975). Gradually rising sea levels would have shortened the descent to the Hudson River banks and flooded any number of Early Archaic sites. Earlier Archaic sites such as Lamoka Lake (Ritchie 1980) and the Sylvan Lake Rockshelter (Funk 1976) are situated along southern latitudes, suggesting a gradual increase in semi-sedentary occupation corresponding with changing environmental conditions. By the Late Archaic period, human occupation is widespread throughout New York State. Curtin and Bender suggest that the seemingly dramatic increase in the density of Late Archaic sites may be a manifestation of a fully developed strategic exploitation system (1990).

Generalized hunter-gatherers exploiting large game and a wide variety of fauna, including small mammals and birds, as well as riverine resources, characterize the Archaic Period. A great number of shell mounds in the Lower Hudson River Valley indicate systematic exploitation of oysters at least as far north as Croton (Schaper 1989, 1993), and oysters have been found in Archaic levels as far north at Cruger's Island in northern Dutchess County, New York (Ritchie 1958). Excavated sites in the Lower Hudson River Valley, such as Dogon Point, suggest that exploitation of oysters increased throughout the Archaic Period (Claassen 1995). The popularity of oysters in the native diet from the Archaic Period onward is indicated by the size of various New York shell mounds, which ranged from lenses of a few square feet up to mounds of many acres (Schaper 1989). Fishing equipment such as netsinkers is also common at Archaic sites, but the extensive presence of not only knives, which were also used for fish processing, but other butchering tools at sites also point to the continued importance of hunting.

Excavated Archaic sites in the Lower Hudson River Valley include Wicker's Creek (Roberts 1991), Teller's Point (Fiedel 1991), and the Ossining Rockshelter (Fiedel 1986), all located close to the Hudson River. Late Archaic sites also become numerous on Long Island (Wyatt 1977). In Rockland County the Old Kakiat Trail Rockshelter likely dates to the Late Archaic Period (Lenik 1995). This small site is located in the Ramapo Mountains, a section of the Hudson Highlands.

Rockshelter sites have also been excavated in Monsey Glen Park, located north of I-287 in Rockland County, providing evidence of domestic occupation and tool processing activities, with diagnostic artifacts dating to the Late Archaic and Woodland Periods (Quarry Glen Rockshelter site). The rockshelters in Monsey Glen Park took advantage of overhangs in the surrounding rock outcrop for protection. A massive boulder in the Village of Montebello known as Indian Rock provides evidence of another form of rockshelter; this glacial erratic situated in an otherwise flat portion of the landscape reportedly provided shelter for native groups traveling through the area (likely both NYSM Site No. 7624 and 6435) (Village of Montebello 2009). The thin soils, exposed bedrock, glacial erratics, and numerous lakes and ponds would have been impediments to Archaic settlement and subsistence in the interiors of Westchester and Rockland Counties.

In contrast, the upland Archaic settlement pattern is of an increasingly complex series of sites, including base camps up to 5 acres in size, such as Lamoka Lake and the Bent site on the Mohawk River (Ritchie and Funk 1973); seasonal rockshelters such as Sylvan Lake and Zimmerman, in Greene County (Funk 1976); and smaller hunting and fishing camps. It has been suggested that a similar pattern of base camps and smaller sites is found in the Lower Hudson River Valley, centered on several major shellfish processing middens: Dogan Point, Piping Rock, Wickers Creek, Twombley Landing, and possibly Croton (Schaper 1993), and such smaller encampments as the Requa site (Schaper 1991). Schaper also suggested that dried or smoked oysters and portions of the shell or valve may have served as trade goods (Schaper 1993).

Brennan noted that Archaic exploitation was centered on two pools or bays: the Tappan Zee bay, stretching from just north of Yonkers to the Croton River, and Haverstraw Bay, which stretches from the Croton River to Bear Mountain. He disagreed, however, with the notion that any of the sites represented long-term, much less permanent, settlements and specialized subsistence. Instead he suggested that Archaic exploitation of the Lower Hudson River Valley was only seasonal, as part of a generalized subsistence strategy (Brennan 1977).

The complexity of Archaic settlement is matched by the increasing diversity of projectile point styles, suggesting that New York State was occupied by a variety of groups with different subsistence strategies and social identities (Salwen 1975). Archaic groups did not possess domesticated plants, but the size and depth of deposits in many sites suggest that occupation was either year-round or repeated. There is evidence of increasing familiarity with microenvironments and technological innovations, in particular the emergence of stone bowls, evidently of southeastern derivation, which were important preadaptive features for the development of agriculture during the Woodland Period.

3.1.5 Holocene, Woodland Horticulturalists

The Woodland Period in New York State initiates the establishment of horticulture and the development of larger social units, including matriarchal and matrilocal clans, sedentary villages, and tribes. Pottery is gradually introduced, and a much wider variety of material culture appears. While minor climate fluctuations took place during this period, the overall environment was very similar to that of today.

Early Woodland Period sites are similar to those of the Late Archaic Period. They are typically small, and projectile points, scrapers, and bone tools provide evidence of hunting, fishing, and limited cultivation (Funk 1976). Pottery – typically, stamped and impressed cooking pots tempered with crushed shell – is found at an increasing number of sites. The wide variety of pottery types, however, points to low levels of interaction between groups. Other new features of the early Woodland Period are burials with elaborate grave goods, including flints and bone tools, shell and copper beads, and stone pendants (Ritchie 1980). These symbolic and religious developments are related in part to the emergence of a broad variety of religious practices in eastern North America (Brown 1997).

By the Middle and Late Woodland Periods, the size and complexity of sites had increased tremendously. The key to later developments was the introduction of horticulture and the triad of cultigens: maize (*Zea mays*), beans (*Phaseolus vulgaris*), and squash (*Cucurbita pepo*). The processing of these cultigens was facilitated by the use of cooking pots and storage pits. Villages were occupied year-round and by the end of the period were often comprised of multiple longhouses positioned on defensible hills and palisaded. One of the largest Late Woodland sites is Garoga in Fulton County, New York. It reached some 2.5 acres in size and was comprised of at least seven longhouses, each between 150 and 200 feet in length, with hundreds of storage pits (Ritchie and Funk 1973). Smaller hunting, fishing, and farming settlements developed as offshoots. The Dennis site in Albany County, New York (Funk 1976) is located on a series of alluvial flats on a Hudson River tributary. Sturgeon plates, deer bones, freshwater shells, and corn and beans were found in hearth and storage pits, indicating the range of subsistence activities.

Relatively little Early Woodland material is known to have been collected from the Lower Hudson River Valley. Most are small components at Archaic Period sites, including Dogon Point and Goat Island. Of greater significance is the appearance in the Middle and Late Woodland of a distinctive series of traditions in Westchester and Rockland Counties, Manhattan and Staten Islands, and western Long Island (Smith 1950). Sites of the Bowmans Brook and Clasons Point Phases of the East River Tradition are primarily located on tidal streams and coves and included several villages, along with a number of inland rockshelters. Subsistence was focused on shellfish, along with large and small game, and while grinding

implements are reported, no cultigens have been recovered. This may be due to the fact that sites of these traditions were excavated primarily during the early twentieth century (the remains of cultigens are typically only recovered through a flotation system not commonly used until later) (Ritchie 1994).

In the Lower Hudson River Valley, the Woodland settlement pattern expanded upon the Late Archaic. Many of the same riverbank sites were occupied, and villages appear to have been located at the mouths of rivers, with an increasing number of small sites located in the interior (Eugene Boesch, pers. comm. October 18, 2002). Lower Hudson subsistence during the Woodland Period remained heavily oriented toward estuarine and riverine resources. Ethnohistoric evidence is rich with structures such as dams, pens, traps, and weirs connected to fish production (Lutins 1992). Fish species that were indigenous to the Hudson River include anadromous species (i.e., species that reside in saltwater but breed in freshwater) such as salmon, shad, and sturgeon; catadromous species (i.e., species that breed in saltwater but reside in freshwater) such as eels; and freshwater species, such as bass and pike. Sturgeon were so common in the Hudson River and exploited in such quantity that they became known as "Albany beef" (Brumbach 1986). In their survey of Upper Hudson River settlement locations, Curtin and Bender emphasize tributaries, rapids, and waterfalls as having especially high site densities (1990). Preservation problems often make structural and organic remains associated with fishing extremely difficult to identify archaeologically (Schaper 2000).

The Woodland Period has particular significance in that it sees the emergence of the direct antecedents of historically attested Native American groups. The Bowmans Brook and Clasons Point Phases appear ancestral to Lenape groups speaking the Munsee dialect of Algonquian. Subgroups, including the Canarsie, Hackensack, Rechgawawank, and Wiechquaeskeck, were known in Westchester and Rockland Counties and western Long Island during the seventeenth century (Kraft 1991b, 1986). The Middle and Late Woodland Periods also see the emergence of Iroquoian sites populated by Mohawk-speakers, particularly in the Mohawk River Valley and central New York.

The complex pre-contact ethnic geography of the Northeast remains poorly understood through archaeology. A variety of ceramic types are present at Lower Hudson River Valley sites that could be representative of trade relations due to geographic movement of individuals. In the Upper Hudson River Valley and coastal Connecticut, recent excavations (e.g., Brumbach 1975) have explored these questions. Available evidence suggests that the entire Hudson River Valley was a contact zone among various groups and that intergroup relations were highly dynamic (Diamond 1996).

3.1.6 First Contact, 1524 – 1608

The Contact Period in the Lower Hudson River Valley began on April 17, 1524, when the Italian explorer Giovanni da Verrazano reached New York Harbor in his ship, the *DAUPHIN*. He had previously landed on the coast(s) of Maryland and/or Virginia, where he kidnapped several Native Americans, including a group of children. After anchoring near Staten Island he attempted to go ashore in a small boat, observing many locals in small boats and in villages on the shore, but was forced to return to his ship due to a sudden storm. Verrazano then departed quickly and continued up the East Coast. In the years that followed, the Spanish exploited the area between the Chesapeake and the Gulf of Maine, primarily as slavers, while French fishermen appear to have frequented the Grand Banks in the sixteenth century.

At contact, numerous Lenape groups speaking Munsee dialects of Algonquian occupied the Lower Hudson River Valley (Kraft 1991a). Evidence of Native American village sites situated along the Hudson and Saw Mill Rivers in Westchester County were identified in the early 20th century by Arthur C. Parker, then New York State archaeologist (Aliponk and Kitchawan Villages, respectively). Most Lenape groups lived in small, dispersed settlements comprised of rectangular houses constructed of bark or saplings.

While settlements fortified with ditches and stockades were already in use by the Mohawks and Mahicans, the practice does not appear among the Lenape until after contact, and is best attested during the early seventeenth century (Smith 1950). The extent to which Lenape groups practiced agriculture as opposed to simply gardening is unclear; their overall subsistence was oriented toward exceedingly rich coastal resources, including shellfish and anadromous species such as sturgeon (Brumbach 1986; Cantwell and Wall 2001).

No collation of Native American Contact Period settlements in the Lower Hudson River Valley has been made and only rough population estimates can be generated at present. Some studies based on archaeological and textual data suggest that the number of linguistically related Lenape peoples across the Lower Hudson River Valley, Long Island, New Jersey, and eastern Pennsylvania totaled approximately 5,000 at contact (Becker 1993).

3.2 Historic Period

3.2.1 The Dutch Period, 1609 – 1664

The English explorer Henry Hudson undertook two unsuccessful Arctic explorations in search of the Northeast Passage to the Orient in 1608. Hudson's voyage in the *Half Moon* took place in 1609 with the support of the Dutch East India Company during which he discovered instead the river that now bears his name. Evidence suggests that Hudson's expedition made it as far north as the present-day Albany.

Almost immediately thereafter, Dutch traders began flooding into the area in great numbers, primarily in search of furs. The English and then the French tried unsuccessfully to displace the Dutch by force, sending expeditionary forces in 1613 and later (Kraft 1991). In 1614 the United New Netherland Company was formed and given a charter by the Dutch to exploit the areas between the Connecticut, Mohawk, and Hudson Rivers. In 1614 the Dutch established Fort Nassau on the west bank of the Hudson River at what is now Albany.

In 1621 the Dutch West India Company was chartered and given exclusive trading rights in New Netherland for a period of 24 years. The fur trade continued to intensify, and areas accessible to Dutch traders were becoming depleted, forcing trade networks to be extended to the north and west. As part of their charter, the Dutch West India Company began offering free transportation and farmland to settlers who populated areas along the Delaware and Hudson Rivers (Kraft 1991). The borders of the company's charter were secured by Fort Orange on the Upper Hudson River and Fort Casimir on the Delaware River, the latter blocking the expansion of the Swedish colony of New Sweden. The eastern border with New England was more problematic, however, and was the subject of repeated negotiations and treaties with English colonial authorities.

Agricultural settlement in the Lower Hudson River Valley intensified during the first half of the seventeenth century. The island known as Manhattan was purchased from the Lenape in 1626, and other areas such as Staten Island, Hoboken, and Nyack were purchased in the succeeding decades (Francis 1997; Kraft 1991). Dutch, Walloon, Huguenot, and even small numbers of Jews began to arrive as refugees and settlers in New Amsterdam, but by 1630 the population was still only around 300. Small-scale farming, some shipbuilding, and servicing the fur trade took place on Manhattan and around the small number of forts constructed to defend the boundaries of New Netherland. African slaves had already appeared by the late 1620s (Rink 2001).

Investors in the Dutch West India Company were granted huge tracts of land, provided they could supply a number of colonists who would undertake a variety of agricultural and trade activities. These tracts of land, or manors, were typically measured according to the linear river frontage they occupied, and in the case of the largest –Rensselaerwyck near Fort Orange, New York – comprised over one million acres (Nissenson 1937). The high cost of creating and maintaining these private manors, technically forbidden from engaging in either the fur trade or direct overseas trade, as well as Indian uprisings, led to their gradual demise.

The expansion of New Amsterdam accelerated, in part due to the Dutch practice of relative religious tolerance, although such sentiments did not extend to the Quakers, who began arriving during the 1650s. The continued growth of European settlement in the Lower Hudson River Valley, particularly across Long Island, is seen in the number of communities that received municipal charters, including Breuckelen (Brooklyn) in 1646, Beverwyck (Albany) and Midwout (Flatbush) in 1652, and New Amsterdam itself in 1653 (Rink 2001). The Visscher map of 1652 notes the settlement of New Amsterdam and vicinity with Dutch place names and depicts the known Native American group's territories (Figure 3-1).

The Anglo-Dutch war of 1652 caused a panic in New Netherland. The Navigation Act of the previous year had forbidden any trade with England that did not originate in English colonies and that was not carried in English ships. Despite diplomatic efforts by Peter Stuyvesant, suspicion of the English increased and English incitement against the Dutch went on behind the scenes. In 1654 the Dutch faced another threat, the surrender of Fort Casimir to the Swedes. Stuyvesant successfully recaptured territories on the Delaware River, but the situation was symptomatic of the deteriorating Dutch position. At the same time, however, Dutch merchants in New Amsterdam had become a powerful force in international trade and the dominant political class in the city. Settlers bought various tracts of land from natives in Westchester County, but these remained thinly populated.

In 1655 a widespread rebellion of Lenape groups, along with Mahicans, erupted from the Delaware Valley and engulfed the settlements around New Amsterdam. During the so-called Peach War, dozens of settlers were killed and captured, and many outlying farms and settlements were burned. Despite the fact that English settlements on Long Island were also threatened, New England refused to join the Dutch in putting down the rebellion. Further uprisings took place in 1659 along the middle Hudson River and again in 1663, as Dutch encroachment on territories belonging to the Esopus (a Lenape tribe) provoked attacks. By the latter uprising, Stuyvesant had succeeded in cutting off the Esopus from potential allies around New Amsterdam, and a massacre by a Dutch force helped convince the Esopus to cede what remained of their territory.

3.2.2 The English Period, 1664 – 1776

3.2.2.1 Initial Colonization and Regional Conflict

On August 18, 1664 an English fleet sailed into the harbor at New Amsterdam and after some negotiation Stuyvesant capitulated on August 27. The English seized the entire colony of New Amsterdam and renamed the area New York and New Jersey. The Dutch presence in New York, however, continued to be felt both directly through the presence of native Dutch speakers, the retention of all property rights, and some administrative practices, including bilingual records, and other customs, well into the eighteenth century. While a Dutch fleet did recapture the city during the Third Anglo-Dutch War in 1673, they held it for only 15 months. King William's War (1689-1697) was the first of four Anglo-French wars for control of Eastern North America that lasted for almost a century. European settlers and their Indian allies were attacked across a broad front from Maine to New York, but both sides lacked resources for sustained conflict. The peace of Ryswick was established in 1697, but when war broke out again in Europe in 1702

Figure 3-1 Map of New Amsterdam and Vicinity, ca 1652 (source: Visscher ca 1652)

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the French again attacked the various colonies. England responded with another attempt at consolidating its control over the colonies, but suspicion of domination by New England undermined colonial unity.

By the mid-eighteenth century, New York felt the impact of intensifying global warfare. Though the War of Jenkin's Ear in 1739 against Spain initially had little impact in North America, its expansion into King George's War in 1744 and the War of Austrian Succession in 1745 saw New York interests and personalities at the forefront of conflict. French and Indian forces raided the frontiers in New England, but also made a raid against Saratoga, which wiped out the village. The official response was weak and was a factor in the postwar competition between political factions. When the French and Indian War began in 1755, privateering New Yorkers excelled at capturing French ships, but the military successes on the continent were initially French. It was not until the appointment of Jeffrey Amherst as commanding general in 1758 that the tide turned, culminating in the capture of Quebec in 1760 and Montreal in 1761. These victories finally brought an end to French territorial ambitions in North America (Howard 2001).

3.2.2.2 Manor System and Settlement

Six manors were created in what is today Westchester County between 1671 and 1697: Pelham, Fordham, Philipsburg, Morrisania, Cortlandt, and Scarsdale (Howard 2001). These manors were typically granted by the British king to a family that would reside on the large tract of land there and oversee its farming and/or milling operations, carried out by tenant farmers. Pelham illustrates the process by which manors were emerging in New York: in November 1654, Thomas Pell purchased land from natives, and this holding was confirmed as a grant by Governor Nicholls in 1666 and established as a manor in 1687 (Eberlein 1924).

In 1673 the administration of Edmund Andros extended the Duke's Laws to New York City and the Hudson Valley and made English the first language of the entire colony. Dutch and English traders continued to prosper, even as the fur trade continued to decline and customs duties and property assessments rose. New York City itself was feeling the strain of having a high cost of civil administration relative to the population and tax base. Although tremendous amounts of wealth were concentrated in the hands of relatively few merchants, the population of New York as a whole remained low, probably around 15,000 to 20,000 by 1688, with only 3,000 residing in New York City (Middleton 1992).

The surrounding areas also continued to grow slowly. For example, in 1688 a group of Huguenots founded New Rochelle on 6,000 acres purchased from John Pell along the western shore of Long Island Sound, but the population by 1693 was only 44 families. In 1675, Harman Talma (also spelled Talman, Tallman, and Taulman) began to lay claim to lands on the west side of the Hudson in the vicinity of Nyack for Dutch interests by engaging in trade with native groups. Talma would come to settle in the Haverstraw area.

Orange County, founded in 1683, was settled initially by the Dutch and Huguenots (Eager 1846-47). More than a dozen families associated with the Dutch government, but not all of Dutch heritage, came to settle in the area between the Nyack hills and the Hackensack River during the early 1680s (Uris and Capobianco 1976:15).Governor Dongan issued patents in Orange County in 1686. These included provisions for jointly held pasture and woodland, which the descendents requested to be overturned some decades later (Elting 1886). Overall, settlements on the west side of the Hudson River remained sparse as connections to important settlements to the north and south were limited by the area's rocky terrain.

The turn of the eighteenth century saw the continued growth of New York City and surrounding areas, with its prosperity based largely on commerce. Important figures such as the Dutch merchant Frederic Philipse had sufficient resources to undertake manorial responsibilities. In 1692, King William and Queen

Mary granted him a charter for 52,000 acres along the Hudson River in Westchester County and, using African slaves, Philipse established a commercial center with a farm and mill (Brennan 1981). His son, Adolphe, supervised Philipsburg Manor from 1702 to 1745, a period in which its size doubled and the number of tenants increased from 110 to 200, along with some two dozen slaves (Kammen 1975). The Requa family is an example of tenant farmers who leased their land from the Philipse's during the 18th century manor period, and then purchased the land following the dissolution of the manor system. The former Requa farm is situated in the vicinity of the existing Tappan Zee Bridge. Archaeological excavations conducted on a portion of this land in the 1970s recovered cultural material associated with the Requa family's occupation during the manor period, as well as evidence of subsequent landowners dating through the 20th century; evidence of prehistoric activity on the property was also identified (Requa Site) (Brennan 1981).

In exchange for large fees, governors such as Benjamin Fletcher approved even more extravagant land patents. But the proprietary system had important weaknesses, not least of which was that New York's population remained thin and was concentrated in Albany, New York City, and Long Island. The majority of New York's population, however, was not settled in manors. As early as 1696, Fordham had been sold to the Dutch church, and was broken up for lots in 1753. Two-thirds of Pelham had been sold to the Huguenots, while Scarsdale was broken up and sold in 1714 (Bonomi 1971).

The five towns in late seventeenth century Westchester County (Eastchester, Westchester, New Rochelle, Mamaroneck, and Bedford) were joined by White Plains, New Castle, and Rye by the 1730s (Bonomi 1971). New immigrants, primarily Germans, Scots, and Ulstermen, also settled in Orange County in the first decades of the eighteenth century. Newburgh was founded in 1719 on a German land patent, but these Palatine settlers soon sold the site to newcomers from England and Ireland. Presbyterian congregations were quickly established in Orange County at Goshen, Monroe, and elsewhere (Eager 1846-47; Kammen 1975).

Regional conflict and settlement placed intense pressure on native groups. European encroachments had long given way to wide-scale settlement, and native groups throughout the East were presented with few choices. Those who had not been exterminated during the seventeenth century continued to retreat westward, only to find Europeans close behind them. New York's treaty with the Five Nations of the Iroquois had protected the frontier, and the thin population of New York as a whole had limited conflict with upstate and western tribes. Downstate groups, however, were being devastated. Few remained, although some natives were active in the whaling trade on Long Island. Most of the Lenape, by then known to the English as the Delaware, had been pushed westward to the Delaware River Valley by the first decades of the eighteenth century.

A legend noted in early histories of Rockland County highlights the feeling of conflict between native and European groups. This story tells of a dispute between a local tribe and a prominent European settler, which resulted in the sacrifice of the settler's daughter atop an "alter" (sic) of piled stones (Bedell 1941 in Ross 1983). This altar, known locally as Spook Rock, is still present today at the intersection of Spook Rock Road and North Airmont Road/Highview Road, and is commemorated with a plaque erected by the Rockland County Society.

3.2.2.3 Eighteenth-Century Economic Development

After the Treaty of Utrecht in 1713, the fortunes of New York State improved considerably. By 1720, the population had grown to around 40,000, tremendous tonnage cleared New York Harbor, and sound fiscal policy was in place, all of which contributed to New York's prosperity, as did a dramatic increase in the slave trade. European immigrants, some sponsored by major landowners, began to filter into New York.

In particular, the populations of the Lower Hudson River Valley and Long Island surged as colonists moved from Massachusetts and Connecticut into territories claimed by New York. But New York remained a net importer and struggled to find export markets. Tensions emerged between mercantilist and landed factions about the direction of the colony, including the issuance of bills of credit to finance trade and colonial operations, but overall the colony was moving rapidly to a "credit-based, consumer oriented, market economy" (Howard 2001).

Even as population grew rapidly, small-scale farmers were discouraged from settling in New York because of the high taxes and the continued pattern of huge land patents that favored the wealthy. Overall, the plantation system emerging in the South had productive advantages over the mixed farming and commercial economy of the North. The combination of agricultural plantations staffed by slaves and sharecroppers and small-scale farming both made the South predominantly rural and produced a higher per capita income than the North. Regulation of colonial industrial capabilities by England (from raw materials to finished goods), taxes and tariffs, and control over shipping severely restricted colonial development (Middleton 1992).

The poor condition of New York's roads was a serious problem during King William's War, and this deficiency further impeded economic development. In 1703 the New York Assembly ordered the construction of several roads. The first followed a well-known track north from New York City through eastern Westchester County into Connecticut. This became the Boston Post Road, and the Albany Post Road was established on the western side of the county. A third, the "King's Road," ran the length of Long Island from New York City to East Hampton. Other north-south roads were planned for both sides of the Hudson River. These roads were especially important in attracting settlers from New York City to the surrounding counties (Griffin 1946; Howard 2001).

Much of the eighteenth century in New York was taken up with economic expansion. Shipbuilding and ancillary industries were particularly important in Manhattan and along the Long Island Sound, while ironworking began to develop in northern New Jersey and Orange County. Westchester County continued to develop as a series of independent communities (Griffin 1946). Provincial government was increasingly conducted through the assembly, which continued to be dominated by shifting alliances of landed interests and urban merchants.

During the 1750s, a large number of important innovations had been made in New York City and surrounding counties, which contributed to the region's social and economic importance. These included the founding of King's College (now Columbia University), the first library society, completion of the Albany Post Road through the Hudson Highlands, and establishment of the ferry from Manhattan to Staten Island (Greene 1931).

While farming continued to be the major source of economic life in Westchester, a variety of other industries had emerged, many of which utilized the area's many small watercourses for power. Sawmills, which supplied employment for a variety of wheelwrights, carpenters, and other craftsmen, particularly proliferated from the 1740s onward (Griffin 1946). Port Chester, founded near the mouth of the Byram River in eastern Westchester County was first named Saw Pit or Saw Pit Landing after the saw mill and boat building shop established there as part of the early settlement. The settlement grew slowly during the first half of the 18th century, but due to its good harbor and its growing shipbuilding industry, the port became a transshipment point for agricultural produce and farm products from the surrounding countryside. On the verge of the revolution, Westchester County was the wealthiest and most populous in the state.

3.2.3 The Revolutionary War, 1776 – 1783

New York – and Westchester County in particular – was the base of much activity during the American Revolution. The social and economic structure of the state was still dominated by large landowners, and discontent had already emerged among tenant farmers during the 1750s and 1760s. The imperial burden on the colonies increased during the 1760s with passage of the Proclamation Line of 1763, the American Revenue Act (the so-called Sugar Act) of 1764, and the Stamp Act and Quartering Act in 1765, all of which were intended to finance the British Empire from locally collected revenues. These burdens fell hard on colonial economies still in the midst of postwar depression following the French and Indian War.

The formation of the Continental Association by the First Continental Congress in 1774, calling for a strict economic boycott of Britain, made a military confrontation almost inevitable (Howard 2001). Support for rebellion grew, particularly outside of New York City. Orange and Ulster Counties had no large manors and their small landowners were strongly patriotic. Westchester County, however, was strongly divided. The influential Philipse family remained loyal to Britain, while the Morrises and Van Cortlandts were patriotic.

The Battle of Lexington and Concord in Massachusetts in April 1775 helped create momentum that led to increased patriotic militancy in New York and an effort by militias to disarm loyalists. By June 1776, a British invasion force of 30,000 troops was anchored off Sandy Hook. Local disagreements over New York's position dissolved with the landing of British troops on Staten Island in July 1776 (Griffin 1946; Howard 2001).

As the British advanced northward from Staten Island, colonial forces under the command of George Washington were forced to make a strategic retreat north into Westchester County (Griffin 1946). In the Village of White Plains, Washington made his headquarters in the house of Elijah Miller, which became one of the three monuments of the White Plains National Battlefield Site and is now the Washington's Headquarters Museum.

The Hudson River played a key role on numerous occasions during the American Revolution. In August of 1776 Captain Benjamin Tupper led a flotilla of six row galleys in an attack on a British squadron of two frigates, *The Rose* and *The Phoenix*, and three ship tenders that were anchored off of Tarrytown near the location of the present Tappan Zee Bridge. The ensuing exchange of cannon fire resulted in considerable damage to one of the American galleys and minor damage to the remaining five. Captain Tupper reported two of his men killed and six wounded by British cannon shot. The captain of *The Phoenix* reported damage from two cannon balls to his hull, while the captain of *The Rose* reported considerable damage to its starboard rigging and several cannon shot lodged in its hull (McGuinness 2006). This is the only known account of a naval skirmish between American and British forces in the vicinity of the Tappan Zee crossing.

The Battle of White Plains began on October 28, 1776. Figure 3-2 depicts the movement of forces in the vicinity of Westchester County. (Note: the I-287 project corridor is not depicted on this figure due to map's distorted depiction of Westchester County). The American forces had created a defense line with embankments around White Plains, and initial British attacks were unsuccessful. The British waited for reinforcements, but when they attacked again on November 1, the Americans had reoriented their defenses along an east-to-west line that stretched into the hills of North Castle. More reinforcements were summoned. Considerable damage was done to the area during the extended siege. Ironically, the lands belonged to the loyalist Frederick Philipse, and most of the tenants and villagers fled the fighting. Some of Washington's officers favored a scorched-earth policy, and while this was rejected, an officer from Massachusetts did set fire to White Plains, which then burned completely. With a large British force

Figure 3-2 Plan of the Battle of White Plains, 1777 (source: Sauthier 1777)

See note on cover regarding report continuity and references to rescinded project

advancing, the bulk of American forces in Westchester County retreated across the Hudson River to New Jersey (Griffin 1946; Countryman 2001).

The British sought control of the Hudson River to effectively cut New York and New Jersey off from New England. In an attempt to prevent the British from gaining control, American forces implemented countermeasures. In 1778 American forces placed a massive floating chain across the Hudson River at West Point, approximately 25 miles upriver from the Tappan Zee. The chain was approximately 1,500-1,600 feet in length and was comprised of 800 links, each measuring 2 feet in length and weighing 125 pounds (Diamant 1996). The blockade device was floated across the river on giant log rafts from the west shore of the Hudson River to the eastern shore of Constitution Island. The "Great Chain", as it was called, effectively blocked British river traffic along the Hudson River, shifting the focus of the war to points south.

Westchester, however, remained on the front lines until the end of the war, and was devastated. The American defense line stretched from Mamaroneck to Peekskill, with British forces arrayed across southern Westchester, creating a "neutral ground" in between. Present-day Bronx County was included in the so-called neutral ground. Troops from both sides foraged for provisions and marauded for profit, which in turn forced refugees to begin raiding. The British gradually captured the bulk of Westchester County by 1779 but were unable to press their advantage further (Griffin 1946; Countryman 2001).

Gradually the Americans pushed the British back from the Hudson Highlands and then Westchester County. On July 15, 1779 General Anthony Wayne and his Corps of Light Infantry conducted a successful assault against a strong British encampment at Stony Point, the modern Stony Point Battlefield in Orange (now Rockland) County. The strategic importance of the Lower Hudson River Valley was paramount, and Washington made his headquarters in New Windsor in Orange County from 1779 to 1781. Washington also stayed at the home of John DeWint in Tappan several times during the war. The trial of British spy Major John Andre was held in Tappan in1780, and American troops encamped nearby on the "ridge west of Tappan," approximately 4.5 miles south of the I-287 corridor (Uris and Capobianco 1976:21).

French troops under Count Rochambeau marched from Rhode Island toward Westchester County and linked up with Americans crossing the Hudson in June 1781. Washington and his allies ultimately defeated the smaller British force under Cornwallis at Yorktown in October 1781 (Greene 1931; Griffin 1946). The Treaty of Paris was signed on September 3, 1783 and the British completed their evacuation of New York City on November 25.

3.2.4 Late-Eighteenth- and Nineteenth Century Development

3.2.4.1 Post-War Economic Revival and Expansion, 1780s – 1850

After the war, New York State was independent and poised for radical redevelopment. One of the single most important features that shaped the politics and landscape of the nineteenth century future was the Confiscation Act of 1779, which mandated the confiscation and sale of loyalist real estate by the state of New York. While Westchester County lands, including those of the Philipse family, did become the property of tenants and new landowners from New York, the vast estates of the Mohawk Valley and other frontiers largely ended up in the hands of speculators. Figure 3-3 shows the Tarrytown-Irvington portion of the Commissioners of Forfeiture map of the Philipsburg Manor as divided into large tracts that were given/sold to the former tenants of the Manor. Of particular relevance to the current study is the history of the Requa Property, presently owned by Kraft Global, Inc. In 1785, following the American Revolution, Captain Glode Requa Jr. (1729-1806) paid 888 pounds in cash to the Commissioners of Forfeiture for title

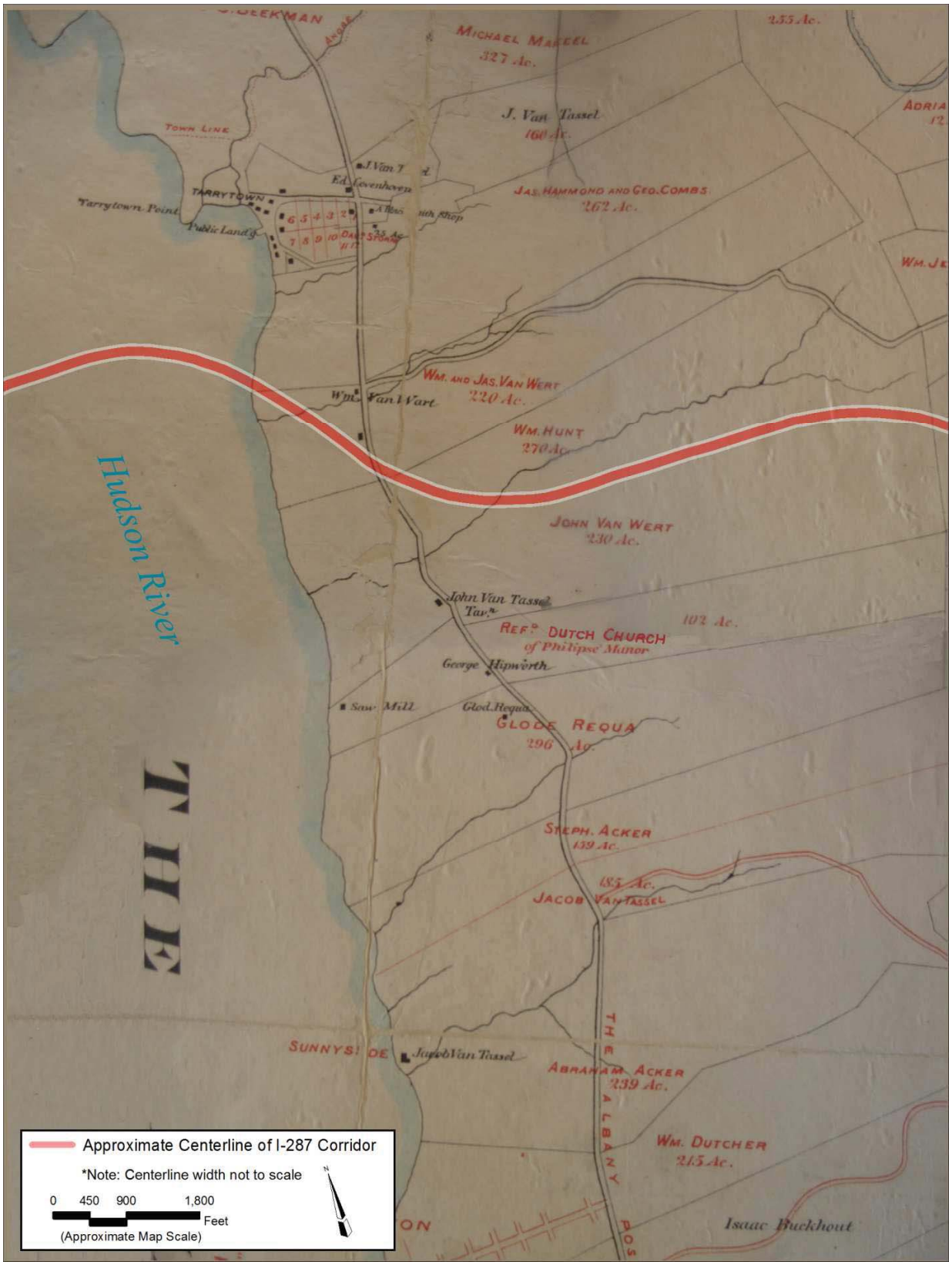

Figure 3-3 Map of Lands of Philipsburg Manor, 1785 (source: Couzen 1880)

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to the 296 acres of land that his father, Glode Requa had farmed as a tenant on the manor. The Requa family held title to the land until 1859.

Land reform was coupled with legislation such as the Citation Act of 1782, designed to protect patriot debtors against loyalist and British creditors. Furthermore, legislation designed to disenfranchise loyalists who had taken up arms against the patriotic cause apparently effectively denied voting rights to all residents of Westchester County. Nevertheless, in 1788 the county was divided into 20 towns and began an economic revival (Griffin 1946; Countryman 2001).

The Confiscation Act of 1779 began a long cycle of land reform that effectively broke the remaining influence of the old propertied classes on New York's political and economic life (Fox 1919). Taking their place were farmers and artisans, a much smaller landed class, and land speculators. Unlike the eighteenth-century manorial system, the many land sales of the nineteenth century were intended to generate wealth through the purchase and resale of immense tracts of land. The semi-feudal manorial system was almost entirely replaced by rural capitalism, which saw landowners creating entire communities on the pattern of the New England market town. The population doubled to almost 60,000 during the decade from 1790 to 1800, as migrants from Britain and New England flooded into the open lands of the state. Massive deforestation occurred as almost the entirety of New York State was converted to farming.

In 1798 Rockland County was established. It was already heavily deforested from having been a source of mast timber for shipbuilders prior to the Revolution and, along with the Bergen woods, a source of firewood during the later 1770s and early 1780s. Broken off from the much larger Orange County, Rockland, at only 176 square miles, is one of New York's smallest counties. It is characterized by difficult terrain, including coastal marshes and the Ramapo Mountains, with only one break, the Ramapo Pass, permitting access to the Hudson River. Until the advent of the steamboat and construction of railroads, the economy of Rockland County was dependent on backcountry farming, highland timber-cutting, and small communities along the shore (O'Brien 1981). By contrast, in Westchester County there were almost 3,000 farms by the 1780s. Few farms were larger than 500 acres and only three were larger than 1,000 acres; most were cultivated by independent farmers (Griffin 1946). Figure 3-4 depicts Rockland and Westchester counties with major place names, roads, and water courses. Note that the area of present day Bronx County is noted as the settlement of Westchester.

The economies of Westchester and Rockland Counties remained overwhelmingly agricultural during the first half of the nineteenth century, and this drove a number of infrastructure improvements. The Croton Turnpike, for example, was organized in 1807 to carry the enormous amount of cattle traffic en route to New York City. But proximity to national and international markets, access to energy sources, and increasing capital investment in technology and industry began to expand the longstanding tradition of small-scale industrial production in these counties. Copper was mined near Sing-Sing (now Ossining) and iron was mined near Port Chester and Irvington, as well as throughout Rockland County. Ironworking was established in Peekskill, and was especially widespread throughout Rockland County and northern New Jersey (Lenik 1996). Brick making and quarrying were also industries with a visible impact, especially in the Palisades where, along with deforestation, they had a major impact on the landscape (O'Brien 1981). Other industries developed to service local and international markets. The streams that had powered saw mills a century earlier now provided energy for new industries, including glue, shoe, hat, and pencil factories and paper, carpet, and clothing mills (Griffin 1946).

The impact of the vast changes during the first half of the nineteenth century cannot be overstated. The landscape of New York State was profoundly transformed by land speculation, which opened virtually the entirety of the state for farming, and more gradually by the spread of industry. As an economic class, however, land speculators were fairly short-lived.

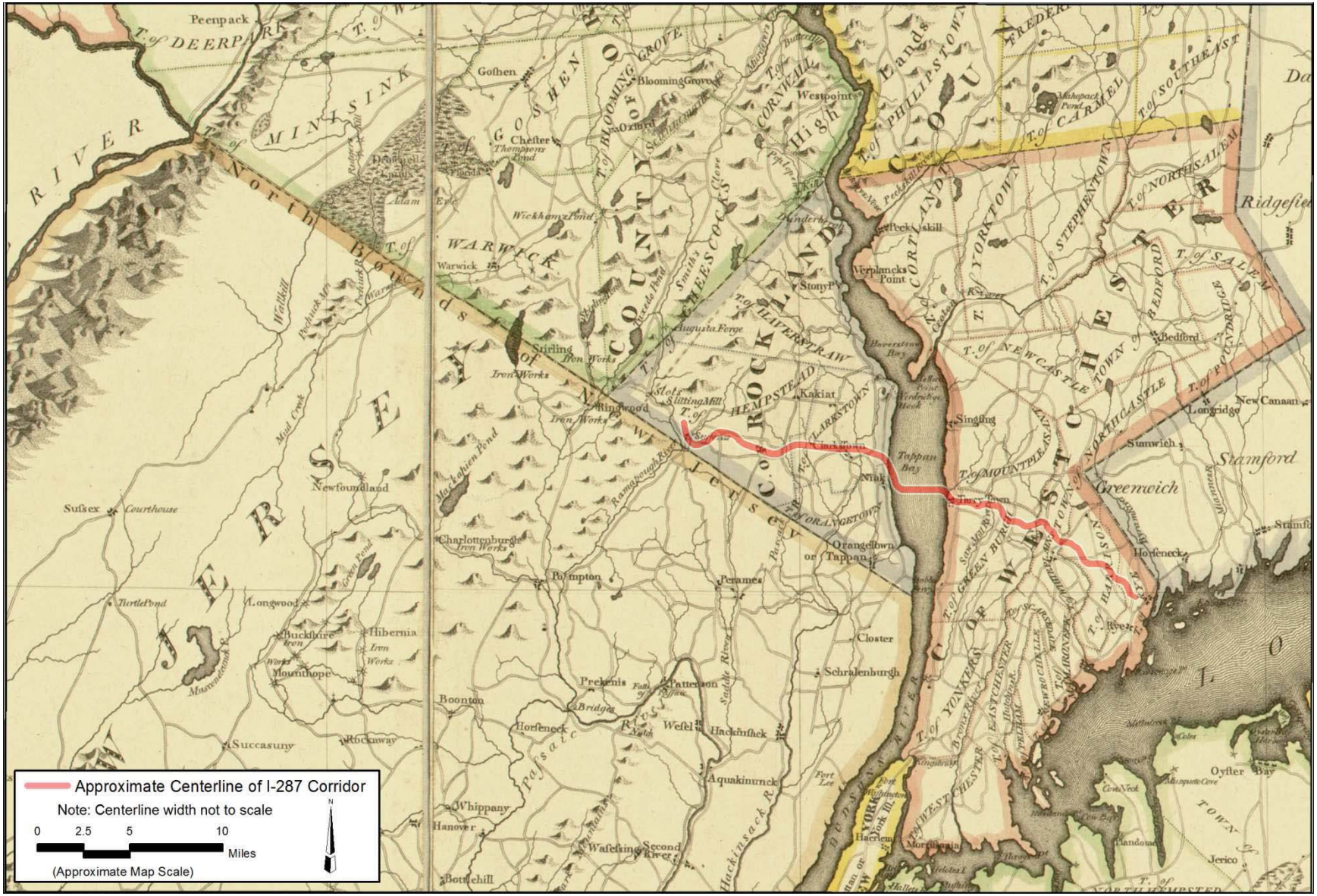

Figure 3-4 Rockland and Westchester Counties and Vicinity, 1802 (source: De Witt 1802)

3.2.4.2 Early-Nineteenth-Century Transportation System

The vast spread of private landholding meant that agricultural and finished products needed to be transported to urban centers, primarily New York City. Along the Lower Hudson River Valley, crossing the various rivers and streams that separated Manhattan, Staten Island, and Long Island from the surrounding mainland had been an issue since European colonization began. More bridges had been proposed than actually constructed from the seventeenth century onward, and ferries carried the bulk of river traffic. Stagecoaches carried the bulk of passenger traffic into Westchester County and inland counties until the spread of railroads after 1830 (Griffin 1946).

The Burr 1829 map sheet for Rockland County, shown as Figure 3-5, depicts the paucity of roads in the county at this time. The few roads connect isolated areas of settlement such as Ramapo, Suffern, Clarkstown, and Nyack. In contrast, the Burr 1829 map sheet for Westchester County, shown as Figure 3-6, shows an established Township system with a far more developed transportation network of roads between the settlements of Tarrytown, White Plains, Saw Pitts (Port Chester), and Rye.

Though shipbuilding was a major industry on both the Hudson River and Long Island Sound sides of Westchester, regular sloop traffic to Manhattan did not begin until the later eighteenth century. Nyack, in Rockland, became a major center for shipbuilding in the early part of the nineteenth century. In 1836, the sloop *Robert Wiltsie* was built at Nyack by William Dickey. The ship had a 63’ 9” length, 23’ 5” beam, and with a 5’ 9” depth of hold, modernized the Hudson River sloop hull lines to an extent that has not been improved on since (HRSRI 1970). In 1807 the steamboat revolution, engineered by Robert Livingston and Robert Fulton, opened a new era on the Hudson River.

The first steamboat ferry to sail from Nyack was the *Orange*, which made 1 to 2 trips per week to and from New York City beginning in 1828. Regular roundtrip ferry service between Nyack and New York City did not begin until 1849, when the faster, more efficient ship *Warren* began its term of service (Nanriello 1993). The first franchise granted for ferry service between Tarrytown and Nyack was given to George W. B. Gedney in 1839. Gedney operated a 16-ton sailboat which began service every morning, weather permitting, from its dock at the foot of Third Street in Nyack (Nanriello 1993). The Tarrytown to Nyack ferry crossing of the Hudson River would be replaced by the Tappan Zee Bridge by 1955.

3.2.4.3 The Canal System

The population increases after the American Revolution made water transportation a pressing issue. In 1792 the Western Inland Lock Navigation Company was organized to improve the route from the Great Lakes to the Hudson River, and the Northern Inland Lock Navigation Company was set up to improve the route from Lake Champlain to the Hudson River. While the latter was unsuccessful, the former quickly undertook to clear and straighten an existing riverbed and then to cut through and circumvent falls on the Mohawk River with a series of locks. Construction of the Erie Canal (1817 to 1825) connecting the Hudson River to Lake Erie via Rome and the Seneca River began after the inconclusive end of the War of 1812. The canals quickly proved their value by shortening routes and dramatically reducing freight costs (Larkin 1998; Countryman 2001).

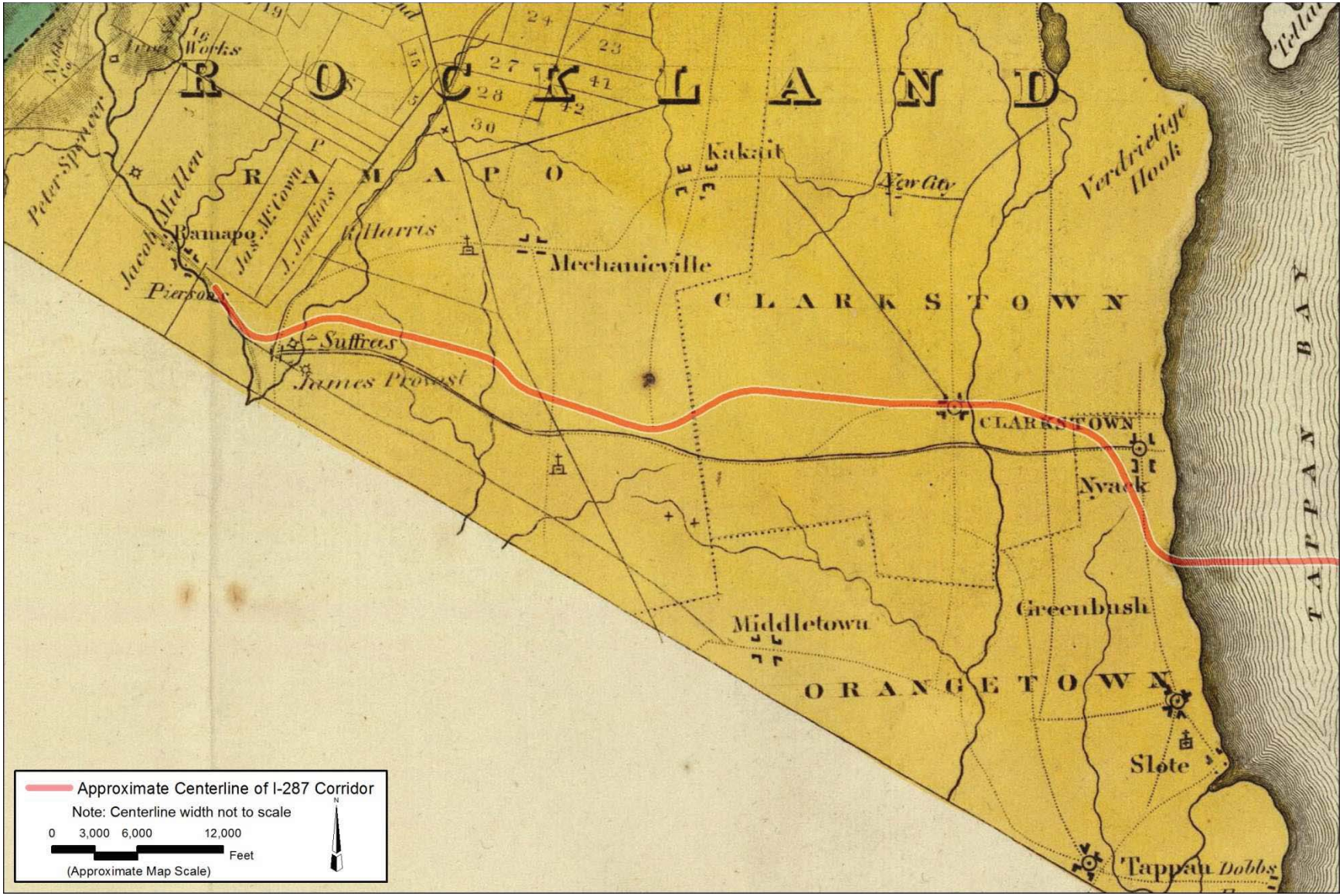

Figure 3-5 Rockland County, 1829 (source: Burr 1829)

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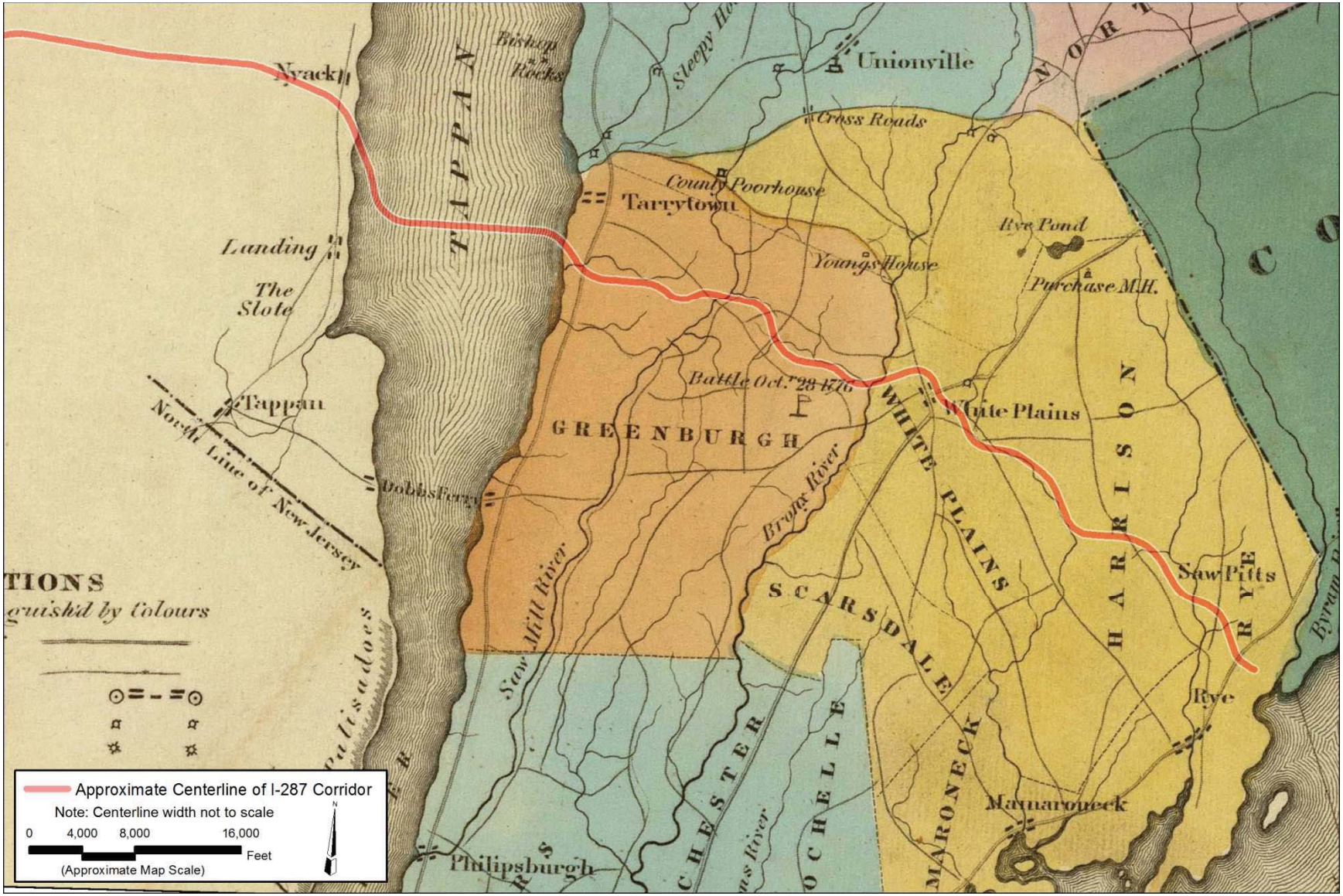

Figure 3-6 Westchester County, 1829 (source: Burr 1829)

See note on cover regarding report continuity and references to rescinded project

Most canals and waterway improvements were located in the northern and western parts of the state, but their impact on the Lower Hudson River Valley was tremendous. Hudson River Valley farmers had opposed the Erie Canal, fearing competition from further west (Countryman 2001), as New York could boast to be the breadbasket of the nation at this time. The success of the new waterway did deprive the state of this claim by allowing the Midwest to become the leading producer of wheat in the US, but the export of grain to Europe was a major industry that benefited the economy of the Lower Hudson River Valley as a whole. The Erie Canal fostered the growth of cities along its course, including western cities like Rochester and Buffalo as well as eastern ones like Albany and New York City. The Erie Canal was completed in 1825, the same year that the state legislature approved surveys for 17 more canals and one year before the incorporation of New York's first railroad.

The construction of the Delaware and Hudson Canal in 1825 added another significant link, this time between Honesdale, Pennsylvania, Port Jervis on the Delaware River, and Kingston on the Hudson River. The Morris Canal was completed from Philipsburg to Newark, New Jersey by 1831, and extended to Jersey City on the Hudson River by 1838. These canals were important in that they were privately funded and constructed, and also employed a variety of technological innovations, including the use of hydraulically powered plane systems to compensate for the rugged terrain through which they were constructed.

3.2.4.4 The Establishment of Railroads

The advent of canals and ferries had already begun to transform the economic geography of New York by providing access to some towns and bypassing others. Population and economic growth was greatest in the western parts of the state. Kingston in Ulster County had become the terminus of the Delaware and Hudson Canal and was transformed from a small town to a medium-sized manufacturing city (Countryman 2001). However, the final land-based transportation innovation that altered the landscape of New York prior to the Civil War was the railroad, which created a transportation revolution that would eventually supersede the canals.

In 1826 the legislature incorporated the first railroad, a 16-mile stretch connecting Albany and Schenectady. Opened in 1831, the Mohawk and Hudson Lines were followed by frenzied construction and speculation throughout the state. By 1842 the New York and Harlem Line was operational from Manhattan to The Bronx; five years later the line was extended to White Plains, and thereafter further north to Bedford. The Hudson River Railroad was completed along the east side of the river between New York City and Rensselaer in 1851. During the next decade, the Hudson River Railroad and New York Central were absorbed into the Vanderbilt railroad empire, ultimately leaving Cornelius Vanderbilt in control of all the lines between New York City and Albany.

On the west side of the Hudson River, the New York and Erie Railroad reached Orange County in 1841, and spur lines quickly spanned the county. In Rockland County, Piermont Pier marked the terminus of the Erie Railroad, completed to Ramapo by 1841 (Figure 3-7), and extended to Lake Erie by 1851. Connections were made to rail systems on the east shore via a rail ferry. In 1859 the Northern Railroad of New Jersey also completed a link from Fort Lee to Closter, allowing extractive industries to ship materials south and northbound passenger traffic to reach burgeoning resorts (O'Brien 1981).

In the 1870s, railroads connecting New York City and Albany were built along the west shore of the Hudson River, in direct competition to Vanderbilt's New York Central Line. During the same period, the Jersey City & Albany Railroad was constructed between Jersey City and Congers in Rockland County. In the 1880s, the New York, West Shore & Buffalo Railroad took over the Jersey City & Albany Railroad. The line then merged with the New York, West Shore & Chicago to provide service from Albany to

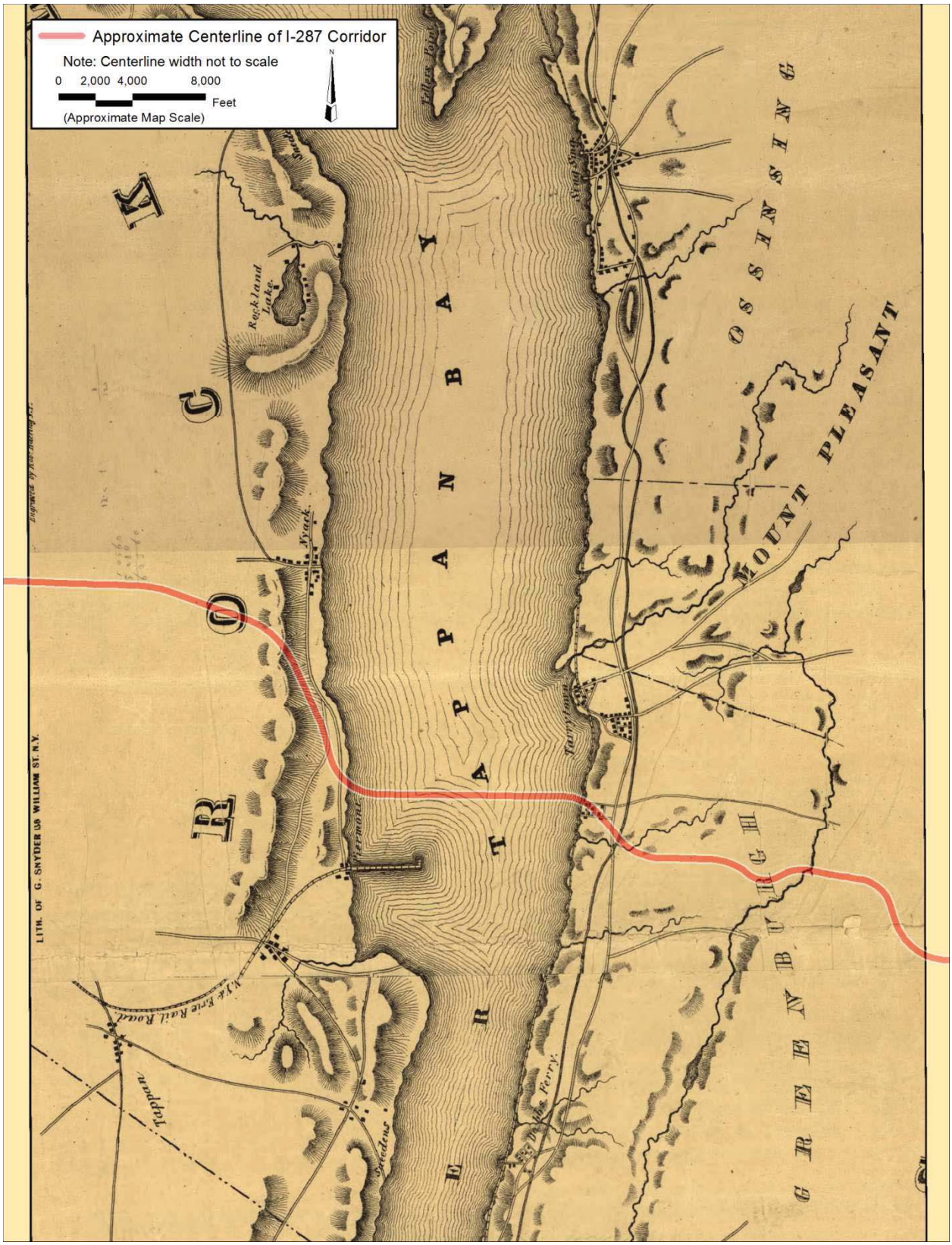

Figure 3-7 Transportation Development Paralleling the Hudson River, 1848 (source: Snyder 1848)

See note on cover regarding report continuity and references to rescinded project

Buffalo, and by 1884 trains were running between Weehawken, New Jersey and Buffalo. Vanderbilt moved across the Hudson River and took over the line in 1885, which came to be known as the West Shore Railroad.

Improved transportation networks across both counties saw a growth in population during the second half of the 19th century. Figures 3-8A and 3-8B depict the Tappan Zee Bridge/I-287 project corridor across Rockland County in the mid-1880s, while Figures 3-9A and 3-9B depict the Westchester County portion of the project corridor in the early 1880s.

While the canals had contributed to an economic boom, the fortunes made by the railroads were much larger in comparison. The railroads were private undertakings, and the vast amounts of capital necessary to launch railroads had also made New York City and its banks the financial capital of the US.

The rapid spread of trolleys also created local transportation networks throughout New York City and surrounding counties; those networks were gradually consolidated by the early decades of the twentieth century (Gunn 2001; Friedman 1984).

3.2.4.5 Development of the Water Supply System

A major development during the nineteenth century was the construction of a water supply system for New York City. Public water sources, such as wells, had been created during the seventeenth century in Manhattan, but streams and ponds were adequate until the mid-eighteenth century. After the Revolutionary War the growing population of New York City made the fresh water situation a pressing social and political issue, which had important implications for surrounding regions. A private company had dug several wells and had 25 miles of pipe and 2,000 customers by 1801, but these were inadequate to the needs of the growing population and the increasing risk and too-frequent reality of fire. Plans to dam the Bronx River went unrealized, but as fire and infectious disease struck with great severity during the 1820s and early 1830s, the issue of water reached crisis proportions (Galusha 1999).

The cholera epidemic of 1832, which killed more than 3,500 people, finally forced the city to act. A committee led by Col. DeWitt Clinton, Jr. investigated a variety of water sources from the Passaic to the Bronx Rivers. They quickly recommended that the Croton River in northern Westchester County be dammed and aqueducts be constructed to carry water to New York City. The proposal was approved and funded, but before construction began a massive fire consumed 17 square blocks of lower Manhattan on December 17, 1835. Under the direction of engineer John Jervis, a dam was constructed on the Croton River to create a 400-acre reservoir. A receiving reservoir was constructed in Manhattan and a closed aqueduct stretched for 42 miles to Croton, cutting through hills and flowing through aqueducts over the Sing-Sing Kill and the Harlem River (Galusha 1999).

The impact of the Croton aqueduct in Westchester County set the pattern for the next 150 years. Local landowners complained bitterly that they were being underpaid for lands being seized by the city, while the city complained about the opposition. Lawsuits were filed by all sides, workers (mostly Irish immigrants) went on strike for higher wages, and contractors absconded with funds. Damage claims and even fatalities resulted from accidental releases of water flooding over the partially constructed dam, and there were local complaints about the appearance of various components, such as the aqueducts. Despite all this, the project was finally completed and went on line in 1842, at a cost of $12 million (Griffin 1946; Galusha 1999). Figure 3-10 shows the route of the Croton Aqueduct through North Tarrytown and Tarrytown.

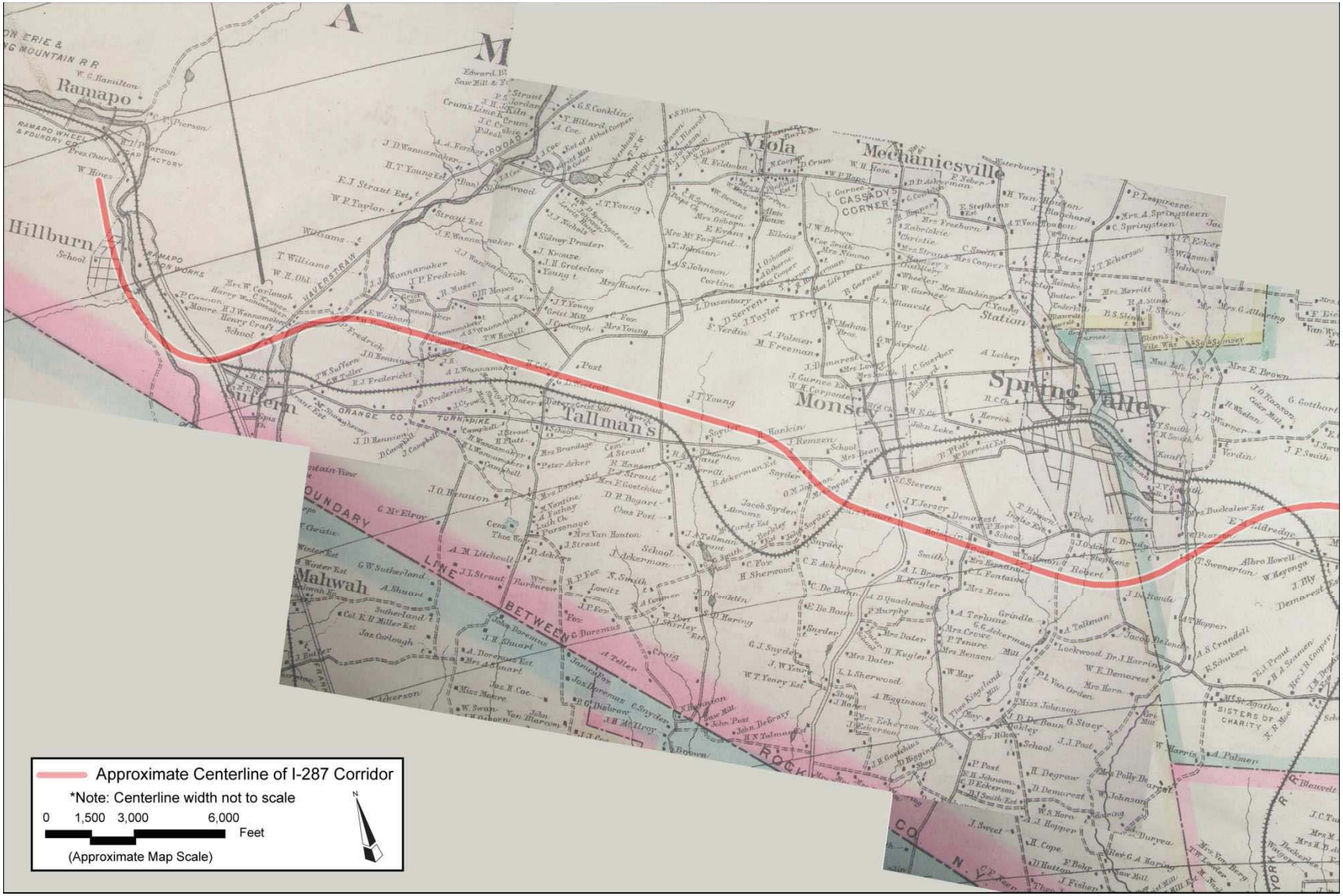

Figure 3-8A Rockland County in the Vicinity of the Tappan Zee Bridge/I-287 Corridor, Mid-1880s (source: Hyde 1886)

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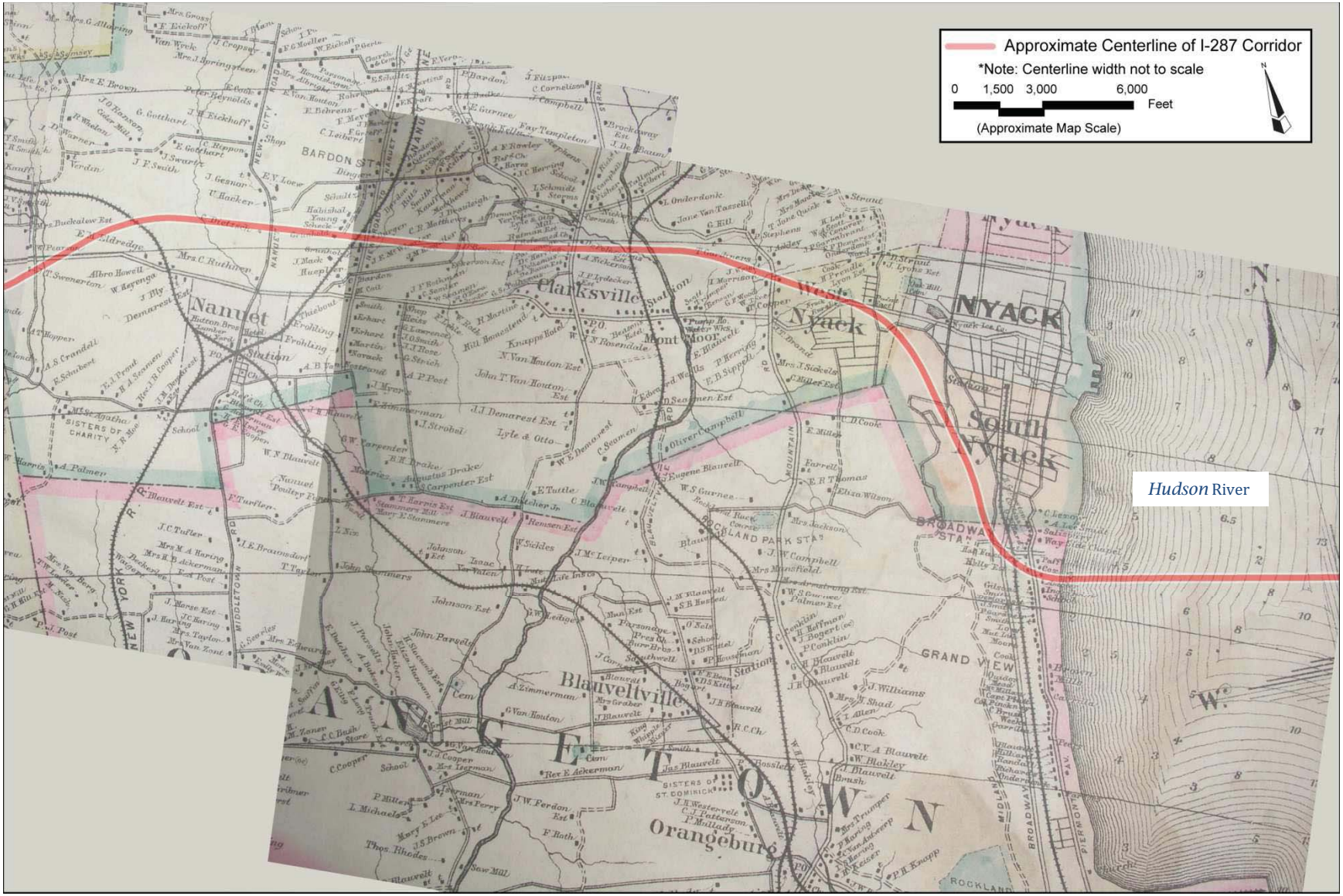

Figure 3-8B Rockland County in the Vicinity of the Tappan Zee Bridge/I-287 Corridor, Mid-1880s (source: Hyde 1886)

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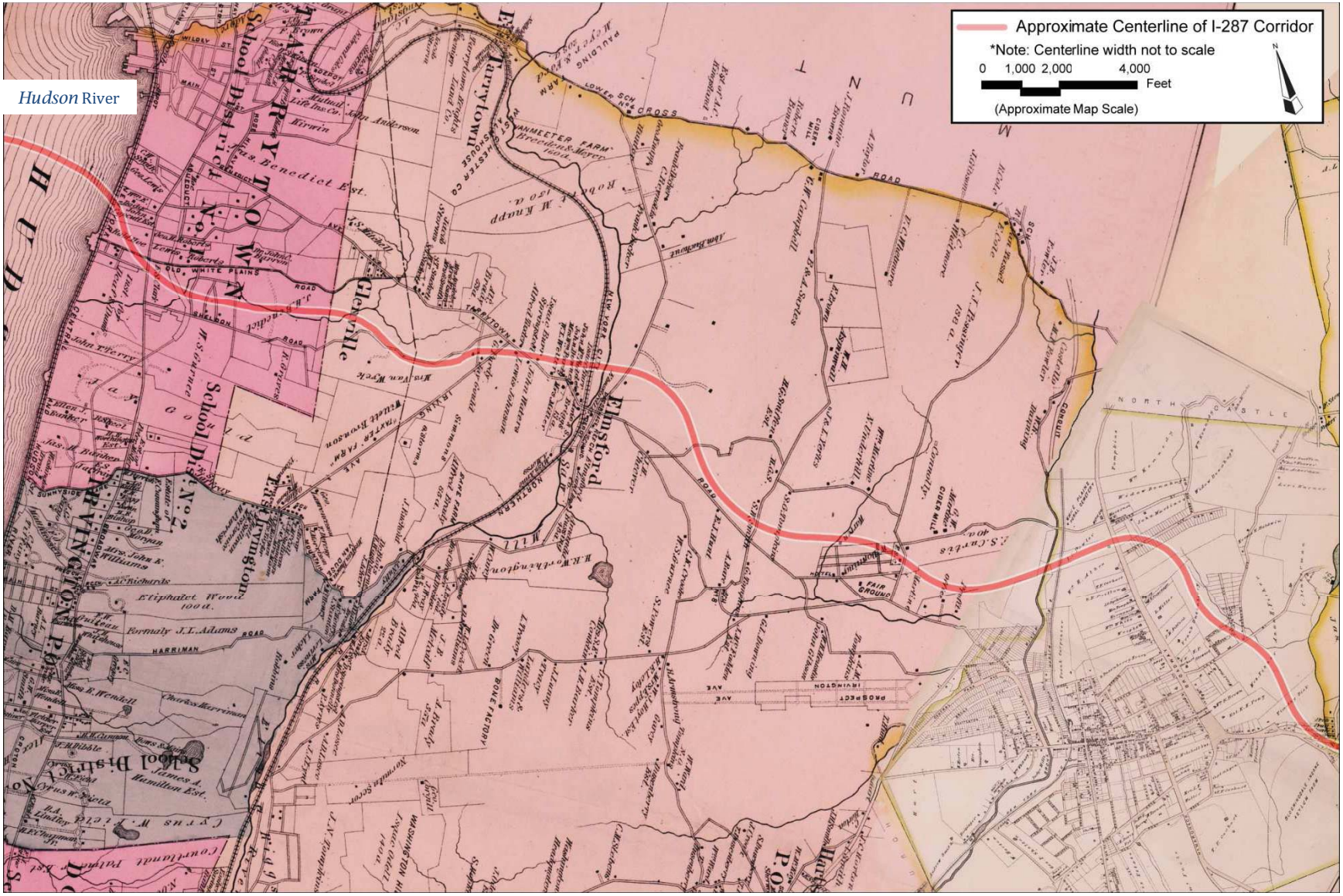

Figure 3-9A Westchester County in the Vicinity of the Tappan Zee Bridge/I-287 Corridor, Early-1880s (source: Bromley 1881)

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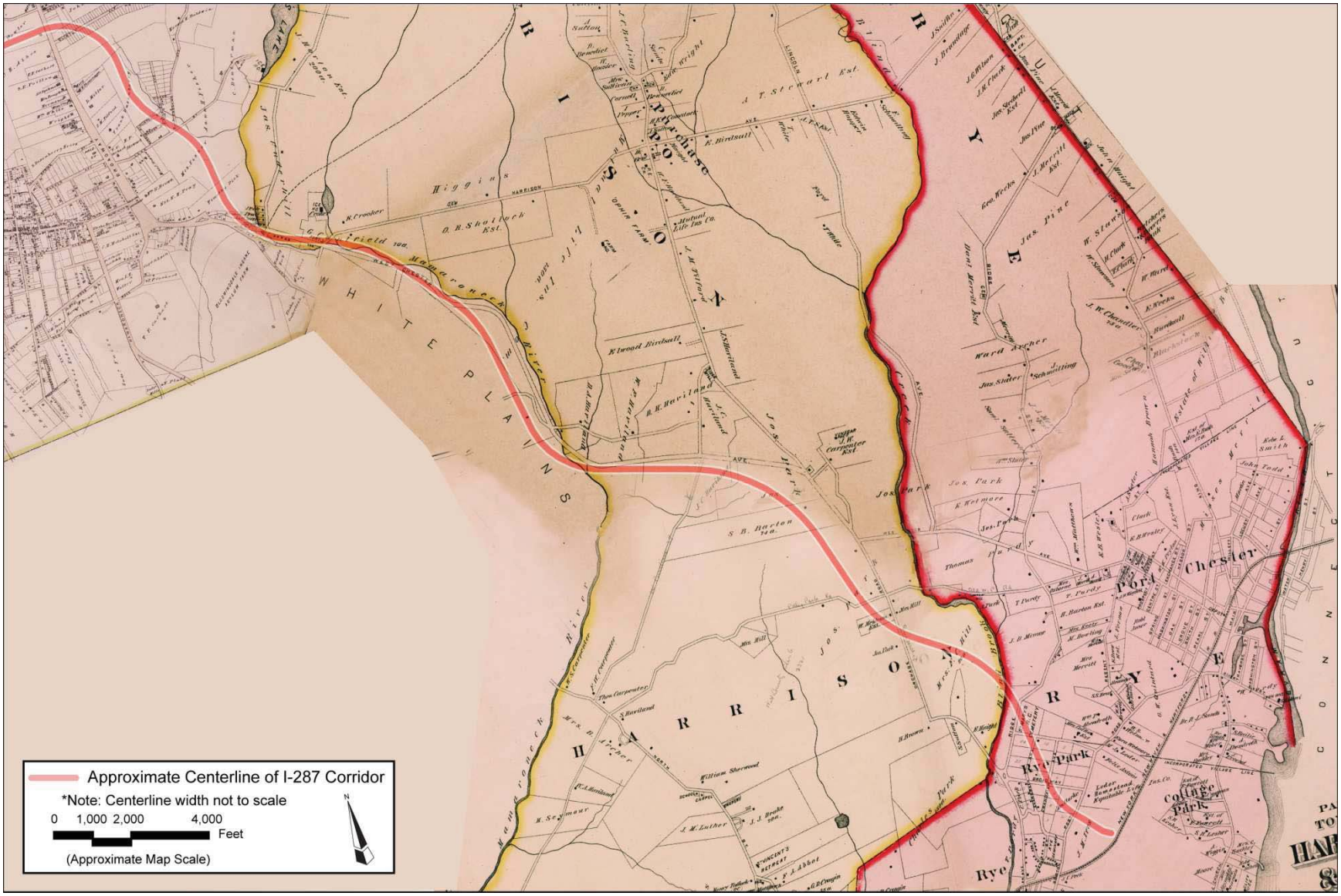

Figure 3-9B Westchester County in the Vicinity of the Tappan Zee Bridge/I-287 Corridor, Early-1880s (source: Bromley 1881)

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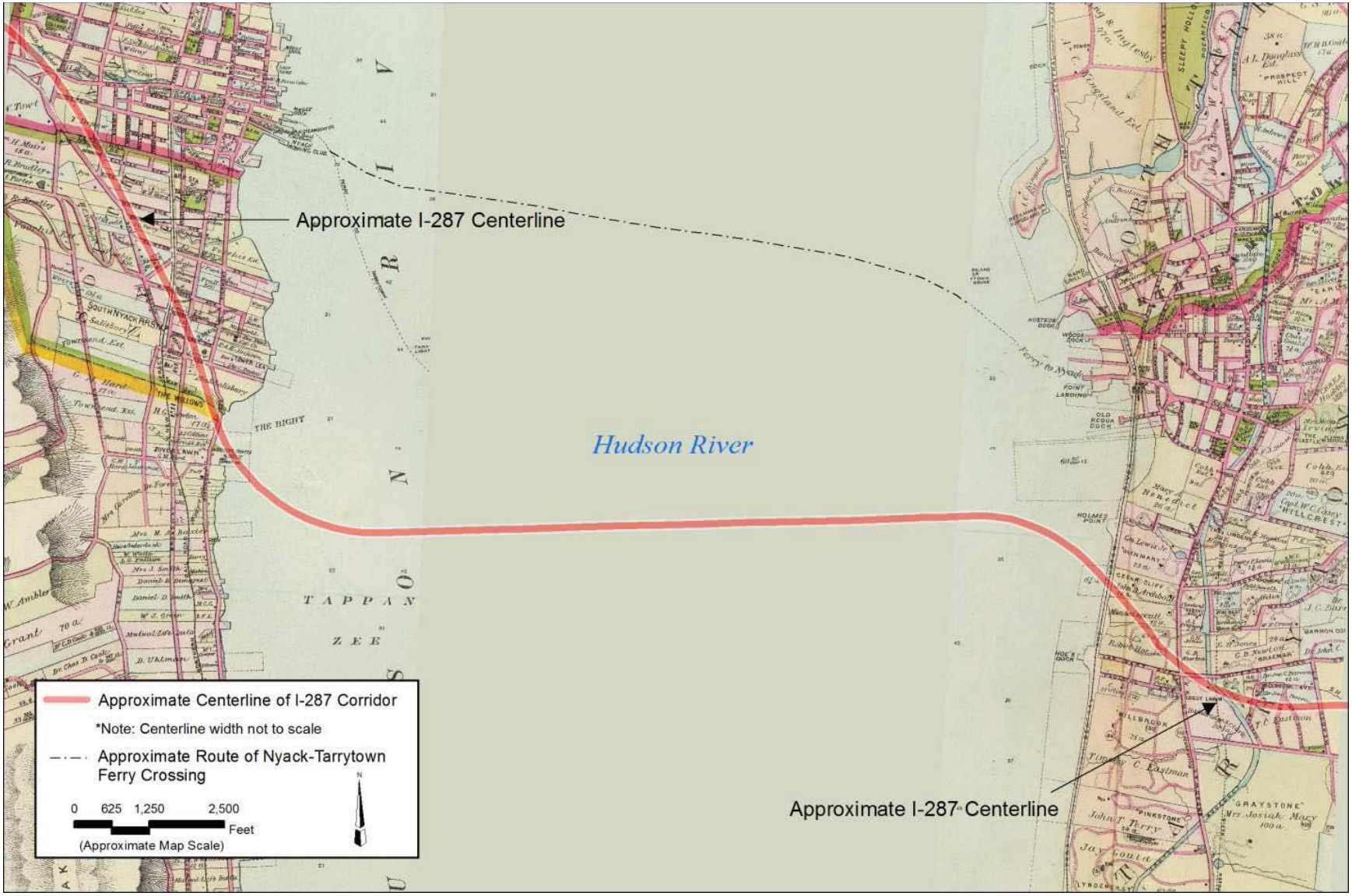


Figure 3-10 Late-19th Century Development in the Vicinity of the Hudson River (source: Beers 1891)

See note on cover regarding report continuity and references to rescinded project

New York City's growing population and the advent of indoor plumbing quickly made the Croton aqueduct inadequate. With a population of half a million at 1850, additions to the water system were necessary, and Westchester County was the renewed object of New York City's insatiable thirst. Maintenance of the aqueduct had been necessary to clear roots that had penetrated the masonry, and in 1851 the managing authority ordered areas surrounding the aqueduct cleared of plants and fenced. The aqueduct would quickly expand still further. Surveys of the Croton watershed during 1858 revealed 31natural lakes and ponds in a 352-square-mile catchment, stretched out along a 101-mile ridgeline (Griffin 1946). In 1852 a second reservoir was approved for Manhattan, although it was not completed for a decade. New York City's truly great era of land expropriation and lake building did not begin until after the Civil War.

The original Croton aqueduct was inadequate from the beginning and by 1858 New York City was eyeing the entirety of the Croton River watershed. In 1865 the state legislature empowered the aqueduct board to acquire land in Westchester, Dutchess, and Putnam Counties, and the Boyd's Corner project in the late 1860s created a 300-acre lake and condemned 8,300 acres in central Putnam County. Mass displacement of communities followed, with entire valleys and towns, such as the Town of Southeast, flooded and more lands expropriated around the watershed. The first Kensico Dam on the Bronx River created a 230-acre lake, the Sodom Dam a 553-acre lake, and the Titicus Reservoir a 734-acre waterbody. The New Croton Reservoir had 38 miles of shoreline and encompassed 1,962 acres.

Tens of thousands of acres had been taken, thousands of residents displaced, and the landscape transformed not simply by the waterworks themselves but also by the transportation routes and industrial centers they created. By 1894 New York City owned seven completed and four incomplete reservoirs and a number of lakes, connected to the city by an enlarged aqueduct system (Galusha 1999). Demand continued to increase in New York City with the annexation of surrounding communities and the incorporation of the five boroughs in 1898 (Baker 2001). But the capacity of the watersheds to the east of the Hudson had largely been reached and the willingness of those counties to submit further to New York City had long been exceeded. With the completion of the Croton Falls Reservoir in 1911, New York City turned its attention to the west, first to the Catskills and then to the Delaware River.

3.2.4.6 Late-Nineteenth-Century Industrial and Demographic Change

Farming was dramatically reduced in Westchester by the end of the nineteenth century. Within Westchester County's population doubled to 180,000 by 1900. Farming towns such as Bedford and Harrison shrank, while residential areas such as New Rochelle and White Plains grew. The increased availability of transportation and labor made the counties around New York highly attractive for industrial investment, as did the expansion of local urban infrastructure, such as water and sewer projects (Friedman 1984). Gas had been first used for illumination in Yonkers in 1854 and by the turn of the century virtually the entire county was supplied. The small electric companies that had begun supplying the county in 1886 were also gradually consolidated after the turn of the century, as were the numerous telephone exchanges (Griffin 1946). These infrastructures served not only industry but also the growing urban populations of southern Westchester County.

At the same time, however, parts of Westchester County were experiencing a sort of renewal of manorial life. The new era of mansion building began after 1850, as the county was linked to New York City by railroads, making it easy for wealthy individuals to commute. The decline in farming and the demise of the colonial propertied class had made privately held lands available, which were purchased by wealthy industrial and financial elites for estates. Figure 3-11 highlights some of these estates along the Hudson River in Westchester. Some notable examples include the following:

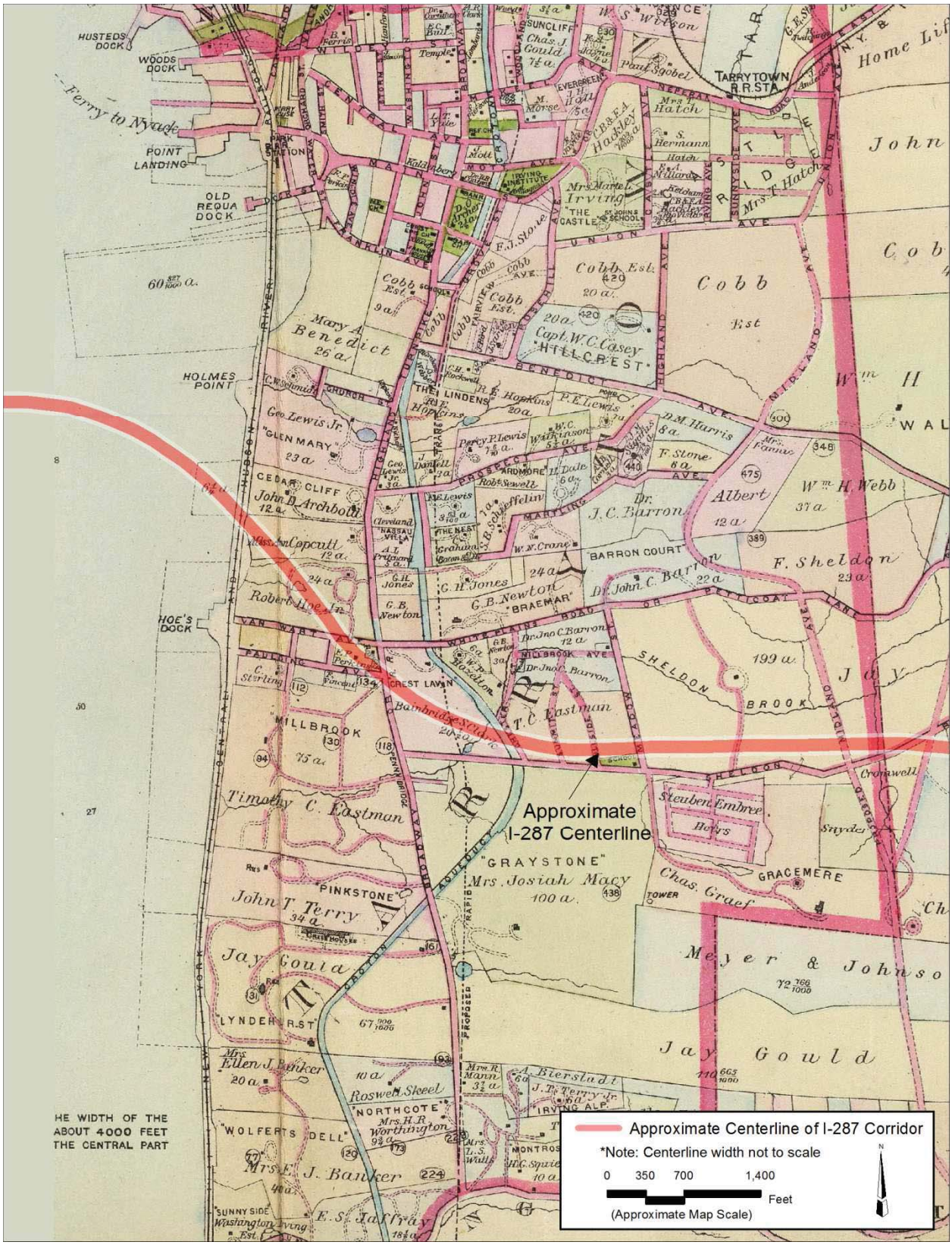


Figure 3-11 Westchester County Estates along the Hudson River, 1891 (source: Beers 1891)

See note on cover regarding report continuity and references to rescinded project

- The largest of Westchester's estates was John D. Rockefeller's in Pocantico Hills, now the core of Rockefeller State Park, comprising Kykuit, the main mansion with its art collections, and various lakes, streams, and vistas (Comstock 1984).

- Lyndhurst, on the east bank of the Hudson River in Tarrytown, was purchased by financier and railroad tycoon Jay Gould in 1880. Designed by Alexander Jackson Davis, Lyndhurst is considered to be one of the finest examples of Gothic Revival architecture in the US. Gould often commuted to Manhattan from Lyndhurst on his yacht. He built a bridge to his Hudson River dock across the railroad tracks that flanked the western edge of the property, as the Hudson Line was owned by his arch-rival Vanderbilt (see Figure 3-11).

- On the Long Island Sound outside of Port Chester, the industrialist and mechanical engineer William E. Ward engaged New York architect Robert Mook to design what is acknowledged to be the first reinforced concrete house in the US. Between 1870 and 1875, Mook built the castle-like structure, now known as Ward's Castle.

- In Purchase, Whitelaw Reid, the owner of The New York Tribune, rebuilt entrepreneur Ben Holladay's original structure into a castle. With gardens designed by Frederick Law Olmsted, the estate remained in the Reid family until 1949, when it was purchased by Manhattanville College.

By the end of the nineteenth century, industrialization was widespread in southern Westchester County, with Yonkers the clear leader, followed by Irvington, New Rochelle, and Dobbs Ferry. In Yonkers the leading industries were carpet manufacturing, land development, the Otis Elevator Company, sugar refining, and smaller manufacturing concerns, such as those engaged in hat making. The appearance of major companies such as Otis Elevator and Habirshaw Cable and Wire in Yonkers and the National Conduit Manufacturing Company (later the Anaconda Wire and Cable Company) in Hastings, among others, foreshadowed the early-twentieth-century pattern of immense industrial complexes along the Hudson River (Friedman 1984; Griffin 1946). As with the various infrastructure and service industries, consolidation of manufacturing would be one of the first economic trends of the early twentieth century.

In Rockland County, however, small-scale farming, particularly dairy production, apple orchards, and vineyards that utilized lands that could not be used for grain production, and light industry continued to compete with extractive industries such as quarries, which utilized new techniques such as high explosives. Resort industries were also important along the west shore of the Hudson River from Bergen County through Orange County (O'Brien 1981).

3.2.5 Twentieth-Century Development

Land remained the dominant theme for the twentieth century in Westchester and Rockland Counties, but in a far different sense than during the nineteenth century. The preceding century had seen the landscape transformed first through the end of the manorial system and the spread of freehold farming, then by industrialization and transportation networks, and finally by deliberate peripheralization as New York City's water source. Though the surrounding counties had always been secondary to New York City in terms of population, productivity, and wealth, the twentieth century gradually saw decisive political and economic subordination. The major difference in the theme of land during the twentieth century is that it is dominated by suburbanization.

3.2.5.1 Suburbanization

The suburbanization of Westchester County and surrounding areas had already begun during the nineteenth century with the decline of agriculture and the increase in estates for wealthy New Yorkers. Massive immigration had taken place due to the railroad and trolley systems and the labor demands of the new industries and public-works projects. The population of Westchester County alone grew from 131,000 in 1870 to 183,000 in 1890, and then from 344,000 in 1920 to 520,000 in 1930 (Friedman 1984; McMahon and McMahon 1984). The period from 1920 to 1930 alone represents a 51 percent increase in population. The increases should also be attributed to the consolidation of New York City and the reorganization of towns in surrounding counties, which gave local politicians opportunities to create new power bases and land speculators and developers the opening to create new neighborhoods.

A growing middle class also sought to relocate away from cities teeming with new immigrants. In the Palisades, for example, a strong upper-middle-class presence appeared in new communities from Fort Lee to Nyack, where estates filled much of the cliff-top space (O'Brien 1981), while laborers continued to live alongside rail, boat, and coal yards. All of this was made possible by a new transportation revolution.

3.2.5.2 Railroads, Trolleys, and Ferries

During the nineteenth century, railroads had tightened the economic linkages between New York City and surrounding regions and had made massive immigration possible. The trolley systems had created internal linkages within and between the major and minor settlements. In Westchester County, for example, trolleys connected Tuckahoe, New Rochelle, Mount Vernon, White Plains, and Tarrytown with Stamford, Connecticut and New York City, while towns as small as Peekskill had their own systems. These began to be consolidated with the shrinking number of commuter rail systems early in the twentieth century. Initial suburban development during the late nineteenth and early twentieth centuries closely followed the routes of rail lines. In many locations residents had the choice of numerous stations and different companies, and developers took advantage of the transportation geography to fill in open space with housing.

The larger trend, however, was for rail transportation to become increasingly oriented toward New York City, especially after the opening of Grand Central Terminal (GCT) in 1873 (Griffin 1946; Friedman 1984). The consolidation of competing rail and trolley companies after 1900 gradually intensified this north-south focus at the expense of lateral and local connections. Predictably, during the twentieth century other forms of surface transportation, subsidized by all levels of government, created a road system that diminished railroads and trolleys further. By the 1940s only a handful of streetcars remained in service in Westchester County, having been replaced by buses; by the end of the century none remained.

During the post-World War II era, regional railroad systems, like trolleys, began to decline as schedules were trimmed, equipment disintegrated, and personnel cutbacks were made. During the mid-1950s, construction of the interstate highway system paralleling major railroad lines foreshadowed the demise of railroads. By the end of the 1950s only three commuter rail lines remained in Westchester County: the Hudson, Harlem, and New Haven Lines, operated by the New York Central and the New Haven Railroad. A fourth line, the Putnam, shut down in 1958.

During the wave of railroad bankruptcies and consolidations of the 1960s and 1970s, the New York Central and the New Haven Railroads merged with the Pennsylvania Railroad to form Penn Central in 1968, which then went bankrupt in 1970. The Regional Rail Reorganization Act of 1973 created the Consolidated Rail Corporation, or Conrail, which assumed control of three commuter lines (the Hudson,

Harlem, and New Haven Lines) for the Metropolitan Transportation Authority (MTA), a public benefit corporation chartered by New York State in 1965.

In 1983, Metro-North Railroad (Metro-North), a division of MTA, was created to assume control of Conrail commuter operations in New York and Connecticut. Metro-North currently operates daily commuter trains between New York City and points north of the city, including communities in Rockland and Westchester Counties, on many railroad lines constructed during the nineteenth century such as the New York Central and New Haven Railroads, including the Hudson, Harlem, and New Haven Lines. Additionally, in the early 1980s, New Jersey Transit (NJT) acquired Conrail's commuter train operations in New Jersey, including the Pascack Valley and Main Line/Bergen County Lines (Canning 1984; www.mta.nyc.ny.us/mnr 2002).

Like trolley and railroad travel, ferry service also declined during the post-World War II era. The construction of the Tappan Zee Bridge (described below) and surface transportation links in the 1950s caused the demise of the last remaining cross-Hudson ferry service by 1956, as well as north-south passenger ferries.

3.2.5.3 Parkways

While railroads and trolleys had begun suburbanization, the construction of roads and the economic domination of the automobile made it a permanent condition. The Bronx River Parkway was the first significant roadway project that had wide-ranging effects on New York's suburbs. By the end of the nineteenth century, the Bronx River was an open sewer serving communities from White Plains down to the Hunts Point section of The Bronx. Diverse interests, including the newly created New York Zoological Society (through whose grounds the river flowed) and developers in Bronxville and Scarsdale demanded that the river be saved. By 1905, part of the solution was a proposal to run a sewer trunk line along the river. The land on either side of the river was purchased for a 25-mile-long park running up to northern Westchester County, and a "parkway" ran through this new sewage project and park (Martin 1984).

The Bronx River Parkway was an early example of a hybrid park-roadway concept, with a total area of some 1,155 acres. Construction took place from 1907 to 1925, but the Bronx River Parkway quickly spurred additional roadways:

- The Hutchinson River Parkway, constructed from 1924 to 1941 as a supplement to the Boston Post Road (and which was connected to the Merritt Parkway in Connecticut in 1940).
- The Saw Mill River Parkway, constructed from 1924 to 1951 as a supplement to the Albany Post Road.
- The Taconic State Parkway, constructed from 1923 to 1967, which extended the Bronx River Parkway far to the north into Columbia County and the Berkshires.

The three initial north-south parkways had created the need for larger east-west connections, and three were planned at various points in Westchester County. These were intended to replace existing east-west roads and were conceived as part of a scheme that included a ring road around New York City.

- The first and southernmost section constructed was the Cross-County Parkway, running from Rye to Yonkers, built from 1929 to 1947.

- The relatively short sections of the Central Westchester Parkway were constructed from 1929 to 1932 in White Plains, but the Cross Westchester Expressway (I-287), constructed in the 1950s and described in the next section, ultimately supplanted the road as a whole.

- The third east-west route was to be the Bear Mountain State Parkway, linking the Taconic State Parkway and Bear Mountain, constructed between 1927 and 1932; this road was never entirely completed, and currently consists of two segments (www.nycroads.com 2002a).

In Rockland County, fears that quarries would destroy the scenic 550-foot-high palisades spurred wealthy individuals to lobby the legislatures of New York and New Jersey to create the Palisades Interstate Park Commission in 1900. A 14-mile stretch from Fort Lee, New Jersey, to Piermont, New York, was set aside, with financial assistance from J.P. Morgan. But the need for a route on the western side of the Hudson River between New York City and Albany quickly led to the building of US Route 9 West in the late 1920s. Figure 3-12 shows the transportation network circa 1940; note the ferry crossing connecting Nyack in Rockland County to Tarrytown in Westchester County.

With the opening of the George Washington Bridge in 1931, a larger highway heading north was deemed necessary. Land was purchased throughout the 1930s, but at the insistence of John D. Rockefeller the road was planned far enough back from the crest of the Palisades so as to make it invisible from the river and opposite shore. Controversy continued through the 1940s among New Jersey, New York, various conservation groups, and Robert Moses, but the project was finally approved and construction on the Palisades Interstate Parkway commenced in 1947 (www.nycroads.com 2002b; O'Brien 1981).

3.2.5.4 Interstate Highways, the Tappan Zee Bridge, and the Regional Road Network

The inadequacy of the combined post road and parkway system was apparent by the 1930s, and planning began on a much larger series of highways. Interest at the national level also appeared in the late 1930s, but after World War II another wave of suburbanization put still greater pressure on surface road systems. The interstate highway system (now the Dwight D. Eisenhower System of Interstate and Defense Highways) was formally created by the Federal Aid Highway Act of 1954, followed by the Federal Aid Highway Act of 1956. Rather than the 60-40 percent federal-local cost-sharing formula of the 1954 legislation, the 1956 act legislation provided up to 90 percent federal funds and increased the overall plan to more than 41,000 miles. Some $25 billion was allocated for the period from 1957 through 1969 (Weingroff 1996). The impact on New York and New Jersey would be especially profound.

Just before World War II plans began for a new series of north-south highways. The US Route 1 (Boston Post Road) corridor was overstressed by the 1930s, and planning had begun for a superhighway toward New England. A planned parkway from Pelham to Port Chester had never been built, but land had been acquired that provided the initial concept of a route for the highway. In 1950 the New York State Thruway Authority (NYSTA) was created, and the planned "Thruway" became eligible for federal funds after 1957. The first section was opened in 1958. The 14-mile section linked Pelham Bay Park with the Connecticut Turnpike, and this was extended to the East River with the construction of the Bruckner Expressway in 1961 (www.nycroads.com 2002c).

The construction of the New York State Thruway (I-87) from 1950 to 1956 was similarly designed to link New York City with Albany and west to Buffalo (www.nycroads.com 2002d). Initially, the Thruway was to cross from Westchester County to Rockland County at the proposed Newburgh-Beacon Bridge, but the location was subsequently shifted south to the planned Tappan Zee Bridge. The Westchester and

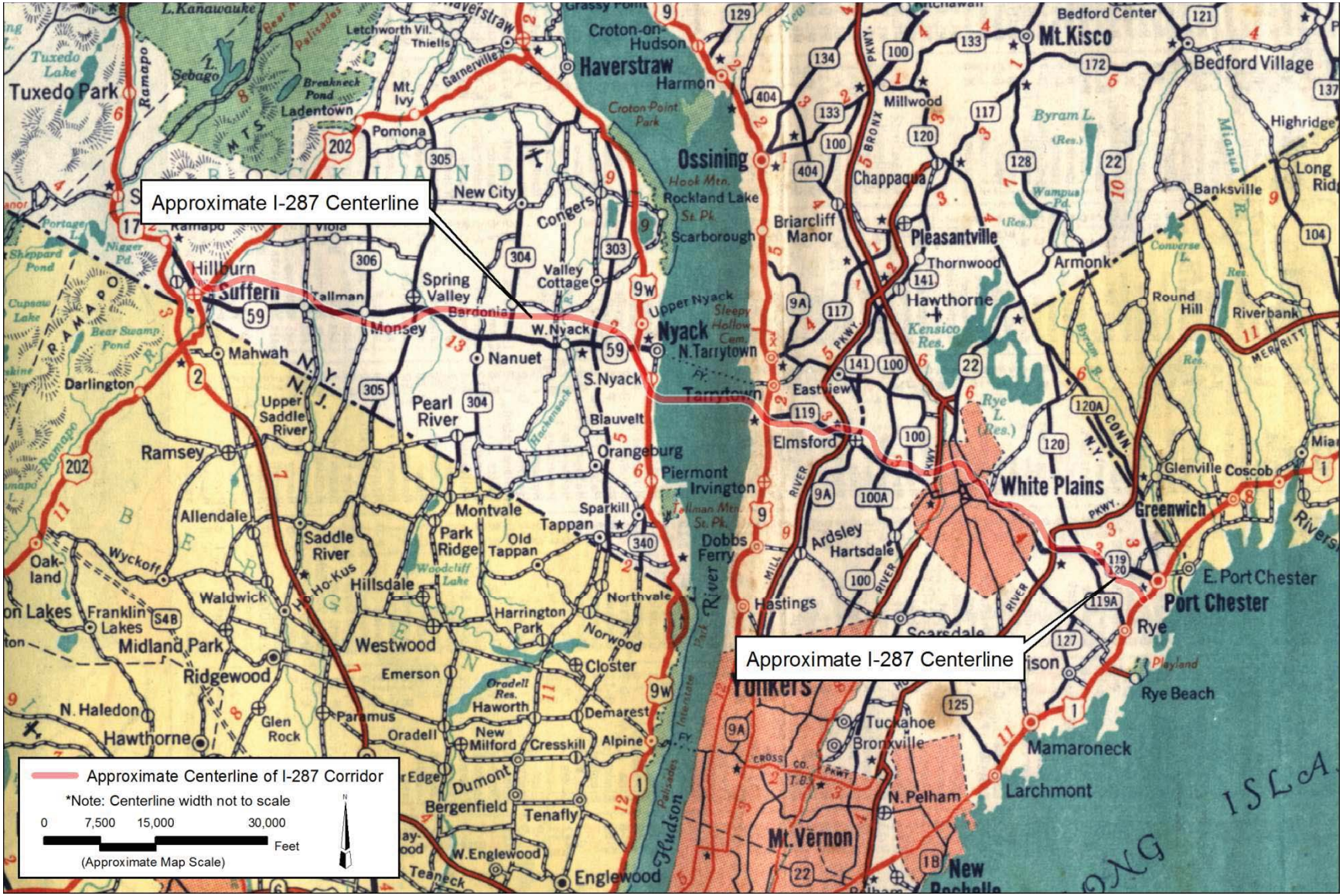


Figure 3-12 Road Map of Rockland and Westchester Counties, 1940 (source: General Drafting 1940)

See note on cover regarding report continuity and references to rescinded project

Rockland County sections were completed by 1956. Planning for a cross-Hudson bridge at Dobbs Ferry began in 1950, but that location was also shifted, this time north to Tarrytown.

The Tappan Zee Bridge itself was begun in 1952 and completed in 1955 (www.nycroads.com 2002e). To construct it, engineers designed a unique floating caisson system, or buoyant underwater foundations, to support the bridge and deck. The 3.2-mile-long highway bridge is the longest bridge in New York State and one of the longest in the country, as well as having the distinction of having the world's ninth longest cantilever span at 1,212 feet. The bridge functions as an essential component of the New York State Thruway, with 135,000 vehicles crossing the bridge daily to and from the New York metropolitan area. The bridge has undergone only minor modifications since its completion in 1955, and in 2003 was determined eligible for listing in the National/State Register of Historic Places for its state and local historical and engineering importance (Peter Shaver pers. comm. October 20, 2003).

Other roads were also constructed during the 1950s that provided linkages to the New York State Thruway. For example, the link between the Thruway and the Garden State Parkway was completed in 1957 (www.nycroads.com 2002f). The Cross-Westchester Expressway (I-287) was the initial realization of the New York ring road concept and was designed to link up with north-south roads on the west of the Hudson River by means of a bridge. Construction of the Cross-Westchester Expressway (I-287) began in 1956 and was completed in 1960 (www.nycroads.com 2002g).

The construction of I-84 from 1960 to 1971 from Connecticut to Pennsylvania via the Newburgh-Beacon Bridge, connecting with the Thruway, completed the outermost loop of the New Jersey-New York-Connecticut highway system (www.nycroads.com 2002h).

3.2.5.5 Economic Change and Corporate Headquarters

Beginning in the early twentieth century, regional industries were consolidated and manufacturing diminished greatly. This led to a gradual transition from diversified urban economies dependent on New York City for labor and transportation links to suburbs with primarily service and white-collar economies. The transportation integration of the counties permitted consolidation of gas, electric, and telephone providers. The growing suburban and residential character of Westchester and Rockland Counties also put pressure on middle-scale industries to relocate, as did the gradual decline of New York City as an industrial center.

The trend toward locating corporate headquarters outside of New York City was started by *Reader's Digest* in 1923 (Crandell 1961). This trend continued after World War II, when major firms started to take advantage of improved transportation and communication infrastructures, lower taxes, and suburban lifestyles, which made Westchester County particularly attractive. General Foods and Nestlé relocated to White Plains in the 1950s, and IBM and Texaco built large headquarters in Armonk and Harrison, respectively, as did many others.

A strong emphasis on retail also emerged during the 1950s; Westchester County became a retail center, with construction of the Cross-County Shopping Center and commercial districts on heavily trafficked stretches of roads in White Plains (Mamaroneck and Westchester Avenues), New Rochelle (Main Street/Boston Post Road), and Yonkers (Central Park Avenue). However, the relative lack of public transportation, aside from the three major commuter rails that connect the suburbs to the city, has inhibited the development of more diversified economies (Crandell 1961; Canning 1984). Westchester County remains closely linked to the economic health of and highly dependent on, New York City and on service industries, and this condition increasingly describes Rockland County.

3.3 Map Documented Structures (MDSs)

The archaeological assessment (included in Chapter 4) identified areas of archaeological potential within the I-287 ROW and in areas outside of the ROW where particular project actions were proposed (i.e., the Piermont Line ROW, various station locations, etc.). A cartographic analysis focusing on these areas of archaeological potential was then conducted in order to determine the potential for map documented structures (MDSs) to be present.

The cartographic analysis included a review of maps from the late-18th, mid- to late-19th, and 20th centuries. It should be noted that the exact location of many of these MDSs cannot be confirmed through cartographic research alone, due in part to the difficulty in attempting to superimpose modern conditions onto historic maps. Figures 3-8A and B and Figures 3-9A and B, included earlier in this chapter, provide an example of the approximate location of the I-287 corridor on late-19th century atlas maps of Rockland and Westchester counties. Mapping from the mid-20th century, particularly the 1953 Thruway As-Built maps, provided more detailed and precise information about the presence and absence of property features, such as outbuildings, stone walls, and driveways. The presence or potential presence of structures and/or associated features within the areas of archaeological potential based on the cartographic analysis is highlighted in the table of MDSs below (the presence of MDSs and/or associated features that were verified through the walkover reconnaissance survey are depicted on figures included in Appendix D, and discussed in Chapter 6).

Table 3-2

Map Documented Structures (MDSs)

MDS Rockland County	Map Identification	MDS Westchester County	Map Identification
#1	Name not identified (1854)	#1	Glode Requa (1785)
#2	George R. Van Dunk (1953)	#2	John T. Terry "Pinkstone" (1881, 1891)
#3	George R. Van Dunk(1953)	#3	Institute for Deaf and Dumb (1881)
#4	Name not noted (1910)	#4	Timothy C. Eastman "Millbrook" (1891)
#5	Elbert Talman (1953)	#5	Alf. Brady (1881)
#6	A.Dater (1867)	#6	Name not identified (1956)
#7	E.H. Hagler (1867) , Snyder (1886), Joseph Dolson (1953)		
#8	Robert L. Johnson (1953)		
#9	Holstein (1886)		
#10	Alice C. Patterson (1953)		
#11	Charles Juzek / Celia Denis (1953)		
#12	August Pralle and Anne Pralle (1953)		
#13	Grunhold (1886)		
#14	Lillian E. Irving (1953)		
#15	Ralph and Rosalie Faenotico (1953)		
#16	D. Benson (1886)		
#17	William J. Elliot (1953)		
#18	Charles H. Seifert (1953)		
#19	Parsonage (1886)		
Map Reference: O'Connor 1854, Smith 1867, Hyde 1886, USGS 1910, NYSTA 1953, Couzens 1785 (printed 1880), Bromley 1881, Beers 1891, NYSDOT 1956 (in Ross 1990).			

4 Background Research and Sensitivity Assessment

The value of archaeological resources is dependent upon an understanding of the cultural context in which they were deposited and post-depositional processes that may have impacted their degree of preservation. This Chapter details the results of the Phase IA background research and sensitivity assessment, and consists of discussions of previously identified archaeological sites; previous surveys that have included portions of the APE; prior ground disturbance characterization; and identifies areas of archaeological sensitivity.

The background research is presented in subsections separated by area, from west to east: Rockland County, the Hudson River, and Westchester County.

4.1 Background Research Methodology

In order to develop necessary background information on the environment, prehistory, history, and known cultural resources in the 30-mile-long corridor, documentary and cartographic research was conducted at the following repositories in New York State:

- New York State Office of Parks, Recreation and Historic Preservation (NYSHPO) archaeological site files, Peebles Island, Waterford.
- New York State Museum (NYSM) archaeological site files, Peebles Island, Waterford.
- New York Public Library, New York City.
- New-York Historical Society, New York City.
- Rockland County Archives, Pomona.
- The Historical Society of Rockland County, New City.
- New City Free Library, New City.
- Westchester County Archives, Elmsford.
- Westchester County Historical Society, Elmsford.
- Tarrytown Historical Society, Tarrytown.
- Tarrytown Tax Assessor's Office, Tarrytown.
- Warner Library, Tarrytown.
- Greenburgh Public Library, Elmsford.
- White Plains Public Library, White Plains.
- Westchester County Hall of Records, White Plains.
- Harrison Public Library, Harrison.
- The Rye Historical Society Knapp House Archives, Rye.
- Port Chester Public Library, Port Chester.

The files of the NYSM and SHPO were consulted for relevant cultural resource studies, assessments, and surveys, as well as locations of previously identified, state-listed archaeological sites. The village and town libraries and historical society archives were consulted for completed EISs, State Environmental Quality Review Act (SEQRA) compliance-related reports, and locally sponsored surveys that were relevant to the current project corridor.

County, town and village municipal offices were visited across the corridor to research master plans, comprehensive development plans, historic resources surveys, natural resources surveys, completed EIS

and SEQRA reports, street maps, zoning maps, block and lot maps, deeds, water lot grants, and tax-assessment maps.

Archival literature and historic cartographic searches were conducted to document historic land use along and in the immediate vicinity of the project corridor. Modern cartographic resources were consulted in order to document recent changes in land usage and alterations to the physical environment of the project corridor. Other documents consulted included local and regional histories, contemporary and historic periodicals and newspapers, books and reports, historic photographs, and recent aerial photographs. Together these elements of the background research help to establish an appropriate context against which to consider the significance of any identified potential archaeological resources.

4.2 Background Research Results: Rockland County

Traces of thousands of years of prehistoric occupation, historic settlement and development, and more recent industrialization and suburbanization remain throughout Rockland County in the form of archaeological resources.

The present survey has sought to determine the potential for archaeological remains to be present within that portion of the proposed corridor that could be impacted by project actions associated with the four build alternatives identified on mapping through June 2010. The archaeological APE takes into account all construction activities that would result in subsurface disturbances, including excavation, grading, extensive cutting and filling, compression from movement or storage of heavy objects or equipment, and vibrations caused by movement or operation of heavy machinery.

Previously identified prehistoric and historic site information was collected from the site files of the NYSM and NYSHPO beginning in 2002 as part of the baseline research. The site file research has been updated by additional site file searches conducted during 2006, 2007, 2008, 2009, and 2010. The search radius for Rockland County consisted of one mile on either side of the I-287 centerline.

The site files were initiated during the first decades of the 20th century through systematic county-wide surveys conducted by the office of the state archaeologist. In addition, specific county-wide surveys that had been conducted in Rockland County were examined for archaeological sites that were known at the local level and were not always listed in the state files.

4.2.1 Previously Identified Archaeological Resources

Within Rockland County, 7 previously identified archaeological sites that are listed in the files of the NYSM or NYSHPO are located within a one-mile radius of the centerline of the Thruway. One site represents historic activity; 7 represent prehistoric activity, although the period of sensitivity is not specifically mentioned on the form. The National or State Register eligibility status of these sites has not been evaluated by NYSHPO. Most of these sites were first reported during the first few decades of the 20th century. Table 4-1 presents the limited information obtained from the state site files on the previously identified archaeological resources within a one-mile radius of the centerline of the Thruway.

Of these 7 sites, 1 is within the APE. This site represents prehistoric activity, although the period of sensitivity is not specifically mentioned on the forms. Figures depicting these approximate site locations in Rockland County are found in Appendix D.

It is highly probable that many of the sites located within or immediately adjacent to the existing I-287 ROW have been disturbed or destroyed by the original construction of I-287 during the 1950s and subsequent modifications. It is equally probable that portions of the ROW that have not been disturbed by the original construction of I-287 may contain intact portions of previously identified archaeological resources.

4.2.2 Previously Conducted Cultural Resources Surveys

Two previous surveys in areas that are adjacent to or have been included as part of the current archaeological APE have been examined for the Rockland County portion of the I-287 Corridor. The results of these surveys are summarized below. The surveys were conducted in conjunction with proposed road improvements, utility installations, or commercial development. The extent of previously surveyed area represents a small percentage of the Rockland County corridor APE. The survey locations are depicted on Figures 4-1A through 4-1D.

Most archaeological survey reports reviewed by New York State and archived at NYSHPO are designated a report number unique to the project, by county. As these report numbers are unique to a project (i.e. proposed sewer installations), there are sometimes several reports assigned the same number within a county, due to multiple reports being submitted for different phases of work. These report numbers are included with the report summaries below, alongside the report titles (i.e. “RC #1” represents Rockland County report number 1).The locations of the survey areas are keyed to Figures 4-1A through 4-1D, using the county specific report numbers assigned by New York State (i.e. #1). Some of the survey reports were not assigned numbers by New York State; when these reports could not be associated with another mapped survey area, they were labeled on the figures alphabetically for identification purposes in this report (i.e. #A).

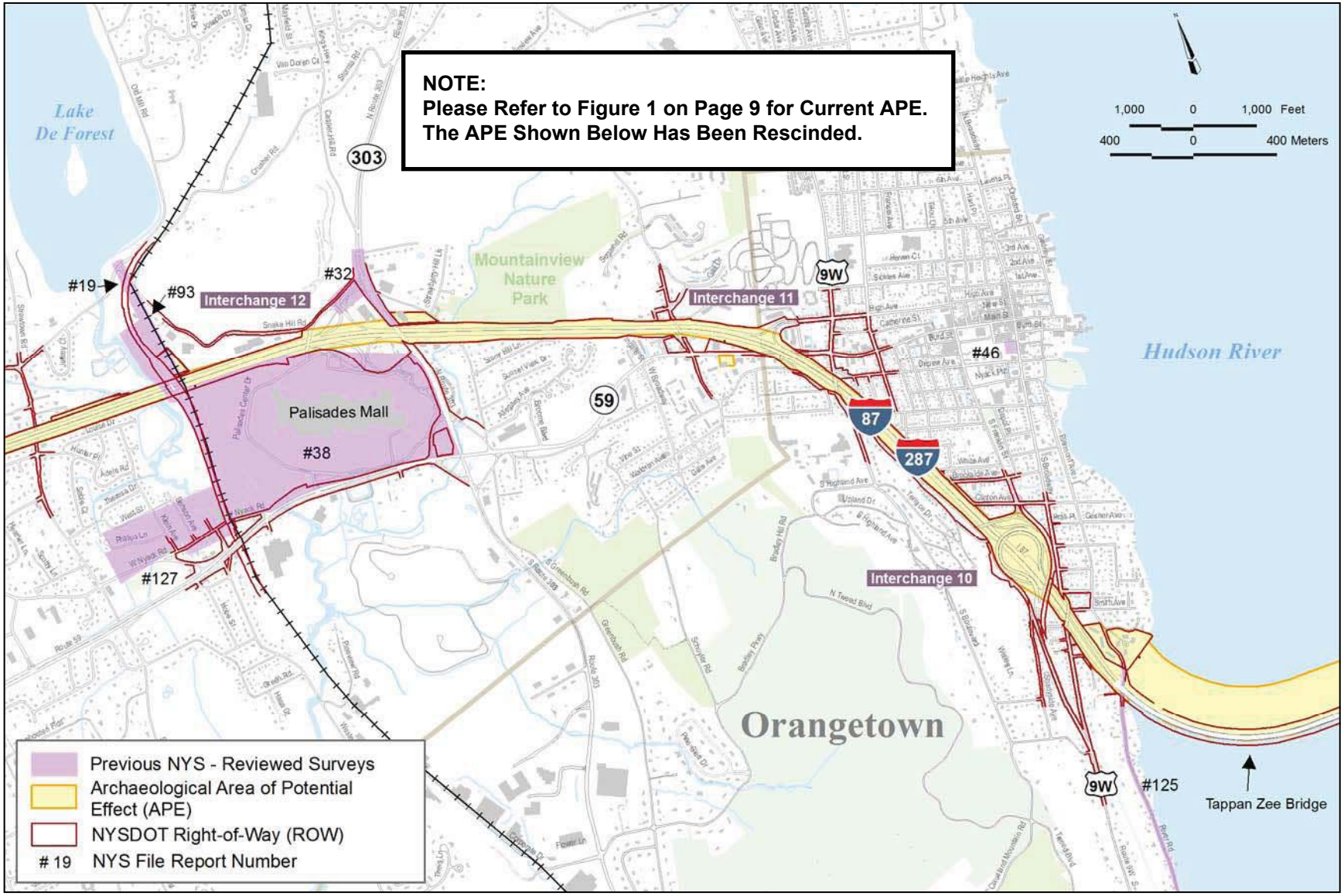


Figure 4-1D Previously Surveyed Areas within APE - Rockland County

See note on cover regarding report continuity and references to rescinded project

4.3 Background Research Results: Hudson River Crossing

Evidence of historic use of the Hudson River exists in the form of submerged archaeological resources. In addition, there is potential for encountering submerged prehistoric archaeological resources in the Hudson River portion of the I-287 Corridor. The present survey has sought to determine the potential for archaeological resources to be present within the APE. In this section of the proposed Tappan Zee Bridge/I-287 alignment, the APE includes an 800-foot wide area extending north from the centerline of the existing bridge as well as areas of proposed dredging and/or staging adjacent to the Rockland and Westchester county shorelines (Figure 4-2A).

This subchapter details the results of the Phase IA archaeological survey for the Hudson River portion of the I-287 Corridor. Potential archaeological resources located within Hudson River in the vicinity of the Tappan Zee Bridge are discussed in subchapter 4.3.1, while details of the surveys conducted within the Hudson River portion of the archaeological APE are presented in subchapter 4.3.2.

4.4 Background Research Results: Westchester County

This subchapter details the results of the Phase IA archaeological survey in Westchester County, and consists of discussions of previously identified archaeological sites and previous cultural resources surveys that have included portions of the archaeological APE.

4.4.1 Previously Identified Archaeological Resources

Within Westchester County, 6 previously identified archaeological sites are located within a one-mile radius of the I-287 centerline. The majority of these sites were listed in the NYSHPO and NYSM site files; two of the sites were identified through the work of avocational archaeological groups. One site represents historic activity, 3 represent prehistoric activity, and 2 likely represent prehistoric activity, although the period of sensitivity is not specified on the site form. One of these state site numbers identifies two distinct sites in the same general location; they have been considered as separate sites for this study. The National or State Register eligibility status of most of these sites has not been evaluated. Prehistoric site attribute information such as temporal sequence or cultural affiliation is often lacking on the state site forms; historic site information is, for the most part, more comprehensive.

County-wide inventories of known archaeological sites conducted by the Westchester County Emergency Work Bureau/Works Progress Administration in 1939 and the Junior League of Westchester County in 1978 were examined for archaeological resources known only at the local level. Many of the state sites first reported during the 1920s appear on the maps generated for the above-mentioned inventories. No additional sites were identified on these maps within the APE for the current project.

Of the 6 previously identified sites identified within a one mile radius of the I-287 centerline, nine are located within the APE. One of these sites represents historic activity; three represent prehistoric activity; and three likely represent prehistoric activity, although the period of sensitivity is not specifically mentioned on the form.

As mentioned above, some state-listed site location information is approximate, and it should be noted that location data mapped by early-20th century NYS archaeologists was deliberately vague, so as to discourage unauthorized digging in such locations. Figures depicting the approximate site locations in Westchester County are located in Appendix D.

4.4.2 Previously Conducted Cultural Resources Surveys

10 previous surveys that are adjacent to or have included part of the current preliminary archaeological APE have been reviewed for the Westchester County portion of the I-287 Corridor. The surveys were conducted in conjunction with proposed I-287 and NY Route 119 corridor improvements, other proposed roadway improvements, proposed Saw Mill River flood-control measures, proposed private development, and excavations by avocational archaeology groups. In addition to the state-reviewed cultural resource reports, documentation published by archaeologists conducting an avocational archaeological survey of a portion of a property within the Archaeological APE was also reviewed (Brennan 1981).

A large percentage of the Westchester County portion of the current APE within the existing I-287 Corridor has been included in previous surveys, notably the multiple archaeological survey reports conducted as part of the DEIS for PIN 8729.30, I-287 / Cross Westchester Expressway, NYS Thruway NY Route 303 to NY Route 120, Westchester and Rockland Counties, New York (USDOT, FHWA, and NYSDOT 1995). All survey locations discussed below are depicted on Figures 4-2A through 4-2D.

Figure 4-2A Previously Surveyed Areas within APE – Westchester County

See note on cover regarding report continuity and references to rescinded project

4.5 Sensitivity Assessment

As stated above, the primary objective of the present Phase IA archaeological survey is to identify those areas that possess the potential for encountering intact prehistoric and/or historic resources that would be adversely affected by project actions.

4.5.1 Prior Ground Disturbance Analysis

The analysis of prior ground disturbance is a critical component in the assessment of archaeological sensitivity for any given area within the current Phase I APE. Prior ground disturbance may be ranked by the level of surface and/or subsurface disturbance created by a particular action with regard to its effect on buried archaeological resources.

Highly disturbed areas are defined from an archaeological standpoint as those areas where construction activity has occurred to depths at or below which one could reasonably expect to encounter archaeological deposits. Deep excavation into or through the subsoil, cutting, blasting, and grading would obliterate any archaeological resources that may once have been present in a given area. The digging of new channels for watercourses that were moved in conjunction with the original construction of the Thruway would have highly disturbed, destroyed, and/or flooded any archaeological resources that may once have been present.

Moderately disturbed areas are here defined as those areas where construction activity has occurred to depths at or above which one could reasonably expect to encounter archaeological deposits. Shallow excavation, ground-cover clearing, low-embankment construction, shallow utility installations, topsoil removal, or minor grading do not usually create subsurface disturbances deep enough to completely destroy archaeological resources. Moderately disturbed areas could contain intact archaeological deposits, intact features, or truncated features. De-mapping and/or truncating of historic roads during the original construction of the Thruway have likely resulted in moderate ground disturbances. The removal of structures within the ROW during the original construction of the Thruway may or may not have caused significant subsurface disturbances. In such cases, intact archaeological deposits and/or features associated with the former structures may remain.

Undisturbed areas are those areas for which there is no evidence of previous construction activity or land alteration. The potential for encountering intact archaeological resources exists in undisturbed areas within the current project's Phase I, or preliminary APE. Sections of the original Thruway corridor that were constructed at existing grade would likely have some undisturbed portions of the ROW flanking the curb-to-curb roadway.

Fill deposits are indicative of prior ground disturbance, but not necessarily indicative of subsurface disturbance. Topography and the type of construction project dictate the depth and extent of fill required. Archaeological resources may in fact be protected under fill layers. The alteration of watercourses during the original construction of the Thruway involved digging new channels and the filling in of the original channels. Archaeological resources that had been located along the original watercourses were likely buried under a substantial layer of fill. If no subsequent construction activity took place at these locations, the locations are considered to be archaeologically sensitive.

The general plan and profile map series created for the 1950s construction of I-287 was the primary cartographic resource utilized to determine the pre-I-287 topography of the corridor in Rockland and Westchester Counties. The ground disturbance characterization focused on plotting the 1950s construction actions of cut, fill, or at-grade construction on contemporary project maps, which are depicted on Figures 4-3A through 4-3D for the Rockland County portion of the corridor and Figures 4-3E through 4-3H for the Westchester County portion.

Analysis of prior ground and subsurface disturbances to the 30-mile long Tappan Zee Bridge/I-287 Corridor archaeological APE was essentially a synthesis of cartographic data obtained from a variety of sources. Data sets utilized include the following:

- General plan and profile map series for the original 1950s construction of I-287 (as-builts).
- Aerial photographs taken during the original 1950s construction of I-287.
- USGS 15-minute and 7.5-minute topographic maps, 1890s through 1940s.
- USGS 7.5-minute series topographic maps, 1960s through 1990s.
- Palisades Interstate Park Commission land taking maps for Palisades Interstate Parkway, 1946.
- New York State Thruway property acquisitions, Garden State Parkway Connection map series, 1956.
- Project-specific, complete corridor aerial photograph series taken in March 2004.
- Sanborn Map Company fire-insurance maps 1887-1952.
- Historic atlases 1867-1920s.
- Historic maps dating from the late-18th century through the early-20th century.
- Project maps of previous archaeological surveys that did not encounter any cultural resources.

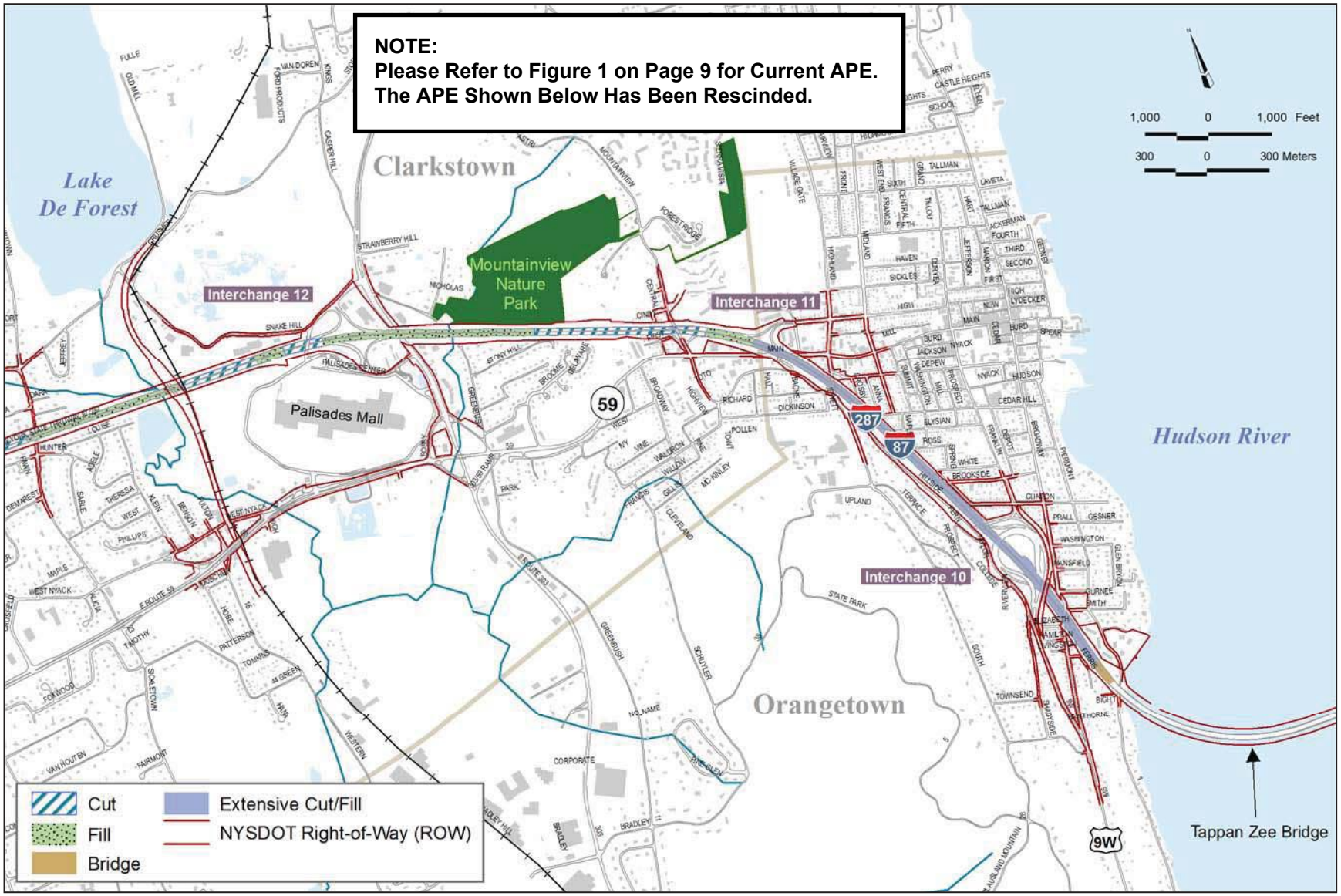


Figure 4-3D Prior Ground Disturbance from 1950s Thruway Construction – Rockland County

See note on cover regarding report continuity and references to rescinded project

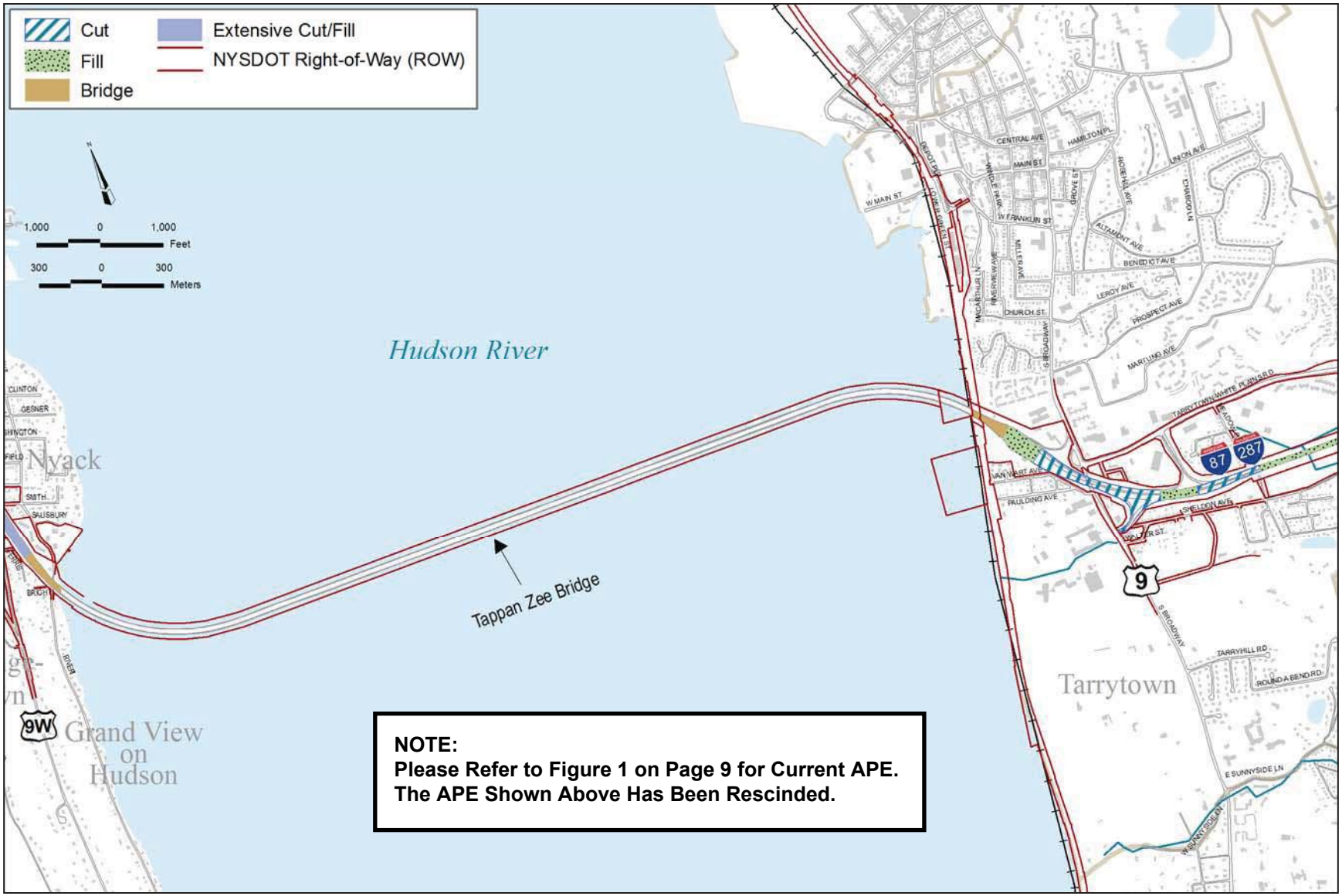


Figure 4-3E Prior Ground Disturbance from 1950s Thruway Construction – Rockland County

See note on cover regarding report continuity and references to rescinded project

4.5.2 Ranking of Archaeological Potential

Assessing the archaeological sensitivity of a given area provides the archaeologist with a tool with which to design and implement appropriate field procedures for the investigation of that area (NYAC 1994). Sensitivity assessments are generally derived through analysis of the following factors:

- Presence/absence of previously identified Native American sites.
- Presence of MDS's in the APE
- Cartographic or archival documentation of historic settlement.
- Proximity of a perennial source of fresh water.
- Level of subsistence potential of immediate environs (e.g., upland mast forest).
- Topographic features (e.g., hilltops overlooking marshland, river terraces, etc.).
- General soil characteristics (e.g., well-drained sandy loam).
- Trade and transportation routes (e.g., Native American trails, documented historic roads).
- Presence/absence/extent of prior ground disturbance.

Archaeologists often rank the potential of a given project area as high, moderate, or low, based on the presence of one or more of these factors. The importance of one factor over another can vary regionally, seasonally, culturally, or over time. The basis for ranking the archaeological potential of the proposed ground disturbance areas defined for the present study as high, moderate, or low is as follows:

- **High potential** – characterized by three or more of these factors.
- **Moderate potential** – characterized by fewer than three of these factors.
- **Low potential** – characterized by no more than one of these factors.

4.5.3 Sensitivity Evaluation Methodology

The sensitivity evaluation of the 30-mile Tappan Zee Bridge/I-287 Corridor required a multi-step process that was focused primarily on cartographic data and field reconnaissance. The steps in the sensitivity process for the corridor were:

- **Step 1** – Determine the project actions for all alternatives that will create ground and/or subsurface disturbance areas; taken together, these areas make up the archaeological APE.

- **Step 2** – Plot the locations of previously identified prehistoric and historic sites within the APE and within a one-mile radius of the I-287 centerline.

- **Step 3** – Plot the project areas for all previously conducted archaeological surveys that include the current APE or part of it; plot the archaeological sites identified through the previous surveys, if any. If the previous surveys did not identify any sites, then there is no archaeological potential for those portions of the current APE covered by the prior surveys.

- **Step 4** – Plot the cut vs. fill vs. grade sections of the as-built I-287 corridor from the general plan and profile maps from 1950s construction, focusing on the width of the curb-to-curb roadway vs. the width of the existing ROW.

- **Step 5** – Evaluate the cut areas from the general plan and profile maps as follows:
    - Archaeological potential
        - Top of original landform is within the ROW.
        - Terraces along or across original landform remain within the ROW.
        - Cut area is through larger landform with previously identified rock shelters.
    - No archaeological potential
        - Cut areas leave steep slope within remaining ROW.
        - Cut area is the entire ROW.
- **Step 6** – Evaluate the fill areas from the general plan and profile maps:
    - Fill includes areas of former water courses – archaeological potential along former banks and floodplains; periphery of former swamp areas.
    - Fill includes areas of former water bodies – archaeological potential of former mill ponds and prehistoric ponds; former or altered lake shores.
    - Fill covers cartographically documented historic roads and/or settlements – archaeological potential.
    - Fill is result of recent municipal landfill – no potential.
- **Step 7** – Evaluate the at-grade areas from the general plan and profile maps:
    - Archaeological potential – no recent ground disturbance observed in the at-grade area between the roadway and ROW boundary.
    - No archaeological potential – recent ground disturbance observed in the at-grade area between the roadway and ROW boundary.
- **Step 8** – Review historic maps for areas initially determined to possess potential through steps 1-7 (i.e., were potential resources present before the construction of I-287 in the 1950s).
- **Step 9** – Compare previously identified prehistoric site locations with areas initially determined in steps 1 through 7 to possess archaeological potential.
- **Step 10** – Refine areas of archaeological potential based on steps 8 and 9; these locations are the potential Phase IB test areas.
- **Step 11** – Conduct targeted reconnaissance walkover survey of the potential test areas identified through steps 1-10.

4.6 Areas of Archaeological Potential

Archaeological potential of the current project's APE was evaluated through a synthesis of the Phase IA background research, which included cartographic information, archival research, and analysis of prior subsurface disturbance. The APE includes the entire existing I-287 ROW, the Piermont Line ROW between Route 59 in Suffern and Spook Rock Road in Rockland County, as well as discrete areas outside the ROWs that would be impacted by one or more of the build alternatives. The curb-to-curb roadway of the existing Thruway has no archaeological sensitivity. The areas between the curb and ROW boundary however, were evaluated as part of this sensitivity assessment.

4.6.1 Rockland County

The 1950s construction of I-287 has altered the natural landscape of its corridor within Rockland County, involving large-scale subsurface disturbances. Historic routes were most often laid out to avoid obstacles presented by natural topographic features of the rugged Rockland County terrain, such as large hills, steep valleys, rock outcrops, and extensive swamps. Modern construction technology, on the other hand, alters the natural topography to suit the needs of the project at hand. For example, during the construction of I-287 in the 1950s, river and stream courses were channeled, moved, or otherwise altered; drainage systems were impacted by filling in swamp areas and creating new wetlands where none had existed before; and hills and rock outcrops were cut or blasted through to accommodate the roadway. The built environment was also affected, in that railroads were often realigned to cross the corridor; historic routes and local roads were truncated, realigned, re-routed or eliminated; and communities that were in the path of the construction had to be moved or taken.

The original channels of rivers such as the Ramapo, Mahwah, Saddle, and Hackensack have been either re-channeled, moved considerable distances, or realigned as they intersect with the Thruway corridor. Numerous unnamed streams, brooks, and their tributaries have been moved, realigned or placed in culverts as they intersect with the Thruway corridor. Several former ponds and swamps were filled during the original Thruway construction.

Discrete areas of archaeological sensitivity have been identified within the existing I-287 ROW and outside the boundaries of the existing ROW. Tables 4-4, 4-5, and 4-6 summarize the archaeologically sensitive areas identified along the Rockland County corridor. The areas of archaeological potential are depicted on Figures 4-4A through 4-4D.

The areas of archaeological potential that were identified through the Phase IA research that will be subject to ground disturbance as a result of project actions have been designated as Phase IB test areas. The primary objective of a Phase IB subsurface survey is to document the presence or absence of archaeological remains. The Phase IB survey results will either confirm or negate the results of the Phase IA sensitivity assessment.

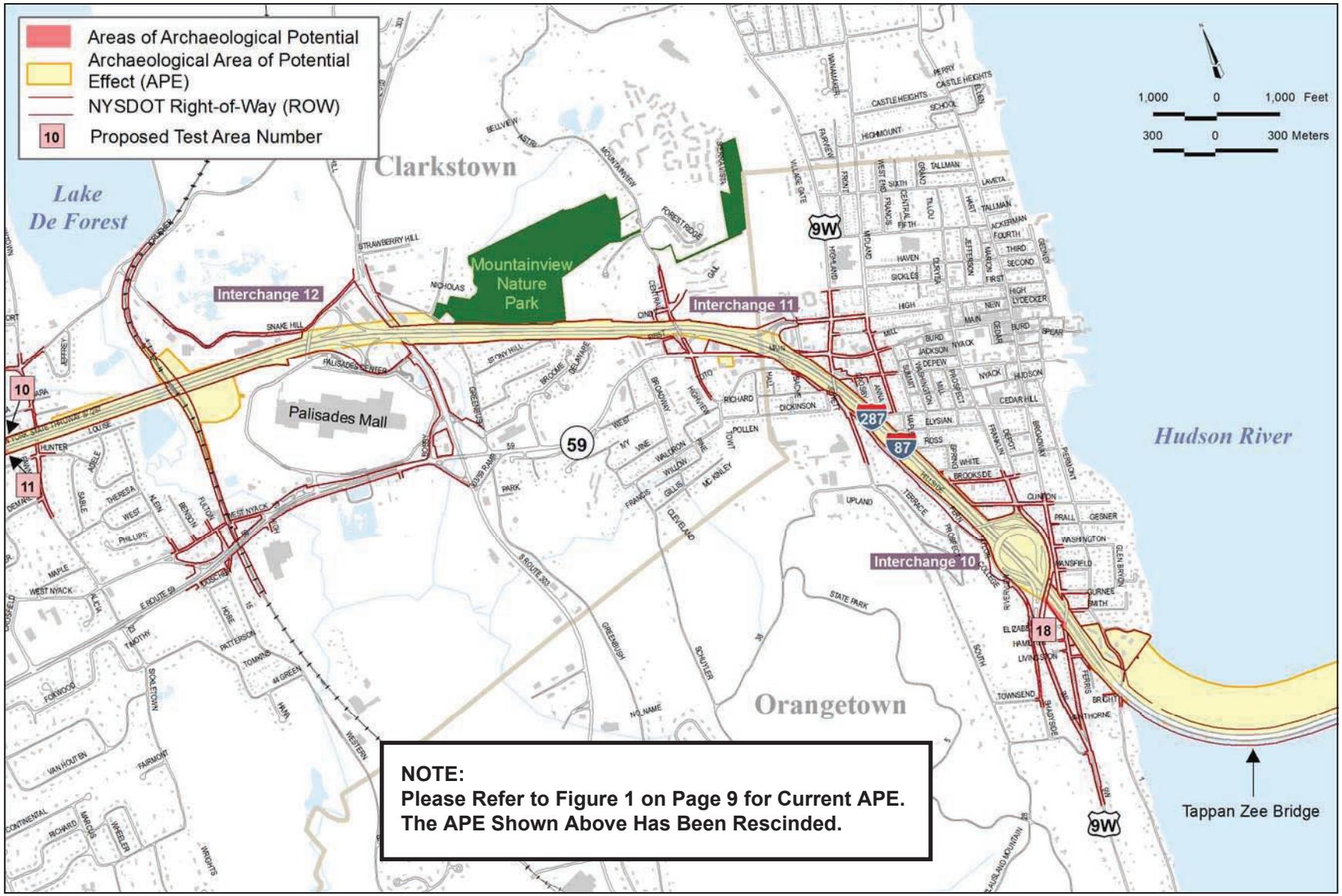


Figure 4-4D Areas of Archaeological Potential – Rockland County

See note on cover regarding report continuity and references to rescinded project

4.6.2 Hudson River

The 1950s construction of the Tappan Zee Bridge has altered the natural landscape of its corridor within the Hudson River, involving large-scale subsurface disturbances to the river bed and underlying stratigraphy. The proposed bridge alignment would be located to the north of the existing bridge, within an area up to 800 feet to the north of the current alignment, which comprises the archaeological APE within the Hudson River.

The Phase IA archaeological survey for the Hudson River portion of the I-287 Corridor consisted of a review of the available state archaeological site files and shipwreck database; cartographic resources; and prior surveys of the Hudson River in the vicinity of the Corridor that have included portions of the Archaeological APE.

A review of the shipwreck database maintained by the SHPO noted that there were no previously identified shipwrecks currently on file within or immediately adjacent to the archaeological APE (Peckham 2010). However, it was noted that surveys conducted in the 1990s and 2000s may have identified shipwrecks not yet entered into the SHPO database (IBID).

The potential for prehistoric archaeological resources to be present within the Hudson River crossing portion of the archaeological APE cannot be fully assessed based on the level of information collected for this Phase IA survey. Additional survey work in the form of geoarchaeological analysis of core samples of riverbed sediments will be conducted in order to assess the potential for encountering buried former living surfaces within the APE.

4.6.3 Westchester County

As discussed above in subchapter 4.6.1 describing Rockland County, the 1950s construction of I-287 has altered the natural landscape of its corridor within Westchester County, also involving large-scale subsurface disturbances.

In Westchester County, the APE includes the existing I-287 ROW, the existing NY Route 119 ROW, as well as discrete areas outside both ROWs that would be impacted by the build alternatives. The curb to curb roadways of I-287 and NY Route 119 have no archaeological sensitivity. The areas between the curb and ROW boundary, however, were evaluated as part of the current Phase IA sensitivity assessment.

It should be noted that most of the existing ROW area on both the I-287 and NY Route 119 corridors has been previously evaluated as part of prior archaeological surveys. The reports generated by these prior surveys have been reviewed as part of the current project; it is not the intention of the current project to re-assess ROW areas that have already been evaluated. The prior survey reports have been reviewed and accepted by the appropriate state agencies.

Discrete areas of archaeological sensitivity have been identified within the existing I-287 ROW and outside the boundaries of the existing ROW. Table 4-7 summarizes the archaeologically sensitive areas identified along the Westchester County portion of the Corridor. The areas are depicted on Figures 4-5A through 4-5D.

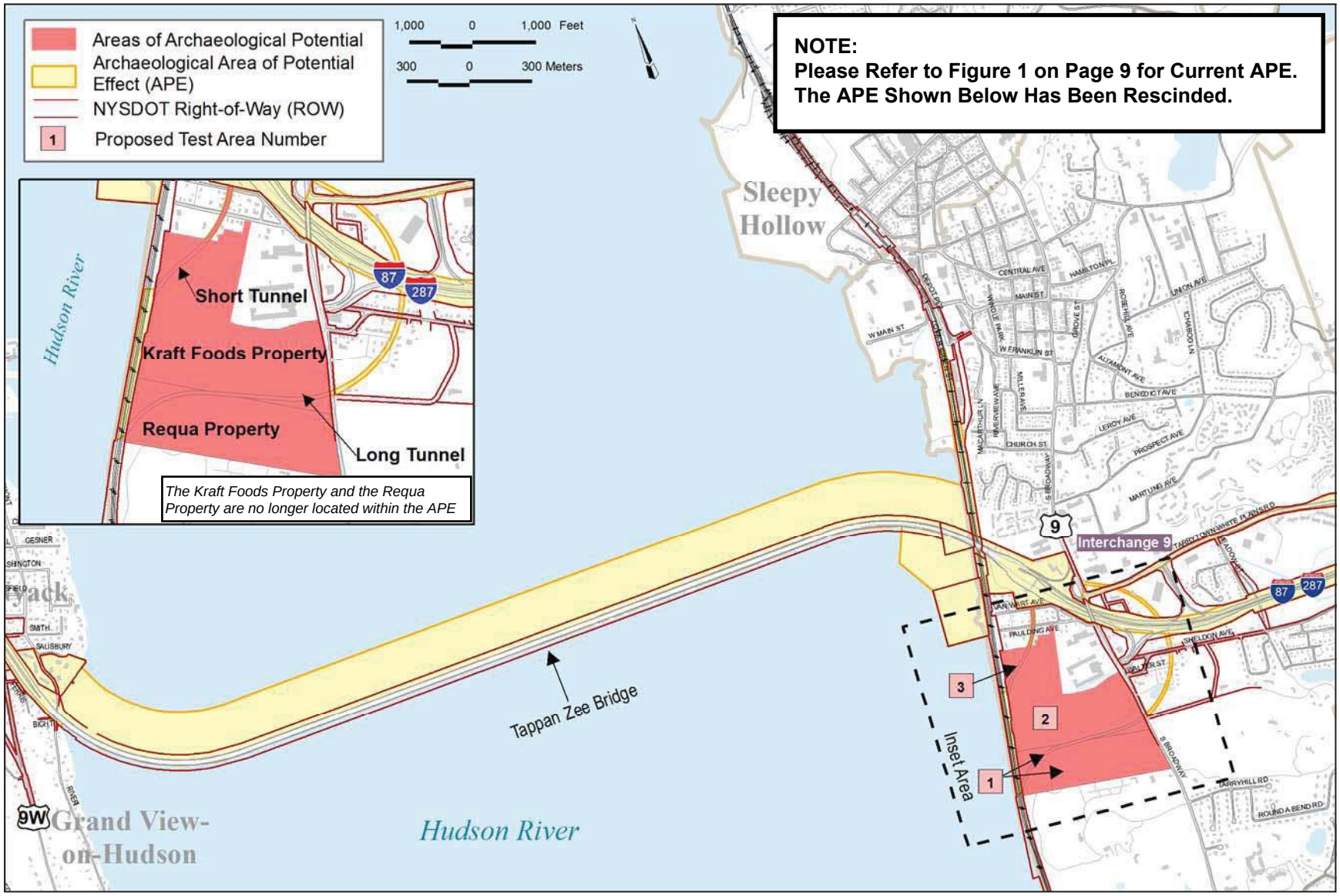


Figure 4-5A Areas of Archaeological Potential – Westchester County

See note on cover regarding report continuity and references to rescinded project

5 Phase IA Archaeological Survey: Methodology and Results

The archaeological reconnaissance survey, conducted in 2006, incorporated a windshield survey of the entire Tappan Zee Bridge/I-287 project corridor and a walkover survey to more closely inspect targeted areas. The walkover survey was concerned with documenting the existing conditions of discrete areas thought to be archaeologically sensitive through the initial documentary and cartographic research (including evidence of MDSs), as well as the locations of previously identified state-listed sites. Existing conditions were documented through visual observation, field notes, photography, and project-map notations.

The 2006 reconnaissance walkover survey results are organized by town/village from west to east along the I-287 corridor beginning with Rockland County, then Westchester County. Previously identified site locations within one half mile of the I-287 centerline were examined to document existing conditions during the reconnaissance walkover. These previously identified areas were visited despite their being outside the APE in order to compare environmental conditions with those sites that fall within the APE.

An intensive walkover was conducted in 2009-2010 of the areas of archaeological potential defined through the 2006 Phase IA sensitivity assessment. Over the course of three-plus years, project engineering had been continually progressing and many project elements had been refined, modified, dropped, or newly introduced. This was the case for proposed project elements that would likely result in impacts to potential archaeological resources both within and outside of the I-287 ROW, the Piermont Line ROW, and the NY Route 119 ROW.

As the defined areas of archaeological potential are those areas recommended for Phase IB subsurface testing, it was deemed necessary to visually inspect those areas that would be subject to potential impacts by newly introduced project actions, particularly those within the north and south I-287 ROW. It was also necessary to visually inspect those newly introduced project elements that had not been previously evaluated archaeologically, all of which lie outside the existing ROWs. As an example, the 22 storm water management facilities across Rockland County were introduced in October 2010. The storm water management facilities that were accessible by or adjacent to public roadways were visually inspected during November 2010. The results of this walkover survey appear below as Table 5-1.

The 2009-2010 walkover survey results are organized by town/village from west to east along the I-287 corridor beginning with Rockland County, then Westchester County in Subchapters 5.3 and 5.4 below.

5.1.3 Town of Orangetown

5.1.3.1 Village of South Nyack

East of Interchange 10

The project would require taking part of an existing triangle-shaped park north of Elizabeth Place. This area was included in the South Nyack street grid prior to the construction of the Thruway. At present the western and central areas make up a fairly level grassy field with stone foundation remains

visible at the surface. The grassy field drops three to four feet in elevation to the east, toward the I-287 ROW fence. There is a basketball hoop and half court at the north end of the triangle. The western boundary is a retaining wall with wooden steps up to the level of the extant rail-to-trail corridor.

The area possesses moderate archaeological sensitivity and may contain historic features in addition to the foundation remains noted during the walkover, or intact prehistoric deposits.

5.1.3.2 Village of Grand View on Hudson

East of Interchange 10

The proposed widening would require taking one to two structures on the north side of Bight Road, west of the ROW. Bight Road leaves the west side of River Road and proceeds up a steep hill on the west side of the Thruway. There is also a service road that leaves the west side of River Road just north of Bight Road, and runs uphill, parallel to the Thruway in this area. There is an apparently abandoned estate surrounded by a low brownstone retaining wall on River Road on the south corner of Bight Road. The general area is wooded, with scattered houses on large lots. The first structure that may be taken by the widening is identified as #1 River Road on the mailbox. It is located on the north side of Bight Road, and is surrounded by yard area. There is a privacy fence along the service road that separates the properties on Bight Road from the Thruway. The second house that may be taken was obscured by vegetation, but also

appears to be surrounded by yard area. The area possesses moderate archaeological sensitivity in the undisturbed portions of the yards surrounding the houses.

5.2 Westchester County: Reconnaissance Survey

It is noted that there are three National Historic Landmarks in Tarrytown: Lyndhurst; Sunnyside; and the Old Croton Aqueduct, in the vicinity of the 1-287 Corridor. No direct impacts to these three resources are anticipated based upon project mapping of the four build alternatives utilized for this Phase IA survey.

5.3.25 Test Area 18: Elizabeth Place Park, South ROW; North of Elizabeth Place; 0.5 acres (2006-9), 550 feet (2010)

The results of the 2006 Phase IA targeted walkover survey indicated that this parkland possessed moderate archaeological sensitivity. The area was part of the South Nyack street grid prior to the construction of the Thruway.

Since construction of the Thruway in the 1950s, the vicinity of Elizabeth Place Park has changed dramatically. Several streets were demapped to make to accomodate the roadway; in addition, the alignment of the then operational railroad line had to be reconfigured to cross the Thruway.

Prior to the 2006 reconnaissance walkover, the preliminary design plans had indicated that a wide swath of the park might be subject to ground disturbance activities. As project mapping depicted the entire park within the I-287 ROW, the whole 0.5 acre area was assessed for potential sensitivity through a walkover. At that time, the entire park, from the ROW fence westward in the park, was considered potentially sensitive and was recommended for Phase IB subsurface archaeological testing.

The 2009 intensive walkover showed that the west and central portions of the park consist of a fairly level, open grassy field. Possible stone foundation remains were visible at the surface. The western boundary of the park is a retaining wall with wooden steps leading up to the level of the former railroad track, which is part of the extant rail-to-trail corridor. The park area possesses moderate archaeological sensitivity for historic features as well as intact prehistoric deposits.

The intensive walkover determined that the area within the south ROW, between the chain link fence bounding the park and the pavement of the Thruway, had been extensively disturbed by previous activities, likely associated with construction of the Thruway and realignment of the former rail (current pedestrian) crossing at the north end of the park. A massive brownstone wall was visible in the narrow section of ROW, close to the rail-to-trail crossing of I-287; its exact function is unclear, though it was likely constructed as a retaining wall for the former rail crossing over the Thruway, as the roadway's grade is significantly lower than the ground surface in the adjacent Elizabeth Place Park. Due to the disturbed nature of the area surrounding the possible retaining wall, subsurface testing is not recommended.

In 2010, following the intensive walkover, project mapping was developed that depicted a narrower ground disturbance area. This modified area included a 550-foot long stretch along the eastern end of the park, within approximately 10 feet of the I-287 ROW fence line.

During a subsequent walkover in 2010, several disturbances were noted along the 550-long area of proposed impact. A paved path extends along most of the eastern end of the park, extending between 5 and 8 feet from the ROW fence (Photo 5-38). In addition, the northern portion of the test area has been disturbed by construction of a paved basketball court and, further north, the abutment for the former rail road / current pedestrian path overpass crossing I-287.

Based on the disturbances identified during the subsequent walkover, Phase IB testing is recommended for a 150-foot long by 10-foot wide section of Test Area 18. However, if any of the four build alternatives are further developed so as to include all or a larger portion of Elizabeth Place Park, then additional subsurface testing would be recommended.

Photo 5-38 View south across Elizabeth Place Park from basketball court at north end of park; macadam pathway abutting the ROW fence is visible at left; rear of houses fronting Elizabeth Place are visible in background.

7 Phase IB Archaeological Survey: Methodology and Results

This chapter discusses the methods employed for conducting the Phase IB archaeological subsurface testing survey. It also notes the methods employed in the geoarchaeological survey conducted within the Hudson River.

The results of the subsurface testing survey in Rockland County are summarized in the following subchapters. The laboratory methods and artifact analysis of recovered artifacts are included in Chapter 8. The Phase IB subsurface testing survey in the Westchester County portion of the corridor has not yet been conducted. Access to these areas has repeatedly been denied to the consultant by the owner, Kraft Foods Global, Inc.

7.1 Phase IB Subsurface Testing Methodology

The primary objective of the Phase IB subsurface testing is to determine the presence or absence of archaeological resources. This subchapter describes the methods used during the subsurface survey.

7.1.1 Sampling Strategy

The basic strategy for the placement of the Phase IB shovel test pits (STPs) was to sample each test area by means of a 50-foot (ft) grid pattern. It was recognized that a 50-foot grid would not be feasible across all of the potentially sensitive test areas within the I-287 ROW due to constraints imposed by a number of factors. One such constraint was the width of available ROW.

In several of the test areas it was possible to sight a single transect or base line along which STPs were excavated at 50-foot intervals. In other test areas where it was possible to lay out a 50-foot grid, the grid area included potentially undisturbed and archaeologically sensitive areas as well as areas that were clearly disturbed and exhibited bulldozed piles of dirt and debris, tangled tree falls, and modern refuse dumps. In such areas, judgmental excavation of STPs on the grid was practiced. In many of the test areas it was necessary to adjust the 50-foot interval to avoid stone walls, mature trees, rock outcrops, bulldozed piles of debris, tree falls, cellar holes, and similar features. STPs were not excavated below paved surfaces or in areas of standing water.

Transects were laid out at 50-foot intervals off the ROW fence where feasible, using an optical compass to turn 90 degrees from the angle of the ROW and fiberglass tapes to measure distance. Potential STP locations were marked by survey pin-flags on which the STP coordinates were written using waterproof marking pens. The STP location record is presented in Appendix B (Table B-1).

Some of the larger test areas contained substantial areas of disturbance that geographically separated potentially undisturbed segments of the test areas. In cases where a test area exhibited large areas of disturbance, or where a test area was several acres in size, they were divided into subareas for provenience and mapping control.

Subsurface testing also helped to identify the presence or absence of features in the APE that might be associated with MDSs noted during the reconnaissance walkover survey.

7.1.2 Shovel Test Pits

The locations of all STPs were drawn onto a base map of the individual test area. Field notes were kept on a daily basis by the field crew in field notebooks; all STP information was recorded on pre-printed, standardized STP forms. The STPs averaged 20 inches in diameter, and were excavated where possible by natural stratigraphic levels or fill deposits as interpreted in the field. Each STP was excavated into culturally sterile soil, unless impeded by rock, large roots, or other obstruction.

All excavated soils were screened through 0.25-inch mesh hardware cloth to ensure artifact recovery. All recovered artifacts were placed into re-closable 4-milliliter (ml)-thick polyethylene bags and labeled with all relevant provenience information using waterproof, permanent marking pens. 20th century debris and recent roadside trash items were noted but not collected during the Phase IB survey.

All field information – such as opening and closing level depths, soil descriptions of the levels and strata encountered, and Munsell standardized color chart descriptions – were recorded for every STP on the standardized STP form. The soils record is presented in Appendix B (Table B-2).

7.1.3 Geoarchaeological Survey

Geoarchaeological sampling and analysis is required to determine the archaeological potential of affected submerged areas within the Hudson River. Geoarchaeological methods rarely identify direct evidence of archaeological sites; however, they are able to determine the archaeological potential of submerged landforms through evaluation of depositional history, stratigraphy, and the radiocarbon dating of suitable samples.

GRA was subcontracted to evaluate the potential for archaeological resources to be located within portions of the Hudson River that may be impacted by the proposed replacement of the Tappan Zee Bridge. The evaluation was based on the analysis of geophysical data and sediment samples. Through this analysis, GRA was able to determine the potential for encountering buried shoreline deposits or former stable surfaces that could yield archaeological resources.

In order to complete the geoarchaeological survey, the following tasks were carried out by GRA:

- Review of the bathymetric survey, sub-bottom profiles, and side-scan sonar data that were collected as part of the environmental review work for the EIS.
- Identification of a discrete number of boring locations for geoarchaeological analysis from the planned boring locations to be conducted across the Hudson River.
- Provided a geoarchaeologist to monitor the boring locations chosen for geoarchaeological analysis.
- Recorded all pertinent stratigraphic data for each boring and collect up to three sediment samples per boring appropriate for radiocarbon dating.
- Prepared and submitted the sediment samples to Beta Analytic, Inc. for radiocarbon dating.
- Prepared a comprehensive report summarizing the methods, results, and conclusions.

The geoarchaeological survey report appears as Appendix F.

7.2 Results of Phase IB Subsurface Testing Survey – Rockland County

One test area was targeted for Phase IB subsurface survey in Rockland County. This test area was originally highlighted as archaeologically sensitive through the Phase IA survey based primarily on cartographic research; the reconnaissance walkover surveys further defined test areas that appeared to represent undisturbed landforms with potential to contain intact archaeological resources. Some of these test areas also contained historic-period features visible at or above the ground surface, providing further evidence of archaeological sensitivity.

Subsurface testing involved excavation of 3 shovel test pits across the eight test areas. A total of 106 historic and modern artifacts were recovered. The historic artifact analysis is discussed in Chapter 8.

Table 7-1
Summary of Phase IB Archaeological Subsurface Testing

Test Area Locations	Test Area No.	No. of STPS	Approximate Area or Length of Test Area	Resources Encountered *		Recommendations*
				Pre-Historic	Historic	
Elizabeth Place Park	18	3	0.5 ac (2006-9) 550 ft (2010)	N	Y	No further testing

Note: *Resources identified and recommendations based on results of Phase IB archaeological survey.

7.2.8 Test Area 18: Elizabeth Place Park, South ROW; North of Elizabeth Place; 550 feet

Subsurface testing in TA 18 involved excavation of three STPs along the eastern most end of the park. The tests were excavated at 50-foot intervals along a single transect within approximately 10 feet of the existing I-287 ROW; the datum point was along the ROW fence, in line with the rear property line of the houses fronting Elizabeth Place (see Photo 5-38). These test pits were east and northeast of a large rectangular footprint, which may be evidence of a former structure at this location (though no clear evidence of a structure in this location was identified through cartographic analysis).

Figure D-4-8 depicts the location of the three STPs.

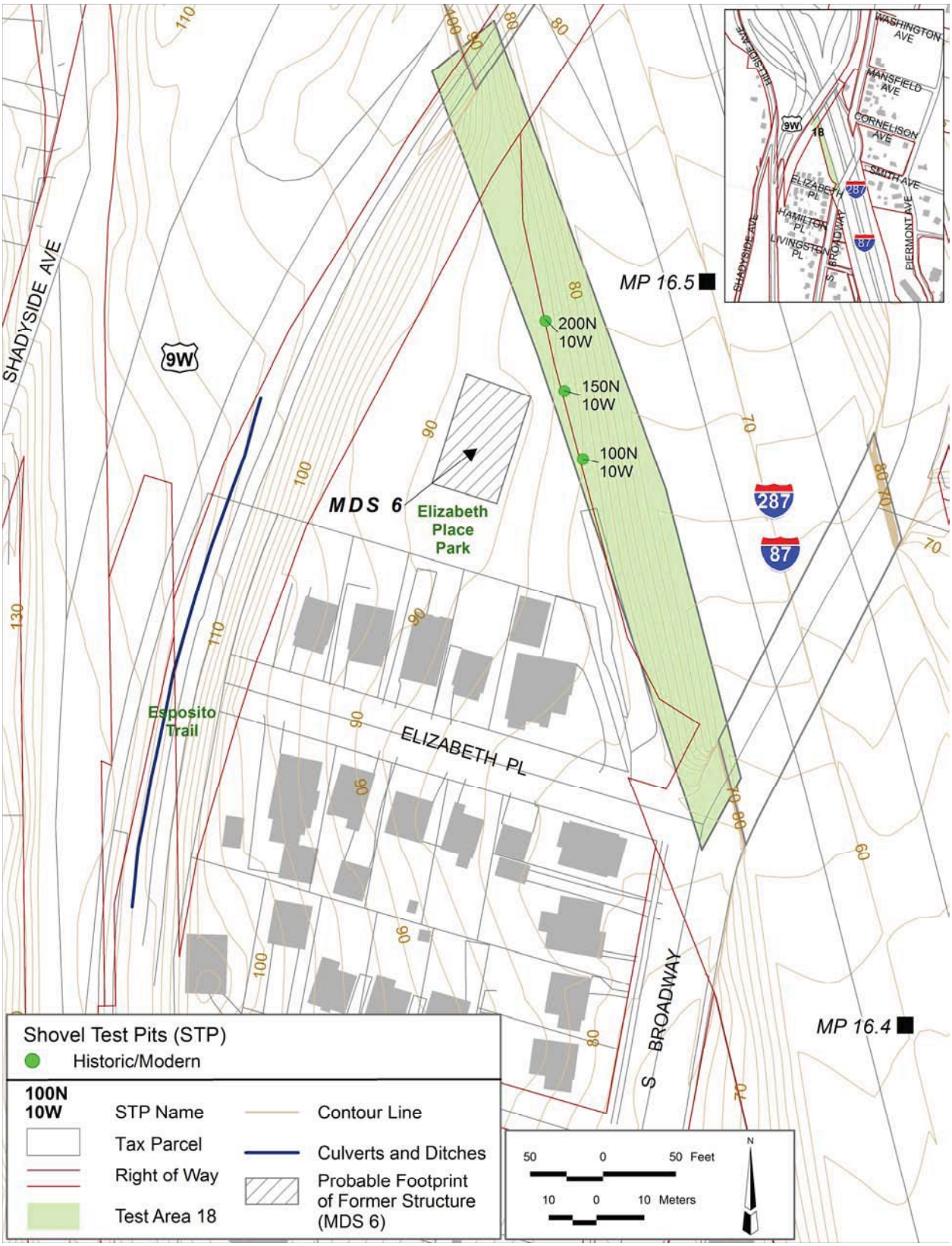


Figure D-4-8 Test Area 18: Results of Subsurface Testing

See note on cover regarding report continuity
and references to rescinded project

All three STPs encountered similar subsurface conditions. Excavated to an average depth of 17.3 inches below ground surface, the first layer was a thin root mat; the second layer was a thick silty sand fill, containing a mix of 19th and 20th debris; and the third layer was compact and also appeared to be fill, though it was culturally sterile.

The fill layer encountered included a variety of materials, including ceramic sherds, bottle/container glass fragments, window glass fragments, chunks of coal and clinker, and ceramic water/sewer pipe fragments. The deposits encountered appear to represent a filling and grading episode from some point during the 20th century, likely in association with construction of the Thruway.

No further testing is recommended for this test area. However, if any of the four build alternatives are further developed so as to include all or a larger portion of Elizabeth Place Park, then additional subsurface testing would be recommended.

7.3 Results of Phase IB Subsurface Testing Survey – Westchester County

No areas of archaeological sensitivity were identified in the Westchester County portion of the project area.

7.4 Results of Geoarchaeological Survey – Hudson River

Geoarcheology Research Associates (GRA) conducted vibracore sediment sampling of the Hudson River bottom sediments in November of 2008. The purpose of the geoarchaeological investigation was to determine the potential for submerged prehistoric archaeological sites to be present in the replacement Tappan Zee Bridge area of potential effect. Results of this geoarchaeological assessment are briefly summarized below; the report is included as Appendix F.

A total of four vibracore sediment samples extending up to ten feet below the sediment-water interface were collected for this geoarchaeological survey (Figure 7-1, Location of Geoarchaeological Cores from GRA and Select Cores from Mueser Rutledge). These sediments were analyzed to determine past environmental conditions that may have supported occupation of the area by prehistoric people. Samples recovered were analyzed for sediment type (i.e., sand, silt, clay, etc.) and presence of faunal material. Radiocarbon dating of samples provided dates within the stratigraphic column.

Geotechnical data collected by other recent surveys in the vicinity of the Tappan Zee Bridge was also reviewed by GRA (LDEO 2006a and b; Mueser Rutledge Consulting Engineers 2007) (Figure 7-1). This information was combined with data collected from GRA's survey, as well as information from previously identified archaeological sites in the area, to help identify environmental conditions during prehistoric times. The presence of oysters within the sediment columns was interpreted as an indication of a time period capable of supporting oyster harvesting by prehistoric peoples.

Based on these data, there is a possibility for the presence of deeply buried *in situ* marsh deposits and underlying river terraces approximately 45 to 50 feet below sea level to the north of the bridge (Figure 7-2, Profile View of Hudson River Sediment Showing Core Locations). These deposits may contain

evidence of prehistoric activity dating to the beginning of the Early Archaic Period or the Paleo-Indian Period. The deposits and terraces occur in the vicinity of the causeway, in an area extending approximately 1,500 feet from the Nyack shore (Larsen, Smith and Schuldenrein 2010:33-34; Mueser Rutledge 2007).

Since some penetration of these deposits can be expected during staging, dredging, pile driving, and other construction activities associated with construction of the replacement Tappan Zee Bridge, it is recommended that samples be taken for further geoarchaeological analysis when additional borings are obtained in association with final bridge design. The purpose of the additional geoarchaeological data would be to delineate the extent of such deposits within the archaeological APE.

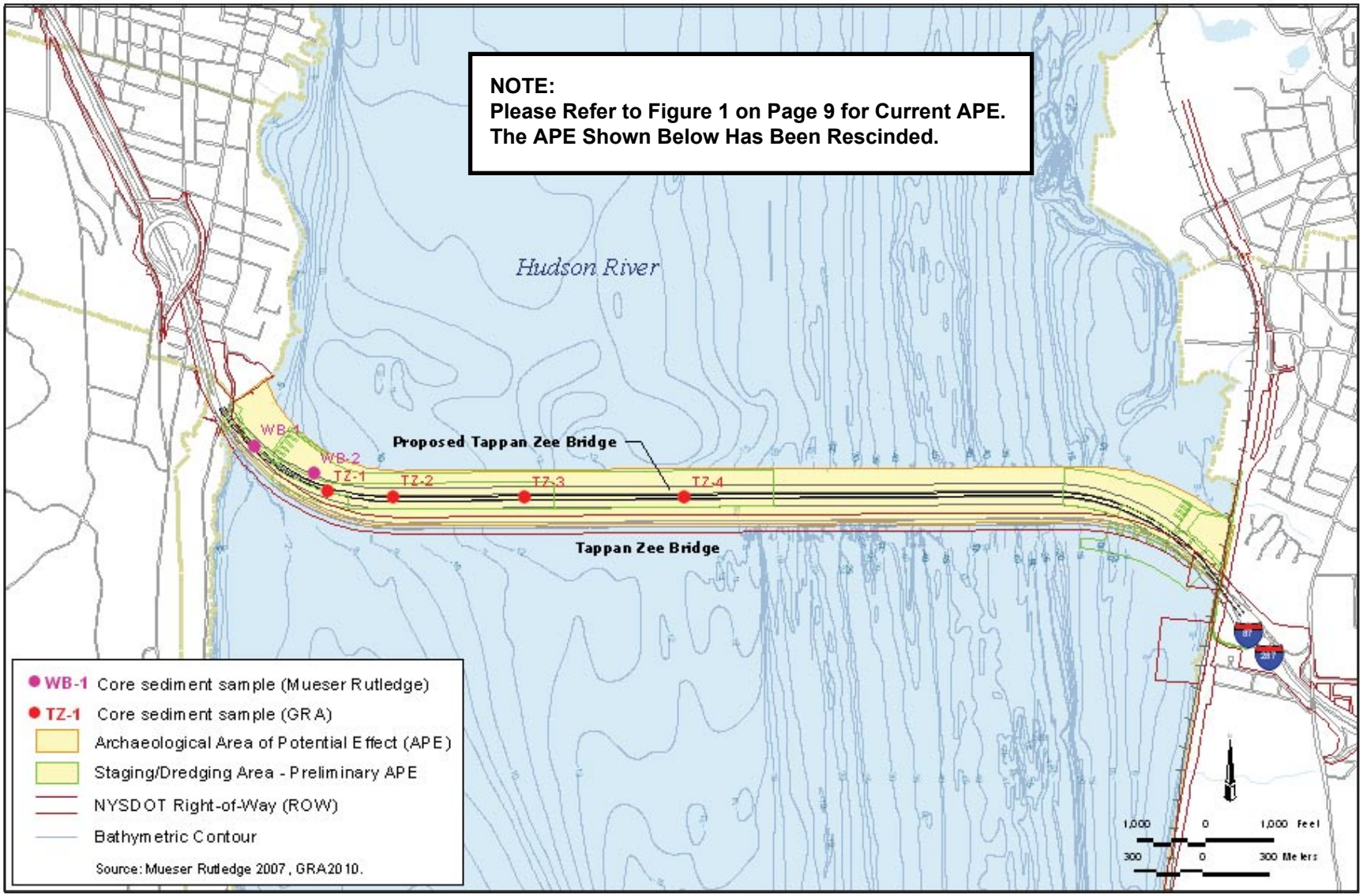
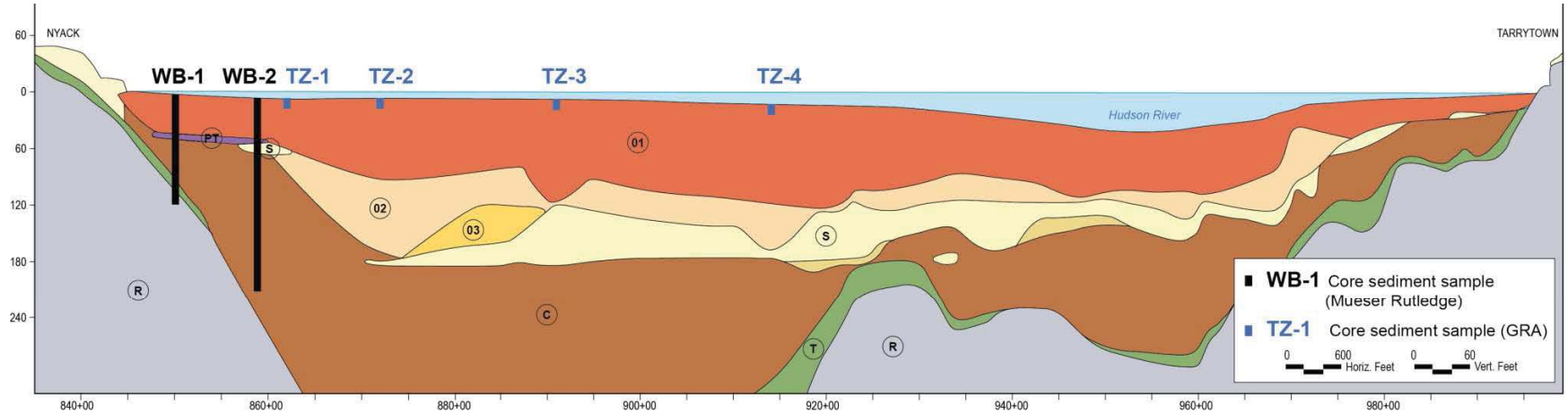


Figure 7-1 Location of Geoarchaeological Cores from GRA and Select Cores from Mueser Rutledge

See note on cover regarding report continuity and references to rescinded project



01 Organic silty clay soft dark gray organic silty clay, trace shell, vegetation, wood, loam and peat.

02 Organic silty clay with traces of sand, soft gray organic silty clay, trace fine sand, sand seams and partings peat.

03 Organic silty clay with some sand, medium gray silty clay, trace to some fine sand, silt, trace fine sand seams or pockets.

PT Peat. Brown Peat

S Sand: Medium compact to very compact fine to medium sand, some salt, trace coarse sand and gravel.

C Glacial groved sand and clay fine to coarse sand. Some gravel trace rock fragments, salt, gray brown silty clay layers and boulders.

T Glacial till: Very compact rough gray clay fine to coarse sand. Some gravel trace rock fragments, slat gray brown silty clay layers and boulders.

R Rock intermediate to hard unweathered to slightly weathered granitic gneiss or sandstone, blocky to loosely jointed, weathered to iron seamed joints.

Sources: Arup 2007. Mueser Rutledge 2007. GRA 2010.

Datum NGVD29.

Figure 7-2 Profile View of Hudson River Sediments Showing Core Locations

8 Laboratory Methods and Results of Artifact Analysis

The Phase IB subsurface survey of 1 test area in the Rockland County portion of the Corridor involved the excavation of 3 STPs. These STPs yielded a total of 106 historic and modern artifacts. The historic artifact catalogue appears as Appendix B-4.

8.1 Laboratory Methods

This subchapter details the laboratory methods and procedures utilized for the processing and cataloguing of the prehistoric and historic artifact assemblages recovered during the Phase IB survey.

8.1.1 Artifact Processing

Following the completion of all fieldwork, all recovered artifacts were cleaned and processed in compliance with the guidelines established by the US Department of the Interior (USDOI) for the proper curation of federally owned and administered archaeological collections (36 CFR 79 and 66), as adapted by NYAC 2004. The objectives of the laboratory procedures are:

- To prepare artifacts and samples for analysis, including wet or dry cleaning, special drying procedures when needed, and special packaging or handling of samples intended for instrumental analysis.
- To record artifact and provenience data and prepare an artifact catalogue.

A catalogue number, consisting of the STP coordinate location and level, was assigned in the field to each bag of recovered artifacts and followed the artifacts throughout the laboratory process as the basic unit of recording and identification.

The artifacts, dependent upon condition, were either dry-brushed or washed in room-temperature water to facilitate identification. After air drying on racks, the artifacts were sorted, catalogued, and computer-inventoried. The inventory is intended to provide a preliminary level of control on the nature, date range, and number of recovered artifacts.

Individual or multiple items representing unique catalogue entries were packaged in re-closable 4-ml-thick polyethylene bags with clearly visible provenience information written on the bag using a

waterproof, permanent marking pen. Prehistoric cultural material and historic artifacts were sorted, catalogued, and bagged as separate assemblages of material remains to be analyzed by the appropriate specialist. The prehistoric and historic assemblages were then re-integrated and organized by test area and transect and placed into two-piece acid-free boxes for temporary storage.

8.1.2 Cataloguing Procedures

The process of cataloguing the artifacts recovered from the Phase IB survey involved collecting information on several attributes for each artifact. The Phase IB artifact assemblage included historic cultural material.

8.1.2.2 Historic Artifacts

The process of cataloguing the historic artifact assemblage recovered from the Phase IB survey involved collecting information on several attributes for each artifact. Table 8-4 provides a list and brief description of these attributes. Table 8-5 provides a breakdown of the functional groups by their respective artifact classes, by which the recovered historic artifact assemblage was sorted and catalogued. The historic artifact catalogue is presented in Appendix B (Table B-4).

A primary objective of the diagnostic historic artifact analysis is to establish a chronological framework for strata encountered during the STP survey. The age of each excavated level is determined by the age of the most recent artifact found within it. The earliest date that can be assigned for the initial date of manufacture or production for any identified artifact is known as the *Terminus Post Quem*, or TPQ date.

Therefore, the most recently manufactured artifact identified in any archaeological context represents the earliest date at which the context could have been deposited. The TPQ dates were explained by James Deetz as follows:

> *The principle of dating (such) deposits on the basis of the newest artifact found in them is common to all archaeology…known as the Terminus Post Quem (date after which) is powerful when combined with a detailed knowledge of the history and development of the artifacts in question* (Deetz 1977).

The dating of artifacts from a highly fragmented assemblage is always problematic. However, guidance is available from numerous reference works considered standard by most professionals in the field of historic archaeology. The dates used for historic ceramics in this analysis were taken primarily from Noel Hume (1976) and South (1972), with additional information regarding diagnostic stylistic and decorative changes or refinements derived from Miller (2000) and Wetherbee (1980). Glass references include Jones and Sullivan (1985), Lief (n.d.), Munsey (1980), Noel Hume (1976), and Wilson in Peterson (1976). Dates and descriptive information for other classes of artifacts were taken from Busch (1981), McKee (1976), Miller (2000), Noel Hume (1976), Peterson (1976), and Sickels (1972).

Table 8-1

Prehistoric Artifact Attributes

Attribute	Values	Explanation
Group	Prehistoric, Historic	Describes the general artifact type.
Artifact Class	Debitage, core, projectile, tool, fire-cracked rock	More narrowly defines the class the artifact represents within the broader group.
Material	Quartz, rhyolite, chert, jasper, etc.	The parent material that the artifact is composed of.
Artifact Type	Flake, stemmed point, flake tool, etc.	A term describing a diagnostic attribute of the artifact, where relevant.

Table 8-2

Debitage Types

Artifact	Description
Shatter	The by-product of a blow to a core that produces debitage, but does not exhibit the easily recognizable characteristics of a flake due to inclusions or irregularities in the raw material.
Broken Cobble	Large portion of rock with most of the cortex remaining.
Flake	The by-product of an intentional blow to a core or tool during flint knapping; exhibits certain characteristics (a platform, bulb of force, and previous flake scars) easily identifiable to a lithic technologist.
Broken Flake	A flake with an intact striking platform and bulb of force, with one or more of its margins missing.
Flake Fragment	A flake with a missing striking platform and bulb of force.

Table 8-3

Debitage Attributes

Attribute	Values	Explanation
Length	Actual length in centimeters (cm)	Provides a measure of overall flake size.
Cortex	Yes, no	Indicates whether or not some portion of the weathered outer layer of the parent material is present.
Platform	Corticated, plain, prepared, lipped, missing	Corticated platforms bear the original, unmodified surface of the parent material; prepared platforms show evidence of platform preparation flaking; lipped platforms are the product of pressure flaking using a soft hammerstone (e.g., antler, billet).
Negative Scars	None, single, multiple	Number of previously detached flakes before the flake in question was removed.

Table 8-4

Historic Artifact Attributes

Attribute	Values	Explanation
Functional Group	Food Service, Architectural Materials, etc.	Describes the general type of activity that the artifact is reflective of.
Artifact Class	Historic Ceramics, Nails, Window Glass, etc.	More narrowly defines the activity the artifact represents within the broader functional group.
Material	Wood, glass, iron, etc.	The primary material that the artifact is composed of.
Type	Whiteware, redware, aqua glass, etc.	A term describing a diagnostic attribute of the artifact, where relevant.
Element	Fragment, bodysherd, spall, etc.	The portion of the original object that the particular artifact was once part of.
Specific Date Range	1880-1900+	For certain artifact classes, specific date ranges are available based on documented ranges of manufacture.
General Time Period	20th century	This field describes the century during which the artifact was likely manufactured.
Comments	Motif and/or vessel form	More specific information concerning the artifact and any diagnostic aspects or details.

Table 8-5

Historic Functional Groups and Artifact Classes

Functional Group	Artifact Class
Food Service/ Preparation/Storage	Historic Ceramic, Bottle/Container Glass, Bottle/Container Closure, Tableware Glass
Architectural Materials	Construction Materials, Nails, Window Glass, Door/Window Hardware, Other Structural Materials
Furnishings	Furniture Hardware, Furniture/Parts, Decorative Furnishings, Lighting Related
Clothing Related	Fasteners, Manufacture/Repair, Apparel, Ornamentation
Personal Items	Coins, Keys, Jewelry, Grooming/Hygiene, Writing Related, Other Personal Items
Smoking Pipes	Pipes
Military Arms/Arms	Projectiles, Cartridge Casings, Gun Parts
Faunal Remains	Bone, Shell, Other Faunal
Floral Remains	Food Remains, Other Floral
Activities Related Items	Toys, Tools, Public Services, Specialized Activities, Miscellaneous Hardware, Miscellaneous Artifacts, 20th Century Debris
Not Assigned	Unspecified

8.3.8 Test Area 18 Elizabeth Place Park, South ROW

A total of 106 historic and modern artifacts were recovered from three STPs excavated in TA 18. The artifacts are indicative of recent fill activity; potentially mid-19th century historic and modern material were recovered in association in all three STPs. The artifact assemblage from this test area has been assigned to a variety of functional groups and artifact classes representative of historic and recent domestic occupation as well as construction/demolition debris. Table 8-9 depicts the functional groups and artifact classes by STP for this test area.

Table 8-9

Test Area 18 – Functional Groups and Artifact Classes by STP

Functional Group	Artifact Class	STP 100N 10W	STP 150N 10W	STP 200N 10W	Total by Artifact Class
Food Service/ Preparation/Storage	Historic Ceramic		25		25
	Bottle/ Container	5	6	7	18
Architectural Materials	Nails		12	4	16
	Window Glass		9	7	16
	Other Structural Materials		3		3
Furnishings	Decorative Furnishings	5			5
Smoking Pipes	Pipes		1		1
Faunal Remains	Shell		2		2
Activities Related Items	Toys		1		1
	Public Services		1		1
	Miscellaneous Hardware	1	3	1	5
	Miscellaneous Artifacts		3		3
	20th Century Debris	Discarded	10	Discarded	10
Totals by STP		11	76	19	106

As illustrated in Table 8-9, the TA 18 artifacts were identified to six functional groups representing thirteen artifact classes. The functional groups are: Food service/preparation/storage; Architectural materials; Furnishings; Smoking pipes; Faunal remains; and Activities related items. The assemblage recovered from the three STPs in TA 18 have been assigned to the artifact classes of: Historic ceramics (25); Bottle/container glass (18); Nails (16); Window glass (16); Other structural materials (3); Decorative furnishings (5); Pipes (1); Shell (2); Toys (1), Public services (1); Miscellaneous hardware (5); Miscellaneous artifacts (3); and 20th Century debris (10).

Of note is the presence of dated 20th century artifacts in all three STPs in TA 18. STP 100N 10W, Level 2 yielded an embossed, brown glass, machine-made beer bottle base. Noted in this level, but not collected, were 20th century molded plastic fragments.

STP 200N 10W, Level 2 yielded bottle/container glass, iron nails, window glass, and miscellaneous hardware. Noted in Level 2, but not collected were numerous plastic wrap fragments and molded plastic fragments. 20th century glass fragments recovered include brown beer bottle and clear, stippled food bottle/jar fragments.

STP 150N 10W is most representative of the fill deposit that was identified across the testable portion of TA 18. Potentially mid-19th century dated ceramic and bottle glass sherds and a ball clay pipestem were recovered in Level 2 in association with 20th century dated electrical wire sections and molded plastic fragments, including a Tiparillo-type molded plastic filter tip.

10 Summary of Phase IB Survey

The Phase IB survey in Rockland County consisted of subsurface testing in one area determined through the Phase IA cartographic research to have archaeological sensitivity and confirmed through the Phase IA intensive walkover. The Phase IB survey in Westchester County has not been completed. The Phase IB for the Hudson River crossing consisted of a geoarchaeological core sediment sampling and analysis survey.

10.2.1 Rockland County

Subsurface testing involved excavation of 3 shovel test pits. A total of 106 historic and modern artifacts were recovered. Cultural material recovered during the Phase IB survey is discussed by test area in Chapter 8. The area was determined to have no archaeological sensitivity.

10.2.2 Westchester County

No areas of archaeological sensitivity were identified in the Westchester County portion of the project area.

10.2.3 Hudson River

The geoarchaeological survey concluded that there is a possibility for the presence of deeply buried *in situ* marsh deposits and underlying river terraces approximately 45 to 50 feet below sea level to the north of the bridge. These deposits may contain evidence of prehistoric activity dating to the beginning of the Early Archaic Period or the Paleo-Indian Period.

Since some penetration of these deposits can be expected during staging, dredging, pile driving, and other construction activities associated with construction of the replacement Tappan Zee Bridge, it is recommended that samples be taken for further geoarchaeological analysis when additional borings are obtained in association with final bridge design. The purpose of the additional geoarchaeological data would be to delineate the extent of such deposits within the archaeological APE.

In additional to geoarchaeological analysis for potential prehistoric deposits, archaeological survey will be required to determine the presence or absence of historic archaeological deposits in the Hudson River. One or more shipwrecks in the river channel may be present in the APE; wharves and/or piers and other constructions may be present in and about the waterline on the western shoreline. Given the costs associated with submerged archaeological investigations, it is recommended that survey of these areas be postponed until details of proposed construction are available. Submerged investigations can then be targeted in those areas that will be impacted by construction, to determine whether archaeological remains are present.

Appendix A

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See note on cover regarding report continuity and references to rescinded project

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Appendix B

Location Record
Soils Record
Historic Artifact Catalogue

See note on cover regarding report continuity and references to rescinded project

Table B-1

Location Record

Test Area	STP	Association	Date	Depth (in)	Termination	Cultural Material	Notes
18	100N 10W	Elizabeth Place Park	04/20/10	20	Depth	Modern	Fill
18	150N 10W	Elizabeth Place Park	04/20/10	14	Compaction	Modern	Fill
18	200N 10	Elizabeth Place Park	04/20/10	18	Depth	Modern	Fill

Table B-2

Soils Record

Test Area	STP	Level	Name	Depth (in)	Soil Disruption	Munsell Hue	Inclusions	Intrusions
18	100N 10 W	1	O	2	Silty loam	10YR 4/2	Sod, roots	
18	100N 10 W	2	Fill	14	Silty sand	5 YR 4/4	Slag, cinder some pebbles	hist/mod materials
18	100N 10 W	3	Fill	20	Silty sand	7.5 YR 5/6	More pebbles	
18	150N 10W	1	Root mat	1	Silty loam	10 YR 3/4		
18	150N 10 W	2	Fill	13	Silty sand	10 YR 4/3	Few gravels + rd pebbles	hist/mod materials
18	150N 10 W	3	Fill	14	Silty sand	7.5 YR 4/4	Few pebbles	
18	2000N 10 W	1	O	2	Silty loam	10 YR 4/2	Sod, roots	
18	2000N 10 W	2	Fill	8	Silty sand	5 YR 4/4	Slag, cinder some pebbles	hist/mod materials
18	2000N 10 W	3	Fill	18	Silty sand	7.5 YR 5/6	Few pebbles	

Table B-4
Historic Artifact Catalogue

STP	Level	Functional Group	Artifact Class	Material	Count	Type	Element	TPQ or Date Range	General Time Period	Wgt. (gm)	Specific Motif/Comments/ Vessel Form
Test Area 18											
100N 10W	2	Food service /prep/storage	Bottle /Container	Brown glass	1	Embossed brown	partial base		20th C		Prob. mod. beer;embossed...AT O...A...;machine made
100N 10W	2	Food service /prep/storage	Bottle /Container	Clear Glass	1	Thin, clear	Body sherd				Possibly tableware glass?
100N 10W	2	Food service /prep/storage	Bottle /Container	Clear Glass	3	Clear	Body sherd				Unidentified form
100N 10W	2	Furnishings	Decorative furnishings	Glass	5	Mirror	Fragments				
100N 10W	2	Activities	Misc. hardware	Iron	1	Wire	Fragment				Twisted, thin iron wire

Table B-4

Historic Artifact Catalogue

STP	Level	Functional Group	Artifact Class	Material	Count	Type	Element	TPQ or Date Range	General Time Period	Wgt. (gm)	Specific Motif/Comments/ Vessel Form
150N 10 W	2	Food service /prep/storage	Historic ceramic	Refined earthenware	11	Annular yellowware	bowl rim + bodysherds	1860	L19-20th C		Embossed bands; blue and white; large dia. bowl
150N 10 W	2	Food service /prep/storage	Historic ceramic	Refined white earthenware	8	Decorated whiteware	base spalls	1840	M19-20th C		Polychrome painted green/blue/pink; cursive mark "Blue...";not identified
150N 10 W	2	Food service /prep/storage	Historic ceramic	Refined white earthenware	4	Undecorated whiteware	base spalls	1820	19th-20th C		Prob. flatware; badly spalled interior
150N 10 W	2	Food service /prep/storage	Historic ceramic	Refined earthenware	1	Undecorated ironstone	Base sherd	1850	M19-20th C		Small; thin; hard paste
150N 10 W	2	Food service /prep/storage	Historic ceramic	Red earthenware	1	Red earthenware	Body spall				Unidentified form
150N 10 W	2	Food service /prep/storage	Bottle /Container	Dark green glass	1	Dark green	Pontilled partial base		19th C		Smoothed pontil mark; wine/liquor
150N 10 W	2	Food service /prep/storage	Bottle /Container	Clear Glass	4	Thick, clear	Body sherds				Unidentified form; beverage/food?
150N 10 W	2	Food service /prep/storage	Bottle /Container	Clear Glass	1	Embossed clear	finish sherd				Possibly tableware glass?
150N 10 W	2	Architectural	Construction materials	Terracotta	1	Unidentified	Chunk				
150N 10 W	2	Architectural	Construction materials	Tar paper	1	Roofing? Underlayment?	Fragment				
150N 10 W	2	Architectural	Nails	Iron	4	Square cut	Fragments				Corroded
150N 10 W	2	Architectural	Nails	Iron	7	Unidentified	Fragments				Corroded
150N 10 W	2	Architectural	Nails	Iron	1	Wire spike	Whole				Round head;5.25" long; corroded
150N 10 W	2	Architectural	Window glass	Aqua tint glass	6	Window	Fragments				
150N 10 W	2	Architectural	Window glass	green tint glass	1	Window	Fragment				Slightly burned

Table B-4
Historic Artifact Catalogue

STP	Level	Functional Group	Artifact Class	Material	Count	Type	Element	TPQ or Date Range	General Time Period	Wgt. (gm)	Specific Motif/Comments/ Vessel Form
150N 10 W	2	Architectural	Window glass	Aqua tint glass	2	Plate glass	Fragments				
150N 10 W	2	Architectural	Other structural materials	Copper	1	Wire	section		20th C		Clad bundle; prob. electrical
150N 10 W	2	Smoking pipes	Pipes	White ball clay	1	Pipestem	Fragment				Undecorated; unmarked; small
150N 10 W	2	Faunal remains	Shell	Shell	2	Unidentified	Fragments				Small; very weathered
150N 10 W	2	Activities	Toys	Glass	1	Marble	Whole		L19-20th C		Clear; swirled green
150N 10 W	2	Activities	Public services	Glazed earthenware	1	Water/sewer pipe	Fragment				Red earthenware; unglazed interior
150N 10 W	2	Activities	Misc. hardware	Iron	1	Wire	Fragment				Corroded; bent; thin wire
150N 10 W	2	Activities	Misc. hardware	Iron	1	Chain link/hook/handle	Partial				Corroded; thick; unidentified
150N 10 W	2	Activities	Misc. hardware	Iron	1	Strap?	section				Thin;1.5” wide; corroded
150N 10 W	2	Activities	Misc. artifacts	Cinder	2	Furnace waste?	Fragments				
150N 10 W	2	Activities	Misc. artifacts	Coal	1	Anthracite	Fragment				
150N 10 W	2	Activities	20th c. debris	Plastic	8	Molded plastic	Fragments		20th C		Carved look; handle? whistle?
150N 10 W	2	Activities	20th c. debris	Plastic	1	Molded plastic	Fragment		20th C		Plastic flower stem; 4” long
150N 10 W	2	Activities	20th c. debris	Plastic	1	Molded plastic	Filter-tip / mouthpiece		20th C		Cigarette/sm. cigar filter tip
200N 10W	2	Food service /prep/storage	Bottle /Container	Brown glass	2	Brown	Body sherds		20th C		Probably modern beer
200N 10W	2	Food service /prep/storage	Bottle /Container	Clear Glass	4	Embossed clear	Base + body sherds				Unidentified form; possibly beverage

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Table B-4

Historic Artifact Catalogue

STP	Level	Functional Group	Artifact Class	Material	Count	Type	Element	TPQ or Date Range	General Time Period	Wgt. (gm)	Specific Motif/Comments/ Vessel Form
200N 10W	2	Food service /prep/storage	Bottle /Container	Clear Glass	1	Stippled clear	Finish fragment		20th C		Jar/food bottle; thick
200N 10W	2	Architectural	Nails	Iron	2	Square cut	Whole				Whole;3.25” long
200N 10W	2	Architectural	Nails	Iron	1	Wire	Whole				3.5” long
200N 10W	2	Architectural	Nails	Iron	1	Square cut spike	Whole				4.25” long; square head
200N 10W	2	Architectural	Window glass	Aqua tint glass	4	Window	Fragments				
200N 10W	2	Architectural	Window glass	Clear Glass	2	Window	Fragments				
200N 10W	2	Architectural	Window glass	Aquatint glass	1	Plate	Fragment				
200N 10W	2	Activities	Misc. hardware	Iron	1	Washer	Partial				Corroded; 1 7/8” diameter

Appendix D

Previously Identified Archaeological Sites

See note on cover regarding report continuity and references to rescinded project

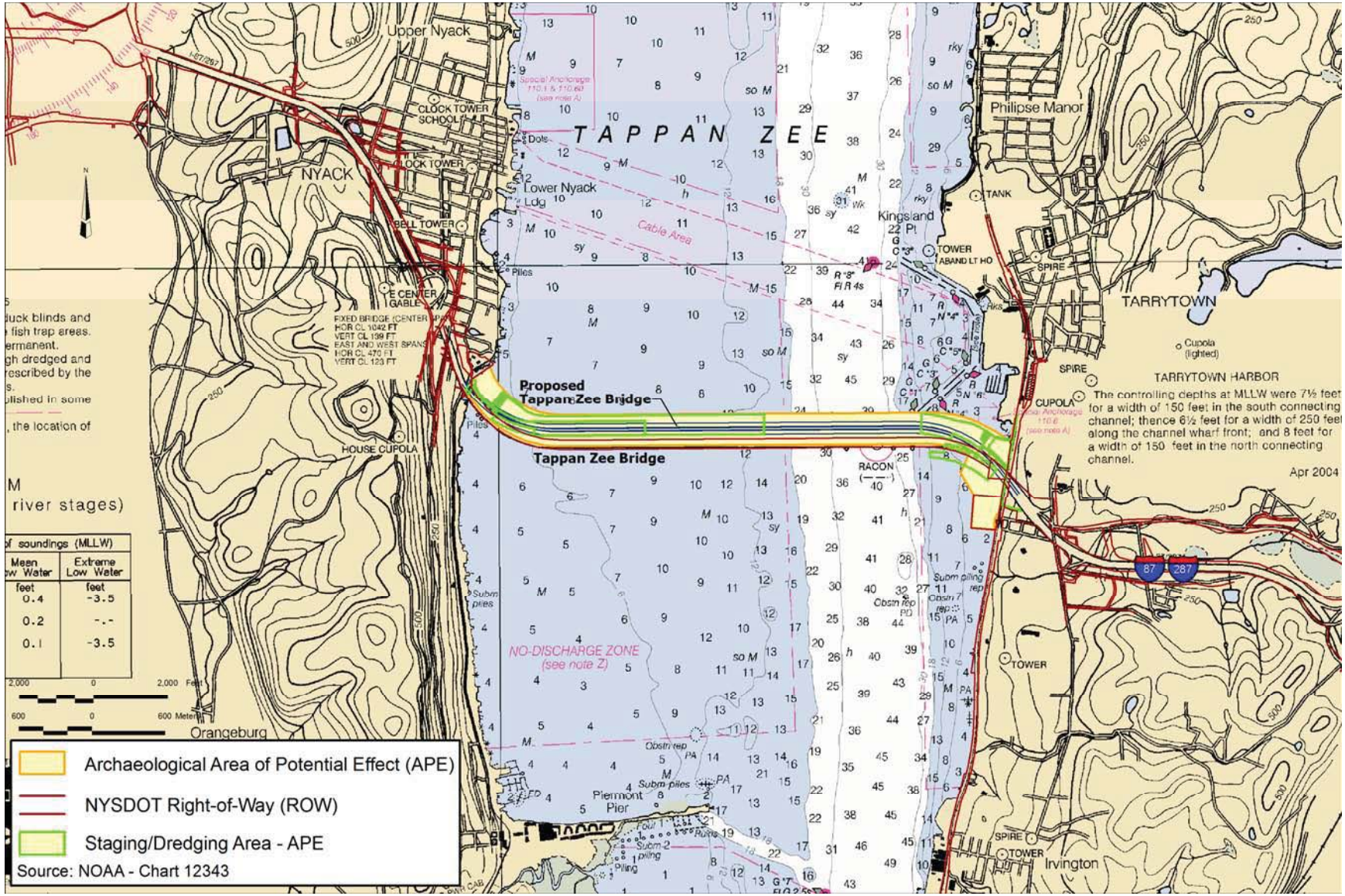

Figure D-2-4 NOAA Chart

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Appendix F

Geoarchaeological Survey Report

See note on cover regarding report continuity and references to rescinded project

GEOARCHAEOLOGICAL STUDY OF CORES FOR THE TAPPAN ZEE BRIDGE HYDROGRAPHIC SURVEY, I-287 CORRIDOR

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February 11, 2010

See note on cover regarding report continuity and references to rescinded project

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and references to rescinded project

INTRODUCTION

Geoarcheological Research Associates (GRA) has been contracted by Earth Tech (now AECOM) to augment its cultural resources investigations along the alignment of the proposed replacement for the Tappan Zee Bridge (Fig. 1). As a project with Federal funding, construction of a new Tappan Zee Bridge along Interstate Highway 287 (I-287) falls under Federal requirements in Section 106 of the National Historic Preservation Act as amended through 1992 and the Advisory Council on Historic Preservation Guidelines for the Protection of Cultural and Historic Properties (36 CFR 800). These responsibilities extend to both land based and submerged cultural resources.

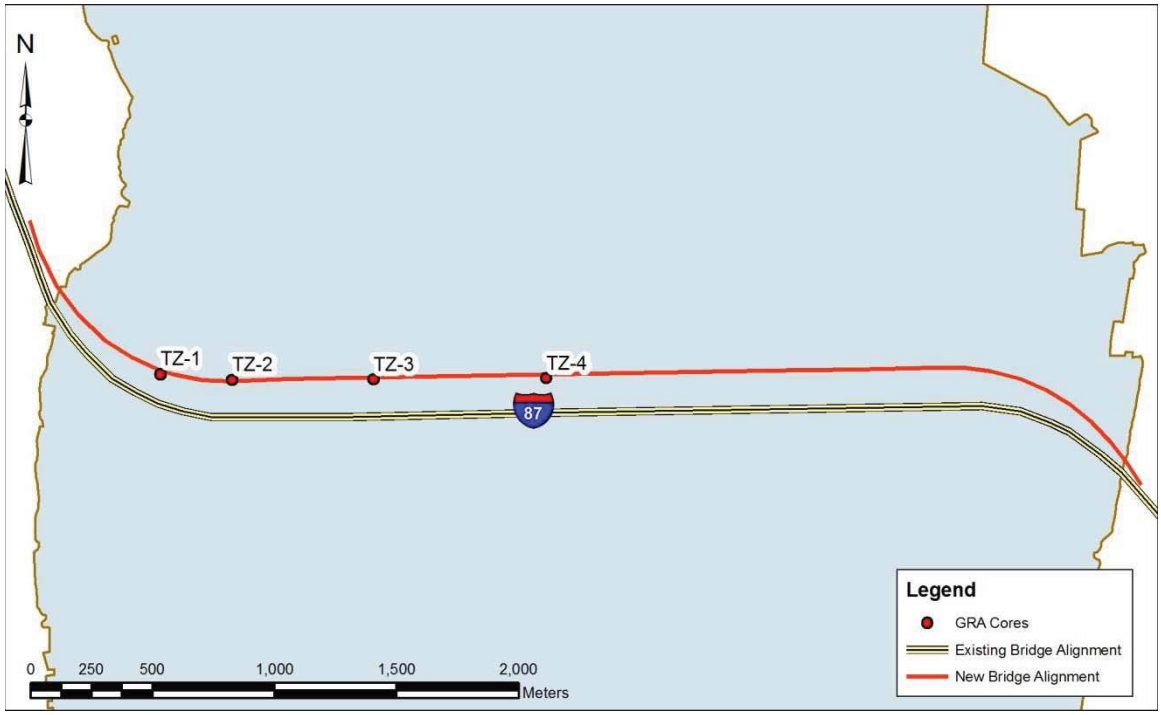

Figure 1. Plan of existing and planned bridge alignments.

Sea level has risen as much as 100 meters since the end of the last glaciation of North America ended approximately 20,000 years ago. Rising sea level has progressively inundated the continental shelves and continues to rise, flood, and cover coastal lands and to fill former river systems. The postglacial rise in sea level has covered former land surfaces that were attractive as settlements for prehistoric peoples

throughout the past. While the probability of affecting "drowned" cultural resources seems remote, the potential for their identification and protection needs to be considered. One of the most efficient methods for avoiding disturbance of submerged cultural resources is to identify and evaluate the former areas of greatest site potential in their former subaerial site settings. Applying this investigative methodology requires an understanding of the relative rise in postglacial sea level and the dynamic interaction between the sea and its contemporaneous coastal and riverine environments through time. The Hudson River estuary including Tappan Zee contains stratigraphic evidence for the late glacial and postglacial history of the region.

GRA investigations focused on determining the potential for submerged prehistoric archeological sites along the construction zone for the new bridge. The scope of work called for the drilling of four vibracores to a depth of 15 feet below the sediment water interface in the zone most likely to be impacted by proposed bridge construction. The sediment data retrieved from the four cores was intended to provide some insight into the depositional history of the Hudson River at Tappan Zee as an aid to understanding the placement of submerged sites. The scope of work provided for radiocarbon dating of the recovered sediment as well as in situ organic material. These newly recovered data in conjunction with project-specific geotechnical research previously conducted for Earth Tech by the Lamont-Doherty Earth Observatory (LDEO) and the New York State Thruway Authority by Arup Associates and Mueser Rutledge Consulting Engineers provided a database for understanding the postglacial rise in sea level in Tappan Zee. In addition, a recent GRA study of sea level rise in the New York Harbor (Schuldenrein et al., 2007) has furnished a detailed reconstruction of the local sea level history as well as a comparison with marine faunal studies in Tappan Zee by LDEO (Carbotte et al., 2004).

Together with the above geotechnical studies, we furnish a synthesis of past and current data to: 1) interpret the sediments underlying the proposed new bridge alignment; 2) discuss the environmental history of the site; and 3) identify a potential area of concern for submerged cultural resources.

FIELD INVESTIGATIONS AND SEDIMENT CORES

A GRA field team of two geoarcheologists met with members of Aqua Survey Inc. of Flemington, NJ at Tarrytown, NY marina on Novmber 6, 2008 to obtain four vibracores along the alignment of the proposed new Tappan Zee Bridge. The Aqua Survey Inc. team was separately contracted by Earth Tech for this work. Figure 2 shows the Aqua Surveys Inc research vessel. Although the scope of work specified the excavation of four 15-foot vibracores at chosen locations, the Aqua Survey vessel was only equipped to recover 10-foot cores. Nonetheless, our team provided suitable coordinates for four vibracore locations along the proposed alignment.

Figure 1 is a plan view of the alignment showing the locations of the cores. Figure 3 is a subsurface profile of the sediment fill along the proposed alignment provided by the geotechnical staff of Mueser Rutledge Consulting Engineers (2007). The four vibracores taken for this study penetrated only the surface of the thick layer of massive estuarine silt and clay beneath the water surface (Fig. 3). After reviewing the Mueser Rutledge geotechnical study and viewing sediment thicknesses, we assessed our inability to drill deep enough to intersect prospective terrains for cultural resources. Our team subsequently elected to develop a sample of the available surface sediments. Our intent was to relate the estuarine silt and clay to previous investigations by LDEO (Carbotte et al., 2004) that examined the history of the oyster reef development in Tappan Zee. This research applied directly to archeological studies of prehistoric oyster shell middens at the Dogan Point archeological site a short distance to the north (Claasen, 1995). Thus we hoped to gain insights into the possibility for submerged prehistoric sites related to early oyster harvesting in the project area.

Figure 2. Aqua Survey research vessel.

Sampling

Vibracores obtained at each of the four sample locations were encased in flexible plastic envelopes or tubes used as core barrel liners. The plastic tubes were removed from the core barrel and stored on deck after each core was taken. Figure 4 shows a vibracore being lowered over the side during coring. Each core was later examined, described, sampled, and photographed at the dock in Tarrytown. Figure 5 shows a core laid out on the dock in a protective plastic trough for description and sampling. Each core was sampled at 20 cm intervals, bagged, and returned to the GRA facility for further examination and analysis. In addition, while describing cores at the dock, the surface of each core was cleaned using a trowel to display any noticeable bedding or structure. At the same time, larger shells (oysters) were sampled separately to submit for radiocarbon dating. After sampling, the remainder of each core was disposed of at the marina site. Sequences for vibracores TZ-1 through TZ-4 are described below.

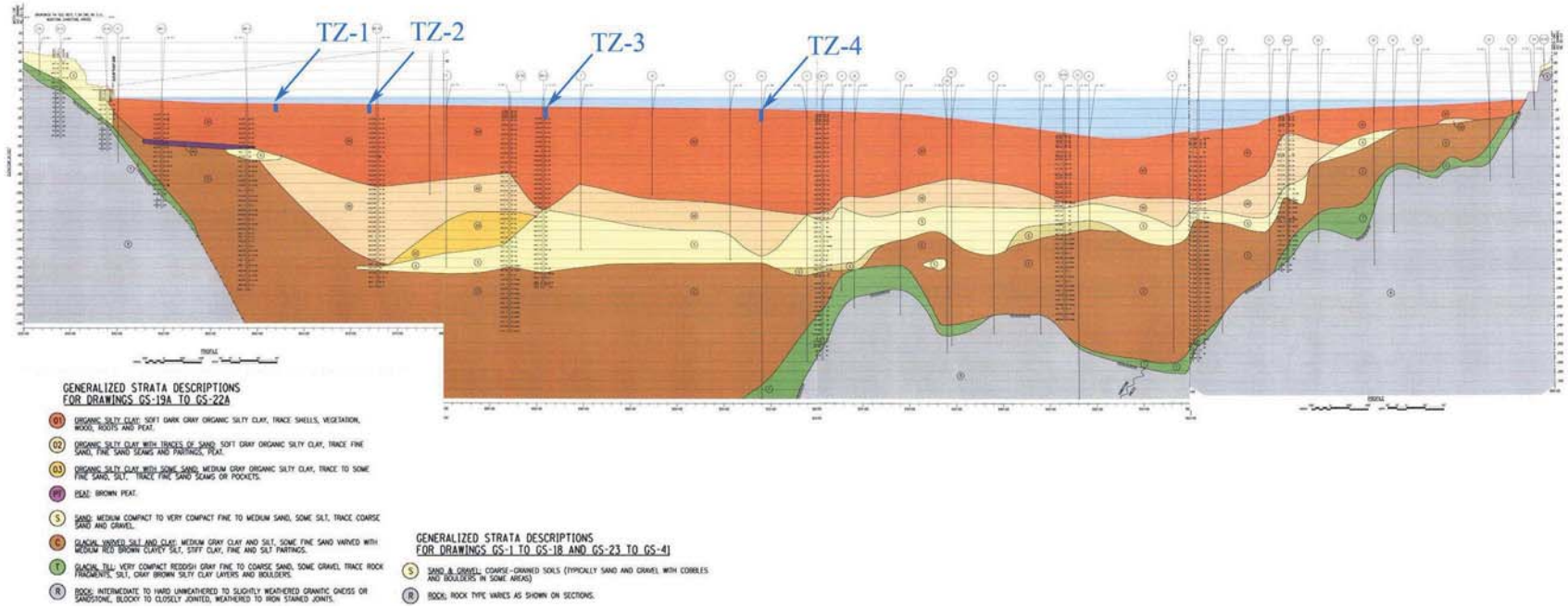

Figure 3. Subsurface profile along proposed alignment (Mueser Rutledge Consulting Engineers, 2007).

See note on cover regarding report continuity and references to rescinded project

Figure 4. Vibracore being lowered over the side of research vessel.

Figure 5. Core laid out on dock for examination.

TZ-1

Vibracore TZ-1 was taken at coordinates 41 04.291540 N and 73 54.856414W. The water depth at 0800 on November 6, 2008 was 9.2 feet (2.8 m). The total recovery was 72" (1.83 m) of gray, silty clay with occasional small shell fragments and oysters. Shells of the eastern oyster (*Crassostrea virginica*) were found at depths below the sediment surface at 6 inches (17 cm) and 24 inches (60 cm). This oyster normally occurs at depths from 8 to 25 feet (2.5 to 7.5 m). A radiocarbon date on the shell at 24 inches (60 cm) provided a conventional age of 1810 ± 40 radiocarbon years before present (B.P.). When corrected for the reservoir effect of older carbonate in Hudson River water in Tappan Zee (Carbotte et al., 2004), the age of the oyster shell at this depth was calibrated by the CALIB calibration method to 770 cal yrs B.P. A photograph and descriptive log of this core is shown in Figure 6. Occasional small shell fragments found deeper in the core appear to be *Mulinia lateralis,* the dwarf surf clam. This is an opportunistic species that grows and reproduces quickly in changing environments with salinities ranging from 15 to 35 ppt.

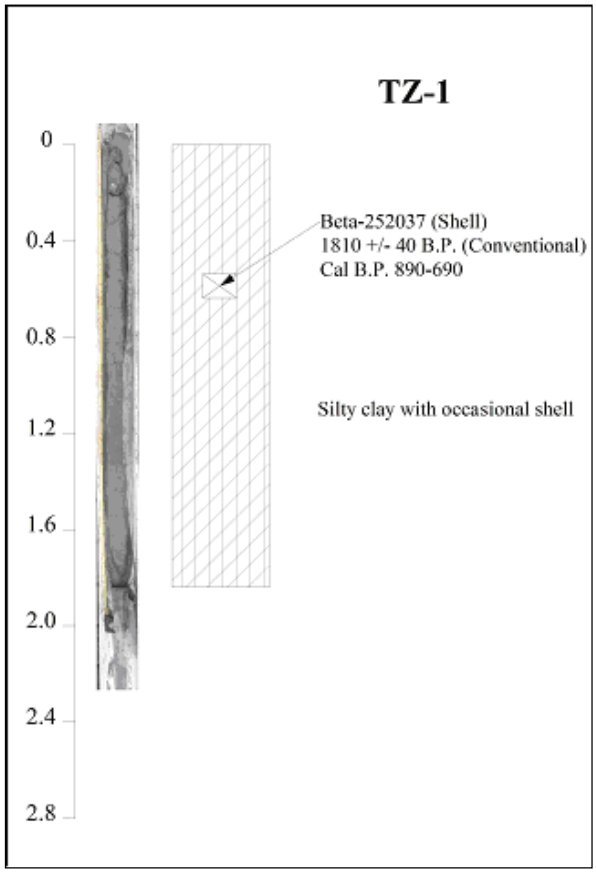

Figure 6. Log of TZ-1.

TZ-2

This core was taken at coordinates 41 04.276095N and 73 54.645809W at a depth of 10.5 feet (3.2 m). The total recovery was 8.3 feet (2.52 m). The sediment matrix was a uniform gray silty clay throughout its length. The oyster *Crassostrea virginica* was present in the upper 4 inches (10 cm) of sediment and again at 16 inches (40 cm) depth. A radiocarbon age for the latter oyster shell was 1910 ± 40 B.P., corrected to 910 cal yrs B.P. and broadly similar to that dated in TZ-1. Deeper in the core there are three zones of concentrated small shell fragments containing the dwarf surf clam *Mulina lateralis*. These occurred at 37 to 40 inches (95 to 102 cm), 60 to 62 inches (153 to 158 cm), and 79 to 90 inches (200 to 228 cm). An additional radiocarbon age was procured on a bulk sediment sample from 94 inches (240 cm) to provide an indication of the sedimentation rate. The sample yielded a conventional age of 4240 ± 40 B.P., calibrated to 4840 cal yrs B.P. suggesting a sedimentation rate of 0.5 mm/yr. The core is illustrated in Figure 7.

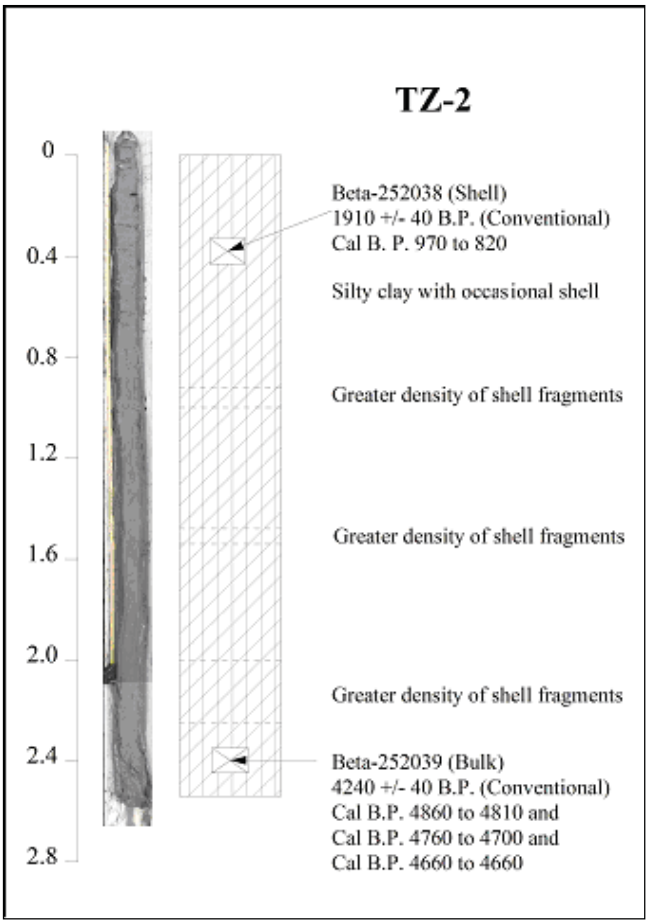

Figure 7. Log of TZ-2

TZ-3

Core TZ-3 was taken further east at coordinates 41 04.273369N, 73 54.231671W and at a depth of 12.2 feet (3.72 m). The total sediment recovery was 8.5 feet (260 cm) of gray silty clay (Figure 8). The oyster *Crassostrea virginica* was recovered at 23.6 inches (60 cm) and dated at 2230 ± 40 B.P. and calibrated to 1210 cal yrs B.P. The central portion of the core contains disseminated shell fragments of *Mulina lateralis*. A bulk carbon sample at 8.5 feet (260 cm) gave a conventional radiocarbon age of 3980 ± 40 B.P. which calibrates to 4430 cal yrs B.P. This date points to an approximate sedimentation rate of 0.59 mm/yr broadly consistent with the rate determined from TZ-2.

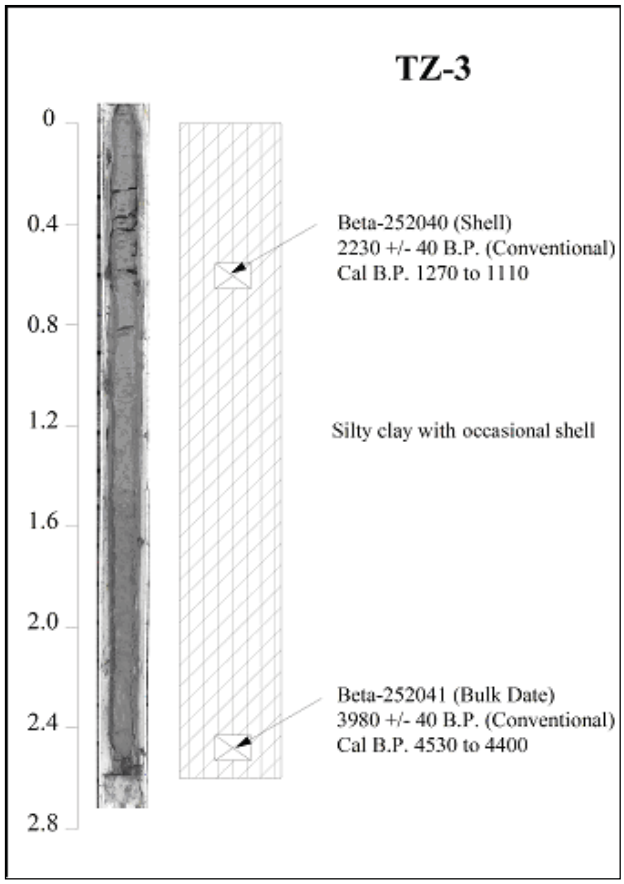

Figure 8. Log of TZ-3.

TZ-4

Figure 9 shows core TZ-4 subsequent to sampling. The core was taken at 41 04.270697N, 73 53.725367W at a depth of 12.5 feet (3.8 m). The recovery was 8.3 feet (240 cm). The upper 10 inches (25 cm) of the core feature a dark gray to black clayey silt devoid of shells. This overlies a gray silty clay with occasional shell fragments most likely of *Mulina lateralis.* A bulk sample from 7.2 feet (220 cm) was radiocarbon dated at 4230 ± 40 B.P. calibrated to 4830 cal yrs B.P. The approximate sedimentation rate at this location was determined to be 0.46 mm/yr. When combined with the radiocarbon ages from TZ-1 and TZ-2 the average sedimentation rate for the cores is 0.52 mm/yr.

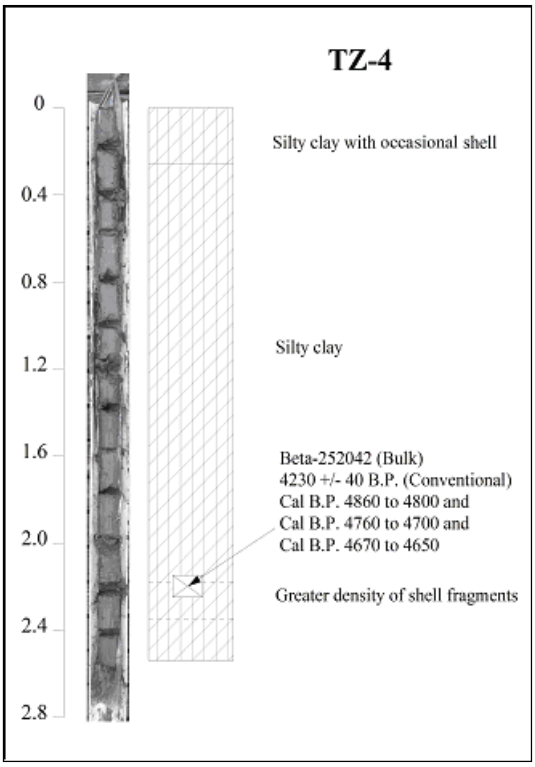

Figure 9. Log of TZ-4.

Figure 10 is a schematic cross section showing the four vibracores described above. The radiocarbon-dated intervals clearly show similarity in the age of the near surface sediment as well as at the base of the cores. Oysters are confined to the upper meter of sediment. This is consistent with findings by Carbotte et al. (2004) who found two dominant periods of oyster colonization in Tappan Zee separated by an underlying zone devoid of oysters but populated by the opportunistic molluscan species, *Mulina lateralis*, the dwarf surf clam. The radiocarbon dates on oyster shell belong to a later period of oyster abundance per Carbotte et al. (2004). While that study points to sedimentation rates on the order of 2-4 mm/yr for the *Mulina* bearing underlying zone, the dates reported here suggest a much lower sedimentation rate for this location.

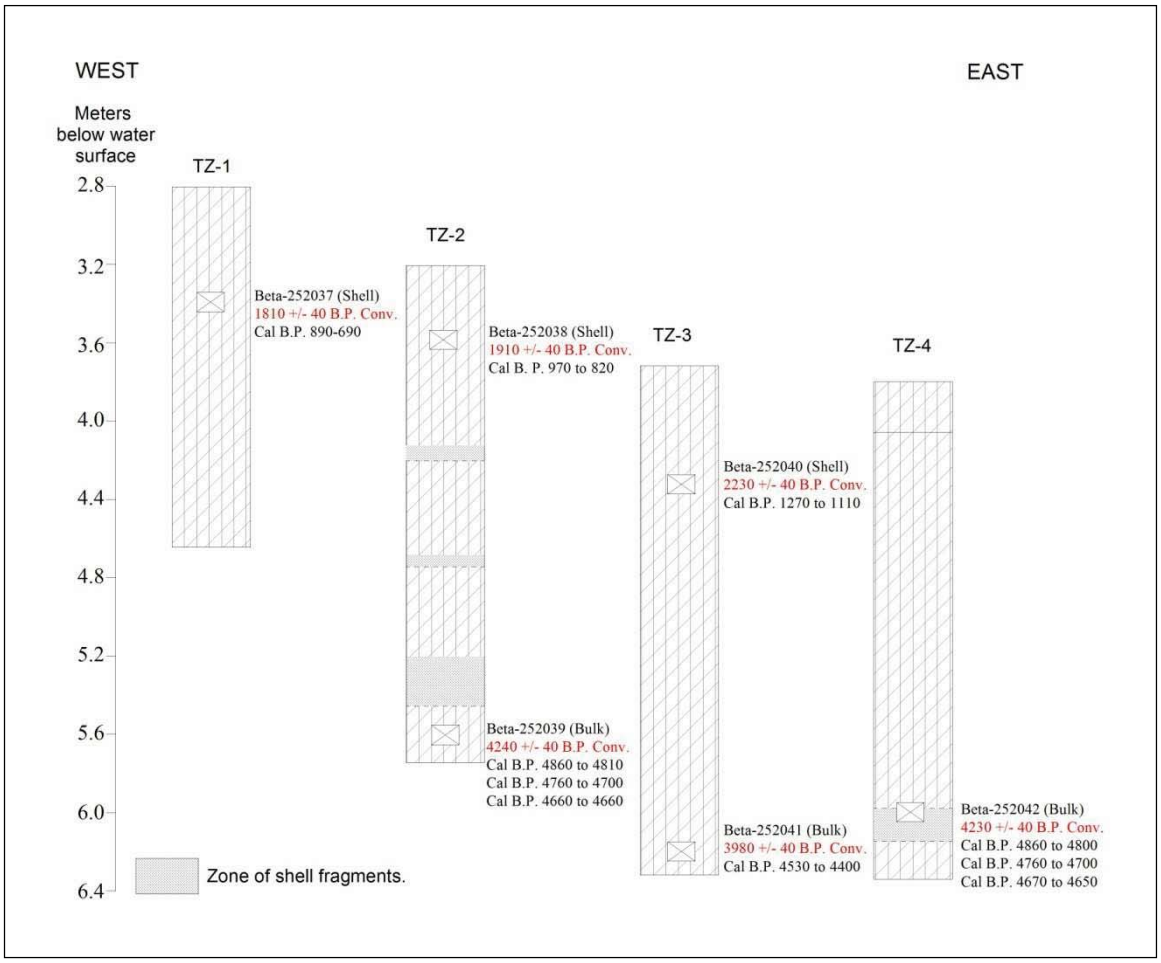

Figure 10. Schematic Cross Section of Cores.

The presence of oyster and dwarf clam faunas in the TZ cores underscores the greater focus of the GRA investigations—the importance of shellfish gathering to prehistoric populations. Accordingly, important archeological sites in the Tappan Zee Bridge vicinity represent the earliest record of marine shellfishing on the western Atlantic coast. The most prominent regional archaeological site, Dogan Point, contains oyster shell middens that date back to 5100 – 5900 cal yrs B.P. (Claassen, 1995).

GEOLOGICAL AND ENVIRONMENTAL SETTING

The Late Quaternary landform history of the lower Hudson River Valley is a function of bedrock geology and events associated with glacial history. The end of the Pleistocene (after 18,000 B.P.) is recorded extensively in the surface and subsurface

deposits of the coast and near shore settings of metropolitan New York City and adjacent New Jersey and New York. Variable accumulations of sediment register the region's history of glaciation and deglaciation as well as the submergence and emergence of current coastal landscapes as ice sheets advanced and retreated. Global (eustatic) sea level changed in response to the cyclical movements of the ice sheets.

Regional geological and paleoenvironmental studies are extensive. Relevant research has focused on bedrock geology (Isachsen et al., 1991; Schuberth, 1968); late Pleistocene and (to a lesser degree) Holocene surficial deposits (Antevs, 1925; Averill et al., 1980; Lovegreen, 1974; Merguerian & Sanders, 1994; Rampino & Sanders, 1981; Reeds, 1925, 1926; Salisbury, 1902; Salisbury & Kummel, 1893; Sirkin, 1986; Stanford, 1997; Stanford & Harper, 1991; Widmer, 1964) as well as postglacial vegetation change (Peteet, et al. 1990; Rue & Traverse 1997; Thieme et al., 1996) and sea level rise (Newman et al., 1969; Weiss, 1974). More recently, there have been detailed studies of archeological preservation potential for the under-studied Holocene surficial deposits (GRA, 1996a, 1996b; Schuldenrein, 1995a, 1995b, 2000; Thieme & Schuldenrein, 1996, 1998) and estuarine sediments (GRA 1999; LaPorta et al., 1999; Wagner & Siegel, 1997).

Physiography and Bedrock Geology

The Hudson River Valley is an estuary formed within a valley deepened and widened by the advance and retreat of the Laurentide continental ice sheet of the last Ice Age. The Hudson Valley, like the Connecticut River valley to the east, occupies an ancient crustal spreading center or "rift zone" that developed during the initial separation of the North American and African continents beginning about 200 million years ago (Isachsen *et al*., 1991: 50-51). Continued expansion along what is now the Mid Atlantic Ridge gave rise to the Atlantic Ocean separating the continents. The Mesozoic age Newark Group rocks underlying most of the New York Harbor region and extending up the west side of the Hudson represent alluvial sediments which filled the rifts as they opened up. The Palisades Sill of Triassic age is an igneous intrusion into the Newark

Group sedimentary rocks. These sedimentary rocks contrast with the Cambrian to Ordovician metamorphic rocks of the New York City Group east of the Hudson River consisting of the Fordham gneiss, the Manhattan schist, and the Inwood marble. Tappan Zee lies along the boundary between these differing rock types. Quaternary-age deposits rest unconformably on the Newark Group sedimentary rocks as well as on those of the New York group.

Pleistocene Glaciation, Chronology, and Paleoecology

Glaciers advanced across the region at least twice during the Pleistocene (Stanford, 1997; Sirkin, 1986). Both Illinoisan (ca. 128-300 ka) and pre-Illinoisan (> 300 ka) terminal moraines are mapped in northern New Jersey, and these ice advances may be represented by lower tills on Long Island, most prominently by the Montauk (Rampino and Sanders, 1981; Merguerian and Sanders, 1994). An abundance of gneiss clasts gives the older tills a "dirty" appearance and they can always be distinguished from late Wisconsinan deposits which feature unweathered mudstone, sandstone, and igneous rock clasts (Stanford, 1997).

The Hudson-Mohawk Lobe of the latest or Wisconsinan ice sheet advanced to its terminus which is offset by the Harbor Hill terminal moraine. The latter is broadly dated to ca. 20,000 radiocarbon years before present (B.P.) based on evidence obtained from Port Washington on Long Island (Sirkin, 1986: 14; Sirkin and Stuckenrath, 1980). Some organic sediments from the preceding, warmer, interstadial period (oxygen isotope Stage 3) appear to have survived beneath or within the till and outwash, and several such sequences were identified by Schuldenrein (2000).

More locally, the age of the Harbor Hill terminal moraine is constrained by basal postglacial radiocarbon dates from northwestern New Jersey of 19,340±695 B.P. in a bog on Jenny Jump Mountain (Witte, 1997) and 18,570±250 B.P. in Francis Lake (Cotter, 1983). Thieme and Schuldenrein (1998) obtained a date of 19,400±60 B.P. from a loamy sediment overlying glacial till along Penhorn Creek in the Hackensack Meadowlands. A

pollen core from Budd Lake in northwestern New Jersey (Harmon, 1968) also provides supporting evidence for Sirkin's chronology of the Hudson-Mohawk Lobe. A sample of clay from 37 feet below surface was dated to 22,870±720 B.P. and contained a pollen assemblage dominated by pine (50-60%) and spruce (10-20%) with some oak (5-10%). A boreal forest vegetation community is further indicated by pollen assemblages dated to 22,310±2070 B.P. and 22,040±550 B.P. from varved silt and clay in the Hackensack Meadowlands (Schuldenrein, 1992; Rue and Traverse, 1997) although reworked Cretaceous spores and pollen were also present. Pollen sequences documenting postglacial vegetation change have been registered in New York Harbor (Schuldenrein, 2000, Schuldenrein et al., 2007), as well as in the examinations of subsurface sequences of the Jersey Flats (Schuldenrein, 2001).

The terminal Pleistocene pollen record has been most informative for environmental reconstructions. Full glacial and late glacial pollen assemblages have been variously attributed to "tundra," "taiga," "spruce park," or "boreal forest" vegetation (Davis, 1965, 1969; Deevey, 1958; Martin, 1958; Ogden, 1959, 1965; Watts, 1979). Several authors have also pointed out that the late Pleistocene vegetation may not have clear analogs in present-day plant communities (Davis, 1969; Overpeck et al., 1985, 1992). Herb-dominated assemblages corresponding to the tundra Zone T of Deevey (1958) have been identified in basal samples of cores studied in the region (Sirkin et al., 1970; Peteet et al., 1990). A radiocarbon date of 12,840±110 B.P. from Alpine Swamp Core A indexes the succession to the spruce-hardwood Zone A (Peteet et al., 1990: 224). Newman et al. (1969) obtained a comparable radiocarbon date of 12,500±600 B.P. for Zone A in their boring UH-1 from Salisbury Meadow on western Iona Island and Sirkin et al. (1970) report a radiocarbon date of 12,330±300 B.P. for Zone A in their boring SH-29 from a Coastal Plain bog west of Raritan Bay.

Spruce-dominated assemblages were present in the basal samples of five cores from the Lower Hudson River estuarine sediments analyzed by Weiss (1974), who obtained a radiocarbon date of 10,280±270 B.P. for the top of Zone A in a core (Core 4) taken in the Hudson west of mid-Manhattan. An increase in "boreal" species such as spruce and paper

birch between 11,000 and 10,000 B.P. was attributed by Peteet et al. (1990) to the Younger Dryas abrupt cooling of global climate. A more direct cause of the migrations of plant species through the project area can be found in the irregular northwesterly retreat of the Laurentide ice sheet, as previously inferred from southern New England pollen records by Ogden (1959), Davis (1976), and others (Davis and Jacobson, 1985; Gaudreau, 1988; Gaudreau and Webb, 1985). Davis (1976:19-21) maps the presence in the New York Harbor region of *Pinus banksiana* (jack pine) and/or *Pinus resinosa* (red pine) by 11,000 B.P. and white pine (*Pinus strobus*) by 10,000 B.P. Hemlock, oak, birch, and alder pollen were also quite abundant in the Alpine Swamp Zone B assemblage (Peteet et al., 1990:222). A change to essentially modern climatic conditions is indicated by a gradual shift toward an oak-dominated pollen assemblage, with basal dates of 9,000±100 B.P. in the Alpine Swamp core (Peteet et al., 1990) and 7,100±180 B.P. in a core (Core 4) from the Hudson west of mid-Manhattan (Weiss, 1974).

During the critical later phases of the Pleistocene, the hydrography at the glacial margin was dynamic and resulted in a glaciolacustrine landscape that involved cyclic retreats and transgressions of linear lakes that approximated the morphologies of structural valleys. Lakes Passaic, Hackensack, Hudson, and Flushing variously occupied the terrain between Long Island and east-central New Jersey as well as the Hudson valley. In Newark Bay and the lower reaches of the Hackensack and Passaic River valleys subsurface stratigraphies have revealed uniform lake bed sequences beginning with deep, classically varved proglacial rhythmites (Antevs, 1925; Lovegreen, 1974; Reeds, 1925, 1926; Salisbury, 1902; Salisbury and Kummel, 1893; Stanford, 1997; Stanford and Harper, 1991; Widmer, 1964). Reddish brown muds derived from Newark Group rocks typify the thicker winter varves while the more sandy varves were deposited as the ice melted during the summer. The top of the glaciolacustrine facies is typically an unconformable contact from 12-30 feet below the present land surface in the Hackensack Meadowlands (Lovegreen, 1974). It is these same varved silts and clays that fill the deeper parts of the incised Hudson valley at Tappan Zee and are overlain by riverine sands and gravel. The latter are subsequently capped by thick marine estuarine muds.

At the last glacial maximum, approximately the time of deposition of the Harbor Hill moraine, nearly one percent of the Earth's water was transformed into glacial ice (Strahler, 1971). Eustatic sea level consequently plummeted, and a terrestrial coastal plain extended from 24 to 60 miles onto the Atlantic continental shelf (Bloom, 1983a: 220-222; Emery and Edwards, 1966; Stright, 1986: 347-350). Sea level rise was extremely rapid in the period immediately following the retreat of the ice as meltwater was delivered to the oceans basins from drainage of proglacial lakes that were impounded by recessional glacial margins. Locally, the lower Hudson and Hackensack River Valleys were sequentially scoured and flooded (Reeds, 1925, 1926; Stanford, 1997; Stanford and Harper, 1991), forming much of the present-day topography surrounding New York and New Jersey Harbor. The basins left behind after the proglacial lakes drained were initially incised by meandering channels and then transformed into tidal marsh in the mid- to late-Holocene (Widmer and Parillo, 1959; Thieme and Schuldenrein, 1996; Carmichael, 1980; Heusser, 1949, 1963).

Critical to interpretation of the submerged sediments underlying New York Harbor and the Hudson estuary is the glacial and sea level rise history of the Late Pleistocene and Holocene. New York lies at the southern limit of the last glaciation where glacier ice reached its final position at approximately 18,000 BP. As noted, the Harbor Hill moraine, extending across Long Island, Staten Island, and Middlesex County, New Jersey marks its terminus. Stone et al., (2002) show the lobate spread of glacier ice across New Jersey and New York. Stone (personal communication) notes that ice did not remain for an extended period at the terminal moraine, thus only small amounts of outwash were deposited at the outer edge of the moraine. This is of importance in interpreting the submerged deposits beneath the lower harbor and Raritan Bay.

Retreat of glacier ice from the terminal moraine supplied meltwater to proglacial lakes retained behind the moraines. Proglacial lakes occupied preexisting depressions determined by the bedrock geology as well as others created by deposition of glacial sediments. The levels of the proglacial lakes were controlled by the contemporaneous altitudes of spillways through adjacent lowlands or across channels cut into the terminal

moraines. This was the case for the New York area where a series of proglacial lakes were retained behind the Harbor Hill moraine. The earliest of these lakes, Lake Bayonne, spread across the New York harbor area and East River while its broader extent occupied the lowlands west of the Palisades sill, including Arthur Kill, Kill Van Kull, and Newark Bay. Lake Bayonne drained southward across the terminal moraine through a spillway at Perth Amboy. The level of Lake Bayonne was controlled by a spillway altitude of 9 m (30 ft). A lower glacial Lake Hackensack of less area drained through the moraine at Perth Amboy as its spillway was eroded more deeply into the Harbor Hill moraine. Further ice retreat from western Long Island allowed additional lowering of lake level to the glacial Lake Hudson level which drained eastward through the East River at Hell Gate. This final lake was contained within the glacially scoured and deepened Hudson River channel that progressively expanded northward with ice retreat until the Mohawk valley lowland was deglaciated about 12,000 BP (13,875 cal yrbp) (Stone et al., 2002).

The time of deglaciation of the Mohawk River lowland between 13,000 and 12,000 BP is a key time in the geologic history of the New York harbor area. About this time drainage of proglacial Lake Iroquois which occupied the Lake Ontario basin was free to drain directly to the Hudson River valley and add to the volume of proglacial Lake Hudson. Researchers disagree on the mechanism, but an outlet through the Harbor Hill moraine at the Narrows was opened at about this same time emptying Lake Hudson and gave rise to the present drainage pattern to the Hudson River. Newman and his coauthors (Newman et al., 1969) note that marine and brackish water filled the -27 m (89ft)-deep channel of the Hudson River at 12,500 +/- 600 B.P. (14,830 cal yrbp) as evidenced by marine and brackish marine microfossils preserved at the base of organic silts beneath peat bogs at Iona Island. It is problematic whether the erosion of the outlet through the Harbor Hill moraine was gradual or catastrophic as recently proposed by Uchupi et al., (2001) and Thieler et al., (2006). Nonetheless, it is clear that flow from the Hudson River eroded a channel and valley across the exposed continental shelf to drain and deposit a delta on the outer shelf at a lowered sea level stand. Most challenging for our understanding of the Hudson River history is the lack of a clear explanation for a direct marine connection between contemporaneous sea level at the edge of the continental

shelf and the upper Hudson River valley. For all intents and purposes we consider the shelf to have been sub aerially exposed at this time. Differential isostatic adjustment of the earth's crust following deglaciation is the most reasonable process accounting for ongoing changing topographies of post-glacial land surfaces. These adjustments are associated with downwarping and depression of the crust beneath glacier ice in the north and possible compensating uplift of the continental shelf to bring sea level in line with the upper Hudson River channel. Differential uplift of the crust along the upper Hudson Valley relative to the New York Harbor area on the basis of historic tide gauge data was presented by Fairbridge and Newman (1969) but the complete relationship remains unclear.

Thieler et al. (2006) present a seismic reflection profile across the area east of the Narrows showing a deeply incised, but filled channel attributed to discharge of the Hudson upon erosion of the Harbor Hill moraine barrier. This channel was cut to 45 m (148 ft) below present mean sea level in underlying Cretaceous sediments and is filled and overlain by 15 m of younger sediment. The depth of this incised channel relative to Thieler's observation of a subaqueous delta for the Hudson at the edge of the continental shelf (-110-120 m, -360-394 ft) underlines the need for a mechanism to reconcile this sea level position relative to the reflooded Hudson river channel at Iona Island.

The present study relies on an accurate record of relative sea level rise developed for the New York Harbor area by Schuldenrein et al. (2007). Here a revised Holocene sea-level model was generated to plot submerged locations of probable prehistoric human settlement in the Hudson River channel. Our model is derived from existing and newly reported radiocarbon analyses from nearby submerged environmental settings acquired during an earlier study of New York Harbor or from previous GRA studies. GRA (Schuldenrein et al., 2007) presented a two part relative sea level history consistent with "far field" eustatic sea level studies (Fleming et al., 1998). We show a rapid rise in relative sea level at a rate of approximately 9 mm/yr (3.5 inches/yr) from at least 9000 cal yrbp until about 8000 cal yrbp when the rate decreases to a consistent 1.5 – 1.6 mm/yr (0.6 inches/yr) from 7000 cal yrbp until the present. The more detailed record of the last

2000 cal yrbp shows low amplitude century-scale fluctuations in sea level on the order +/- 30 cm until the period of historic tide gauge records. Our sea level model is also consistent with studies by Bloom and Stuiver (1963) for the Connecticut shore, Redfield and Rubin (1964) for Barnstable, Massachusetts, Belknap and Kraft (1977), and Nikitina et al. (2001) for Delaware Bay as reexamined by Larsen and Clark (2006). Our new model (Figure 11) differs markedly from that presented by Newman et al., (1969) and is used here for accurate interpretation.

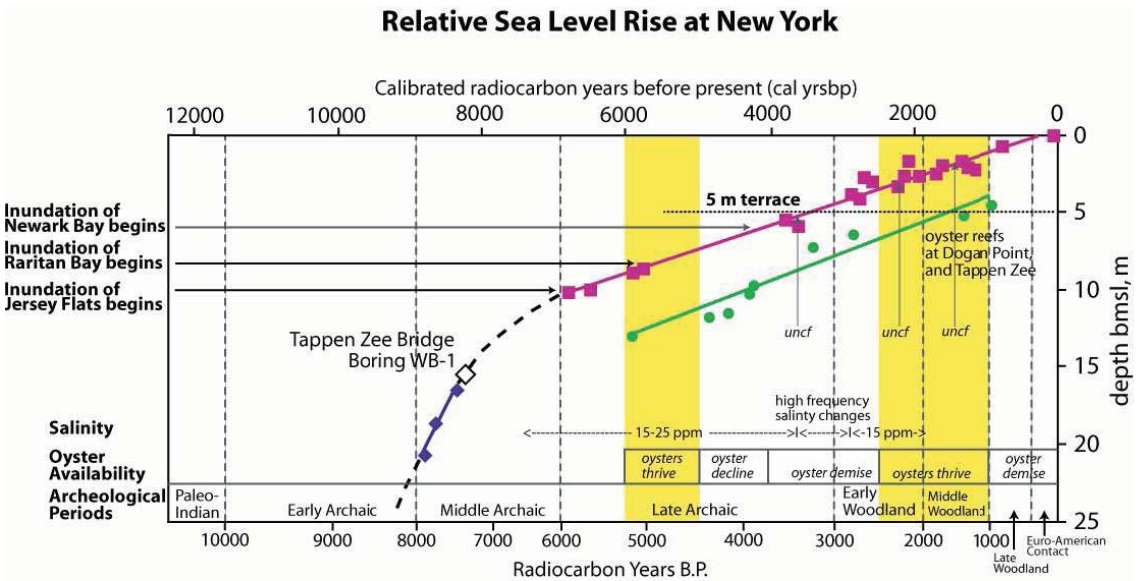

Figure 11. Sea level rise model from Schuldenrein et al. (2007).

In general terms, this new relative sea level model can be hindcast to account for reflooding of the incised Hudson channel described by Thieler et al., (2006) for the Narrows at ca. 12,000 B.P. (13,875 cal yrbp) as well as the marine incursion of the upper Hudson Valley. It cannot, however, resolve the differential positions of the incised channel at the Narrows with the proposed delta at the edge of the continental shelf. Using the same data, we show progressive flooding of the main Hudson channel until its present configuration. The area currently known as the New Jersey flats begins to be flooded about 7000 cal yrbp. Oyster reefs begin to form upriver at Tappan Zee at this time as well and are found at successively shallower depths following the rising sea level (Carbotte et al., 2004). That record of oyster reef upward migration in keeping with sea

level rise is demonstrated by the green data points shown on our relative sea level curve in Figure 11. The common depth range for the eastern oyster *Crassostrea virginica* is 8 to 24 feet. This is indicated in Figure 11 which shows Tappan Zee oyster growth history parallel to but below (deeper than) our calculated contemporaneous sea level curve.

Marine water enters and progressively floods Raritan Bay and Newark Bay about 6,000 cal yrbp. Significantly, we also recognize an erosional marine terrace at 5m (16 ft) below modern chart datum (MLLW). This terrace extends from Raritan Bay to Coney Island and includes Flynn's and Romer shoals as well as the East Bank and the False Hook east of Sandy Hook. This terrace indicates a prolonged hesitation in sea level rise between 2,000 and 3,000 cal yrbp. The terrace also limits the ages of the above shoals to predate this time. Marshes upstream from the present mouth of the Raritan River as well as the Hackensack marshes begin to become saline after 3,000 cal yrbp and subsequently develop into salt marshes. We suspect that portions of Jamaica Bay underwent a similar history but we lack the data.

The sediments encountered in borings along the alignment for the present as well as the proposed Tappan Zee Bridge reflect on the postglacial geological history described above. Newman and his coauthors (1969) presented a generalized subsurface profile along the present bridge alignment that showed the deeply incised channel of the Hudson to a depth of ca.700 feet below present sea level into underlying Triassic sandstones. A similar depth of incision was recorded in engineering borings from the Catskill Aqueduct further up river. The current collection of borings undertaken by Muesser Rutledge Consulting Engineers allows a more detailed interpretation of the postglacial record. Figure 12, adapted from the Muesser Rutledge report (Muesser Rutledge, 2007), gives an excellent color representation of the underlying sediments. Sedimentary and metamorphic rocks form the bedrock floor to the Hudson Valley at Tappan Zee. These rocks are shown in light grey on the figure and are labeled "R". Immediately overlying the bedrock is a thin veneer of glacial till shown in green and labeled "T". Glacial till is an ice contact deposit indicating the former position of overlying ice. This deposit is undated but likely represents the final advance of ice into Hudson Valley that terminated

with the subsequent series of proglacial lakes discussed above. A thick sequence of varved silt and clay was deposited in the proglacial lakes. At Tappan Zee, the proglacial lake deposits are shown in brown in Figure 12, and labeled "C". This is a significant boundary in interpretation as the next overlying sediment unit is fine to medium sand with silt and traces of coarse sand and gravel. The unit is shown in light yellow in the figure and labeled "S". These are active riverine deposits indicative of flow of the ancestral Hudson River during and subsequent to rapid lowering of the final lake, Lake Hudson. The boundary between these sands and the varved clay and silt below marks the erosion or collapse of the Harbor Hill Moraine at the Narrows that brought forth the rapid probable catastrophic drainage of the proglacial lakes and erosion of the Hudson Channel across the Continental Shelf. The base of the riverine deposits suggests that the active Hudson River channel was cut to a present depth of 180 to 190 feet below present sea level. While this is deeper than the base of the erosional channel that Thieler et al. (2006) have documented at the Narrows at -148 feet it is possible that significant scouring of the varved silt and clay occurred during catastrophic drainage of the final proglacial Lake Hudson.

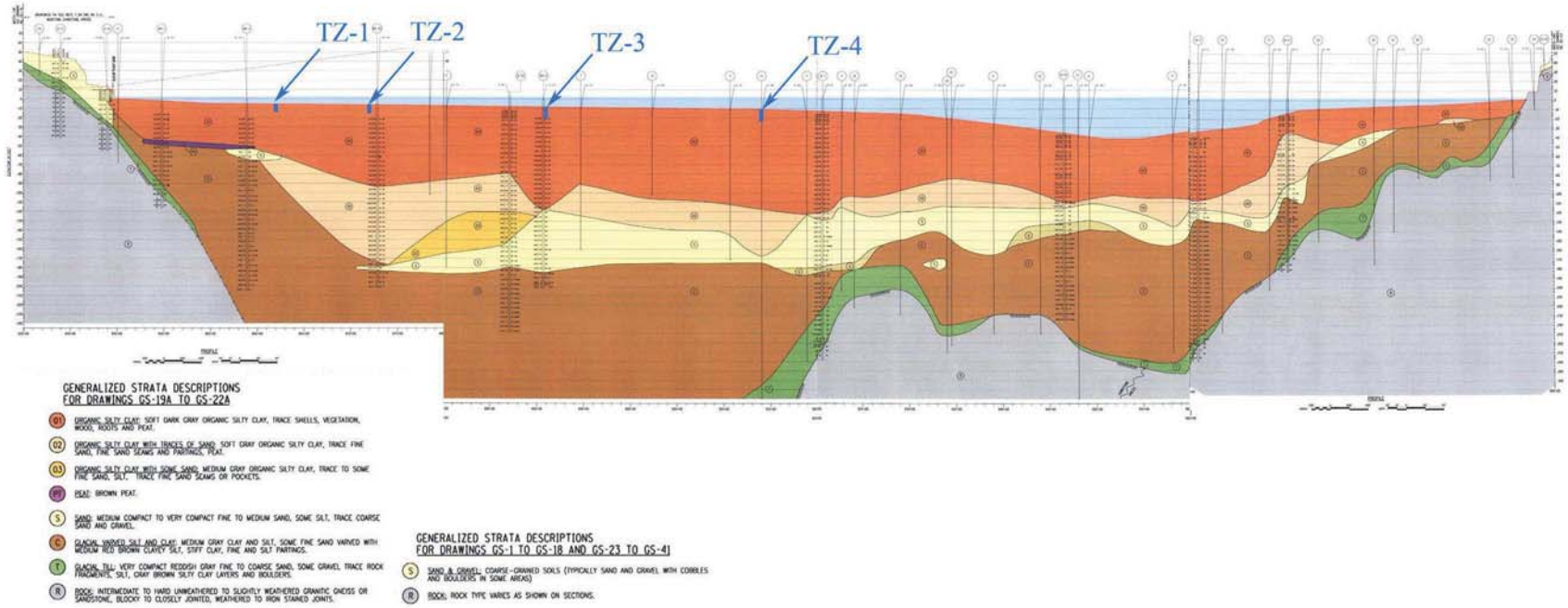

Figure 12. Subsurface profile along proposed alignment (Mueser Rutledge Consulting Engineers, 2007).

See note on cover regarding report continuity and references to rescinded project

Immediately overlying the riverine sand deposits that signify relatively rapid flow of the Hudson are organic silty clays (labeled “02” and “03”) containing significant sand content. These deposits suggest lessened velocity caused by a rising base level. While we do not have fossil evidence to verify a rising sea level, it is the most likely cause. Possible incursion of marine water would cause flocculation of clay particles allowing them to be deposited rapidly. On the other hand, this silt may simply result from lessened stream velocity. The final deposit in the sequence is clearly of marine origin. This deposit, labeled, “01”, is an organic silt and clay containing marine shells, wood fragments, and peat. It is found as deep as 120 feet below sea level in mid channel. The depth is broadly comparable with brackish water deposits farther upriver at Iona Island found as deep as 100 feet and dated at 12,500± 600 B.P. at 90 feet below sea level (Newman et al., 1969). This sediment package represents the infilling of the estuary as sea level progressively rose to its present position. The most detailed geological analyses of this sediment at Tappan Zee have been carried out by Lamont Doherty Environmental Observatory (Carbotte et al., 2004, Pekar et al., 2004). Highly significant for our present study is a peat deposit on the west approach to the bridge shown in dark blue. This peat overlies an erosional terrace cut into the surface of the proglacial lake clays. Dating of this peat deposit was made possible through Earth Tech and Mueser Rutledge. A peat sample recovered from this deposit provided a radiocarbon date of 7450±50 B.P. (8255 cal yrbp) (Mueser Rutledge boring WB-1). This date is shown on our relative sea level curve (Figure 11) and plots within a Middle Archaic occupation range. This represents the only subaerial landform discernible in the extensive subsurface sampling carried in connection with the proposed new bridge.

PREHISTORIC CULTURE HISTORY

Lower Hudson Valley

The earliest occupation of the Lower Hudson Valley and the New York Harbor area probably began during the Paleoindian cultural period, ca. 11,500-8,000 years B.P. Sea level was at least 30 feet below present throughout the period and the habitable Coastal Plain land surface extended from 24 to 60 miles onto the present continental shelf (Bloom, 1983a; Emery and Edwards, 1966; Stright, 1986). Mammoth and mastodon finds on the continental shelf and within the Hudson River channel (Fisher, 1955; Whitmore *et al*., 1967) indicate that both of these large mammals were plentiful enough to have permitted focal hunting adaptations. Paleoindian site excavations in the Northeast suggest a more varied subsistence, however (Adovasio et al., 1977, 1978; Gardner, 1977, 1983; Funk and Steadman, 1994; McNett et al., 1985). Exploitation of marine fish and shellfish in settings now submerged beneath the harbor would not be surprising given the broad spectrum diet of plants, birds, small mammals, and freshwater fish now suggested for Paleoindians in the Northeast.

Several sites with diagnostic artifacts attributed to either the Late Paleoindian or Early Archaic (10,000-8,000 B.P.) cultural periods have been found on the western shore of Staten Island (Kraft, 1977a, 1977b; Ritchie and Funk, 1971). At Port Mobil, fluted points, end and side scrapers, and unifacial tools were among over 51 lithic artifacts recovered from a sandy slope between 20 and 40 feet above sea level. Fluted points are also among the artifacts which have been found on Charlestown Beach south of Port Mobil. Projectile points classified as Kirk, Kanawha, LeCroy, and Stanly have been recovered from the Hollowell and Ward's Point sites at the island's southwestern tip. The Old Place site near the crossing of the Goethals Bridge appears to be primarily a Middle Archaic (8,000-6,000 B.P.) through Late Archaic (6,000-3,000 B.P.) encampment, although a radiocarbon date of 7,260±140 B.P. (7530 cal yrbp) (I-4070) was obtained on hearth charcoal associated with Stanly, LeCroy, and Kirk points.

It is very likely that the sites with Paleoindian, Early Archaic, or Middle Archaic artifacts discovered to date represent only a very small portion of settlement networks which extended across surfaces within the Harbor Region which have since been inundated by rising sea level. The rate of sea level rise slowed at approximately 5,000 B.P., due in part to postglacial crustal rebound (Bloom, 1971; Bloom and Stuiver, 1963; Fairbridge and Newman, 1968). This may explain the abundance of Late Archaic sites in settings that are now at or slightly below present shoreline positions. Of five inundated sites along shores or tidal stream banks on Long Island reported by Stright (1990), for example, all are Late Archaic or Woodland period encampments.

Exploitation of shellfish and other marine resources was a definite specialization among Late Archaic hunter-gatherers of coastal New York and New Jersey (Brennan, 1974; Kraft and Mounier, 1982; Ritchie, 1980). Although Brennan (1977) argued for antecedents extending back to the Early Archaic, his only evidence was the date of 6,950±100 B.P. (7124 cal yrbp)(L-1381) from the deepest level of the Dogan Point shell midden (Little, 1995). Dogan Point did have a small Middle Archaic component, as evidenced by both the radiocarbon chronology and presence of Neville, Stark, and other large side-notched projectile points (Claassen, 1995a). The main shellfish gathering period, however, dates from 5,900-4,400 B.P. (Claassen, 1995b: 131) and thus correlates with other shell midden sites in the Lower Hudson such as the Twombly Landing site below the Palisades near Edgewater, New Jersey (Brennan, 1968).

As noted by Funk (1991: 51), shell matrix and shell bearing sites on Martha's Vineyard (Ritchie, 1969), Nantucket (Pretola and Little, 1988), Fishers Island (Funk and Pfeiffer, 1988), and Long Island (Ritchie, 1980; Stright, 1990) are all younger than 4,000 years old. Older shell middens may once have existed, however, along coastlines that are now beneath the sea. In addition to the more ephemeral hunting camps of the earlier cultural periods, this type of prehistoric culture resource is likely to be present within the Harbor navigation channels.

The transition between the Archaic and Woodland periods in the Northeast is marked by the presence of ceramics and, in many areas, by the first remains of cultivated plants. The Woodland period is generally divided into three stages, Early (3,000-2,000 B.P.), Middle (2,000-1,000 B.P.), and Late (1,000 B.P. to European contact). In coastal New York, however, the Windsor and East River "traditions" were defined by Smith (1950, 1980) as distinct ethnic groups manifested in several contemporaneous phases. The Windsor tradition originates earlier, and its North Beach phase is contemporaneous with shell-bearing Terminal Archaic sites of the Orient phase. In several sites on Long Island, Windsor ceramics have been found associated with steatite vessels and Orient fishtail points.

The Clearview phase of the Windsor tradition is Middle Woodland in age and is followed by the Late Woodland Sebonac phase. Sebonac phase sites are most common in Connecticut, although the phase is named for a site on eastern Long Island excavated by Harrington (1924). These later phases of the Windsor tradition were suggested by Smith (1950, 1980) to coincide with the earliest, Bowmans Brook phase sites of the East River tradition on Staten Island. Bowmans Brook begins ca. A.D. 1000 and its geographic range eventually included western Long Island, Manhattan, and the lower Hudson River Valley (Ritchie, 1980: 268-270). The type site on the northwestern shore of Staten Island was investigated by Skinner in 1906 (Skinner, 1909: 5-9; Smith, 1950,: 176-177). Pits filled with shell and other refuse ranged from four to six feet in diameter and from three to six feet in depth. The pottery is either stamped or incised and tempered with grit or occasionally shell.

The Clasons Point phase of the East River tradition begins ca. A.D. 1300. The type site on the north side of the East River in the Bronx was excavated by Skinner in 1918 (Skinner, 1919: 75-124; Smith, 1950). The few known village sites are approximately an acre in size and are located on higher landforms well above any tidal submergence (Ritchie, 1980). The pottery is typically shell tempered but there is a wide range of both vessel forms and surface decoration. European trade goods have been found in the upper levels of some Clasons Point phase sites.

Tappan Zee – Haverstraw Bay

More central to this report are prehistoric sites in the specific vicinity of Tappan Zee. We have already discussed in passing the presence of oyster shell middens at Dogan and Croton Points further upriver. In addition we have mentioned the time depth of shell middens from Matha's Vineyard to Long Island that post date 4,000 years (Ritchie, 1980, Stright, 1990). The outstanding question focuses on the chronology of oyster bed associated sites in the lower Hudson Valley and especially at Tappan Zee where the archeological evidence is most abundant. When were environmental conditions suitable for oysters and when did aboriginal use of this dietary resource begin? Work by Carbotte and her coworkers (Carbotte et al., 2004) establishes basal dates for oysters in her 30-foot cores as 6100 cal yrbp, but we know little about potentially earlier evidence from greater depths.

Clues to the beginnings of shellfish harvesting come from previous investigations of archeological sites. Figure 13 maps key archeological locations excavated by regional researchers. The map, adapted from Funk (1976) and Schuldenrein (1995) shows dominantly Late Archaic to Transitional phase rockshelters to the north as well as the important oyster shell midden sites at Montrose Point—including Wolcott and Dogan Point--and similar sites at Croton Point. Also important is the Parham Ridge site north of Croton Point.

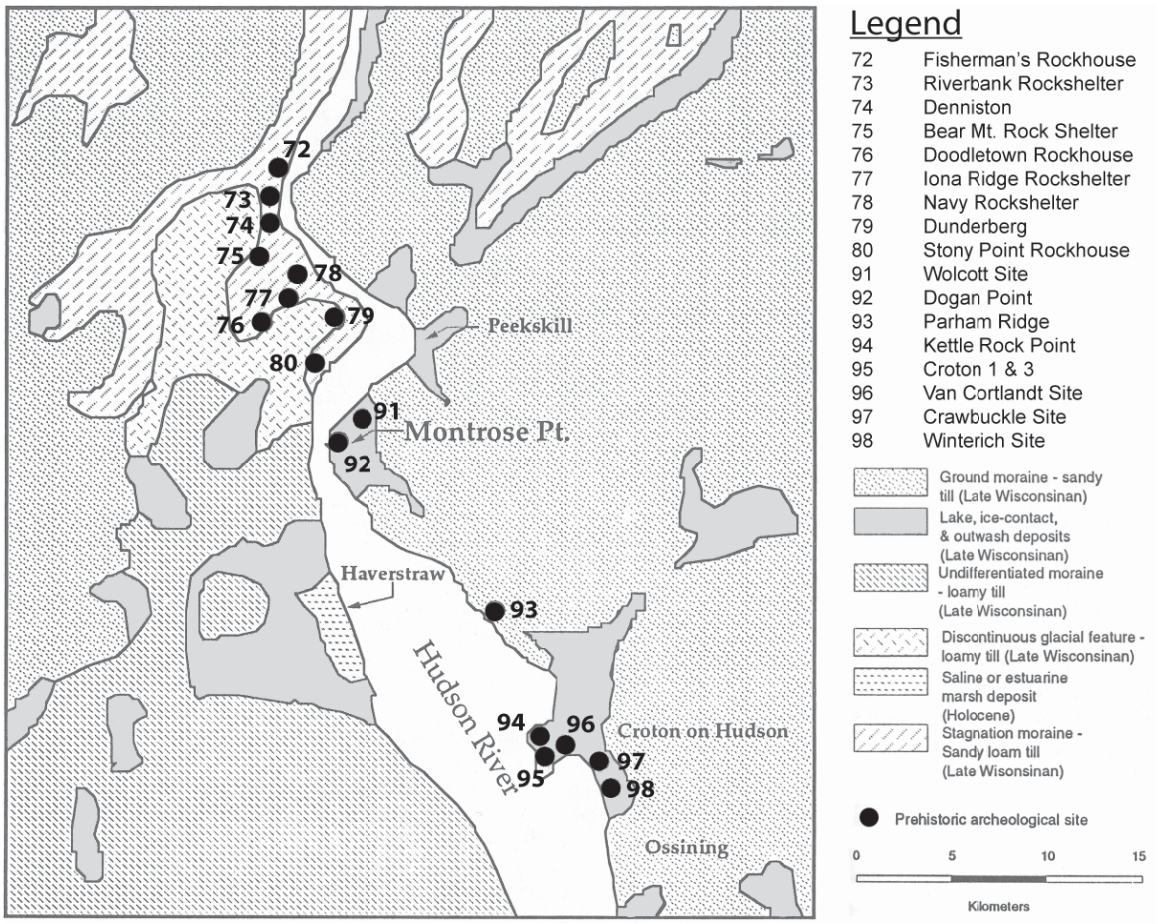

Figure 13. Map of key archaeological sites in immediate region of the project.

Although Goldring (1922) originally considered the various shell middens to be emerged oyster reefs, subsequent finds of artifacts and fire hearths pointed to human use. Salwen (1965) investigated a midden at Croton Point and verified its cultural origin. He reported that the midden consisted of medium to large single valves of the oyster *Crassostrea virginica*. A hearth at the bottom of the midden dated to 5850 $\pm$ 200 years B.P. (6730 cal yr bp). Shells from the base of the midden at Montrose Point provided a similar age. A site still further upstream at Bannerman showed thick lenses of oyster shell with charcoal from a hearth dated by Ritchie (1958) to 4480 $\pm$ 200 years B.P. (5090 cal yrs bp). This early work discussed by Newman et al. (1969) in relation to sea level reconstruction was superceded and synthesized by Funk (1976) and finally by Claassen (1995). Most recently Carbotte et al. (2004) have excellently recaptured the linkage between sea level, climate, and human occupation near Tappan Zee.

Claassen and Carbotte focused on the Dogan Point site located on Montrose Point where shellfishing began before 6,000 cal yr bp (see for example Salwen's calibrated date of 6730 cal yrsbp above) and represents the earliest record of shellfishing along the western Atlantic coast. Funk (1976) notes that shell from the basal midden at Dogan Point dated to 5,000 B.C. (ca 7,000 B.P) by Brennan (1974) indicates a still earlier time frame for oyster harvesting. While it is difficult to rely on shell dates that are uncorrected for the local reservoir effect (of dissolved ancient carbon in local river waters), this date still argues for oyster harvesting prior to 6,000 cal B.P. in Tappan Zee.

The key sites for the Croton-Ossining region (Figure 13) all display ubiquitous bio-stratigraphic contexts for oyster shells. The midden signature is that large oyster shells 10-13 cm long at the base are separated by a weathered shell zone and subsequently overlain by a midden consisting of smaller oyster shells 7 to 8 cm in length. Archeologists have suggested various mechanisms to explain the hiatus between the two types of oysters that brackets the period between the Late Archaic and Middle Woodland. Carbotte et al. (2004) have now presented strong evidence for paleo-climatic impacts on Hudson River ecology to account for the hiatus. Their work finds that the early period of giant oysters in the middens and lower oyster rich zones in cores from Tappan Zee correspond temporally with the Hypsithermal or climatic optimum of the Mid Holocene when summer temperatures averaged 2 to 4 degrees centigrade warmer than today. The onset of cooler temperatures at about 4,000 to 5,000 cal yrsbp are coincident with the hiatus between the two shell zones in the middens as well as the cores. The environmental data from the Tappan Zee cores point to two periods when oysters flourished in Tappan Zee separated by a period of oyster demise centered about 3,000 cal yrsbp bracketing the terminal Late Archaic and Early Woodland periods. Oysters were prevalent once again during the Middle Woodland period only to disappear again in Late Woodland times.

Earlier Evidence for Shellfish Harvesting

The radiocarbon date of 8225 cal yrbp obtained from submerged peat overlying an erosional terrace between 45 and 50 feet below mean sea level in the Mueser and Rutledge borings WB-1 and WB-2 may have critical implications for Hudson Valley human paleoecology. The determination allows for the possibility that Early Holocene submerged landforms and sites may have existed, thus pushing back the dates of oyster harvesting and prehistoric settlement along the Hudson estuary.

It is important to note that Carbotte's cores extended only 30 ft below the bottom, thus we cannot judge the possibility of still earlier and deeper oyster populations available for prehistoric harvesting. By comparison, still earlier fossil oyster reefs are reported from Chesapeake Bay at greater depths (Bratton et al., (2003). Colman et al., (2002) and Baucom et al., (2001) reported articulated oysters shells at 16.5 m (54-55 ft.) below modern sea level that are dated to 7600 cal yrbp. Still earlier oysters were reported from Chesapeake Bay by Vogt et al., (2000) from a paleochannel. These oysters, found at a depth of 17.8 m (58-59 ft.) below sea level, were dated to 8,200 cal yrbp. The point to be made here is that evidence for earlier oyster beds may be found in the Hudson estuary as well and this leads to the important archeological question of "when did prehistoric peoples first utilize shellfish gathering as a resource"? The common answer suggests that shellfish beds only became established after the slowing of sea level rise about 7,000 cal yrbp. The Chesapeake Bay data suggest that oysters had established significant reefs at least 1,000 years earlier when sea level was rising rapidly (see Figure 11 for clarification).

CONCLUSIONS AND RECOMMENDATIONS

During the course of this project, GRA scientists evaluated key reports on the proposed new alignment for the Tappan Zee Bridge furnished by Earth Tech as well as the pertinent geological and archeological literature. The four shallow 15-foot borings authorized under the original contract were restricted to 10-foot borings governed by the equipment available to the contractor supplied by the client. Such limitations

notwithstanding, these four cores provided peripheral data on the age of fossil oysters and sedimentation rates thus allowing for an informed assessment of the potential for submerged prehistoric sites in the project impact area. Analysis of the four cores revealed that oysters in the upper parts of cores to date between 770 and 1200 cal yrs BP; consistent with Late Woodland archeological occupations of the region. Bulk sediment samples taken from near the bases of the cores yielded ages between 4400 and 4800 cal yrs BP suggesting that the sedimentation rates in the project area were on the order of 0.5 mm/yr.

More critical for buried site modeling was our previous work on New York Harbor (Schuldenrein et al., 2007) and various studies carried out by researchers from Lamont-Doherty Earth Observatory (LDEO). Also key to our work was the detailed report of deep borings along the proposed new alignment carried out by Mueser Rutledge and Assoc. (2007). Their study provided field evidence on the geologic history of the Hudson River at the project location and highlighted the presence of a submerged terrestrial river terrace, 45 to 50 feet below mean sea level and cut into the underlying varved lake clays and silts along the western approach to the bridge (Borings WB-1 and WB-2). Peat overlying the terrace was dated by radiocarbon to 8225 cal yrs BP as part of our study.

This latter finding was highly significant in that it was the only identifiable drowned landform that offered the potential for past human occupation. Its chrono-stratigraphic context underscores the possibility of still older submerged landforms and prehistoric sites that might produce earlier evidence of shellfish harvesting. The submerged terrace segment may also signal an extension of this same landform upstream from the proposed bridge alignment. The thick layer of peat overlying the terrace surface is consistent with the establishment of a brackish water or salt marsh along the western bank of the Hudson. Fringing marshes are among the ecological settings conducive to waterfowl hunting and fishing. The radiocarbon age of the peat overlying the terrace surface corresponds to the Middle Archaic period. Although there appears to be little evidence for Middle Archaic habitation further upstream (at the shell midden sites and

rockshelters), radiocarbon ages of oyster shell from the bases of some of the middens suggest oyster harvesting near the end of the Middle Archaic period. Thus it is reasonable to suggest still earlier use of these resources. We know for example that Paleo Indian, as well as Early and Middle Archaic sites have been reported from Staten Island. The apparent lack of equivalent occupational and stratigraphic evidence further up the Hudson into the interior of the highlands is an important archeological question. One possible explanation is submergence of key Middle Archaic sites. While detailed investigation of the submerged terrace seems impractical at this time, preservation of the terrace for future researchers should be undertaken.

We recommend that the following steps be taken:

- Additional borings would be necessary to assess depositional contexts of the submarine environment to 15 ft. (4.5 m). The original SOW prescribed these depths. Our investigations reached 10 ft. (3.0 m) only, because of the limitations of the equipment provided for initial probing. These deeper probes should be investigated for sedimentology of riverine and marsh deposits and to verify the presence or absence of landform/depositional contexts indicative of possible human habitation or use.
- In situ marsh deposits and the underlying terrace north of the bridge alignment should be preserved for future investigation by prohibition of landfilling or other construction activities; alternatively detailed examination of cores in any potentially impacted portion of the crossing should be studied for human ecological or paleo-ecological potential.
- Subsurface disturbance of the submerged terrace/marsh deposits beneath the estuarine sediments should be limited to the actual bridge alignment and not extend further to the north.

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APPENDIX A: RESULTS OF RADIOMETRIC DATING

BETA ANALYTIC INC.
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REPORT OF RADIOCARBON DATING ANALYSES

Mr. Mark Smith — Report Date: 12/10/2008

Geoarcheology Research Associate — Material Received: 11/19/2008

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 252037 SAMPLE : TZ-1-60cm ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (shell): acid etch 2 SIGMA CALIBRATION : Cal AD 1060 to 1260 (Cal BP 890 to 690)	1480 +/- 40 BP	-5.1 o/oo	1810 +/- 40 BP
Beta - 252038 SAMPLE : TZ-2-40cm ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (shell): acid etch 2 SIGMA CALIBRATION : Cal AD 980 to 1130 (Cal BP 970 to 820)	1610 +/- 40 BP	-7.0 o/oo	1910 +/- 40 BP
Beta - 252039 SAMPLE : TZ-2-240cm ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (organic sediment): acid washes 2 SIGMA CALIBRATION : Cal BC 2910 to 2860 (Cal BP 4860 to 4810) AND Cal BC 2800 to 2750 (Cal BP 4760 to 4700) Cal BC 2710 to 2710 (Cal BP 4660 to 4660)	4230 +/- 40 BP	-24.3 o/oo	4240 +/- 40 BP
Beta - 252040 SAMPLE : TZ-3-60cm ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (shell): acid etch 2 SIGMA CALIBRATION : Cal AD 680 to 840 (Cal BP 1270 to 1110)	1910 +/- 40 BP	-5.5 o/oo	2230 +/- 40 BP
Beta - 252041 SAMPLE : TZ-3-260cm ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (organic sediment): acid washes 2 SIGMA CALIBRATION : Cal BC 2580 to 2450 (Cal BP 4530 to 4400)	3960 +/- 40 BP	-23.7 o/oo	3980 +/- 40 BP

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

See note on cover regarding report continuity and references to rescinded project

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Mark Smith

Report Date: 12/10/2008

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 252042	4210 +/- 40 BP	-24.0 o/oo	4230 +/- 40 BP

SAMPLE : TZ-4-220cm
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 2910 to 2850 (Cal BP 4860 to 4800) AND Cal BC 2810 to 2750 (Cal BP 4760 to 4700)
Cal BC 2720 to 2700 (Cal BP 4670 to 4650)

Dates are reported as RCYBP (radiocarbon years before present, 'present' = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

See note on cover regarding report continuity and references to rescinded project

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REPORT OF RADIOCARBON DATING ANALYSES

Dr. Joseph Schuldenrein — Report Date: 3/25/2009

Geoarcheology Research Associates — Material Received: 2/24/2009

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 256323	7450 +/- 50 BP	-27.7 o/oo	7410 +/- 50 BP

SAMPLE : MRCE 9836A
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (peat): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 6400 to 6210 (Cal BP 8350 to 8160)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

See note on cover regarding report continuity and references to rescinded project

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-5.1:Delta-R=570±0:Glob res=-200 to 500:lab. mult=1)

Laboratory number: **Beta-252037**

Conventional radiocarbon age: **1810±40 BP**

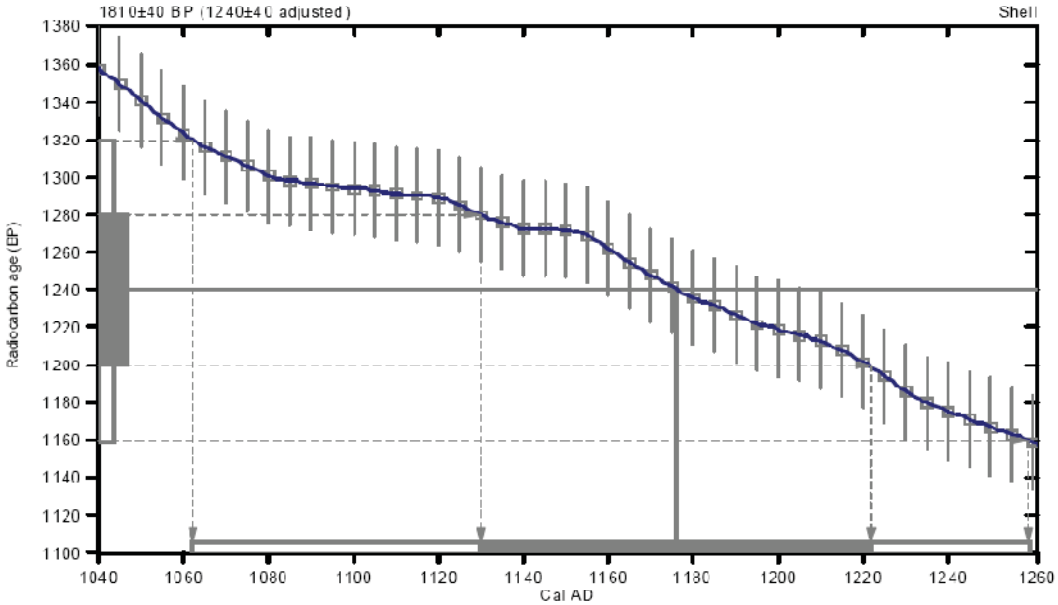
(1240±40 adjusted for local reservoir correction)

2 Sigma calibrated result: **Cal AD 1060 to 1260 (Cal BP 890 to 690)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1180 (Cal BP 770)

1 Sigma calibrated result: Cal AD 1130 to 1220 (Cal BP 820 to 730)
(68% probability)



References:

Database used
MARINE04
Calibration Database
INTCAL04 Radiocarbon Age Calibration
IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004)
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory
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See note on cover regarding report continuity and references to rescinded project

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-7:Delta-R=550±0:Glob res=-200 to 500:lab. mult=1)

Laboratory number: **Beta-252038**

Conventional radiocarbon age: **1910±40 BP**

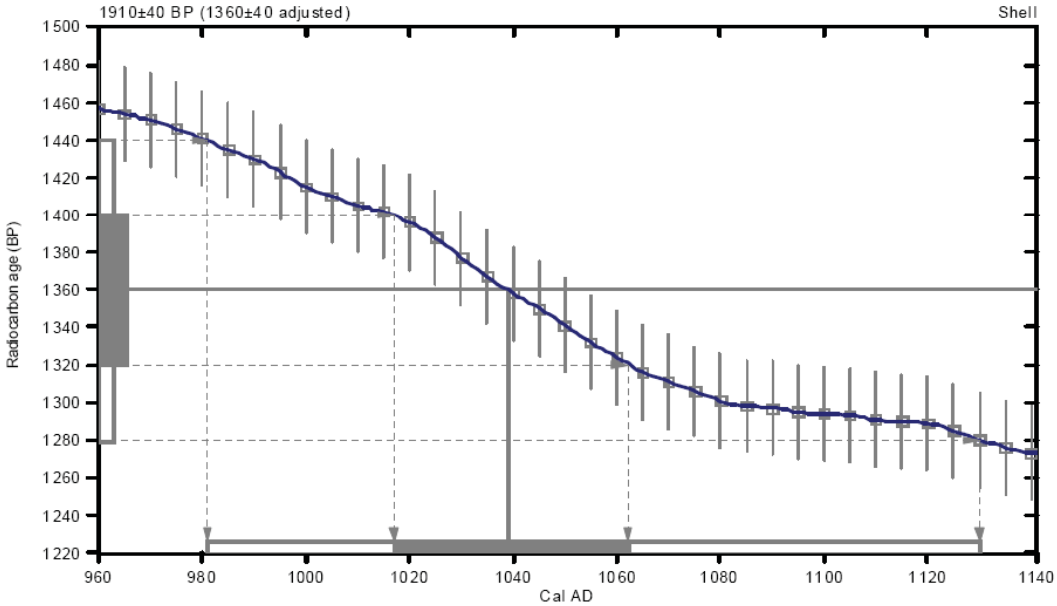
(1360±40 adjusted for local reservoir correction)

2 Sigma calibrated result: **Cal AD 980 to 1130 (Cal BP 970 to 820)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1040 (Cal BP 910)

1 Sigma calibrated result: Cal AD 1020 to 1060 (Cal BP 930 to 890)
(68% probability)



References:

Database used
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Calibration Database
INTCAL04 Radiocarbon Age Calibration
IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).
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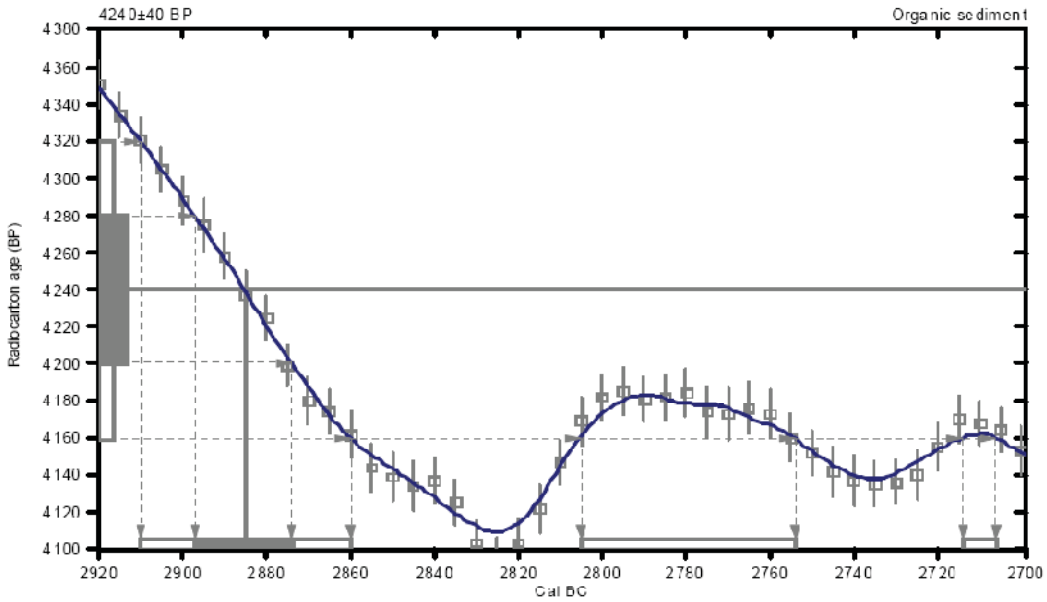
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.3:lab. mult=1)

Laboratory number:	**Beta-252039**
Conventional radiocarbon age:	**4240+40 BP**
2 Sigma calibrated results: (95% probability)	**Cal BC 2910 to 2860 (Cal BP 4860 to 4810) and Cal BC 2800 to 2750 (Cal BP 4760 to 4700) and Cal BC 2710 to 2710 (Cal BP 4660 to 4660)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal BC 2880 (Cal BP 4840)
1 Sigma calibrated result: (68% probability)	Cal BC 2900 to 2870 (Cal BP 4850 to 4820)



References:

Database used

INTCAL04

Calibration Database

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Mathematics

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-5.5:Delta-R=600±0:Glob res=-200 to 500:lab. mult=1)

Laboratory number: **Beta-252040**

Conventional radiocarbon age: **2230±40 BP**

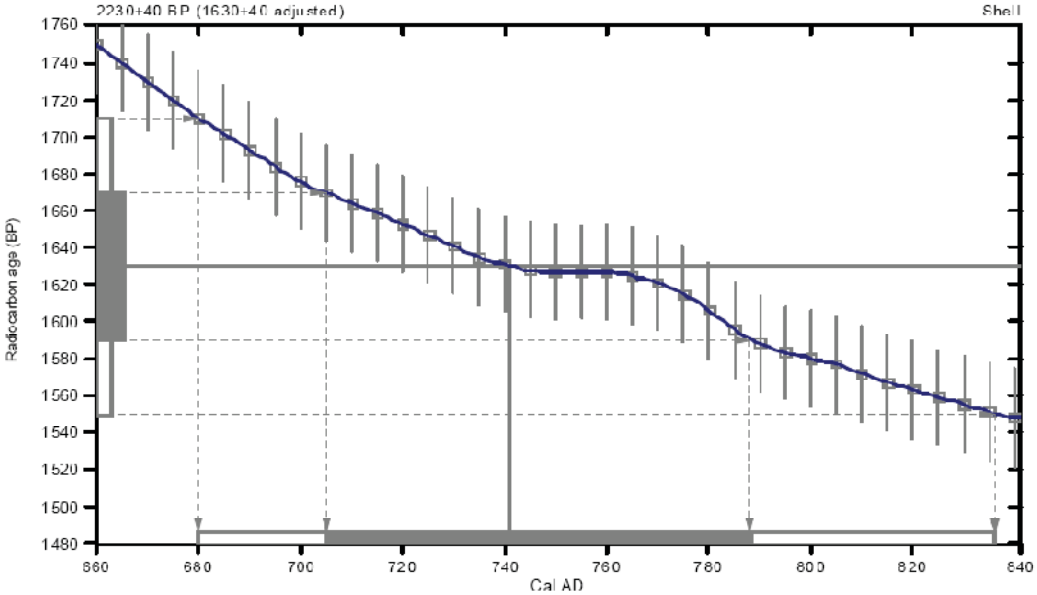
(1630±40 adjusted for local reservoir correction)

2 Sigma calibrated result: **Cal AD 680 to 840 (Cal BP 1270 to 1110)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 740 (Cal BP 1210)

1 Sigma calibrated result: Cal AD 700 to 790 (Cal BP 1240 to 1160)
(68% probability)



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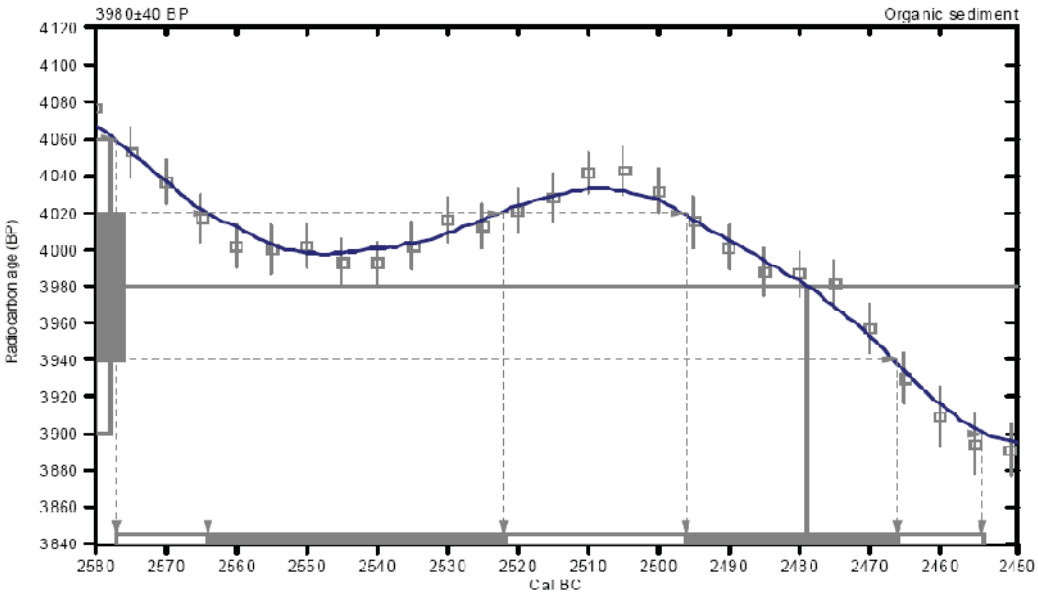
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.7:lab. mult=1)

Laboratory number:	**Beta 252041**
Conventional radiocarbon age:	**3980±40 BP**
2 Sigma calibrated result: (95% probability)	**Cal BC 2580 to 2450 (Cal BP 4530 to 4400)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal BC 2480 (Cal BP 4430)
1 Sigma calibrated results: (68% probability)	Cal BC 2560 to 2520 (Cal BP 4510 to 4470) and Cal BC 2500 to 2470 (Cal BP 4450 to 4420)



References:

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Mathematics

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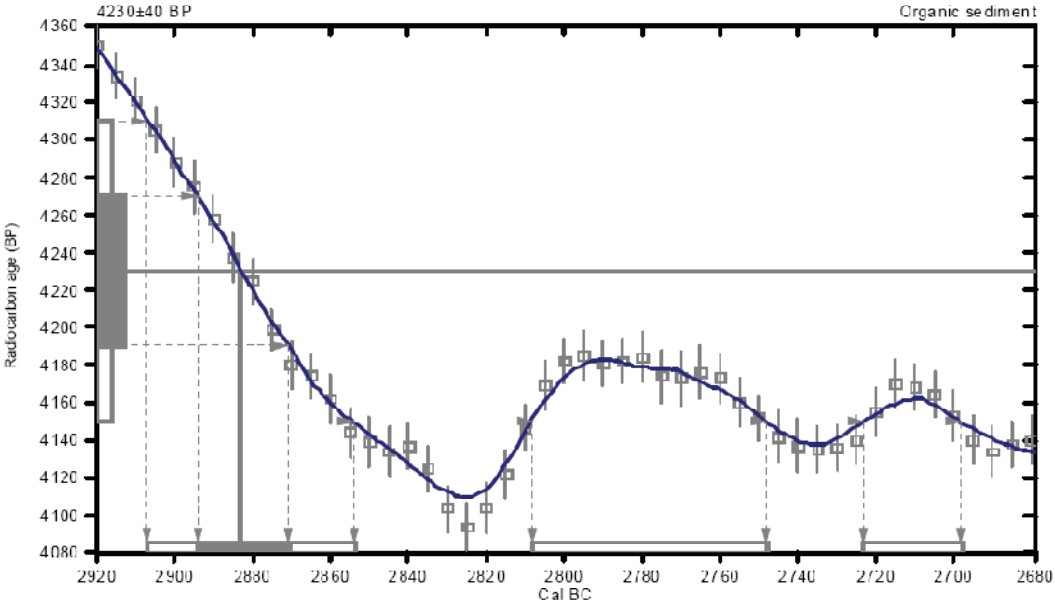
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24:lab. mult=1)

Laboratory number:	**Beta-252042**
Conventional radiocarbon age:	**4230±40 BP**
2 Sigma calibrated results: (95% probability)	**Cal BC 2910 to 2850 (Cal BP 4860 to 4800) and Cal BC 2810 to 2750 (Cal BP 4760 to 4700) and Cal BC 2720 to 2700 (Cal BP 4670 to 4650)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal BC 2880 (Cal BP 4830)
1 Sigma calibrated result: (68% probability)	Cal BC 2890 to 2870 (Cal BP 4840 to 4820)



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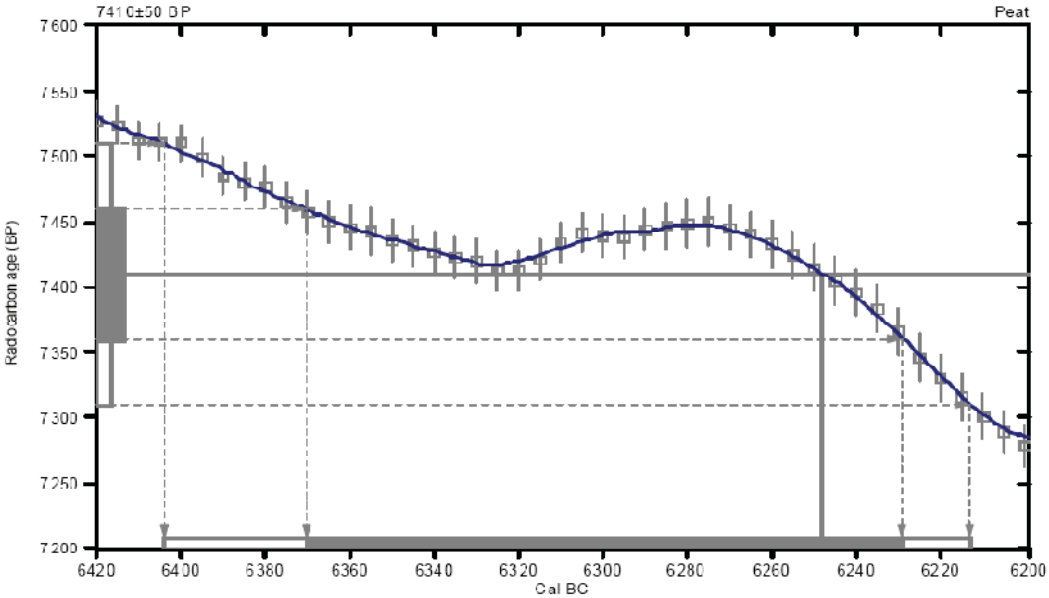
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-27.7:lab. mult=1)

Laboratory number:	**Beta-256323**
Conventional radiocarbon age:	**7410±50 BP**
2 Sigma calibrated result: (95% probability)	**Cal BC 6400 to 6210 (Cal BP 8350 to 8160)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal BC 6250 (Cal BP 8200)
1 Sigma calibrated result: (68% probability)	Cal BC 6370 to 6230 (Cal BP 8320 to 8180)



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See note on cover regarding report continuity and references to rescinded project

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT
SECTION 106 EFFECT FINDING

ATTACHMENT D:

PUBLIC INVOLVEMENT AND CONSULTING PARTY PARTICIPATION

Tappan Zee Hudson River Crossing Project
Section 106 Consulting Parties

Individual/Organization	Contact	Address
Advisory Council on Historic Preservation (ACHP)	Carol Legard, FHWA Liaison	1100 Pennsylvania Avenue NW, Suite 807 Washington, DC 20004
Berezowsky, Adrian, Sleepy Hollow resident		55 West Red Oak Lane, White Plains, NY 10604
Delaware Nation	Tamara Francis, Cultural Resource Preservation Director, Jason Ross, Section 106 Assistant	31064 State Highway 281, Anadarko, OK 73005
Delaware Tribe	Dr. Brice Obermeyer,	Delaware Tribe Historic Preservation Office, 1420 C of E Drive, Suite 190, Emporia, KS 66801
Forrest, Bruce D.		Forrest & Company, Inc., P.O. Box 444, Nyack, NY 10960
Friends of the Old Croton Aqueduct	Robert Kornfeld	47 Summit Drive, Hastings-on-Hudson, NY 10706
The Historical Society Inc.	Sara Mascia	One Grove St, Tarrytown, NY 10591
Historical Society of the Nyacks	Winston C. Perry Jr, President	319 North Broadway, Nyack, NY 10960
Historical Society of Rockland County	Marianne B. Leese	20 Zukor Road, New City, NY 10956
Lecuona, Milagros, White Plains Council woman		269 Old Mamaroneck Rd, White Plains, NY 10605
Lynn, Lawrence, Mayor of Village of Grand View-on-Hudson		276 River Road, Grand View, NY 10960
National Trust for Historic Preservation	Elizabeth S. Merritt, Deputy Counsel	1785 Massachusetts Ave N.W. Washington, DC 20036
	Krystyn Hastings-Silver	Lyndhurst, 635 South Broadway, Tarrytown, NY 10591
	Roberta Lane	7 Faneuil Hall Marketplace, 4th floor, Boston, MA 02109
Riverkeeper	c/o Pace University School of Law	Pace University School of Law, 78 North Broadway, White Plains, NY 10603
Saint Regis Mohawk Tribe	Chief Randy Hart Arnold Printup, Jr. THPO	412 State Route 37, Hogansburg, NY 13655
Shinnecock Indian Nation	Marguerite Smith, Office of Tribal Trustees/Legal	100 Church Street, Shinnecock Community Center, Southampton, NY 11968
SHPO	John Bonafide, Ruth Pierpont, Mark Peckham	P.O. Box 189, Peebles Island, Waterford, NY 12188
Steiner, Henry, Village of Sleepy Hollow Historian		56 Pocantico Street, Sleepy Hollow, NY 10591
Stockbridge-Munsee Band of Mohican Indians	Sherry White, THPO	W13447 Camp 14 Road, Bowler, WI 54416
Stolldorf, Gini, Nyack resident		15 Fourth Avenue, Nyack, NY 10960
Westchester County Historical Society	Katherine Hite, Executive Director	2199 Saw Mill River Rd, Elmsford, NY 10523

Tappan Zee Hudson River Crossing Project
New York State Department of Transportation, Region 8
4 Burnett Boulevard
Poughkeepsie, New York 12603
Telephone: (877) 892-3685

Tappan Zee Hudson River Crossing
Section 106 Consulting Parties Meeting
Friday, December 16, 2011
10:00AM – 12:00PM
Warner Library, 121 North Broadway, Tarrytown, New York

Purpose

To seek and consider views of Consulting Party members regarding the project's effects on historic and cultural resources

Agenda

A. Introductions – Daniel Hitt, NYSDOT and Michael Davies, FHWA
B. Project Presentation – Michael Anderson, NYSDOT
C. Section 106 Presentation – Molly McDonald, AKRF and Michael Pappalardo, AKRF
D. Consulting Parties Discussion of Presentation Materials
E. Upcoming Milestones and Meetings – Chris Calvert, AKRF

Tappan Zee Hudson River Crossing
Section 106 Consulting Parties Meeting
Friday, December 16, 2011
10:00AM – 12:00PM
Warner Library, 121 North Broadway, Tarrytown, New York

Attendees

Jennifer Barry	Metro North
Michael Blau, Village Administrator	Village of Tarrytown
Mary Cardenas, Orangetown Historian	Town of Orangetown
Stacy Cusick	113 Paulding Avenue, Tarrytown
Krystyn Hastings-Silver, Acting Site Director	Lyndhurst/National Trust for Historic Preservation
Frank Jazzo, Town Historian	Town of Greenburgh
Robert Knight, Town Historian	Town of Clarkstown
Robert Kornfeld, Jr., Vice President	Friends of the Old Croton Aqueduct
Milagros Lecuona, Councilwoman	City of White Plains
Carol Legard, FHWA Liaison	Advisory Council on Historic Preservation
Sara Mascia, Executive Director	The Historical Society, Tarrytown and Sleepy Hollow
Susanne Pandich, Board Member	Westchester County Historical Society
Henry Steiner, Village Historian	Village of Sleepy Hollow
Gini Stolldorf	Historical Society of the Nyacks
Tori Weisel, President	Irving Neighborhood Preservation Association
Robert Wisner	21 Cornelison Avenue, South Nyack
Brian Yates, Historic Preservation Specialist	NYS Historic Preservation Office

Also attending:

Diane Helde	Representing Claire Ballantyne of 117 Paulding Avenue, Tarrytown
Yolanda Robinson, Chief of Staff	City of Mount Vernon (also representing the African American Chamber of Commerce of Westchester & Rockland)

Participating by phone:

Adrian Berezowsky	Sleepy Hollow resident/Section 106 consultant
Betsy Merritt, Deputy General Counsel	National Trust for Historic Preservation

Project Team

Michael Anderson	NYS Department of Transportation (NYSDOT)
John Burns	Federal Highway Administration (FHWA)
Chris Calvert	AKRF, Inc.
Rita Campon	Parsons
Dave Capobianco	NYS Thruway Authority (NYSTA)
Hang Chu	NYS Department of Transportation (NYSDOT)
Michael Davies	Federal Highway Administration (FHWA)
Ken Dymond	Federal Highway Administration (FHWA)
Daniel Hitt	NYS Department of Transportation (NYSDOT)

Tappan Zee Hudson River Crossing
Section 106 Consulting Parties Meeting
Friday, December 16, 2011
10:00AM – 12:00PM
Warner Library, 121 North Broadway, Tarrytown, New York

Attendees
(page 2)

Project Team (con't)

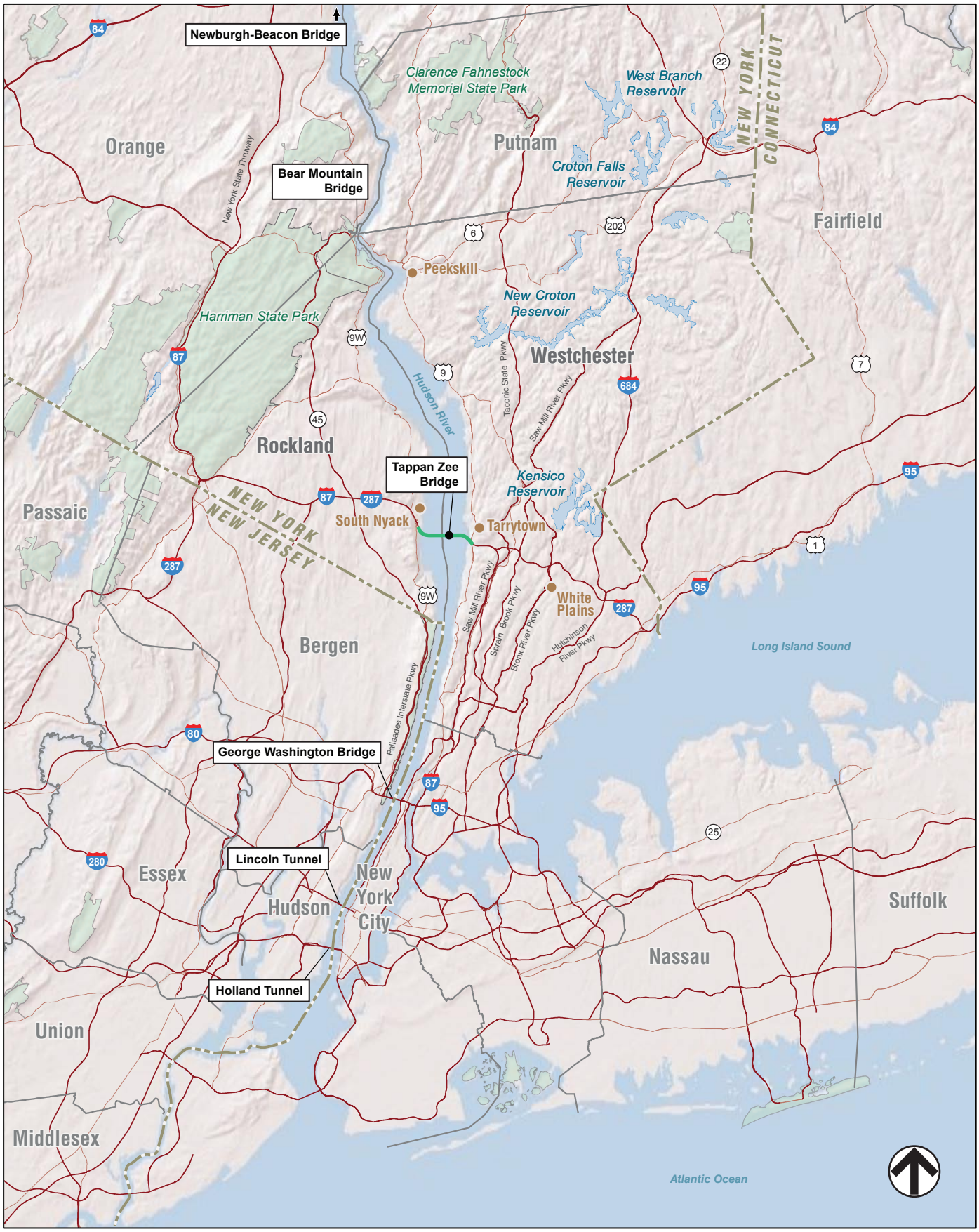
Catherine Leslie	NYS Department of Transportation (NYSDOT)
Molly McDonald	AKRF, Inc.
Patricia Millington	Federal Highway Administration (FHWA)
Elizabeth Novak	NYS Thruway Authority (NYSTA)
Michael Pappalardo	AKRF, Inc.
George Paschalis	Howard/Stein-Hudson Associates, Inc.
Mary Santangelo	NYS Department of Transportation (NYSDOT)
Sandra Vasco	AECOM

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT
SECTION 106 EFFECT FINDING

ATTACHMENT E:

PLANS, PROFIELS, ELEVATIONS, SECTIONS FOR REPLACEMENT BRIDGE ALTERNATIVE/LONG AND SHORT SPAN OPTIONS

1.17.12



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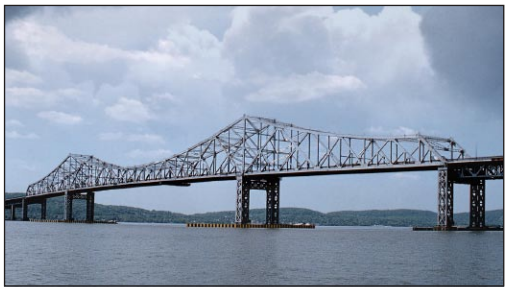
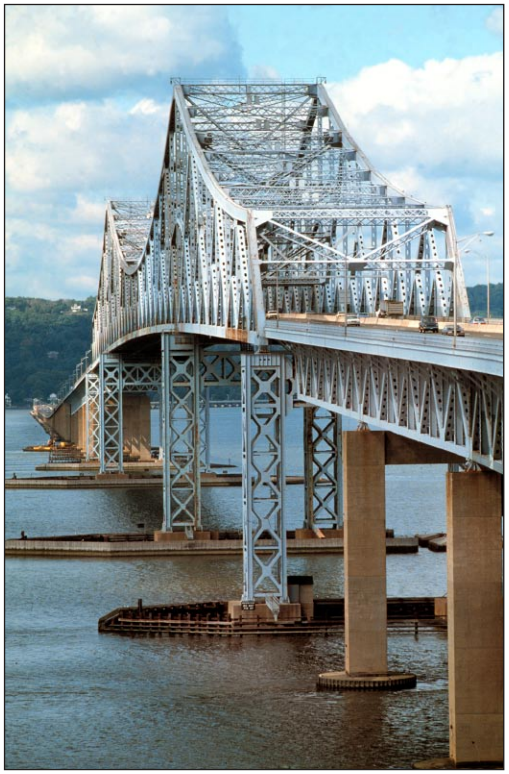
SCALE

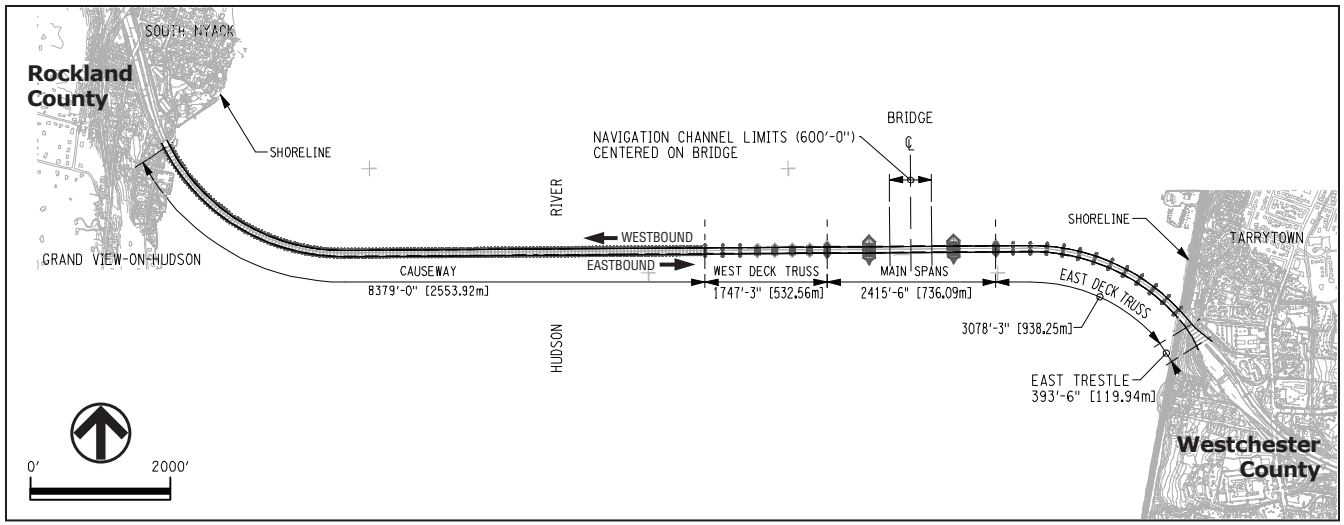
Figure E-1
Project Location and Regional Roadway Network

TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

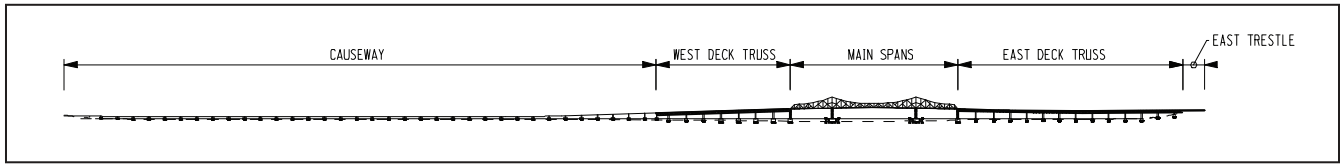
1.17.12



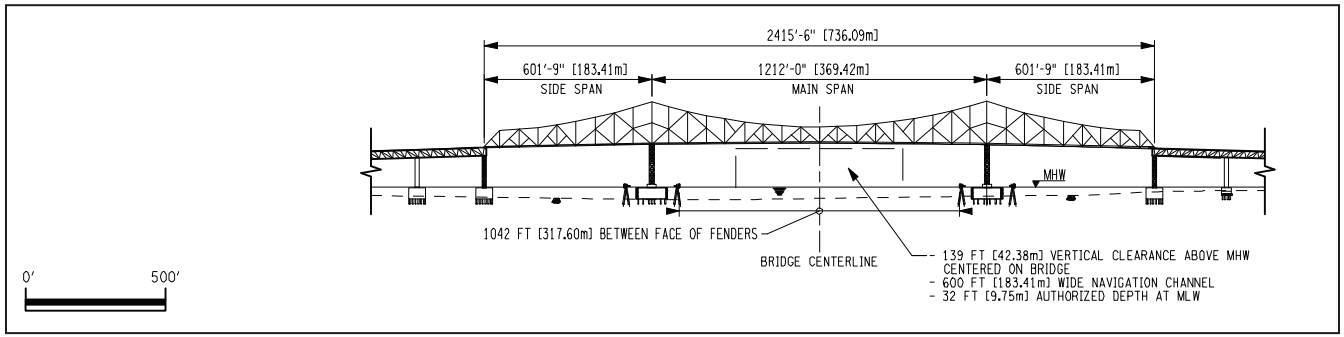




PLAN



PROFILE



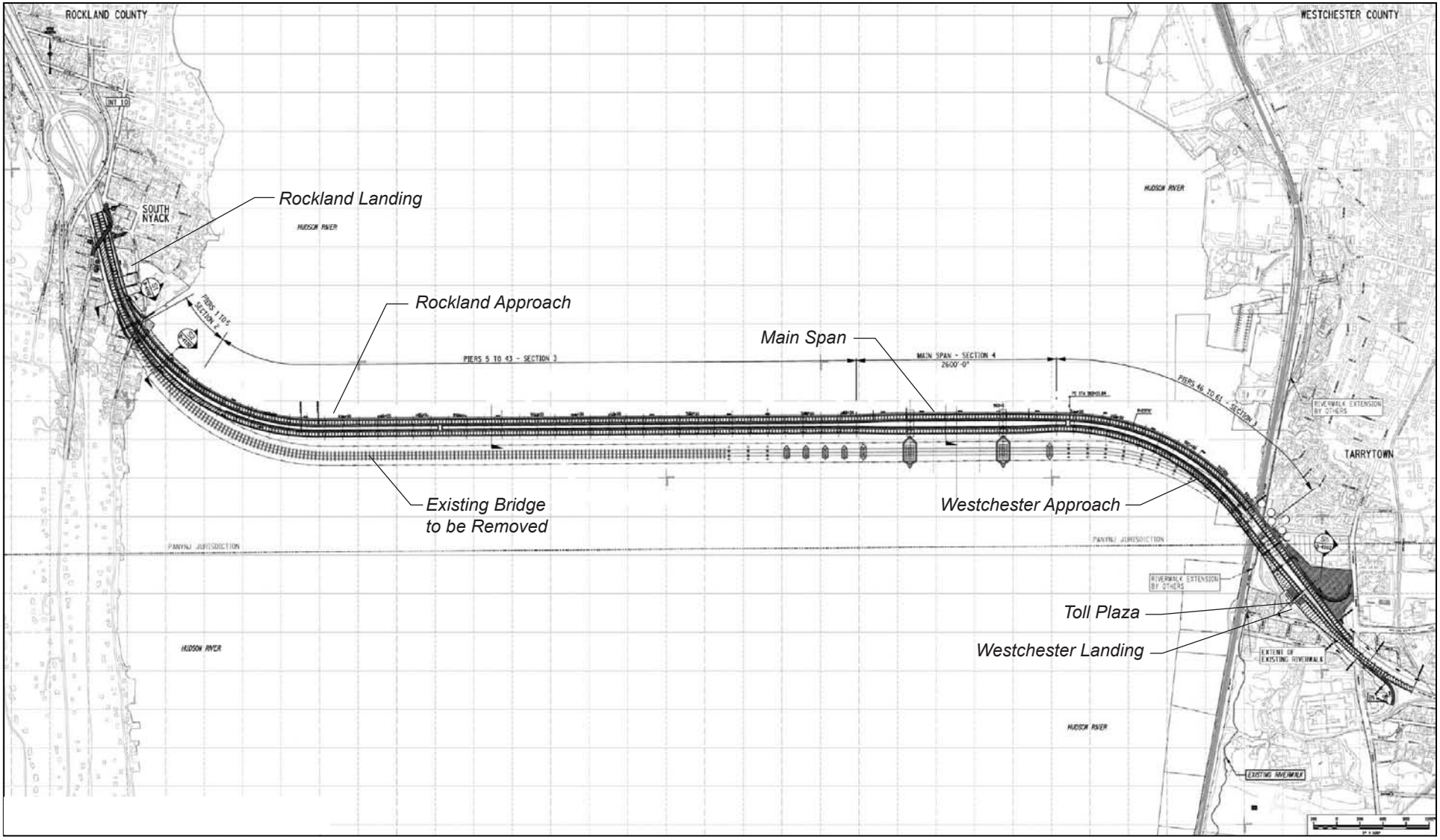
MAIN SPANS

TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

Figure E-2

Existing Bridge Plan, Profile, and Photographs

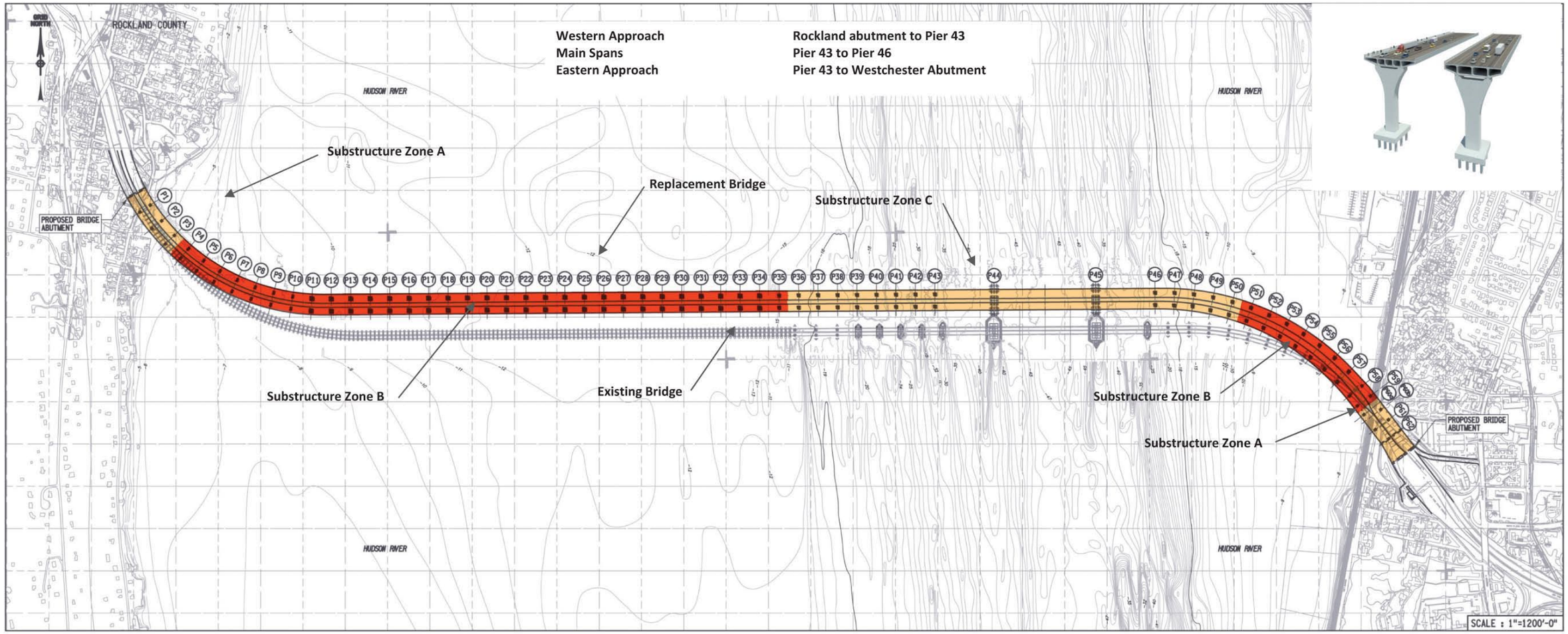
1.17.12

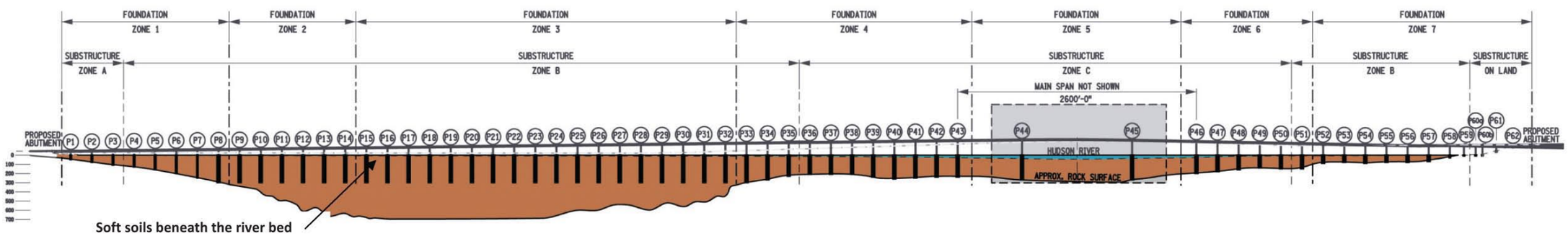


TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

Figure E-3
Replacement Bridge Alternative

1.17.12

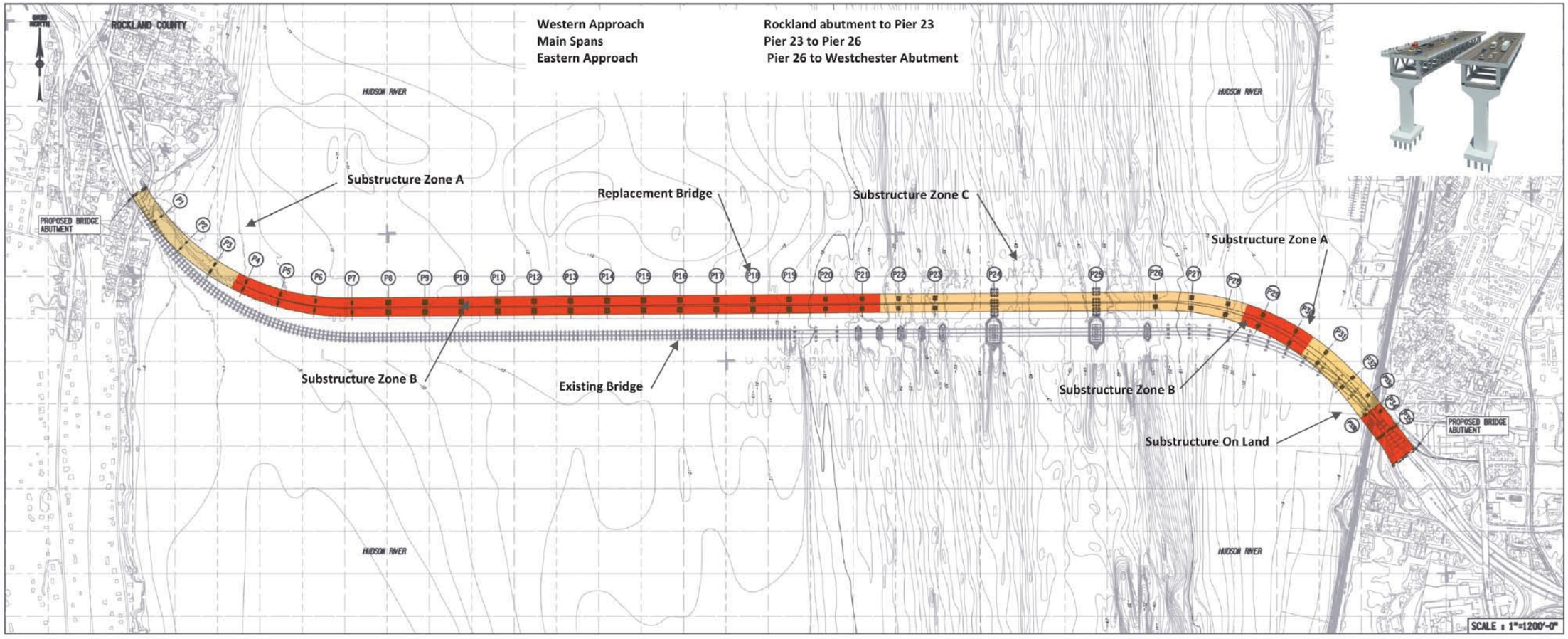


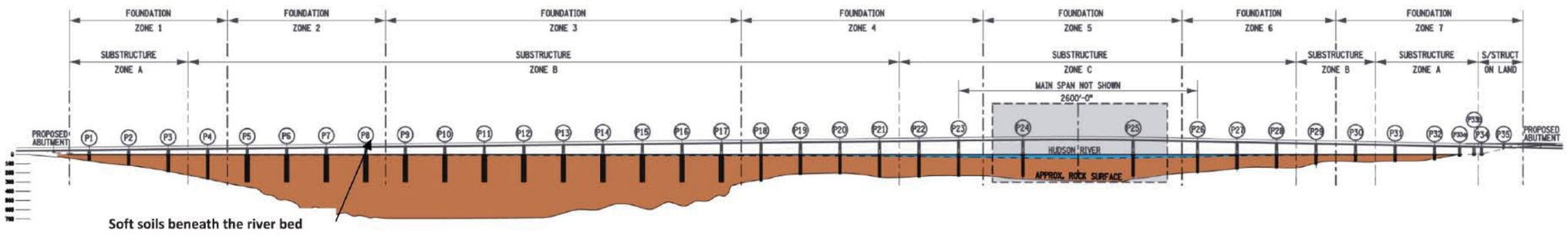


TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

Figure E-4
Short Span Bridge Option - Indicative Plan and Elevation

1.17.12



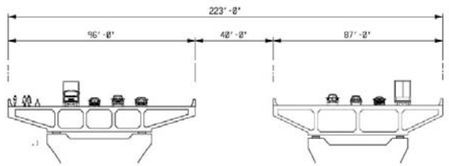


TAPPAN ZEE HUDSON RIVER CROSSING
Section 106 Effect Finding Documentation

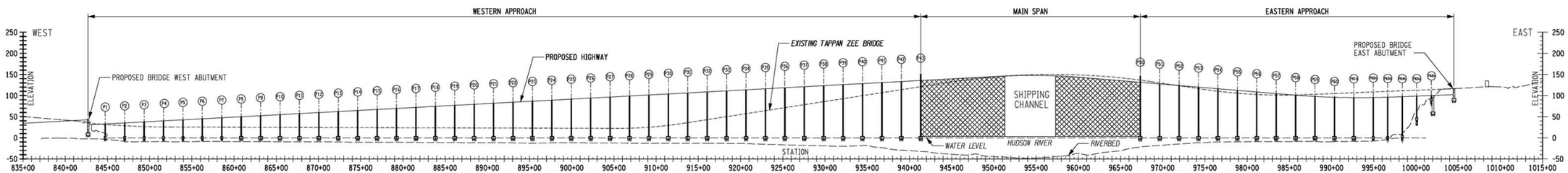
Figure E-5
Long Span Bridge Option - Indicative Plan and Elevation

1.17.12

Short Span Option

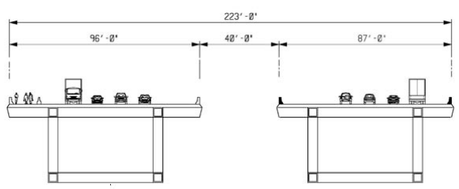


Short Span Cross-Section

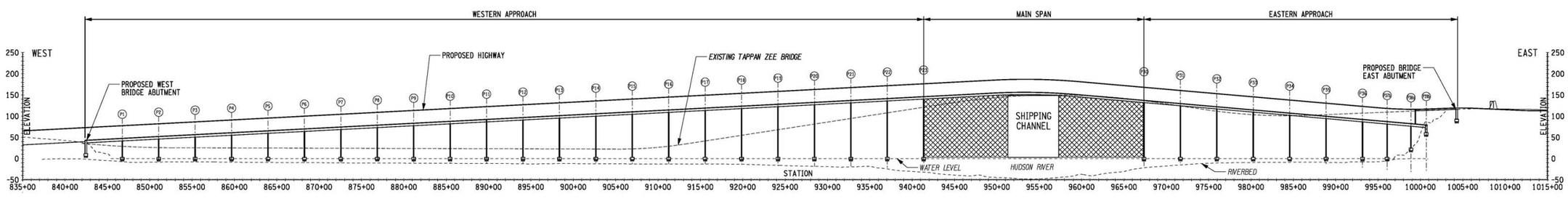


Short Span Plan View

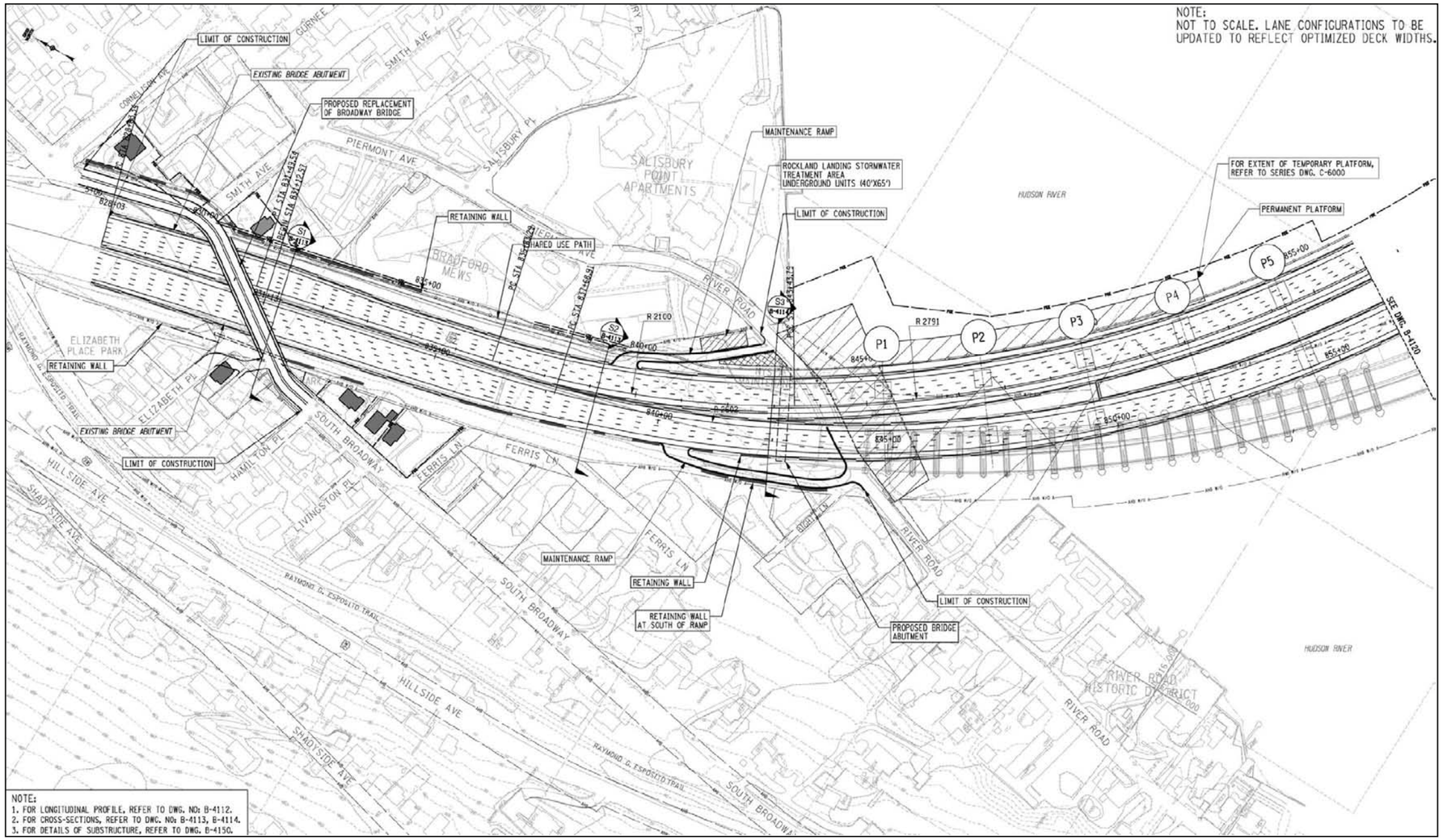
Long Span Option



Long Span Cross-Section



Long Span Plan View



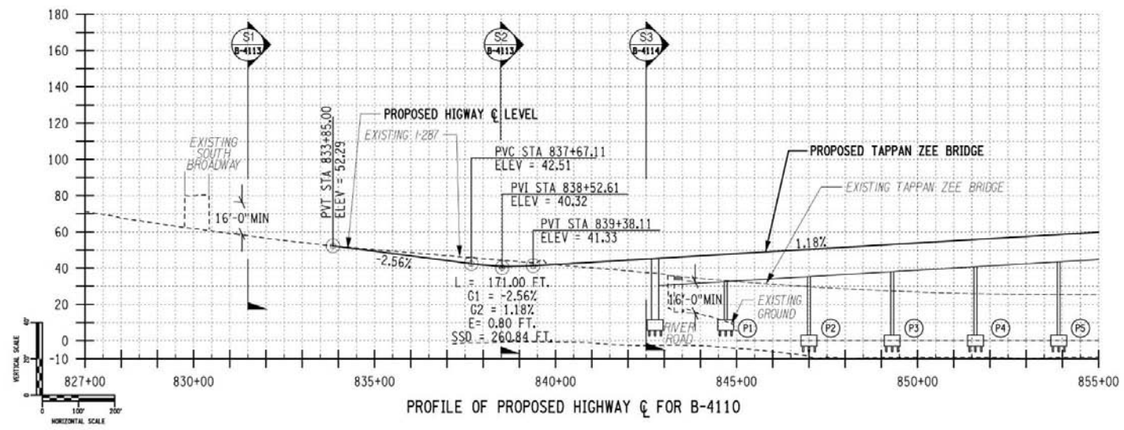
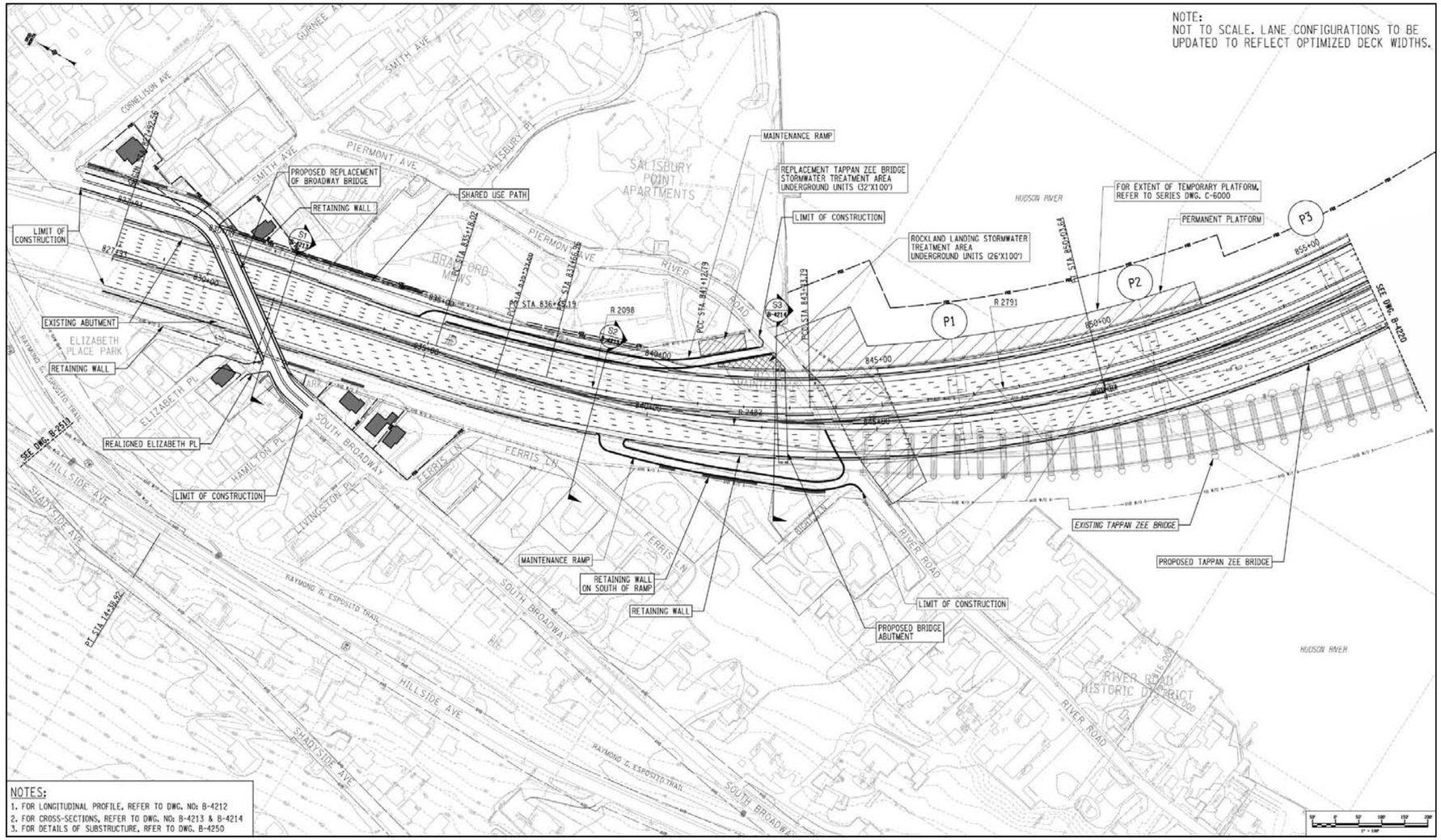


Figure E-7

Short Span Option - Rockland County



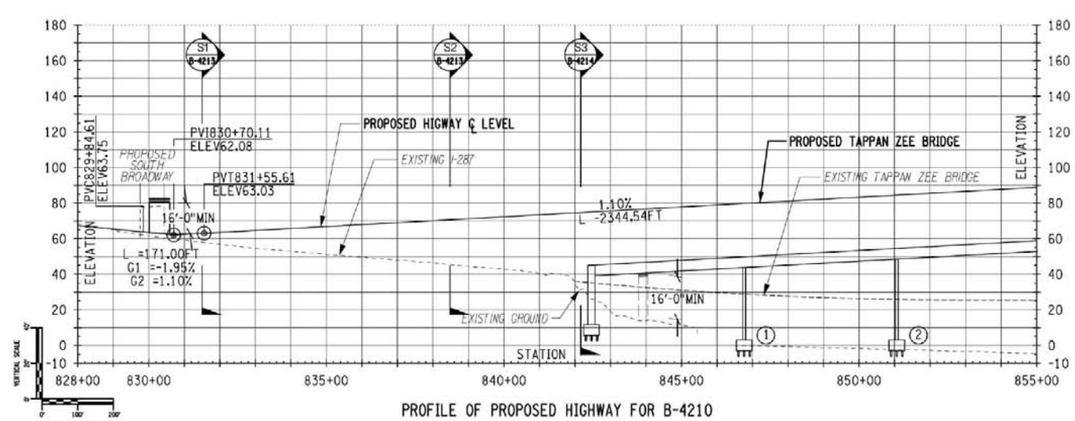
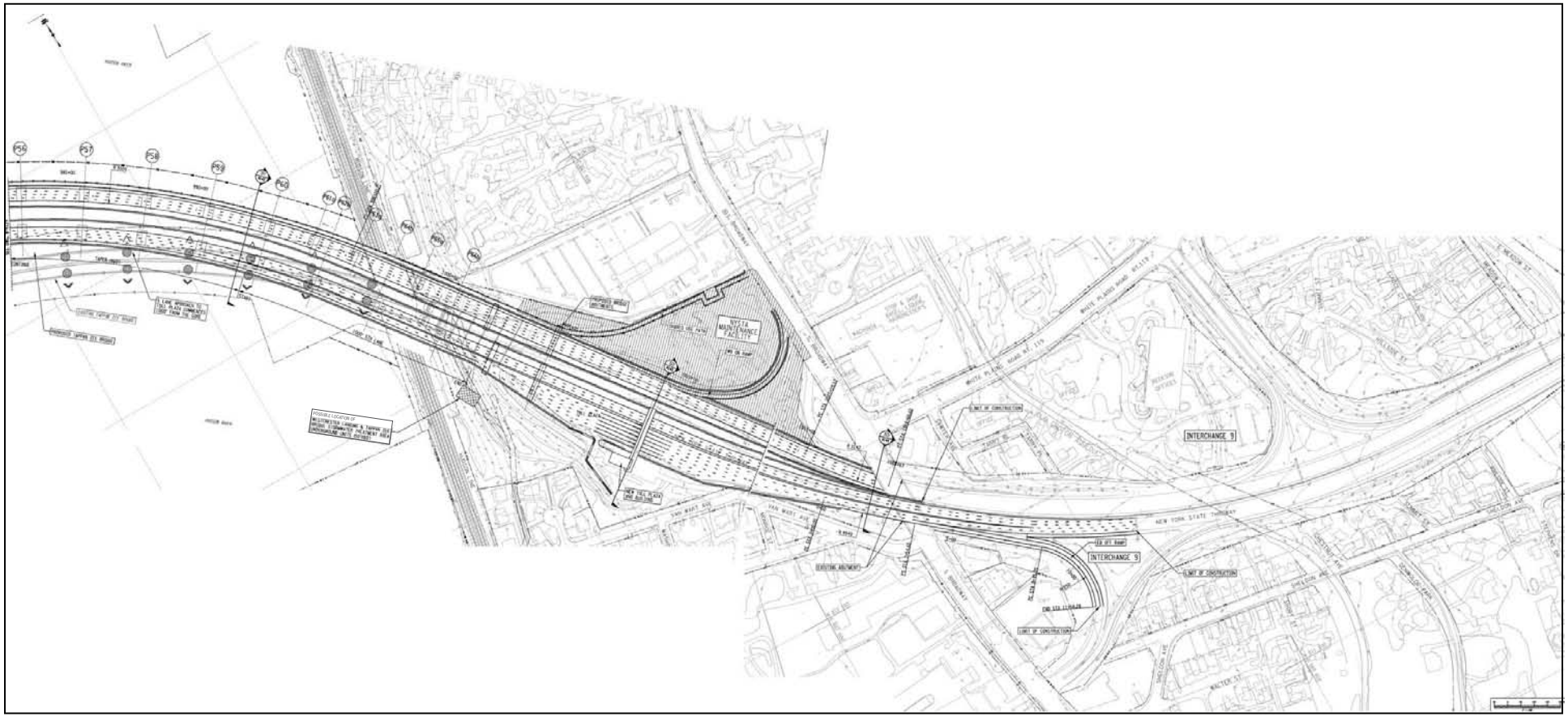


Figure E-8

Long Span Option - Rockland County

1.17.12


INTERCHANGE 9
INTERCHANGE 9
NEW YORK STATE THRUWAY
LIMIT OF CONSTRUCTION
LIMIT OF CONSTRUCTION
LIMIT OF CONSTRUCTION
WHITE PLAINS ROAD
WALTER ST

Example of Cable-Stayed Option (Oresund Bridge, Denmark/Sweden)

Example of Arch Option (Lake Champlain Bridge, New York/Vermont)

Attachment E-10

Main Spans Options

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT
SECTION 106 EFFECT FINDING

ATTACHMENT F:

CORRESPONDENCE

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
ALBANY, N.Y. 12232
www.dot.ny.gov

JOAN MCDONALD
COMMISSIONER

ANDREW M. CUOMO
GOVERNOR

October 17, 2011

Ruth Pierpont
Director and Acting Deputy Commissioner
Division for Historic Preservation
NYS Office of Parks, Recreation & Historic Preservation
P.O. Box 189 - Peebles Island
Waterford, New York 12188

Attn.: Mark Peckham, Director, State Historic Preservation Office
John Bonafide, Historic Preservation Services Coordinator

Re: Tappan Zee Hudson River Crossing
Section 106 - Area of Potential Effect

Dear Ruth:

The Federal Highway Administration (FHWA), in coordination with the project sponsors, the New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA), is initiating consultation with the State Historic Preservation Office (SHPO) for the Tappan Zee Hudson River Crossing Project ("Project"), in accordance with Section 106 of the National Historic Preservation Act (36 CFR Part 800).

The purpose of the Project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The project would address the structural, operational, mobility, safety, and security needs of the Tappan Zee Hudson River Crossing.

Attached for your review is a document to establish the Project's Area of Potential Effects (APE), as defined in 36 CFR 800.16 (d). The APE includes a geographical area incorporating potential direct and indirect effects associated with two options for the Replacement Bridge Alternative being advanced in the Environmental Impact Statement (EIS).

Please forward any questions or comments to my attention at dhitt@dot.state.ny.us . We respectfully request the written concurrence of the SHPO with the APE by October 21, 2011.

Sincerely,

DANIEL P. HITT, RLA
(Acting) Co-Director, Office of Environment

DPH/MCS

cc.: John Burns, FHWA
Michael Anderson, NYSDOT
Elizabeth Novak, NYSTA
Robert Conway, AKRF

Tappan Zee Hudson River Crossing Project
Proposed Area of Potential Effect (APE)
October 14, 2011

I General Project Description

The Tappan Zee Hudson River Crossing ("Project") is being undertaken by the Project Sponsors – New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA) –with the Federal Highway Administration (FHWA), serving as the federal lead agency under the National Environmental Policy Act (NEPA). The purpose of the project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The project would address the structural, operational, mobility, safety, and security needs of the Tappan Zee Hudson River Crossing.

The Environmental Impact Statement (EIS) will consider a Replacement Bridge Alternative. The existing and proposed replacement bridge are 3.1 miles in length, and the tie-in work in Rockland and Westchester Counties will be limited to the minimum work necessary to match existing highway geometry at the landings. The project limits would be approximately 4 miles in total, from the South Broadway Bridge in South Nyack (Rockland County) to the Broadway Bridge in Tarrytown (Westchester County). The Project will not require alteration of existing interchanges or other highway features beyond the project limits.

An EIS will be prepared in accordance with NEPA. The analyses anticipate an Estimated Time of Completion between 2017 and 2019. Two alternatives will be evaluated in the EIS, the No Build Alternative and the Replacement Bridge Alternative. To provide flexibility in the future design of the replacement bridge, two options will be considered. Each alternative is briefly discussed below:

- No Build Alternative – The No Build Alternative would retain the existing Tappan Zee Bridge in its current configuration with ongoing maintenance, as practicable, to ensure its continued safe use by the traveling public. However, given the age of the bridge and its vulnerabilities in extreme events, it is possible that the crossing could be closed altogether at some point in the future. Although the No Build Alternative does not meet the project's purpose and need, NEPA requires it be evaluated in the EIS. The No Build Alternative also serves as the baseline condition against which the potential benefits and impacts of the Replacement Bridge Alternative are evaluated.
- Replacement Bridge Alternative – There are two options for the Replacement Bridge Alternative that would meet the structural and operational requirements of a new crossing. These options differ in two basic ways: 1) the distance between their piers (short vs. long); and 2) the potential number of levels of bridge operations (single vs. dual). These options—Short Span and Long Span—are described below.
    - The Replacement Bridge Alternative—Short Span Option would be two single-level structures separated by a 42-foot gap at their main spans. Under typical operation, each structure would have four traffic lanes and wide shoulders to facilitate emergency vehicle access. The north bridge structure would serve westbound traffic, and the south bridge structure would serve eastbound traffic. A bicycle/pedestrian path would be

provided on the north bridge structure. The north bridge structure would be 96 feet wide and the south bridge structure would be 82 feet wide.

The Short Span option would not preclude future transit service across the Tappan Zee Hudson River crossing.

- The Replacement Bridge Alternative—Long Span Option would be two new truss bridges with two levels each. The dual structures would be separated by a minimum gap of approximately 42 feet at the main span. The northernmost structure would be 96 feet wide. Under normal operations, it would support four westbound lanes and a shared-use (bicycle and pedestrian) path on the upper level. The southernmost structure would be 82 feet wide, and under normal operations, it would support four eastbound lanes. Both structures would include wide shoulders to facilitate emergency access.

  The Long Span option would not preclude future transit service across the Tappan Zee Hudson River crossing.

Both Replacement Bridge Alternative options would result in removal of the existing Tappan Zee Bridge upon completion of the new river crossings.

II Development of the Area of Potential Effect

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the potential effects of their actions on historic properties. A required step in the Section 106 process is determining the Area of Potential Effect (APE) which is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist" (36 CFR § 800.16[d]). The APE is influenced by the scale and nature of an undertaking.

The APE has been developed based on proposed work activities and their potential to affect historic properties, including potential direct and indirect effects, based on information available at this time.

In general, potential effects on historic properties can include both direct physical effects—demolition, alteration, or damage from construction—and indirect effects, such as the isolation of a property from its surrounding environment, or the introduction of visual, audible, or atmospheric (e.g., pollutants) elements that are out of character with a property or that alter its historic setting and context (e.g., contextual effects). Adverse effects can occur if a project would cause a change in the quality of a property that qualifies it for inclusion in the National Register of Historic Places.

The proposed direct and indirect APEs are discussed in greater detail below and are depicted in Figure 1.

III APE for Direct Effects

As discussed above, direct effects may include physical damage or destruction of a resource or to its setting. The proposed APE for Direct Effects includes all locations that could potentially be subject to direct ground disturbing activities. Project activities are anticipated to include demolition, excavation, pile-driving, geological borings, cutting and filling, as well as staging. Figure 1 presents the proposed APE for Direct Effects.

The proposed APE for Direct Effects has been designed to encompass areas directly affected by the construction and operation of the roadway, as follows:

- Rockland County – includes the existing right-of-way (ROW) of the Thruway between the Tappan Zee Bridge and the South Nyack Bridge in South Nyack.

- Hudson River – includes the Tappan Zee Bridge and its existing ROW, the footprint of the proposed replacement bridge, and the staging/dredging areas at both the Westchester and Rockland landings.

- Westchester County – includes the existing ROW of the Thruway between the Tappan Zee Bridge to the Broadway Bridge in Tarrytown.

The proposed APE for Direct Effects consists of horizontal and vertical components. The horizontal extent of the APE is defined as the footprint of construction activity that would result in ground disturbance or other physical impacts to properties. The vertical extent of the APE varies along the 4 mile project area, depending on the type of construction activity, for both above-ground and below-ground components.

IV APE for Indirect Effects

As discussed above, indirect effects may include isolation of a property from its surrounding environment, or the introduction of visual, audible, or atmospheric (e.g., pollutants) elements that are out of character with a property or that alter its historic setting and context. The APE for Indirect Effects was developed to encompass any potential indirect effects resulting from proposed Project construction activities, such as noise, vibration, and changes in visual qualities and setting. Figure 1 presents the proposed APE for Indirect Effects.

For work to the Thruway, the proposed APE for Indirect Effects extends 500 feet from the either side of the existing centerline of the Thruway. The proposed APE for Indirect Effects is more expansive in the area that is within visual range of the Tappan Zee Bridge to encompass potential visual and audible impacts associated with construction of the replacement bridge. The APE takes into consideration topography and the surrounding built environment. The following points explain the expansion of the APE in the area surrounding the river:

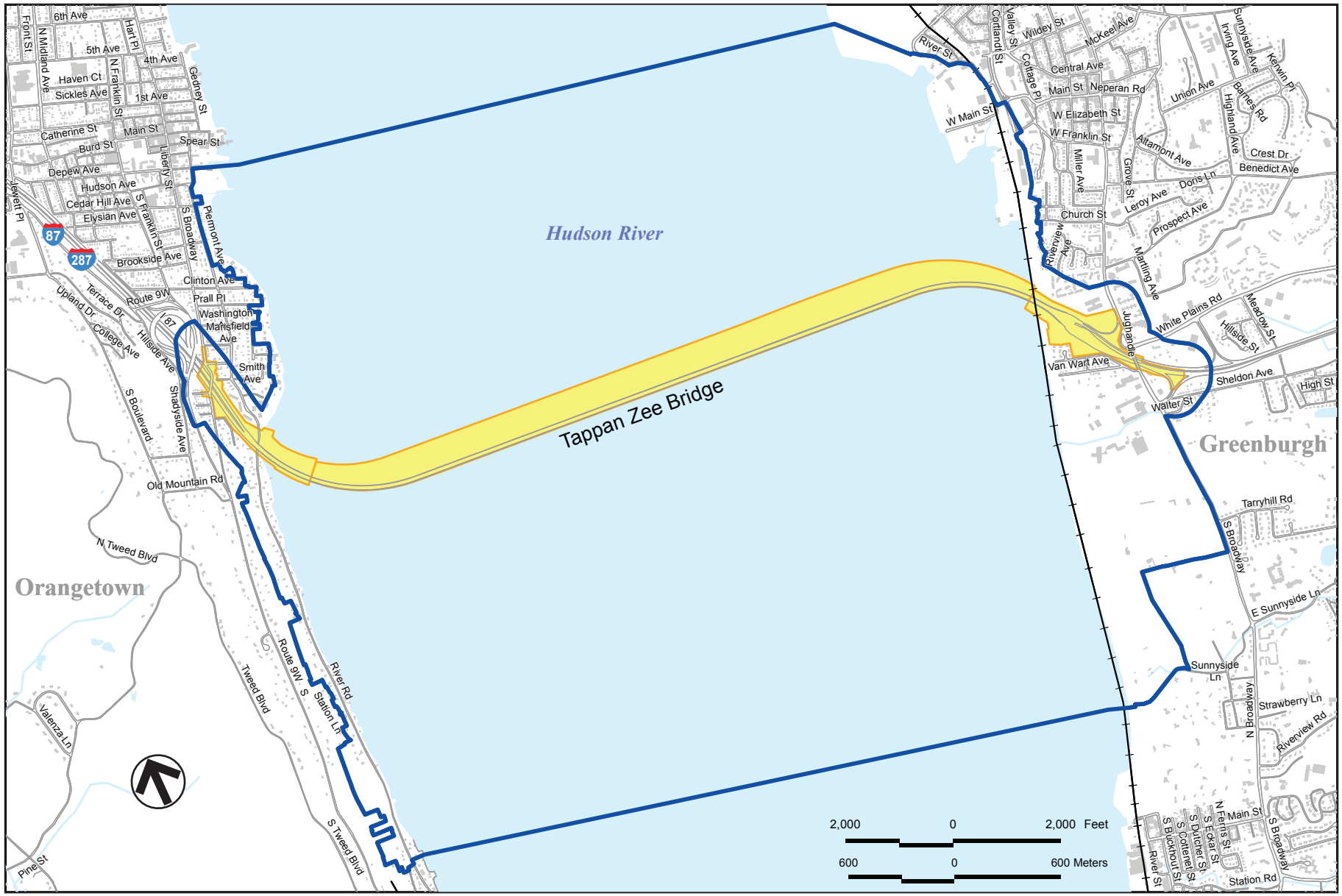
The proposed expanded APE for Indirect Effects associated with the replacement of the Tappan Zee Bridge incorporates areas from which the existing Tappan Zee Bridge and Hudson River are clearly or partially visible, and where the replacement bridge, proposed north of the existing bridge, has the potential to cause indirect alterations in the character or setting of historic properties in these areas. It is anticipated that the replacement bridge would be constructed slightly north of the existing bridge, and would tie into the existing Thruway alignment in Rockland and Westchester Counties. The APE also provides sufficient coverage to the north, south, east, and west to account for areas from which the replacement structure may be visible.

V Project Design Changes and the APE

Any changes in project design or scope that may occur as the Project moves forward may require that the APEs be updated and/or revised accordingly. For example, as construction

staging areas (in addition to those already anticipated adjacent to the landings of the Tappan Zee Bridge on the east and west shores of the Hudson River) are identified in the future, the APEs would be modified as appropriate in consultation with NYSHPO to incorporate these locations.

10.14.11



Direct Effect Area of Potential Effect (APE)

Indirect Effect Area of Potential Effect (APE)

Figure 1

TAPPAN ZEE HUDSON RIVER CROSSING

Direct and Indirect Effects APEs

U.S. Department of Transportation
Federal Highway Administration

New York Division

Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207
518-431-4127
Fax: 518-431-4121
New York.FHWA@dot.gov

October 21, 2011

In Reply Refer To:
HDO-NY

Chief Randy Hart
Saint Regis Mohawk Tribe
412 State Route 37
Hogansburg, NY 13655

Re: Tappan Zee Hudson River Crossing Project
Section 106 Consultation Process

Dear Chief Hart:

As you may be aware, the Federal Highway Administration (FHWA), in coordination with the New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA) acting as co-sponsoring agencies, are advancing the Tappan Zee Hudson River Crossing Project. The purpose of the Project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The Project is intended to address the need to correct substandard structural, operational, mobility, safety, and security features of the existing Tappan Zee Hudson River crossing.

As the lead agency, the FHWA published a Notice of Intent to prepare an Environmental Impact Statement (EIS) in the Federal Register on October 12, 2011.[1] The EIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, and will also comply with requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and other applicable federal laws, rules, and regulations.

For additional information on the Project and the environmental review process, please see the Notice of Intent at http://www.gpo.gov/fdsys/pkg/FR-2011-10-12/pdf/2011-26280.pdf and the Project Web site at http://www.tzbsite.com.

In general, the Section 106 process (36 CFR Part 800) seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the Federal agency and other parties with an interest in the effect of the project on historic

[1] On October 12, 2011, the FHWA and Federal Transit Administration (FTA) issued a rescinded notice to advise the public that FHWA and FTA will not be preparing an EIS for the proposed Tappan Zee Bridge / I-287 Corridor project for highway, bridge, and transit improvements along the 30-miles Interstate 287 corridor.

properties. Through consultation, the Federal agency identifies historic properties potentially affected by the project, assesses the project's effects, and seeks ways to avoid, minimize or mitigate any adverse effects on historic properties. The process requires consultation with the State Historic Preservation Office (SHPO) and federally-recognized Native American tribal nations with an interest in the project location. The Federal agency may also invite and grant consulting party status to individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties."

For additional information, please see "Protecting Historic Properties: A Citizen's Guide to Section 106 Review", Advisory Council on Historic Preservation:
http://www.achp.gov/docs/CitizenGuide.pdf
Saint Regis Mohawk Tribe for Section 106 consultation, FHWA is initiating consultation for the Tappan Zee Hudson River Crossing Project. Through consultation, we hope to incorporate into the Section 106 process the concerns of the Saint Regis Mohawk Tribe for locations of religious or cultural significance.

If you agree to participate, a separate package will be provided that identifies areas of potential effect (APEs) for the project and materials pertinent to the analysis of existing conditions. Through the course of the project, there will be meetings to discuss the potential effects of the Tappan Zee Bridge Hudson River Crossing Project and to identify and discuss appropriate measures to avoid, minimize, or mitigate any adverse effects on historic and cultural resources. The following provides an anticipated timeline for these activities.

Preliminary Section 106 Review Schedule

Activity	**Date**
Publish Notice of Intent	October 12, 2011
Section 106 Initiation Letter	October 21, 2011
Circulate Section 106 Initiation Package—APEs and Existing Conditions	Week of October 24, 2011
Agency and Public Scoping Meetings	Week of October 24, 2011
Section 106 Consulting Parties Meeting #1—Discussion of Effects	Week of November 14, 2011
Publish Draft Environmental Impact Statement and Draft Section 106 Memorandum of Agreement	January 2012
Public Hearing on Draft Environmental Impact Statement	February 2012
Section 106 Consulting Parties Meeting #2—Discussion of Mitigation and Draft Section 106 Memorandum of Agreement	February 2012
Publish Final Environmental Impact Statement and Executed Section 106 Memorandum of Agreement	July 2012
Record of Decision	August 2012

To confirm your interest in participating in Section 106 consultation for the Tappan Zee Hudson River Crossing Project, please respond by email to patricia.millington@dot.gov or by mail to:

Patricia Millington
Environmental Protection Specialist
Federal Highway Administration
New York Division
Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207

Please return your acceptance by October 28, 2011.

If you have any questions or would like to request any further information, please contact the Project Team at **877-892-3685**. Thank you for your interest in the Tappan Zee Hudson River Crossing Project.

Sincerely,

John Burns, P.E.
Major Projects Engineer

cc: Ruth Pierpont, New York State Office of Parks, Recreation, and Historic Preservation
Michael P. Anderson, P.E., New York State Department of Transportation
Elizabeth Novak, New York State Thruway Authority
Daniel P. Hitt, New York State Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

New York Division

Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207
518-431-4127
Fax: 518-431-4121
New York.FHWA@dot.gov

October 21, 2011

In Reply Refer To:
HDO-NY

Ms. Tamara Francis
Cultural Resource Preservation Director
Delaware Nation
31064 State Highway 281
Anadarko, OK 73005

Re: Tappan Zee Hudson River Crossing Project
Section 106 Consultation Process

Dear Ms. Francis:

As you may be aware, the Federal Highway Administration (FHWA), in coordination with the New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA) acting as co-sponsoring agencies, are advancing the Tappan Zee Hudson River Crossing Project. The purpose of the Project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The Project is intended to address the need to correct substandard structural, operational, mobility, safety, and security features of the existing Tappan Zee Hudson River crossing.

As the lead agency, the FHWA published a Notice of Intent to prepare an Environmental Impact Statement (EIS) in the Federal Register on October 12, 2011.[1] The EIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, and will also comply with requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and other applicable federal laws, rules, and regulations.

For additional information on the Project and the environmental review process, please see the Notice of Intent at http://www.gpo.gov/fdsys/pkg/FR-2011-10-12/pdf/2011-26280.pdf and the Project Web site at http://www.tzbsite.com.

In general, the Section 106 process (36 CFR Part 800) seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the

[1] On October 12, 2011, the FHWA and Federal Transit Administration (FTA) issued a rescinded notice to advise the public that FHWA and FTA will not be preparing an EIS for the proposed Tappan Zee Bridge / I-287 Corridor project for highway, bridge, and transit improvements along the 30-miles Interstate 287 corridor.

Federal agency and other parties with an interest in the effect of the project on historic properties. Through consultation, the Federal agency identifies historic properties potentially affected by the project, assesses the project's effects, and seeks ways to avoid, minimize or mitigate any adverse effects on historic properties. The process requires consultation with the State Historic Preservation Office (SHPO) and federally-recognized Native American tribal nations with an interest in the project location. The Federal agency may also invite and grant consulting party status to individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties."

For additional information, please see "Protecting Historic Properties: A Citizen's Guide to Section 106 Review", Advisory Council on Historic Preservation:
http://www.achp.gov/docs/CitizenGuide.pdf
Delaware Nation for Section 106 consultation, FHWA is initiating consultation for the Tappan Zee Hudson River Crossing Project. Through consultation, we hope to incorporate into the Section 106 process the concerns of the Delaware Nation for locations of religious or cultural significance.

If you agree to participate, a separate package will be provided that identifies areas of potential effect (APEs) for the project and materials pertinent to the analysis of existing conditions. Through the course of the project, there will be meetings to discuss the potential effects of the Tappan Zee Bridge Hudson River Crossing Project and to identify and discuss appropriate measures to avoid, minimize, or mitigate any adverse effects on historic and cultural resources. The following provides an anticipated timeline for these activities.

Preliminary Section 106 Review Schedule

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Publish Final Environmental Impact Statement and Executed Section 106 Memorandum of Agreement	July 2012
Record of Decision	August 2012

To confirm your interest in participating in Section 106 consultation for the Tappan Zee Hudson River Crossing Project, please respond by email to patricia.millington@dot.gov or by mail to:

Patricia Millington
Environmental Protection Specialist
Federal Highway Administration
New York Division
Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207

Please return your acceptance by October 28, 2011.

If you have any questions or would like to request any further information, please contact the Project Team at **877-892-3685**. Thank you for your interest in the Tappan Zee Hudson River Crossing Project.

Sincerely,

John Burns, P.E.
Major Projects Engineer

cc: Ruth Pierpont, New York State Office of Parks, Recreation, and Historic Preservation
Michael P. Anderson, P.E., New York State Department of Transportation
Elizabeth Novak, New York State Thruway Authority
Daniel P. Hitt, New York State Department of Transportation

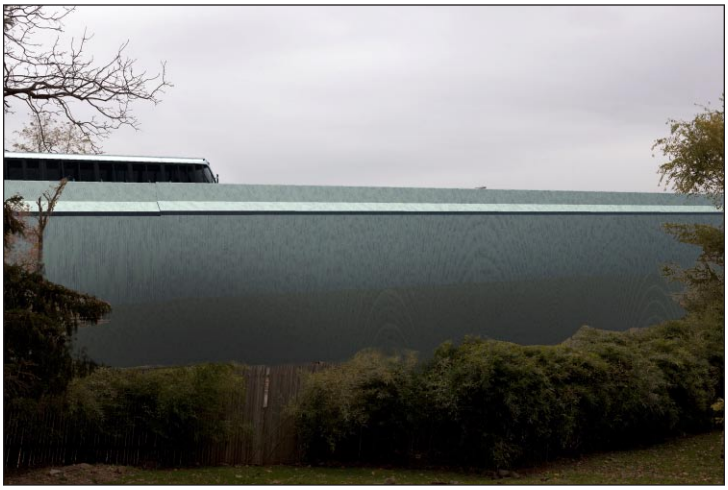
TAPPAN ZEE HUDSON RIVER CROSSING PROJECT
SECTION 106 EFFECT FINDING

ATTACHMENT G:

VISUAL SIMULATIONS

1.17.12

Existing Conditions



Short Span Option

Long Span Option

Figure G-1

Visual Simulation
Bight Lane at River Road, Grand View-on-Hudson
Rockland County

Existing Conditions

Short Span Option

Long Span Option

Figure G-2

Visual Simulation
24 River Road, Grand View-on-Hudson
Rockland County

1.17.12

Existing Conditions

Short Span Option

Long Span Option

Figure G-3

Visual Simulation
31 River Road, Grand View-on-Hudson
Rockland County

1.13.12

Existing Conditions

Short Span Arch Design Option

Short Span Cable-Stayed Design Option

Long Span Arch Design Option

Long Span Cable-Stayed Design Option

Figure G-4

Visual Simulation
74 River Road, Grand View-on-Hudson
Rockland County

Existing Conditions

Short Span Arch Design Option

Short Span Cable-Stayed Design Option

Long Span Arch Design Option

Long Span Cable-Stayed Design Option

Figure G-5

Visual Simulation
Tarrytown Lighthouse, Sleepy Hollow
Westchester County

1.13.12

Existing Conditions

Short Span Arch Design Option

Short Span Cable-Stayed Design Option

Long Span Arch Design Option

Long Span Cable-Stayed Design Option

Figure G-6

Visual Simulation
Lyndhurst, Tarrytown
Westchester County

U.S. Department of Transportation
Federal Highway Administration

New York Division

Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207
518-431-4127
Fax: 518-431-4121
New York.FHWA@dot.gov

October 21, 2011

In Reply Refer To:
HDO-NY

Dr. Brice Obermeyer
Delaware Tribe Historic Preservation Office
1420 C of E Drive, Suite 190
Emporia, KS 66801

Re: Tappan Zee Hudson River Crossing Project
Section 106 Consultation Process

Dear Dr. Obermeyer:

As you may be aware, the Federal Highway Administration (FHWA), in coordination with the New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA) acting as co-sponsoring agencies, are advancing the Tappan Zee Hudson River Crossing Project. The purpose of the Project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The Project is intended to address the need to correct substandard structural, operational, mobility, safety, and security features of the existing Tappan Zee Hudson River crossing.

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For additional information on the Project and the environmental review process, please see the Notice of Intent at http://www.gpo.gov/fdsys/pkg/FR-2011-10-12/pdf/2011-26280.pdf and the Project Web site at http://www.tzbsite.com.

In general, the Section 106 process (36 CFR Part 800) seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the Federal agency and other parties with an interest in the effect of the project on historic

[1] On October 12, 2011, the FHWA and Federal Transit Administration (FTA) issued a rescinded notice to advise the public that FHWA and FTA will not be preparing an EIS for the proposed Tappan Zee Bridge / I-287 Corridor project for highway, bridge, and transit improvements along the 30-miles Interstate 287 corridor.

properties. Through consultation, the Federal agency identifies historic properties potentially affected by the project, assesses the project's effects, and seeks ways to avoid, minimize or mitigate any adverse effects on historic properties. The process requires consultation with the State Historic Preservation Office (SHPO) and federally-recognized Native American tribal nations with an interest in the project location. The Federal agency may also invite and grant consulting party status to individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties."

For additional information, please see "Protecting Historic Properties: A Citizen's Guide to Section 106 Review", Advisory Council on Historic Preservation: http://www.achp.gov/docs/CitizenGuide.pdf Delaware Tribe Preservation consultation, FHWA is initiating consultation for the Tappan Zee Hudson River Crossing Project. Through consultation, we hope to incorporate into the Section 106 process the concerns of the Delaware Tribe for locations of religious or cultural significance.

If you agree to participate, a separate package will be provided that identifies areas of potential effect (APEs) for the project and materials pertinent to the analysis of existing conditions. Through the course of the project, there will be meetings to discuss the potential effects of the Tappan Zee Bridge Hudson River Crossing Project and to identify and discuss appropriate measures to avoid, minimize, or mitigate any adverse effects on historic and cultural resources. The following provides an anticipated timeline for these activities.

Preliminary Section 106 Review Schedule

Activity	Date
Publish Notice of Intent	October 12, 2011
Section 106 Initiation Letter	October 21, 2011
Circulate Section 106 Initiation Package—APEs and Existing Conditions	Week of October 24, 2011
Agency and Public Scoping Meetings	Week of October 24, 2011
Section 106 Consulting Parties Meeting #1—Discussion of Effects	Week of November 14, 2011
Publish Draft Environmental Impact Statement and Draft Section 106 Memorandum of Agreement	January 2012
Public Hearing on Draft Environmental Impact Statement	February 2012
Section 106 Consulting Parties Meeting #2—Discussion of Mitigation and Draft Section 106 Memorandum of Agreement	February 2012
Publish Final Environmental Impact Statement and Executed Section 106 Memorandum of Agreement	July 2012
Record of Decision	August 2012

To confirm your interest in participating in Section 106 consultation for the Tappan Zee Hudson River Crossing Project, please respond by email to patricia.millington@dot.gov or by mail to:

Patricia Millington
Environmental Protection Specialist
Federal Highway Administration
New York Division
Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207

Please return your acceptance by October 28, 2011.

If you have any questions or would like to request any further information, please contact the Project Team at **877-892-3685**. Thank you for your interest in the Tappan Zee Hudson River Crossing Project.

Sincerely,

John Burns, P.E.
Major Projects Engineer

cc: Ruth Pierpont, New York State Office of Parks, Recreation, and Historic Preservation
Michael P. Anderson, P.E., New York State Department of Transportation
Elizabeth Novak, New York State Thruway Authority
Daniel P. Hitt, New York State Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

New York Division

Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207
518-431-4127
Fax: 518-431-4121
New York.FHWA@dot.gov

October 21, 2011

In Reply Refer To:
HDO-NY

Mr. Arnold Printup, Jr.
Saint Regis Mohawk Tribe
Tribal Historic Preservation Officer
412 State Route 37
Hogansburg, NY 13655

Re: Tappan Zee Hudson River Crossing Project
Section 106 Consultation Process

Dear Mr. Printup, Jr.:

As you may be aware, the Federal Highway Administration (FHWA), in coordination with the New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA) acting as co-sponsoring agencies, are advancing the Tappan Zee Hudson River Crossing Project. The purpose of the Project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The Project is intended to address the need to correct substandard structural, operational, mobility, safety, and security features of the existing Tappan Zee Hudson River crossing.

As the lead agency, the FHWA published a Notice of Intent to prepare an Environmental Impact Statement (EIS) in the Federal Register on October 12, 2011.[1] The EIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, and will also comply with requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and other applicable federal laws, rules, and regulations.

For additional information on the Project and the environmental review process, please see the Notice of Intent at http://www.gpo.gov/fdsys/pkg/FR-2011-10-12/pdf/2011-26280.pdf and the Project Web site at http://www.tzbsite.com.

In general, the Section 106 process (36 CFR Part 800) seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the

[1] On October 12, 2011, the FHWA and Federal Transit Administration (FTA) issued a rescinded notice to advise the public that FHWA and FTA will not be preparing an EIS for the proposed Tappan Zee Bridge / I-287 Corridor project for highway, bridge, and transit improvements along the 30-miles Interstate 287 corridor.

Federal agency and other parties with an interest in the effect of the project on historic properties. Through consultation, the Federal agency identifies historic properties potentially affected by the project, assesses the project's effects, and seeks ways to avoid, minimize or mitigate any adverse effects on historic properties. The process requires consultation with the State Historic Preservation Office (SHPO) and federally-recognized Native American tribal nations with an interest in the project location. The Federal agency may also invite and grant consulting party status to individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties."

For additional information, please see "Protecting Historic Properties: A Citizen's Guide to Section 106 Review", Advisory Council on Historic Preservation: http://www.achp.gov/docs/CitizenGuide.pdf Saint Regis Mohawk Tribe for Section 106 consultation, FHWA is initiating consultation for the Tappan Zee Hudson River Crossing Project. Through consultation, we hope to incorporate into the Section 106 process the concerns of the Saint Regis Mohawk Tribe for locations of religious or cultural significance.

If you agree to participate, a separate package will be provided that identifies areas of potential effect (APEs) for the project and materials pertinent to the analysis of existing conditions. Through the course of the project, there will be meetings to discuss the potential effects of the Tappan Zee Bridge Hudson River Crossing Project and to identify and discuss appropriate measures to avoid, minimize, or mitigate any adverse effects on historic and cultural resources. The following provides an anticipated timeline for these activities.

Preliminary Section 106 Review Schedule

Activity	Date
Publish Notice of Intent	October 12, 2011
Section 106 Initiation Letter	October 21, 2011
Circulate Section 106 Initiation Package—APEs and Existing Conditions	Week of October 24, 2011
Agency and Public Scoping Meetings	Week of October 24, 2011
Section 106 Consulting Parties Meeting #1—Discussion of Effects	Week of November 14, 2011
Publish Draft Environmental Impact Statement and Draft Section 106 Memorandum of Agreement	January 2012
Public Hearing on Draft Environmental Impact Statement	February 2012
Section 106 Consulting Parties Meeting #2—Discussion of Mitigation and Draft Section 106 Memorandum of Agreement	February 2012
Publish Final Environmental Impact Statement and Executed Section 106 Memorandum of Agreement	July 2012
Record of Decision	August 2012

To confirm your interest in participating in Section 106 consultation for the Tappan Zee Hudson River Crossing Project, please respond by email to patricia.millington@dot.gov or by mail to:

Patricia Millington
Environmental Protection Specialist
Federal Highway Administration
New York Division
Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207

Please return your acceptance by October 28, 2011.

If you have any questions or would like to request any further information, please contact the Project Team at **877-892-3685**. Thank you for your interest in the Tappan Zee Hudson River Crossing Project.

Sincerely,

John Burns, P.E.
Major Projects Engineer

cc: Ruth Pierpont, New York State Office of Parks, Recreation, and Historic Preservation
Michael P. Anderson, P.E., New York State Department of Transportation
Elizabeth Novak, New York State Thruway Authority
Daniel P. Hitt, New York State Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

New York Division

Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207
518-431-4127
Fax: 518-431-4121
New York.FHWA@dot.gov

October 21, 2011

In Reply Refer To:
HDO-NY

Mr. Jason Ross
Section 106 Assistant
Delaware Nation
31064 State Highway 281
Anadarko, OK 73005

Re: Tappan Zee Hudson River Crossing Project
Section 106 Consultation Process

Dear Mr. Ross:

As you may be aware, the Federal Highway Administration (FHWA), in coordination with the New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA) acting as co-sponsoring agencies, are advancing the Tappan Zee Hudson River Crossing Project. The purpose of the Project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The Project is intended to address the need to correct substandard structural, operational, mobility, safety, and security features of the existing Tappan Zee Hudson River crossing.

As the lead agency, the FHWA published a Notice of Intent to prepare an Environmental Impact Statement (EIS) in the Federal Register on October 12, 2011.[1] The EIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, and will also comply with requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and other applicable federal laws, rules, and regulations.

For additional information on the Project and the environmental review process, please see the Notice of Intent at http://www.gpo.gov/fdsys/pkg/FR-2011-10-12/pdf/2011-26280.pdf and the Project Web site at http://www.tzbsite.com.

[1] On October 12, 2011, the FHWA and Federal Transit Administration (FTA) issued a rescinded notice to advise the public that FHWA and FTA will not be preparing an EIS for the proposed Tappan Zee Bridge / I-287 Corridor project for highway, bridge, and transit improvements along the 30-miles Interstate 287 corridor.

In general, the Section 106 process (36 CFR Part 800) seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the Federal agency and other parties with an interest in the effect of the project on historic properties. Through consultation, the Federal agency identifies historic properties potentially affected by the project, assesses the project's effects, and seeks ways to avoid, minimize or mitigate any adverse effects on historic properties. The process requires consultation with the State Historic Preservation Office (SHPO) and federally-recognized Native American tribal nations with an interest in the project location. The Federal agency may also invite and grant consulting party status to individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties."

For additional information, please see "Protecting Historic Properties: A Citizen's Guide to Section 106 Review", Advisory Council on Historic Preservation:
http://www.achp.gov/docs/CitizenGuide.pdf
Delaware Nation for Section 106 consultation, FHWA is initiating consultation for the Tappan Zee Hudson River Crossing Project. Through consultation, we hope to incorporate into the Section 106 process the concerns of the Delaware Nation for locations of religious or cultural significance.

If you agree to participate, a separate package will be provided that identifies areas of potential effect (APEs) for the project and materials pertinent to the analysis of existing conditions. Through the course of the project, there will be meetings to discuss the potential effects of the Tappan Zee Bridge Hudson River Crossing Project and to identify and discuss appropriate measures to avoid, minimize, or mitigate any adverse effects on historic and cultural resources. The following provides an anticipated timeline for these activities.

Preliminary Section 106 Review Schedule

Activity	**Date**
Publish Notice of Intent	October 12, 2011
Section 106 Initiation Letter	October 21, 2011
Circulate Section 106 Initiation Package—APEs and Existing Conditions	Week of October 24, 2011
Agency and Public Scoping Meetings	Week of October 24, 2011
Section 106 Consulting Parties Meeting #1—Discussion of Effects	Week of November 14, 2011
Publish Draft Environmental Impact Statement and Draft Section 106 Memorandum of Agreement	January 2012
Public Hearing on Draft Environmental Impact Statement	February 2012
Section 106 Consulting Parties Meeting #2—Discussion of Mitigation and Draft Section 106 Memorandum of Agreement	February 2012
Publish Final Environmental Impact Statement and Executed Section 106 Memorandum of Agreement	July 2012
Record of Decision	August 2012

To confirm your interest in participating in Section 106 consultation for the Tappan Zee Hudson River Crossing Project, please respond by email to patricia.millington@dot.gov or by mail to:

Patricia Millington
Environmental Protection Specialist
Federal Highway Administration
New York Division
Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207

Please return your acceptance by October 28, 2011.

If you have any questions or would like to request any further information, please contact the Project Team at **877-892-3685**. Thank you for your interest in the Tappan Zee Hudson River Crossing Project.

Sincerely,

John Burns, P.E.
Major Projects Engineer

cc: Ruth Pierpont, New York State Office of Parks, Recreation, and Historic Preservation
Michael P. Anderson, P.E., New York State Department of Transportation
Elizabeth Novak, New York State Thruway Authority
Daniel P. Hitt, New York State Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

New York Division

Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207
518-431-4127
Fax: 518-431-4121
New York.FHWA@dot.gov

October 21, 2011

In Reply Refer To:
HDO-NY

Ms. Marguerite Smith
Office of Tribal Trustees/Legal
Shinnecock Indian Nation
100 Church Street
Shinnecock Community Center
Southampton NY 11968

Re: Tappan Zee Hudson River Crossing Project
Section 106 Consultation Process

Dear Ms. Smith:

As you may be aware, the Federal Highway Administration (FHWA), in coordination with the New York State Department of Transportation (NYSDOT) and New York State Thruway Authority (NYSTA) acting as co-sponsoring agencies, are advancing the Tappan Zee Hudson River Crossing Project. The purpose of the Project is to maintain a vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties, New York. The Project is intended to address the need to correct substandard structural, operational, mobility, safety, and security features of the existing Tappan Zee Hudson River crossing.

As the lead agency, the FHWA published a Notice of Intent to prepare an Environmental Impact Statement (EIS) in the Federal Register on October 12, 2011.[1] The EIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, and will also comply with requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and other applicable federal laws, rules, and regulations.

For additional information on the Project and the environmental review process, please see the Notice of Intent at http://www.gpo.gov/fdsys/pkg/FR-2011-10-12/pdf/2011-26280.pdf and the Project Web site at http://www.tzbsite.com.

[1] On October 12, 2011, the FHWA and Federal Transit Administration (FTA) issued a rescinded notice to advise the public that FHWA and FTA will not be preparing an EIS for the proposed Tappan Zee Bridge / I-287 Corridor project for highway, bridge, and transit improvements along the 30-miles Interstate 287 corridor.

In general, the Section 106 process (36 CFR Part 800) seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the Federal agency and other parties with an interest in the effect of the project on historic properties. Through consultation, the Federal agency identifies historic properties potentially affected by the project, assesses the project's effects, and seeks ways to avoid, minimize or mitigate any adverse effects on historic properties. The process requires consultation with the State Historic Preservation Office (SHPO) and federally-recognized Native American tribal nations with an interest in the project location. The Federal agency may also invite and grant consulting party status to individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties."

For additional information, please see "Protecting Historic Properties: A Citizen's Guide to Section 106 Review", Advisory Council on Historic Preservation: http://www.achp.gov/docs/CitizenGuide.pdf Shinnecock Indian Nation consultation, FHWA is initiating consultation for the Tappan Zee Hudson River Crossing Project. Through consultation, we hope to incorporate into the Section 106 process the concerns of the Shinnecock Indian Nation for locations of religious or cultural significance.

If you agree to participate, a separate package will be provided that identifies areas of potential effect (APEs) for the project and materials pertinent to the analysis of existing conditions. Through the course of the project, there will be meetings to discuss the potential effects of the Tappan Zee Bridge Hudson River Crossing Project and to identify and discuss appropriate measures to avoid, minimize, or mitigate any adverse effects on historic and cultural resources. The following provides an anticipated timeline for these activities.

Preliminary Section 106 Review Schedule

Activity	**Date**
Publish Notice of Intent	October 12, 2011
Section 106 Initiation Letter	October 21, 2011
Circulate Section 106 Initiation Package—APEs and Existing Conditions	Week of October 24, 2011
Agency and Public Scoping Meetings	Week of October 24, 2011
Section 106 Consulting Parties Meeting #1—Discussion of Effects	Week of November 14, 2011
Publish Draft Environmental Impact Statement and Draft Section 106 Memorandum of Agreement	January 2012
Public Hearing on Draft Environmental Impact Statement	February 2012
Section 106 Consulting Parties Meeting #2—Discussion of Mitigation and Draft Section 106 Memorandum of Agreement	February 2012
Publish Final Environmental Impact Statement and Executed Section 106 Memorandum of Agreement	July 2012
Record of Decision	August 2012

To confirm your interest in participating in Section 106 consultation for the Tappan Zee Hudson River Crossing Project, please respond by email to patricia.millington@dot.gov or by mail to:

Patricia Millington
Environmental Protection Specialist
Federal Highway Administration
New York Division
Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207

Please return your acceptance by October 28, 2011.

If you have any questions or would like to request any further information, please contact the Project Team at **877-892-3685**. Thank you for your interest in the Tappan Zee Hudson River Crossing Project.

Sincerely,

John Burns, P.E.
Major Projects Engineer

cc: Ruth Pierpont, New York State Office of Parks, Recreation, and Historic Preservation
Michael P. Anderson, P.E., New York State Department of Transportation
Elizabeth Novak, New York State Thruway Authority
Daniel P. Hitt, New York State Department of Transportation

Andrew M. Cuomo
Governor

Rose Harvey
Commissioner

New York State Office of Parks, Recreation and Historic Preservation

Historic Preservation Field Services Bureau
Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

October 27, 2011

Daniel P. Hitt
NYS Department of Transportation
50 Wolf Road
Albany, NY 12232
(via e-mail only)

Re: FHWA, NYSDOT
Tappan Zee Hudson River Crossing Project
Rockland and Westchester Counties
11PR06692

Dear Mr. Hitt:

Thank you for requesting the comments of the State Historic Preservation Office (SHPO). We have reviewed the project in accordance with Section 106 of the National Historic Preservation Act of 1966. These comments are those of the SHPO and relate only to Historic/Cultural resources. They do not include potential environmental impacts to New York State Parkland that may be involved in or near your project. Such impacts must be considered as part of the environmental review of the project pursuant to the National Environmental Policy Act and/or the State Environmental Quality Review Act (New York Environmental Conservation Law Article 8).

Based upon this review, the SHPO concurs with the establishment of an Area of Potential Effect for this undertaking as defined in the submitted proposal entitled: Tappan Zee Hudson River Crossing Project Proposed Area of Potential Effect (APE) October 14, 2011.

If I can be of any further assistance do not hesitate to contact me or my staff at (518) 237-8643.

Sincerely,

Ruth L. Pierpont
Deputy Commissioner for
Historic Preservation

cc: *(via e-mail only)*
John Burns, FHWA
Michael Anderson, NYSDOT
Elizabeth Novak, NYSTA
Robert Conway, AKRF

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
ALBANY, N.Y. 12232
www.dot.ny.gov

JOAN MCDONALD
COMMISSIONER

ANDREW M. CUOMO
GOVERNOR

November 8, 2011

Ruth Pierpont
Director and Acting Deputy Commissioner
Division for Historic Preservation
NYS Office of Parks, Recreation & Historic Preservation
P.O. Box 189 - Peebles Island
Waterford, New York 12188

Attn.: Mark Peckham, Director, State Historic Preservation Office
John Bonafide, Historic Preservation Services Coordinator

Re: Tappan Zee Hudson River Crossing Project
Section 106 - Architectural Properties

Dear Ruth:

On behalf of the Federal Highway Administration (FHWA), and in coordination with the New York State Thruway Authority (NYSTA), the New York State Department of Transportation (NYSDOT) submits the enclosed documentation package for the Tappan Zee Hudson River Crossing Project, for review by the State Historic Preservation Office (SHPO) in accordance with Section 106 of the National Historic Preservation Act (36 CFR Part 800).

The package includes the following materials, prepared and assembled by the Project Team to document the evaluation of architectural properties within the Area of Potential Effects (APE).

- Historic Resource Inventory Forms for properties recommended eligible for the National Register of Historic Places (see attached list of properties)
- Maps showing locations of historic resources within the APE (see attached list of maps)
- Cultural Resources Methodology Report

Documentation relating to the identification of archaeological resources within the APE will be submitted as a separate package.

Please forward any questions or comments to my attention at dhitt@dot.state.ny.us . We respectfully request the concurrence of the SHPO with identified architectural properties within the APE, and would appreciate your response by November 15, 2011.

Sincerely,

DANIEL P. HITT, RLA
(Acting) Co-Director, Office of Environment

DPH/MCS
Attachments

cc.: John Burns, FHWA
Michael Anderson, NYSDOT
Elizabeth Novak, NYSTA
Robert Conway, AKRF

List of Maps

List of Historic Resource Inventory Forms

Rockland County

Westchester County

Andrew M. Cuomo
Governor

Rose Harvey
Commissioner

New York State Office of Parks, Recreation and Historic Preservation

Historic Preservation Field Services Bureau • Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

November 16, 2011

Daniel P. Hitt
Acting Co-Director
Office of Environment
NYS Department of Transportation
Wolf Rd.
Albany, NY 12232

Re: 11PR06692
FHWA
Tappan Zee Bridge
Westchester and Rockland counties

Dear Mr. Hitt:

Thank you for providing the State Historic Preservation Office with the completed historic buildings and structures survey for the Area of Potential Effect for the Tappan Zee Bridge replacement project. This survey supplements data on buildings and structures in the APE that have been previously listed and/or determined eligible for listing including, Sunnyside (NHL), Lyndhurst (NHL), the Old Croton Aqueduct (NHL), Wayside Chapel (NR), the Tarrytown Lighthouse (NR), the Tarrytown Railroad Station (eligible), New County Park (eligible) and the existing Tappan Zee Bridge (eligible).

The State Historic Preservation Office reviewed this survey under Section 106 of the National Historic Preservation Act and concurs with the eligibility recommendations for buildings and structures in the Westchester and Rockland portions of the APE. If additional areas will impacted by the project as a result of design changes or the need for construction staging areas outside of the current APE, further survey and evaluation will be required.

Sincerely,

Mark L. Peckham
Director
Historic Preservation
Field Services Bureau

Cc: John Burns, FHWA
Michael Anderson, NYSDOT
Elizabeth Novak, NYSTA
Robert Conway, AKRF

New York State Office of Parks, Recreation and Historic Preservation

Andrew M. Cuomo
Governor

Rose Harvey
Commissioner

Historic Preservation Field Services Bureau
Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

November 18, 2011

Daniel P. Hitt
NYS Department of Transportation
50 Wolf Road
POD-4-1
Albany, NY 12232

Re: FHWA, DOT, NYSTA
Tappan Zee Bridge Replacement/I-287 Corridor
I-287 Corridor over Hudson River
Rockland and Westchester Counties
11PR06692

Dear Mr. Hitt:

Thank you for requesting the comments of the State Historic Preservation Office (SHPO) regarding the alternatives analysis for this undertaking. We continue to review the project in accordance with Section 106 of the National Historic Preservation Act of 1966.

Based upon this review, our office concurs with your agency's finding that the rehabilitation of the National Register eligible Tappan Zee bridge is not a viable alternative.

If I can be of any further assistance do not hesitate to contact me at (518) 237-8643, ext. 3263.

Sincerely,

John A. Bonafide
Historic Preservation Services
Coordinator

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
ALBANY, N.Y. 12232
www.dot.ny.gov

JOAN MCDONALD
COMMISSIONER

ANDREW M. CUOMO
GOVERNOR

November 17, 2011

John Burns
Major Projects Engineer, Tappan Zee Bridge Replacement Project
Federal Highway Administration, New York Division
Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, New York 12207

Re: TAPPAN ZEE HUDSON RIVER CROSSING PROJECT (11PR06692)
SECTION 106 REVIEW / ARCHITECTURAL PROPERTIES

Dear John:

In accordance with the requirements of Section 106 of the National Historic Preservation Act and its implementing regulation (36 CFR Part 800), the New York State Department of Transportation (NYSDOT) submitted documentation to the New York State Historic Preservation Office (SHPO) on November 8, 2011, for the identification of architectural properties within the area of potential effects (APE) for the Tappan Zee Hudson River Crossing Project. The same documentation was sent to the Federal Highway Administration (FHWA) and the New York State Thruway Authority (NYSTA) on that date.

The following documents were included in the November 8, 2011 submission, based on a survey of historic buildings and structures in the APE that have not been previously evaluated for eligibility for the National Register of Historic Places:

- Historic Resource Inventory Forms for properties recommended National Register eligible;
- Maps showing locations of historic resources within the APE; and
- Cultural Resources Methodology Report.

By letter dated November 16, 2011, the SHPO concurred with the eligibility recommendations for buildings and structures within the APE in Rockland and Westchester Counties. As stated in this letter, the above-referenced survey supplements existing data on buildings and structures in the APE that have been previously listed and/or determined eligible for National Register listing. Included is the existing Tappan Zee Bridge (BIN 5516340), determined eligible for the National Register in 2003.

In accordance with 36 CFR 800.4(c)(2), we respectfully request determinations of eligibility and concurrence of the FHWA with the attached list of identified architectural properties for the Tappan Zee Hudson River Crossing Project .

Please forward any questions or comments to my attention at dhitt@dot.state.ny.us . We respectfully request the concurrence of the FHWA by November 25, 2011.

Sincerely,

DANIEL P. HITT, RLA
(Acting) Co-Director, Office of Environment

DPH/MCS

Encl: NYSDOT and SHPO letters – 11/8/11 and 11/16/11
Tappan Zee Bridge Resource Evaluation (NY SHPO 2003)

cc.: Ruth Pierpont, OPRHP / SHPO
Mark Peckham, OPRHP / SHPO
John Bonafide, OPRHP / SHPO
Michael Anderson, NYSDOT
Elizabeth Novak, NYSTA
Robert Conway, AKRF

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT
LIST OF HISTORIC ARCHITECTURAL PROPERTIES WITHIN THE APE

National Register eligible properties evaluated for this project

Rockland County

- 10 Ferris Lane
- 129 Piermont Avenue
- 135 Piermont Avenue
- 147 Piermont Avenue
- 2 Shadyside Avenue
- River Road Historic District
- South Nyack Historic District

Westchester County

- 100 White Plains Road
- 99 White Plains Road
- Glenwolde Park Historic District
- Hope United Presbyterian Church
- Irving Historic District
- South End Historic District
- Tappan Landing Historic District
- Tarrytown Sewage Treatment Plant
- Washington Irving Gardens

Previously listed and/or determined eligible for listing in the National Register of Historic Places

- Sunnyside – National Historic Landmark (NHL)
- Lyndhurst – NHL
- The Old Croton Aqueduct – NHL
- Wayside Chapel – National Register listed (NR)
- Tarrytown Lighthouse – NR
- Tarrytown Railroad Station – National Register eligible
- New County Park – National Register eligible
- Tappan Zee Bridge – National Register eligible

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NEW YORK STATE

New York State Office of Parks, Recreation and Historic Preservation

Historic Preservation Field Services Bureau • Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

Andrew M. Cuomo
Governor

Rose Harvey
Commissioner

November 16, 2011

Daniel P. Hitt
Acting Co-Director
Office of Environment
NYS Department of Transportation
Wolf Rd.
Albany, NY 12232

Re: 11PR06692
FHWA
Tappan Zee Bridge
Westchester and Rockland counties

Dear Mr. Hitt:

Thank you for providing the State Historic Preservation Office with the completed historic buildings and structures survey for the Area of Potential Effect for the Tappan Zee Bridge replacement project. This survey supplements data on buildings and structures in the APE that have been previously listed and/or determined eligible for listing including, Sunnyside (NHL), Lyndhurst (NHL), the Old Croton Aqueduct (NHL), Wayside Chapel (NR), the Tarrytown Lighthouse (NR), the Tarrytown Railroad Station (eligible), New County Park (eligible) and the existing Tappan Zee Bridge (eligible).

The State Historic Preservation Office reviewed this survey under Section 106 of the National Historic Preservation Act and concurs with the eligibility recommendations for buildings and structures in the Westchester and Rockland portions of the APE. If additional areas will impacted by the project as a result of design changes or the need for construction staging areas outside of the current APE, further survey and evaluation will be required.

Sincerely,

Mark L. Peckham
Director
Historic Preservation
Field Services Bureau

Cc: John Burns, FHWA
Michael Anderson, NYSDOT
Elizabeth Novak, NYSTA
Robert Conway, AKRF

RESOURCE EVALUATION

Date:	October 27, 2003	Staff:	Peter Shaver
Property:	Tappan Zee Bridge	MCD:	Tarrytown, Grand View
Address:	NYS Thruway	County:	Westchester, Rockland
Project Ref. No.:	**03PR00385**	USN:	08748.000028, 11950.000388

I. ☐ Property is individually listed on SR/NR :

Name of listing :

☐ Property is a contributing component of a SR/NR district:

Name of District:

II. ☑ Property meets eligibility criteria

☐ Property contributes to a district which appears to meet eligibility criteria.

Pre SRB: ☐ Post SRB: ☐ SRB Date

Criteria for inclusion in the National Register.

A ☑ **Associated** with events that have made a significant contribution to the broad patterns of our history;

B ☐ **Associated** with the lives of persons significant in our past;

C ☑ Embodies the distinctive characteristics of a type, period or method of construction; or represents the work of a master; or possess high artistic values; or represents a significant and distinguishable entity whose component may lack individual distinction;

D ☐ **Have** yielded, or may be likely to yield information important in prehistory or history.

STATEMENT OF SIGNIFICANCE:

Based on the information provided, it is the opinion of the State Historic Preservation Office that the Tappan Zee Bridge is significant in the areas of transportation and engineering as one of the state's most important bridges. Built between 1952 and 1955, the 3.2-mile long highway bridge has a unique caisson system supporting the piers and deck. It is the longest bridge in the state and one of the longest in the country, as well as having the world's ninth longest cantilever span, at 1,212 feet. The bridge is an essential component of the NYS Thruway system, with 135,000 vehicles crossing the bridge daily to and from the New York Metropolitan area. The bridge has received minor modifications since 1955, including the replacement of the concrete deck.

If you have any questions concerning this Determination of Eligibility, please call Peter Shaver at 518-237-8643, ext 3264

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
ALBANY, N.Y. 12232
www.dot.ny.gov

JOAN MCDONALD
COMMISSIONER

ANDREW M. CUOMO
GOVERNOR

November 8, 2011

Ruth Pierpont
Director and Acting Deputy Commissioner
Division for Historic Preservation
NYS Office of Parks, Recreation & Historic Preservation
P.O. Box 189 - Peebles Island
Waterford, New York 12188

Attn.: Mark Peckham, Director, State Historic Preservation Office
John Bonafide, Historic Preservation Services Coordinator

Re: Tappan Zee Hudson River Crossing Project
Section 106 - Architectural Properties

Dear Ruth:

On behalf of the Federal Highway Administration (FHWA), and in coordination with the New York State Thruway Authority (NYSTA), the New York State Department of Transportation (NYSDOT) submits the enclosed documentation package for the Tappan Zee Hudson River Crossing Project, for review by the State Historic Preservation Office (SHPO) in accordance with Section 106 of the National Historic Preservation Act (36 CFR Part 800).

The package includes the following materials, prepared and assembled by the Project Team to document the evaluation of architectural properties within the Area of Potential Effects (APE).

- Historic Resource Inventory Forms for properties recommended eligible for the National Register of Historic Places (see attached list of properties)
- Maps showing locations of historic resources within the APE (see attached list of maps)
- Cultural Resources Methodology Report

Documentation relating to the identification of archaeological resources within the APE will be submitted as a separate package.

Please forward any questions or comments to my attention at dhitt@dot.state.ny.us . We respectfully request the concurrence of the SHPO with identified architectural properties within the APE, and would appreciate your response by November 15, 2011.

Sincerely,

DANIEL P. HITT, RLA
(Acting) Co-Director, Office of Environment

DPH/MCS
Attachments

cc.: John Burns, FHWA
Michael Anderson, NYSDOT
Elizabeth Novak, NYSTA
Robert Conway, AKRF

List of Maps

List of Historic Resource Inventory Forms

Rockland County

Westchester County

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
ALBANY, N.Y. 12232
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JOAN MCDONALD
COMMISSIONER

ANDREW M. CUOMO
GOVERNOR

November 18, 2011

Ruth Pierpont
Director and Acting Deputy Commissioner
Division for Historic Preservation
NYS Office of Parks, Recreation & Historic Preservation
P.O. Box 189 - Peebles Island Resource Center
Waterford, New York 12188-0189

Attn.: Mark Peckham, Director, Historic Preservation Field Services Bureau
John Bonafide, Historic Preservation Services Coordinator

Re: Tappan Zee Hudson River Crossing Project / 11PR06692
Section 106 – Replacement Bridge Alternative

Dear Ruth:

On October 12, 2011, the Federal Highway Administration (FHWA) issued a Notice of Intent (NOI) in the Federal Register for the Tappan Zee Hudson River Crossing Project in Rockland and Westchester Counties (http://www.gpo.gov/fdsys/pkg/FR-2011-10-12/pdf/2011-26280.pdf). As stated in the NOI, "The project is intended to address the need to correct substandard structural, operational, mobility, safety, and security features of the existing Tappan Zee Hudson River crossing. Of particular concern to be examined is the structural integrity of the existing Tappan Zee Bridge and its ability to efficiently and cost-effectively provide for the region's long term infrastructure needs."

Built between 1952 and 1955, the existing Tappan Zee Bridge (BIN 5516340) was determined eligible for the National Register by the New York State Historic Preservation Office (SHPO) in 2003, for its significance under Criteria A and C, in the areas of transportation and engineering. The Statement of Significance cites the structure's unique caisson system supporting the piers and deck, total length of the bridge, and length of the 1, 212 foot cantilever span as contributing features. The 2003 evaluation also describes the Tappan Zee Bridge as an essential component of the NYS Thruway system, part of the I-287 corridor.

In addition to meeting the criteria for National Register eligibility, the Tappan Zee Bridge has been determined an exceptional element of the Federal Interstate Highway System. In 2005, the Advisory Council on Historic Preservation (ACHP) exempted the majority of the Interstate from consideration as an historic property under Section 106 of the National Historic Preservation Act. A similar provision, enacted under Section 6007 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) also exempted most of the Interstate System from Section 4(f) of the Department of Transportation Act. However, the regulatory

exemptions do not apply to historically important, distinctive features of the system, such as certain bridges, tunnels, and rest stops of national or extraordinary significance.

Through a process established by the FHWA, the Tappan Zee Bridge was included in the *Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System,* based on its significance in engineering history for the use of prefabricated buoyant caissons support (Federal Register 12/19/06). As a result of this designation, the Tappan Zee Bridge remains subject to Section 106 and Section 4(f) requirements.

Engineering studies prepared for the Tappan Zee Bridge/ I-287 Corridor Project included four options to retain and rehabilitate the existing bridge, but did not recommend rehabilitation as a reasonable alternative for further development. As documented in the *Alternatives Analysis for Rehabilitation and Replacement of the Tappan Zee Bridge Report* (March 2009),[1] deciding factors included engineering performance and the need for substantial modifications to comply with structural integrity and seismic criteria. All rehabilitation options would involve replacement of the existing buoyant foundations, a contributing feature of the National Register eligible bridge, to meet requirements of the seismic criteria.

Although the earlier project was terminated in October 2011, FHWA and the New York State Department of Transportation (NYSDOT) have reviewed the 2009 alternatives analysis report, and determined the conclusions remain valid and pertinent to the TZHRC Project. The conclusions of the 2009 report are summarized in the TZHRC Project's Scoping Information Packet.

Due to the status of the existing Tappan Zee Bridge as an historic property subject to both Section 106 review and Section 4(f) evaluation, we seek concurrence from the SHPO with the decision to dismiss rehabilitation options for the existing Tappan Zee Bridge from further consideration at this time. With this understanding, the FHWA, the New York State Thruway Authority (NYSTA), and the NYSDOT intend to progress the Replacement Bridge Alternative in the Project's Environmental Impact Statement (EIS), and to incorporate appropriate documentation in accordance with Section 106 and Section 4(f) requirements.

We respectfully request the written concurrence of the SHPO by November 28, 2011. Please forward any questions or comments to my attention at dhitt@dot.state.ny.us.

Sincerely,

DANIEL P. HITT, RLA
(Acting) Co-Director, Office of Environment

DPH/MCS

cc.: John Burns, FHWA
Michael Anderson, NYSDOT
Elizabeth Novak, NYSTA
Robert Conway, AKRF

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[1] http://www.tzbsite.com/tzb-library/study-documents/level-3/L3-rehab-and-replace-tzb-report2009.html

U.S. Department of Transportation
Federal Highway Administration

New York Division

Leo W. O'Brien Federal Building
11A Clinton Avenue, Suite 719
Albany, NY 12207
518-431-4127
Fax: 518-431-4121
New York.FHWA@dot.gov

December 21, 2011

In Reply Refer To:
HDO-NY

Daniel P. Hitt, RLA
Acting Co-Director, Office of Environment
New York State Department of Transportation
50 Wolf Road
Albany, NY 12232

Subject: Tappan Zee Hudson River Crossing Project (11PR06692)
Section 106 Review—Architectural Properties, Rockland and Westchester Counties

Dear Mr. Hitt:

We received your November 17 letter requesting concurrence with the list of identified architectural properties for the Tappan Zee Hudson River Crossing Project.

We have reviewed the documentation relating to the identification of architectural properties within the area of potential effects (APE) for the Tappan Zee Hudson River Crossing Project. The documentation includes Historic Inventory Forms for properties recommended National Register Eligible; Maps showing locations of historic resources within the APE; and the Cultural Resources Methodology Report. The information supplements existing data on buildings and structures in the APE that have been previously listed and/or determined eligible for National Register listing. We have also reviewed the response letter from the State Historic Preservation Officer (SHPO) dated November 16, and we have visited the site.

Based upon our review of the information above, we concur with the eligibility recommendations and identified architectural properties for the Tappan Zee Hudson River Crossing Project.

If you have any questions or concerns, please contact me at 518-431-8875.

Sincerely,

/Original signed by/

John Burns
Tappan Zee Bridge Major Project Engineer

cc: Ruth L. Pierpont, Acting Deputy Commissioner for Historic Preservation (11PR06692)
Mary Santangelo, Environmental Analysis Bureau, NYSDOT MO
Michael Anderson, NYSDOT Tappan Zee Bridge Project Manager, 4 Burnett Blvd, Poughkeepsie, NY 12603
Dave Capobianco, NYSTA Bureau of Structure Design