Phase 1A Archaeological Documentary Study

Hudson Tunnel Project

New York, NY

Prepared for:

NJ TRANSIT
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January 24, 2017

MANAGEMENT SUMMARY

OPRHP Project Review Number: 16PR03710

Involved Agencies: Federal Railroad Administration and NJ TRANSIT

Phase of Survey: Phase 1A Archaeological Documentary Study

Location Information

Location: New York and New Jersey
Minor Civil Division: Multiple
County: Multiple

Survey Area

Length: 4,000 feet
Width: 100 feet
Area: >9 acres

USGS 7.5 Minute Quadrangle Map: New York

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Date of Report: January 24, 2017

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction and Project Description

A. INTRODUCTION

The Federal Railroad Administration (FRA) and NJ TRANSIT are preparing an Environmental Impact Statement (EIS) to evaluate the Hudson Tunnel Project (the "Proposed Action" or the "Project"). As described in the Hudson Tunnel Project Notice of Intent (Federal Register, May 2, 2016, Vol. 81, No. 84), the Proposed Action is intended to preserve the current functionality of the Northeast Corridor's (NEC) Hudson River rail crossing between New Jersey and New York and strengthen the resilience of the NEC. The Project would consist of construction of a new rail tunnel under the Hudson River, including railroad infrastructure in New Jersey and New York connecting the new rail tunnel to the existing NEC, and rehabilitation of the existing NEC tunnel (the North River Tunnel) beneath the Hudson River.

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies, in consultation with stakeholders, to take into account the potential effects of their actions on historic properties within "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties [the Area of Potential Effect or APE], if such properties exist" (36 CFR § 800.16[d]). Historic properties consist of National Register-listed or eligible buildings, structures, sites, objects, or districts and include historic resources and archaeological resources ("cultural resources"). In accordance with Section 106 of NHPA, this Phase 1A Archaeological Documentary Study has been prepared to assist in the identification of potential archaeological resources that could be affected by the Project. Due to the large scale and geographic extent of this Project across portions of two states, the results of this research effort have been provided in two separate Phase 1A reports. The current report focusses on the Hudson River and New York City portions of the APE.

B. PROJECT DESCRIPTION

The Project will occur in portions of New Jersey and New York, beginning in Secaucus, New Jersey and extending eastward through a tunnel beneath the Palisades and the Hudson River to Penn Station in New York City (PSNY) (see **Figure 1** for a map of the preferred alternative across both states, **Figure 2** for a map of the New York portion of the Project, and **Figure 3** through **Figure 5** for photographs of the New York portion of the Project). The Project would include the following major components:

- Two new surface tracks parallel to the south side of the NEC beginning east of Secaucus Junction station in Secaucus, New Jersey.
- A new tunnel with two tracks in two separate tubes beneath the Palisades and continuing east of the Palisades beneath Hoboken, New Jersey, and beneath the Hudson River to Manhattan. In New Jersey, the tunnel would begin at a portal in the western slope of the Palisades near Tonnelle Avenue (US Routes 1 & 9), in North Bergen, New Jersey. The new portal would be approximately 600 feet south of the existing North River Tunnel portal.
- A new tunnel ventilation shaft and fan plant in Hoboken, New Jersey, on land NJ TRANSIT previously acquired for another project, the Access to the Region's Core (ARC) project. The vent shaft/building would provide fresh air to the tunnels and exhaust smoke during emergencies.

1.20.17

LEGEND

- Existing Northeast Corridor
- Existing North River Tunnel to be Rehabilitated
- Amtrak Right-of-Way Preservation
- Tunnel Alignment Option
- Tunnel Portal
- New Surface Tracks
- Ventilation Shaft Site & Construction Staging Area
- Construction Staging Area
- In-Water Construction
- New Ventilation Facilities

N

NEW YORK

WEEHAWKEN

Lincoln Tunnel

EXISTING TUNNEL TO BE REHABILITATED

NEW VENTILATION FACILITY

To PSNY

EXISTING TUNNEL PORTAL

NEW TUNNEL PORTAL

NORTH BERGEN

CONSTRUCTION ACTIVITY DURING TUNNELING

30th St

29th St

SECAUCUS

CONSTRUCTION STAGING AREA

Paterson Plank Rd

UNION CITY

Hudson River Park

SHAFT SITE & CONSTRUCTION STAGING AREA

12th Ave

IN-WATER CONSTRUCTION

NEW TUNNEL

NEW VENTILATION FACILITY

Willow Ave

Park Ave

SHAFT SITE & CONSTRUCTION STAGING AREA

To Secaucus

Secaucus Rd

Penhorn Creek

NYS & W / Norfolk Southern

Tonnelle Ave

HUDSON RIVER

NEW SURFACE TRACKS

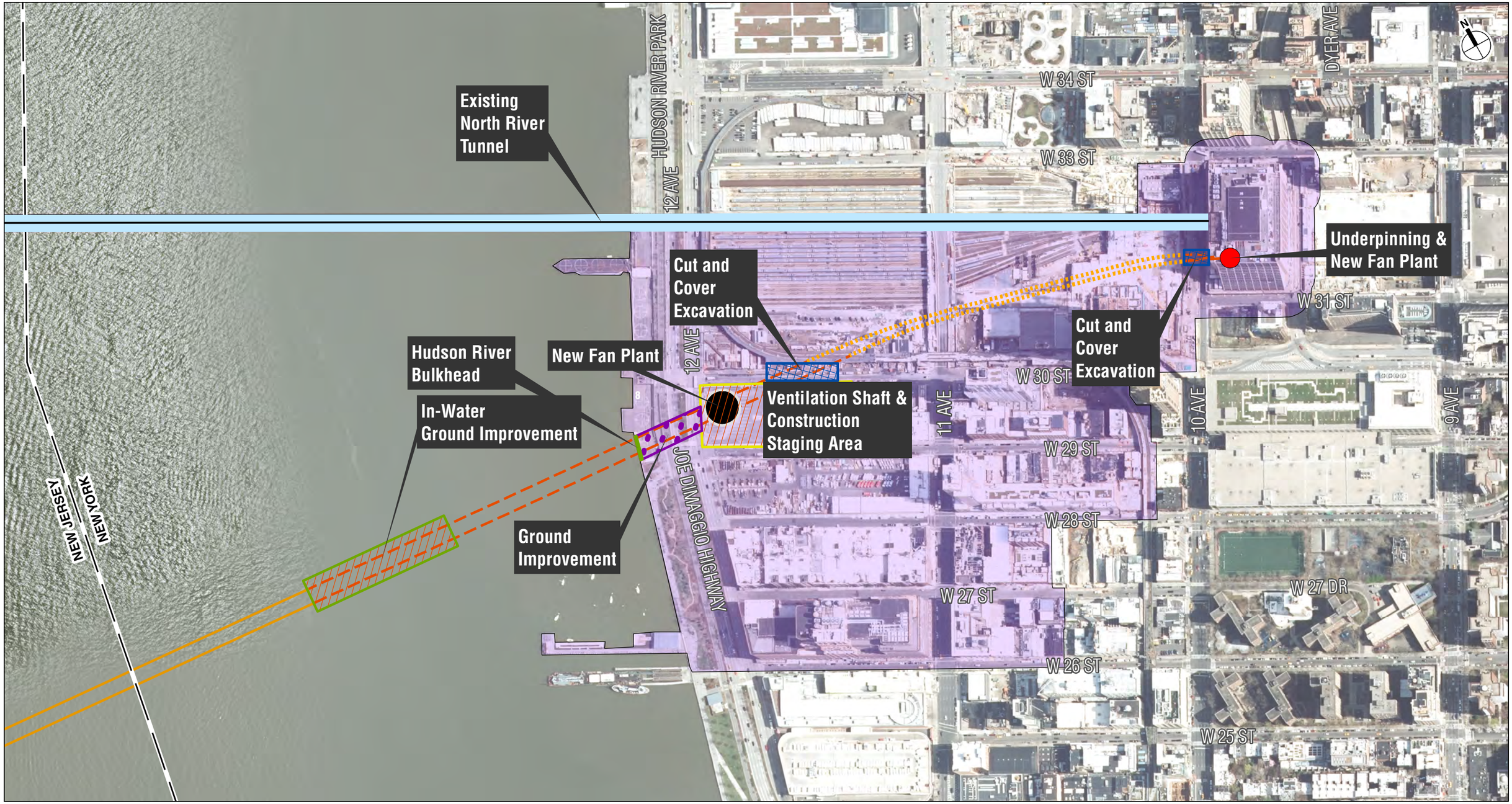
County Rd

HOBOKEN

Hudson Tunnel Project

Preferred Alternative

Figure 1



Existing Northeast Corridor
Deeply Bored New Tunnel
Right-of-way being preserved through the Western and Eastern Railyards
Area of Potential Effect for Indirect Effects

Area of Potential Effect for Direct Effects

New Fan Plant
Existing North River Tunnel
Shallowly Constructed New Tunnel
Ventilation Shaft & Construction Staging Area
Ground Improvement
Construction Staging Area
In-Water Ground Improvement
Cut and Cover Excavation
Underpinning

0 1,000 FEET

HUDSON TUNNEL PROJECT

Area of Potential Effects

Figure 2

Location: *Manhattan, NY*
Photographer: *Claudia Cooney, AKRF, Inc.*
Date: *October 11, 2016*

View southwest on West 30th Street west of Eleventh Avenue, including the block where the proposed ventilation shaft site and construction staging area would be located. **1**

Location: *Manhattan, NY*
Photographer: *Claudia Cooney, AKRF, Inc.*
Date: *October 11, 2016*

View northeast on Tenth Avenue, including the Lerner Building on the east side of Tenth Avenue between West 31st and West 33rd Streets. **2**

HUDSON TUNNEL PROJECT

Area of Potential Effects—
Photographs: New York

Figure 3

Location: *Manhattan, NY*
Photographer: *Erica Mollon, AKRF, Inc.*
Date: *November 30, 2016*

View southeast at Twelfth Avenue and West 30th Street of the location of the proposed ventilation shaft site, fan plant, and construction staging area. **3**

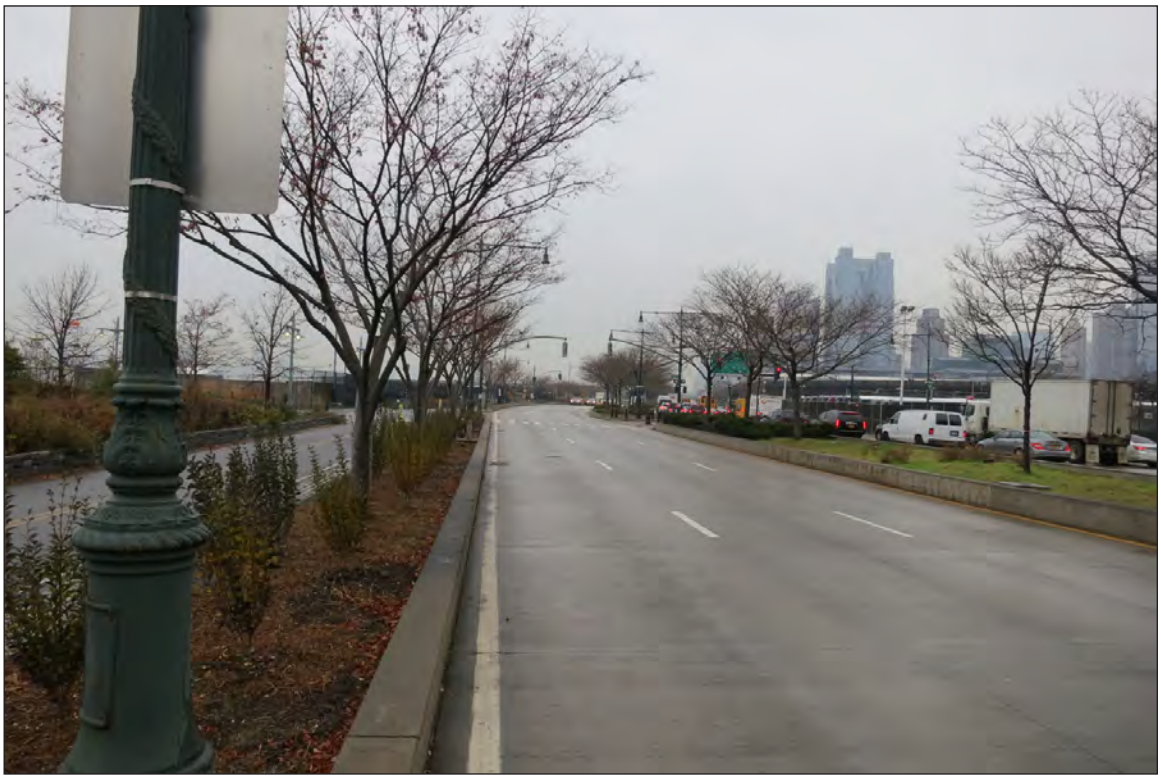
Location: *Manhattan, NY*
Photographer: *Erica Mollon, AKRF, Inc.*
Date: *November 30, 2016*

View north at the the Hudson River bulkhead in the location where the new tunnel would cross through the bulkhead and where ground improvements would also be needed to construct the tunnel. **4**

HUDSON TUNNEL PROJECT

Area of Potential Effects—
Photographs: New York

Figure 4



Location: *Manhattan, NY*
Photographer: *Erica Mollon, AKRF, Inc.*
Date: *November 30, 2016*

View north on Route 9A/Twelfth Avenue towards the location where ground improvements would occur to construct the new tunnel. The location of the proposed ventilation shaft site and fan plant is on the right.

5

HUDSON TUNNEL PROJECT

Area of Potential Effects—
Photographs: New York

Figure 5

- Two new tracks continuing in Manhattan, New York, beneath Hudson River Park and NYS Route 9A (West Side Highway) to meet the underground right-of-way being preserved by Amtrak through the John D. Caemmerer Yard (Western and Eastern Rail Yards) in Manhattan.
- A new tunnel ventilation shaft and fan plant at Route 9A and West 30th Street in Manhattan.
- A new fan plant beneath the Lerner Building at 450 West 33rd Street in Manhattan, New York.
- Two new tracks running through the right-of-way being preserved through the Western and Eastern Rail Yards, to connect to the existing approach tracks that serve PSNY.
- Track connections to the existing approach tracks that lead into PSNY.
- Rehabilitation of the North River Tunnel.

The new tunnel would be constructed predominantly using Tunnel Boring Machine (TBM) technology, with construction staging areas located at the tunnel portal and vent shaft site in New Jersey. The construction staging area at the tunnel portal in New Jersey would also be used for rehabilitation of the existing tunnel once the new tunnel is complete. A construction staging site would also be located at the vent shaft site in Manhattan. In-water construction activities would be required to modify river bottom soils in order to construct a segment of the tunnel that must be relatively shallow beneath the Hudson River; these activities would occur in a small area of the Hudson River near the Manhattan shoreline (**Figure 2**).

Once the North River Tunnel rehabilitation is complete, both the old and new tunnel would be in service, providing redundant capacity and increased operational flexibility for Amtrak and NJ TRANSIT.

C. PREVIOUS ARCHAEOLOGICAL RESEARCH

The Project Site and its vicinity, the west side of Midtown Manhattan and the Hudson Yards, have been the subject of multiple previous archaeological investigations, many of which were quite substantive. Of most relevance are the Phase 1A Archaeological Survey Report (prepared in August 2005/Revised October 2007) and supplemental studies prepared for the ARC Project (at times referred to as the Trans-Hudson Express [THE] Project[1]), which concerned a similar APE to the current Project. Other relevant surveys include those prepared for the No. 7 Line/Hudson Yards completed in 2004 and numerous studies associated with reconstruction of Route 9A. The current research has sought to minimize duplicative effort by utilizing these previous studies and relying on their interpretations and recommendations as appropriate. For situations where the recommendations of previous projects are in disagreement, this report has deferred to the more recent determinations of the ARC analyses.

[1] In 2008, NJ TRANSIT and the Federal Transit Administration prepared an EIS for ARC/the THE Project in accordance with NEPA and NHPA.

Chapter 2: Research Design and Survey Methods

A. REGULATORY CONTEXT

FRA has determined that the Project constitutes an undertaking under Section 106 of National Historic Preservation Act (NHPA) of 1966, as Amended. FRA is responsible for compliance with Section 106 for this Project, and FRA, in cooperation with NJ TRANSIT, will conduct all required consultations and 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 within the Area of Potential Effects (APE) established for the undertaking.

Historic properties are defined as buildings, structures, sites, objects, and districts that are over 50 years old, possess integrity, and meet the National Register of Historic Places (NRHP) criteria for evaluation, as defined by 36 CFR Part 60. Resource categories to be identified within the APE will include National Historic Landmarks (NHLs); State and National Register-listed resources (S/NRHP-listed); and State and National Register-eligible (S/NRHP-eligible) resources that have either been previously identified and evaluated, or are identified during field surveys for the Project and are found to meet the NRHP criteria of evaluation. This report is concerned exclusively with archaeological resources. Archaeological resources are defined as "the place or places where the remnants of a past culture survive in a physical context that allows for the interpretation of these remains," meeting the NRHP criteria for evaluation as defined by 36 CFR Part 60. Archaeological resources may date to the prehistoric or historic period and may be located in terrestrial or submerged environments.

The Section 106 analyses will be integrated with the National Environmental Policy Act (NEPA) compliance processes in accordance with 36 CFR 800.8 and a guidance document put forth by the Advisory Council on Historic Preservation (ACHP) entitled NHPA: A Handbook for Integrating NEPA and Section 106 (March 2013). The undertaking will also be subject to review under Section 4(f) of the Department of Transportation Act.

Identification of archaeological resources will be undertaken in accordance with Section 106 of the NHPA and NYSHPO procedures for implementing Section 106. In addition, archaeological assessments and surveys will be conducted pursuant to the standards of the New York Archaeological Council (NYAC) and NYSHPO's Phase I Archaeological Report Format Requirements.

When a project is being reviewed pursuant to Section 106 of the NHPA, the procedures of Section 14.09 of the New York State Historic Preservation Act (SHPA) do not apply, and any review and comment by NYSHPO must be within the framework of Section 106 procedures (New York State Historic Preservation Act § 14.09(2)). The Proposed Action is, however, subject to the New Jersey Register of Historic Places Act (NJSA) due to the involvement of NJ TRANSIT, an instrumentality of the State of New Jersey[1].

[1] As stated earlier, the Phase 1A Archaeological Survey for the New Jersey portion of the Project has been prepared under separate cover.

Therefore, this Phase 1A Archaeological Documentary Study will fulfill cultural resource compliance obligations under NEPA and Section 106 of NHPA. FRA and NJ TRANSIT will consult and coordinate with NJHPO and NYSHPO to identify archaeological resources that have the potential to be affected by the Project Alternatives and determine the nature of the potential effect on those properties.

If FRA determines that archaeological resources would be adversely affected as a result of the undertaking, and these effects cannot be avoided, FRA and NJ TRANSIT would collaborate with NYSHPO and other consulting parties (including ACHP if applicable) to develop and implement measures to minimize and/or mitigate such effects.

B. DEVELOPMENT OF APE

The APE has been developed in consultation with the consulting parties based on proposed construction activities for the Project and their potential to affect cultural resources, including potential direct and indirect effects, based on information available at this time. The Project has one APE, which has been subdivided to indicate the area in which the Project could cause potential direct effects and the area in which the Project could cause potential indirect effects. The APE has been further subdivided by those portions of the Project that will occur in New Jersey and those that will occur in the Hudson River and New York (see **Figure 1** and **Figure 2**). In general, potential effects on cultural resources can include both direct physical effects— physical alteration, damage, or demolition—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.

CONSTRUCTION ACTIVITIES

FRA and NJ TRANSIT anticipate that the following types of construction activities and permanent features would be necessary for the Project (**Figure 1** and **Figure 2**):

- Construction (via TBM) of a new tunnel containing two new tracks in two separate tubes under the Hudson River, beginning at a portal east of Tonnelle Avenue and continuing under the Palisades in New Jersey, under the Hudson River, and through the Hudson River Bulkhead to 30th Street between Eleventh and Twelfth Avenues.
- Rehabilitation of the existing passenger rail tunnel under the Hudson River, the North River Tunnel.
- Construction of new surface tracks along and connecting to the existing NEC, including a segment of retained fill, segments of embankment, and new viaduct segments.
- Construction of an access road for new surface tracks in Secaucus and North Bergen in New Jersey south of the existing NEC, including a temporary access road for use during construction as well as a permanent access road in some locations for use by Amtrak maintenance crews.
- Construction of an access road to the ventilation shaft site in Hoboken in New Jersey to facilitate truck movements to and from the site. Two potential routes for that access road are being evaluated.
- Cut and cover excavation for a section of the new tunnel between Tonnelle Avenue and Paterson Plank Road in North Bergen, New Jersey and sections of the new tunnel beneath West 30th Street and Tenth Avenue in Manhattan, New York.
- Construction staging areas east and west of Tonnelle Avenue in North Bergen, New Jersey and south of West 18th Street in Hoboken, New Jersey and on the block bounded by Eleventh and Twelfth Avenues and West 29th and West 30th Streets in Manhattan, New York (Block 675).

- Ventilation shafts to be constructed at a location south of West 18th Street in Hoboken, New Jersey and on the block bounded by Eleventh and Twelfth Avenues and West 29th and West 30th Streets in Manhattan, New York.
- New fan plants at the ventilation shaft sites in Hoboken, New Jersey and Manhattan, New York and a new fan plant beneath and within the Lerner Building in Manhattan, New York.
- Ground improvements between the proposed construction staging area and Willow Avenue in Hoboken, New Jersey and between the Hudson River Bulkhead and Route 9A/Twelfth Avenue in Manhattan, New York.
- Underpinning of structures which includes the Willow Avenue Bridge in Hoboken, New Jersey and the Lerner Building at 450 West 33rd Street in Manhattan, New York.
- In-water ground improvement within the Hudson River.
- Construction through the Hudson River Bulkhead in Manhattan, New York.
- Installation of tracks and infrastructure within the right-of-way being preserved through the Western and Eastern Rail Yards in Manhattan, New York.

The following two components of the Project do not have the potential to affect historic properties and, therefore, an APE for Direct and Indirect Effects has not been defined for these Project components:

- Deeply Bored Hudson Tunnel: The portions of the new tunnel that would be deeply bored in New Jersey beneath the Palisades, the land area east of the Palisades, and beneath the river to a point just east of the New Jersey/New York State Line in the Hudson River in New York are not included in the APE as construction impacts associated with boring in the bedrock or tunnelling in the deep sediments of the Hudson River do not have the potential to affect archaeological and historic resources because:
    - Archaeological and historic resources are not anticipated to be located within the rock or deep soils being bored in these areas.
    - Based on analyses conducted as part of a previous project, because of the tunnel's depth (approximately 250 to 300 feet beneath the Palisades, and 80 feet below the land surface in Hoboken, New Jersey between the Palisades and the New Jersey shoreline of the Hudson River), TBM operations and operations of trains within the completed tunnel in these areas would not result in vibration impacts to structures above.
- Installation of tracks and infrastructure within the right-of-way being preserved through the Western and Eastern Rail Yards in Manhattan: Amtrak is currently constructing an underground right-of-way preservation project that consists of a concrete casing beneath the Eastern and Western Railyards in Manhattan to preserve the right-of-way for trains to reach PSNY from a new Hudson River tunnel. The concrete casing extends through the Western Railyard from West 30th Street to Eleventh Avenue, beneath Eleventh Avenue, and through the Eastern Railyard to Tenth Avenue. The right-of-way preservation project is being completed separately from the Hudson Tunnel Project and has previously been evaluated pursuant to NEPA in Environmental Assessments dated March 2013 and August 2014, both of which included Section 106 review[1]. The Hudson Tunnel Project would install tracks and equipment within this concrete casing, which does not have the potential to affect historic or archaeological resources.

[1] National Railroad Passenger Corporation (Amtrak) and Federal Railroad Administration (FRA). Environmental Assessment for Construction of a Concrete Casing in the Hudson Yards, New York, New York, March 2013 and Supplemental Environmental Assessment for Construction of a Concrete Casing Extension in the Hudson Yards, New York, New York, August 2014.

The proposed APE for the Project components that have the potential to affect historic properties is discussed in greater detail below. The locations of these Project components – where direct effects could occur – and the areas delineated to assess potential indirect effects of the Project on historic properties are depicted in **Figure 1** and **Figure 2**.

AREA OF POTENTIAL EFFECT FOR DIRECT EFFECTS IN NEW YORK

The proposed APE for the Project components that have the potential for direct effects to archaeological resources in the Hudson River and New York is discussed in greater detail below and are depicted in **Figure 2**, **Figure 6**, and **Figure 7**. Photographs of the New York APE are provided in **Figure 3** through **Figure 5**.

Direct effects may include physical alteration, damage, or demolition of a resource. The portion of the Project APE in which there is the potential for the Project Alternatives to cause direct effects includes all locations that could potentially be subject to direct ground-disturbing activities, including construction of ventilation shafts. Project activities are anticipated to include demolition, excavation, cutting and filling, and construction staging, including work in the Hudson River. No direct effects APE has been identified in the Hudson River in New York where the tunnel would be bored through deep sediments, as there would be no potential for impacts to archaeological resources at such depths.

The direct effects APE is defined to include:

- The area where proposed in-water construction is anticipated to build the two new rail tubes beneath the Hudson River (the "Hudson Tunnel");
- Shallowly constructed new tunnel beneath the Hudson River river bottom;
- The locations of proposed cut-and-cover tunnel and ventilation shaft construction in New York, and also locations where cut-and-cover and bored tunnel construction may require the strengthening of soils above the tunnels; and
- Areas of other potential subsurface disturbance, including construction staging areas and ventilation shaft site construction in New York.

CUT AND COVER EXCAVATION

Cut-and-cover construction is a proven method typically undertaken for shallow tunnels, where a trench is excavated and the tunnel is constructed within the trench. The walls of the trench are typically supported by metal sheeting and cross-beams to prevent collapse. Work in areas where tunnel cut-and-cover activities would occur are included in the proposed APE for Direct Effects as these areas would require ground disturbance which has the potential to directly impact archaeological resources if any are present. This type of construction method will occur at the tunnel alignment as it crosses both West 30th Street and Tenth Avenue in Manhattan, New York (see **Figure 2** and **Figure 3**).

CONSTRUCTION STAGING AREAS

The construction staging area in New York is included in the proposed APE for Direct Effects as at-grade and subsurface ground disturbance would occur, which could directly impact archaeological resources if any are present. The New York construction staging area is anticipated to be located on the block bounded by Twelfth and Eleventh Avenues and West 29th and West 30th Streets (see **Figure 2; Figure 3, Photograph 1** and **Figure 4, Photograph 3**).

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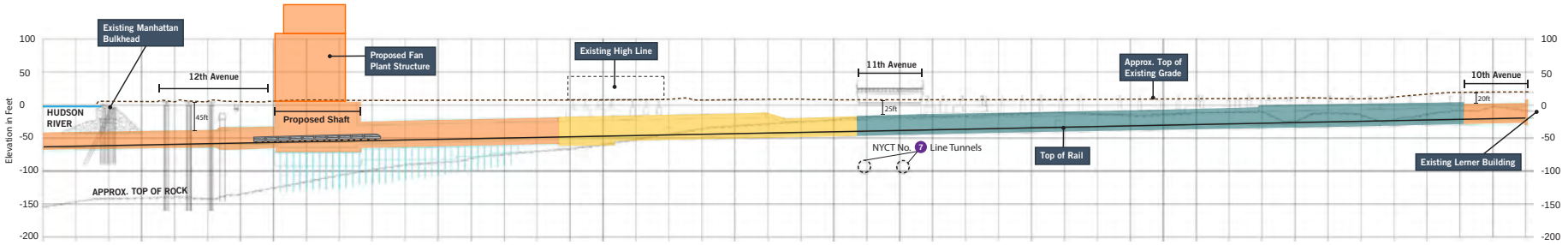
Tunnel Plan View

Tunnel Profile View



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HUDSON TUNNEL PROJECT

Profile/Cross Section
View of Tunnel and Fan Plant

Figure 6

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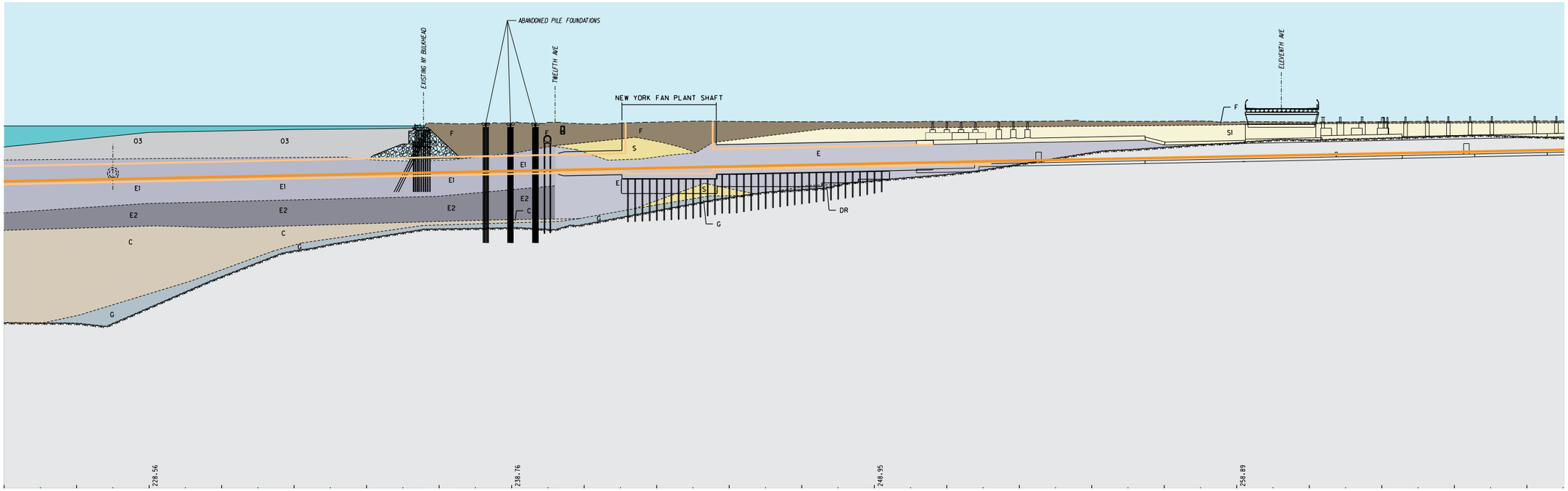

HUDSON TUNNEL PROJECT

Profile/Cross Section
View of Tunnel and Fan Plant

Figure 7

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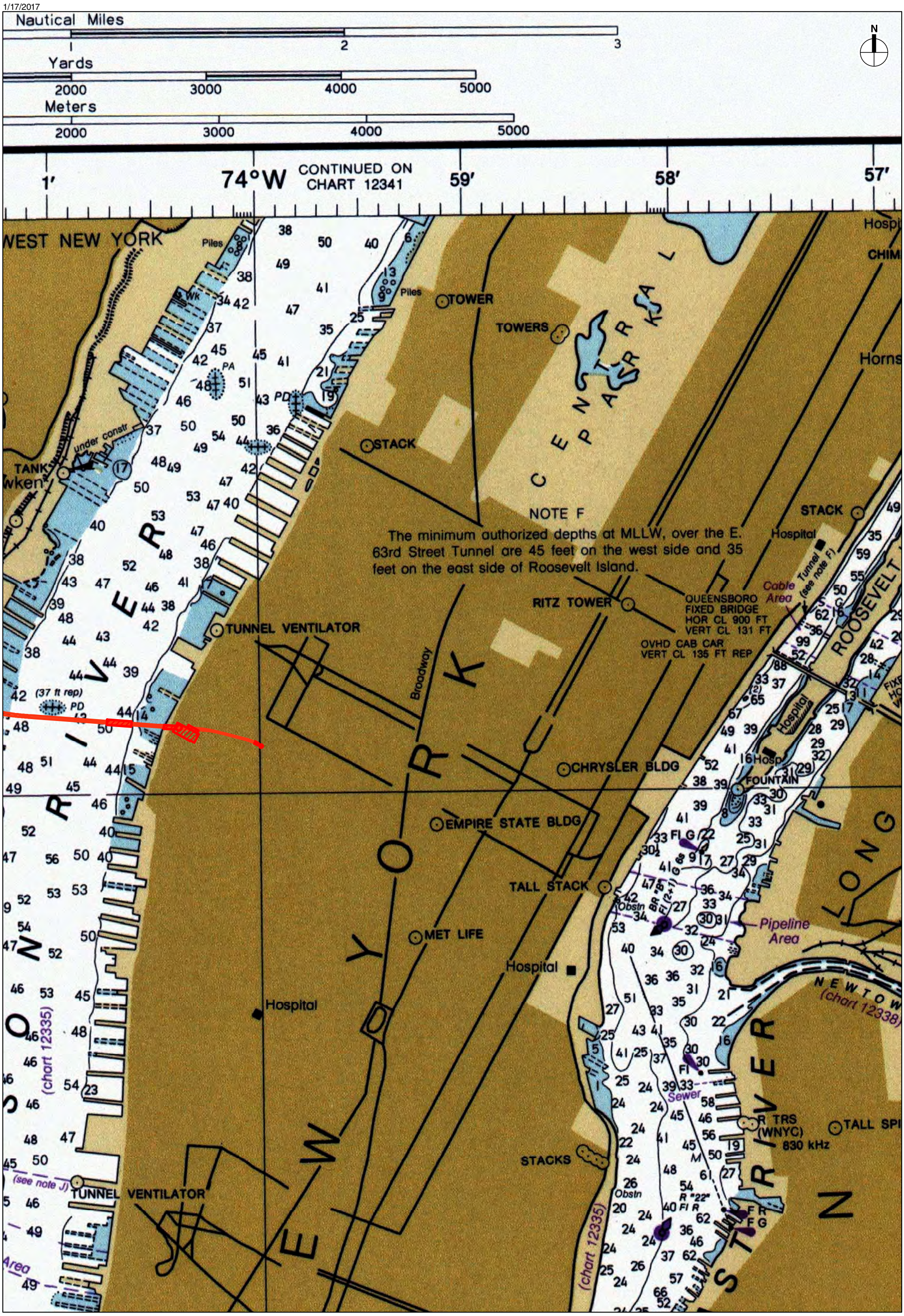
Area of Potential Effects (APE) Boundary for Direct Effects

Previously Surveyed for Archaeology

HUDSON TUNNEL PROJECT

Previously Assessed Archaeologically Sensitive Areas

Figure 8



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Area of Potential Effects (APE) Boundary for Direct Effects

HUDSON TUNNEL PROJECT

NOAA - New York Harbor, 1989

Figure 9

VENTILATION SHAFT AND FAN PLANT

The New York APE for Direct Effects includes the site where a ventilation shaft would be constructed, which would include an approximately 140-foot-diameter shaft leading from the tunnel to the surface as well as a fan plant building constructed above the shaft, since at-grade and subsurface ground disturbance would occur, and could directly impact archaeological resources if any are present. In New York, the ventilation shaft and associated fan plant is proposed on the block bounded by Twelfth and Eleventh Avenues and West 29th and West 30th Streets, where a construction staging area is also proposed (see **Figure 2** and **Figure 4, Photograph 3**).

In addition, a fan plant is proposed beneath and within the Lerner Building at 450 West 33rd Street (between Dyer and Tenth Avenues and West 31st and West 33rd Streets) in Manhattan to provide ventilation from the portion of the new tunnel between the proposed Twelfth Avenue ventilation building and PSNY's existing "A" Yard (see **Figure 2** and **Figure 3, Photograph 2**).

GROUND IMPROVEMENT

Work at ground improvement locations in New York are included in the proposed APE for Direct Effects as this Project component would include subsurface ground disturbance to stabilize soils that could directly impact archaeological resources if any are present. Ground improvements are anticipated along the tunnel route between the Hudson River Bulkhead and the eastern edge of Route 9A / Twelfth Avenue (see **Figure 2; Figure 4, Photograph 4** and **Figure 5**).

UNDERPINNING OF STRUCTURES

Underpinning, which consists of the strengthening of the below grade foundations of an existing building or structure, may be required beneath the Lerner Building at 450 West 33rd Street (between Dyer and Tenth Avenues and West 31st and West 33rd Streets) because of changes to track layout beneath the building (see **Figure 2** and **Figure 3, Photograph 2**).

IN-WATER GROUND IMPROVEMENT IN THE HUDSON RIVER IN NEW YORK

As the new tunnel passes beneath the Hudson River in New York, one segment of the tunnel would require ground improvement to the river bottom because the tunnel would be relatively shallow in this location (see **Figure 2**). This work would result in ground-disturbing activities that could directly impact archaeological resources if any are present. The proposed APE for Direct Effects for this Project component consists of the limits of the ground disturbance itself.

SHALLOWLY BORED HUDSON TUNNEL IN THE HUDSON RIVER IN NEW YORK

Because the new bored tunnel in the Hudson River would be more shallowly bored in relation to the existing river bottom near the New York shoreline, the proposed APE in the Hudson River will extend from the western side of the area of proposed in-water construction to the western face of the Hudson River Bulkhead (see **Figure 2**). Portions of the Hudson River riverbed and buried potentially Holocene-era sediments would be disturbed in this area.

CONSTRUCTION THROUGH THE MANHATTAN BULKHEAD IN NEW YORK

The two tubes of the Hudson Tunnel Project would be below the bottom of the Hudson River, but relatively shallow, in order to align with the existing approach tracks leading into Penn Station New York. Therefore, the tubes must pass directly beneath the substructure portion of the existing National Register-eligible Hudson River Bulkhead at Hudson River Park (see **Figure 2** and **Figure 4, Photograph**

4). The location where the TBM will pass through the bulkhead foundation is included in the proposed APE for Direct Effects because the tunnelling activity would directly affect this structure.

For the tunnel alignment between the bulkhead and the Manhattan shaft site at Twelfth Avenue, ground improvement would first be implemented, potentially using a ground freezing technique. With ground freezing, a network of vertical or inclined pipes would be installed into the ground from the surface. The pipes would be connected by supply lines to a refrigerator plant on a nearby construction staging site. After the pipes are in place, a refrigerated brine would be circulated through the closed system of pipes, and this brine would gradually freeze the ground around the pipes until it is solid. The pipes would then be removed and the tunneling would be conducted through the frozen ground.

Once the ground is frozen at Hudson River Park, the Tunnel Boring Machine, moving east from the tunnel created beneath the bottom of the river, would tunnel directly through the foundation of the bulkhead. The TBM would be capable of cutting through the timber piles and riprap under frozen ground conditions.

As the tunnel is bored, a concrete liner would be installed to form the tunnel. The area above the concrete liner and below the remaining bulkhead structure would be filled with grout to stabilize the bulkhead above.

While construction through the bulkhead is occurring, a monitoring plan will be in place to protect the remaining bulkhead structure.

C. RESEARCH GOALS

This Phase 1A Archaeological Documentary Study was prepared to generate a general assessment of the archaeological sensitivity of the APE for Direct Effects and entailed (1) documenting the overall developmental history of the Project Site; (2) assessing the potential for archaeological resources to be present in the Project Site; (3) determining the effect of subsequent development and landscape alteration on any potential archaeological resources; and (4) determining the potential for the Project to affect archaeological resources dating to the prehistoric or historic periods. The goal of this study was not to assemble a detailed lot by lot history of the APE's ownership and occupancy nor a detailed accounting of all subsequent disturbances or development that could affect site integrity.

The results of this analysis are presented by the project components that constitute the New York APE for Direct Effects. From west to east, these components, as described in the previous subsection and depicted on Figure 2, are:

- In-water construction on the Hudson River river bottom;
- Shallowly constructed new tunnel beneath the Hudson River river bottom;
- Shallowly constructed new tunnel from the western face of the Hudson River Bulkhead to 30th Street;
- Ground improvements at Hudson River Bulkhead, Hudson River Park, and Twelfth Avenue;
- Construction of New Ventilation Shaft on Block 675;
- Construction of the New Fan Plant Structure on Block 675;
- Construction staging Area on Block 675;
- Cut and Cover Excavation at 30th Street;
- Cut and Cover Excavation at Tenth Avenue; and
- Underpinning and Construction of New Fan Plant at Lerner Building.

This Phase 1A study concludes with recommendations regarding the need for additional archaeological investigations of the APE for Direct Effects, if any. Additional analysis, archaeological monitoring during construction, or subsurface testing in advance of construction are generally warranted for areas determined to have moderate sensitivity or higher. Archaeological testing is designed to determine the presence or absence of archaeological resources, including submerged resources, which could be impacted by a proposed project. Should they exist on the project site, such archaeological resources could provide new insight into the development of the project site and vicinity, the creation of its bulkheads and piers, and mid-nineteenth through early-twentieth century residential and industrial activity.

The process of determining the presence or absence of archaeological resources is referred to as a Phase 1B archaeological survey. If the Phase 1B survey identifies potentially significant archaeological resources, including submerged resources, a Phase 2 survey may be necessary to determine site integrity, significance, and ultimately S/NRHP eligibility, and would include an effects assessment for any identified S/NRHP-eligible archaeological resources. The need for Phase 2 survey will be determined as a result of consultation between NJHPO, NYSHPO, NJ TRANSIT and FRA based on the conclusions of the Phase 1B report. These two phases of fieldwork are frequently completed in tandem for urban projects. If necessary, a data recovery will be conducted to document affected resources as part of the process of mitigating unavoidable adverse effects through performance of a data recovery.

D. RESEARCH AND SURVEY METHODS

DATA SOURCES

As stated in the introduction, the APE for Direct Effects and its vicinity, the west side of Midtown Manhattan and the Hudson Yards, have been the subject of multiple previous archaeological investigations, many of which were quite substantive. Of most relevance are the Phase 1A Archaeological Survey Report (prepared in August 2005/Revised October 2007) and supplemental studies prepared for the ARC Project, which had a similar APE to the current Project. The current research has sought to minimize duplicative effort by utilizing these previous studies and relying on their interpretations and recommendations as appropriate. Some of the conclusions and interpretations of these previous surveys are contradictory. This is at least partly explained by changing standards of significance over the past decades. For situations where the recommendations of previous projects are in disagreement, this report has deferred to the conclusions of the most recent determination, which in this case would be the ARC analyses.

This study has also drawn on other background research to establish a chronology of the APE for Direct Effects' development and landscape alteration, to identify some of the activities that may have occurred there, and to determine the types of archaeological resources that may be present. Documentary research included examination of historic maps, aerial photographs, and accounts of major site disturbances such as the construction of roadways. Disturbance is also associated with other development and landscape alteration such as landfilling, paving, and utility installation. The primary data source for this survey is the ARC Phase 1A Archaeological Survey Report prepared in August 2005/Revised October 2007 and its several follow-up volumes, as it analyzed an area including the current APE for direct effects. Similarly, other relevant archaeological studies conducted in or adjacent to the APE were reviewed for relevant data. Additional research was conducted as appropriate to assess current conditions, including a review of databases and reports maintained by the NYSHPO and the New York City Landmarks Preservation Commission (NYCLPC).

Modern subsurface ground disturbance within the APE for Direct Effects was assessed through cartographic research to evaluate historic and modern land use factors that may affect the integrity of archaeological resources. Archival research, historic and modern cartographic research, and an analysis

of the environmental setting will contribute to the evaluation of the potential for encountering archaeological resources. An analysis of known modifications of naturally occurring landscapes (i.e., human or natural transformational processes) that may have destroyed (or be in the process of destroying) the archaeological value of those resources will be considered in evaluating the sensitivity of the APE for archaeological resources. Sensitivity is defined as a measure of the probability that intact cultural resources (prehistoric or historic) exist within the archaeological APE.

GEOMORPHOLOGICAL SURVEY

The ARC Phase 1A included a preliminary geomorphological review of core borings collected in both the New Jersey and Manhattan sections of the APE by Dr. Joseph Schuldenrein (AD Marble 2005, Volume II). Soil samples were submitted for radiocarbon dating and a generalized soil profile was generated.

GEOPHYSICAL SURVEY

The Project team conducted a geophysical survey of the affected portion of the Hudson River riverbed as part of the exploration program for the conceptual engineering effort. The work consisted of a limited marine geophysical survey of the potential low-cover area on the east side of the Hudson River along the alignment the proposed Hudson Tunnel Project. The location of the geophysical study area includes the area of In-water river bottom improvements and extended to the western face of the Hudson River Bulkhead (**Figure 2** and **Appendix B**) and it was about 1,200 feet wide and covered a north-south swath of approximately 2,000 feet. The geophysical included the following methods and analyses:

1. A swath bathymetric survey, providing high-resolution multibeam data to develop contours of water depths and the general shape of the river bottom, allowing determination of current depth of cover over the proposed tunnel alignments. Additionally, estimated size and location of obstructions on the river bottom, such as shipwrecks and dumped materials, will be identified.
2. A digital side-scan sonar survey, to provide more detailed information on the character of the river bed, supplementing the multibeam bathymetry data in locating debris on the river bottom as well as scars, old piling, and areas of scour due to past storm surges.
3. A magnetic survey, to identify significant magnetic anomalies caused by metal objects on and beneath the river bed. This information would supplement the information obtained from the side-scan sonar and bathymetry.

E. CRITERIA OF ADVERSE EFFECTS

The criteria of adverse effects in Table 1 will be applied to determine whether archaeological resources would be adversely affected by the Project. FRA, in cooperation with NJ TRANSIT, will consult with NJHPO, NYSHPO, the consulting parties, and ACHP as appropriate to develop mitigation measures for any identified adverse effects. Mitigation measures will be set forth in a memorandum of agreement to be executed among FRA, NJ TRANSIT, NYSHPO, NJHPO, and concurring parties.

Table 1
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, design, 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."
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][1] and 36 CFR 800.5[a][2].

The Gateway Trans-Hudson Partnership, a joint venture of WSP/Parsons Brinckerhoff, Inc., AECOM USA, Inc., and STV Incorporated, is providing preliminary engineering services for the Project under contract to Amtrak, the first phase of which was preparation of a Conceptual Engineering (CE) Geotechnical Report. That report (Gateway Trans-Hudson Partnership 2016) drew upon the voluminous geological and geotechnical data gathered for the ARC Project and was used as the primary data source for the summary environmental data included in this chapter.

A. GEOLOGY AND TOPOGRAPHY

The New York portion of the project region is located within the Manhattan Prong of the New England Upland section of the New England physiographic province. The general topography of Manhattan is a product of the bedrock geology and the island's linear ridges trend generally northeast-southwest, as does the established street grid. The Hudson River portion of the APE is located between the Piedmont physiographic province to the west and the New England physiographic province to the east. In Manhattan, the ground surface gradually rises east of the Hudson River and reaches an elevation of about 30 feet above sea level near Tenth Avenue. Most of the study area's bedrock consists of the Hartland Formation (Lower Cambrian to Middle Ordovician), which consists of gray interbedded schist, schistose gneiss, gneiss, granulite, and amphibolite, with pegmatites relatively common and garnet as a minor accessory mineral (ARC 2007). Within the Hartland Formation, granitic intrusions are present near the Hudson River. Serpentinite rock has been reported in the vicinity of Eleventh Avenue between 26th and 29th Streets (ibid).

Geologic structure, lithology, and stratigraphy of rock and soils in the project region are complex and "reflect a complex sequence of tectonic, erosional, and depositional events" (Gateway Trans-Hudson Partnership 2016). At least five major phases of deformation are believed to have affected the project region during the Taconic, Acadian, and Appalachian orogenies (440 to 260 million years ago). The oldest rocks in the project region, mostly in New York, show effects of thrusting and isoclinal folding, intrusion, retrograde metamorphism, folding of earlier structures and fabrics, reactivation of ductile faults, hydrothermal mineralization and brittle normal faulting (ibid).

As the Late Wisconsin-age ice front retreated from its southernmost location at Perth Amboy, the glacial meltwaters formed lakes behind the terminal moraine. Sediments from these glacial lakes accumulated in the trough-shaped bedrock floor of the Hudson River and later eroded away once the morainal dam was breached across the Narrows (Stanford and Harper 1991 as referenced in Gateway Trans-Hudson Partnership 2016).

A thick sequence of post-glacial estuarine deposits was formed by marine incursion into the Hudson River trough. Variable rates of Holocene and late-Pleistocene post-glacial sea-level rise and isostatic adjustment resulted in the observed variation of the texture and composition of the estuarine deposits (Gateway Trans-Hudson Partnership 2016).

Other post-glacial materials deposited in the project region include stream deposits in terraces and—as alluvium—wetlands deposits in swamps, estuaries, and marshes; aeolian deposits adjacent to plains and terraces; and talus deposits at the base of rock cliffs (ibid).

B. HYDROLOGY

The primary hydrologic feature of the Project Site is the Hudson River, the main drainage channel of the Lower Hudson River Estuary, a tidally influenced portion of the Hudson River that is part of the New York-New Jersey Harbor Estuary, which also includes upper and lower New York Harbor, Arthur Kill, Kill Van Kull, East River, Raritan Bay, and Jamaica Bay (AKRF 2016). Saltwater from Upper New York Harbor enters the lower Hudson River Estuary during the flood phase of the tidal cycle and lower salinity water is discharged from the Estuary to the Harbor during the ebb phase (ibid). The western coastline of midtown Manhattan featured a number of small streams and salt marshes draining higher elevation areas further to the east until large-scale landfilling activity beginning in the mid-nineteenth century.

C. SOILS

As much as 300 feet of often stratigraphically complex post-glacial, glacial, fluvial, lacustrine, and estuarine deposits soils overly the study area's bedrock within the Hudson River channel. The deposits are far shallower and simpler along the coastline of Manhattan, where the thickness of surficial materials is generally less than 50 feet, except for the area adjacent to the Hudson River, where the rock surface drops off steeply. At Tenth Avenue and to the east, the bedrock is located at or near the ground surface. The predominant natural surficial material is the Harbor Hill ground moraine, a glacial till consisting of clay, sand, gravel, and boulders. A number of buried stream channels are present on the west side of Manhattan and are filled with glacial or alluvial deposits or manmade fill. Most of the surface soils have been altered by excavation, filling, or paving for residential, commercial, or industrial purposes. The original western Manhattan shoreline extended inland as far as Tenth Avenue within the APE. This subsection summarizes the soil stratigraphic units in the study area in sequence from youngest to oldest.

POST-GLACIAL SOILS

ARTIFICIAL FILL

Given the obvious modern, urbanized nature of the Project Site, the soils have been altered by excavation or filling for residential, commercial, industrial, or transportation-related purposes. Earth and man-made materials that have been emplaced as fill include gravel, sand, silt, clay, trash, cinders, ash, and construction debris. Along the Hudson River shoreline in Manhattan, historical records indicate that current land in the study area extends well beyond the mid-nineteenth century shoreline. Filled for urban development, these areas were former bays or tidal marshes. The original western Manhattan shoreline in the study area extended inland to nearly Tenth Avenue. Along the former shoreline of Manhattan, the many former minor tributary streams were altered, channelized, or obliterated by fill. Upland areas are fully urbanized and have all been affected by either residential or commercial development or both for over one hundred years (ARC 2007). **Figure 7** depicts the soil layers and underlying bedrock in profile.

TIDAL MARSH DEPOSITS

Former bays or tidal marshes near the Hudson River shoreline which were filled for urban development in Manhattan typically have post-glacial organic tidal marsh deposits of Holocene age beneath the fill (Gateway Trans-Hudson Partnership 2016). However, this does not appear to be the case in most of the APE for Direct Effects; organic peat deposits only appear in the off-shore, submerged portion of the APE (see **Figure 7**).

ESTUARINE DEPOSITS

The Hudson River's underlining bedrock has a trough shape and is covered with a thick sequence of post-glacial estuarine deposits. These deposits overlie glacial lake deposits and in New Jersey, the older tidal marsh deposits. The estuarine deposits consist of gray clayey silt and silty clay with traces of fine sand and shells. They were deposited under variable rates of Holocene and late-Pleistocene post-glacial sea-level rise and isostatic adjustment as a result of marine incursion into the Hudson River trough during and after post-glacial sea-level rise (Gateway Trans-Hudson Partnership 2016). This complex process led to variations in texture and composition of the material.

ALLUVIUM

Alluvial deposits are present along active stream channels in New Jersey. A number of buried stream channels are also present in the vicinity of the study area in Manhattan and are at least partly filled with glacial or alluvial deposits. Some have also received additional artificial fill.

GLACIAL SOILS

LAKE HUDSON DEPOSITS

Most of the material that accumulated on the bed of glacial Lake Hudson eroded away as a result of flooding associated with flooding glacial meltwater. They are now only discontinuously present in the Hudson River bedrock trough. The lacustrine-fan and lake-bottom sediments of glacial Lake Hudson are similar to the underlying older sediments of glacial Lake Bayonne (Gateway Trans-Hudson Partnership 2016).

HARBOR HILL MORAINE

The Harbor Hill ground moraine is the glacial till that is the predominant natural overburden material overlying rock in most of the study area in Manhattan. It consists of a mix of clay, sand, gravel, and boulders and is reworked in places (ibid).

D. CURRENT CONDITIONS

The west side of Midtown Manhattan is a highly urbanized and developed area. Block 675, between 30th and 29th Streets and Route 9a/Twelfth Avenue and Eleventh Avenue, is primarily a paved lot currently being used for truck and bus storage although a few two- to four-story buildings and a gas station are located along the eastern portion of the block. The adjacent block to the south is similarly used as a utility storage/staging area and a natural gas vehicle fueling station. Surrounding land uses include the rail infrastructure of the Western Rail Yard to the north and the urban structure of the historic Terminal Warehouse located two blocks south of the site between West 27th and West 28th Streets. All of the blocks in the area are enclosed by local streets and Route 9A is a major north-south roadway extending through the west side of the APE. To the west, the Hudson River Park, part of the Manhattan Waterfront Greenway, extends from 59th Street south to Battery Park.

A. PREHISTORIC CONTEXT

A number of researchers have conducted substantive analyses of the prehistoric period of Manhattan Island and several previous reports have included detailed descriptions of those efforts. For example, the ARC Phase 1A provides a detailed review of these efforts and a summary of the various phases of Manhattan's prehistoric occupation. Also, HCI's 1983 survey conducted for the Westside Highway Project includes a detailed analysis of the paleoenvironment and submergence of the coastline following the receding of Holocene ice sheets including the area between 23rd Street and 39th Street, which encompasses the portion of the current APE for Direct Effects west of Block 675 (Rutsch et al. in HCI 1983). HCI's analysis included the review of soil borings and identified the steeply plunging bedrock depths to the west indicating that the area was inundated for most of prehistory. HCI concluded that the current APE for Direct Effects is not sensitive for prehistoric sites. The ARC Phase 1A also included a geomorphological review of soil borings (see **Figure 10**) and radiocarbon dates of soil samples.

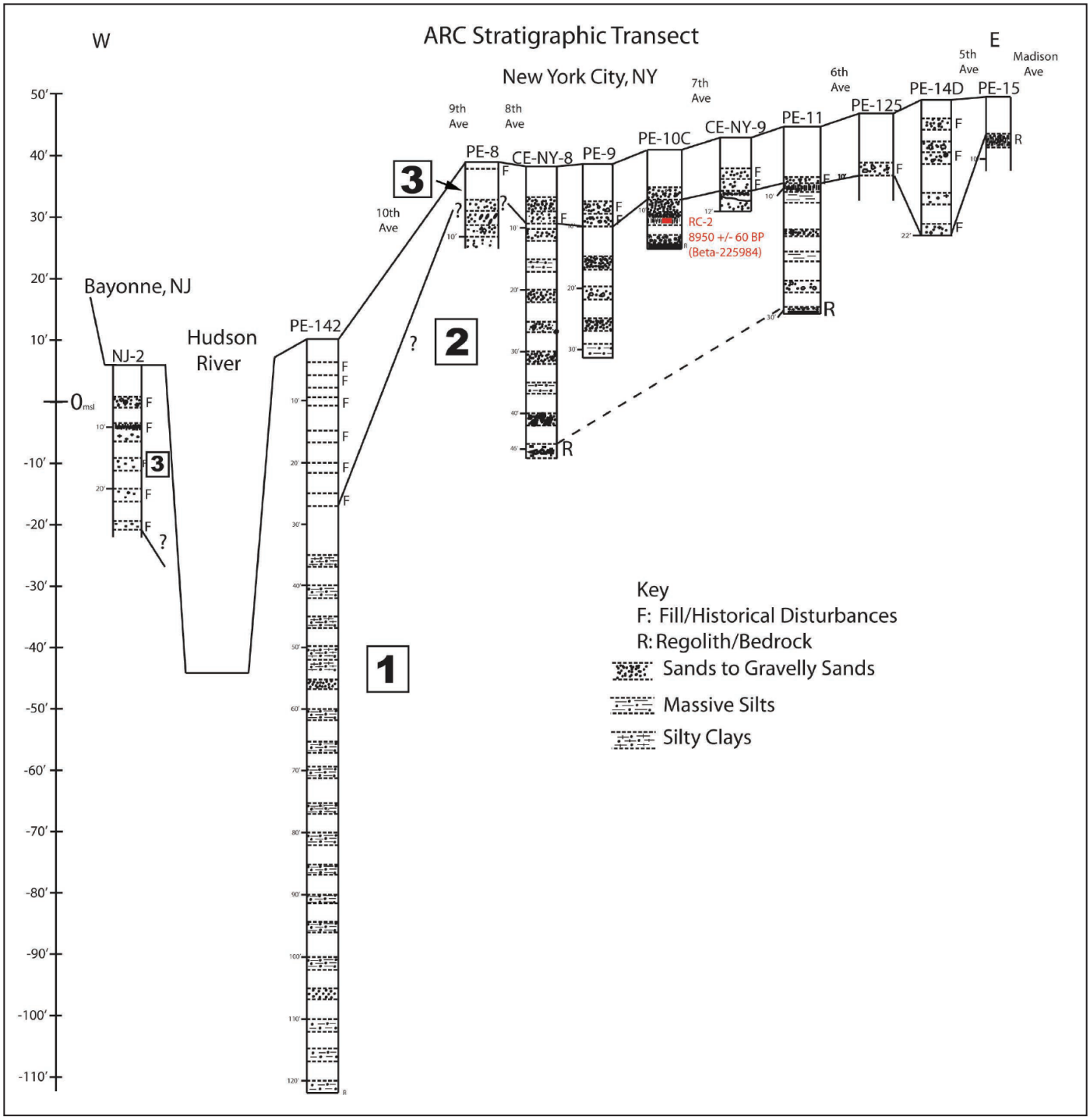
Most of the current APE for Direct Effects has been inundated by the rising waters of the Hudson River since approximately 13,000 years ago, before the human occupation of the island. The higher elevation inland portion of the APE has shallow bedrock and has been intensively developed for well over 150 years. Due to the lack of sensitivity of the current APE for Direct Effects for prehistoric archaeological resources the detailed prehistoric context available in the aforementioned reports will not be repeated in this report.

B. HISTORIC CONTEXT

The following is a generalized context of the historic development of the west side of Midtown Manhattan during the nineteenth and early twentieth centuries. A more detailed description of the development of the APE for Direct Effects is included in Chapter 5.

EIGHTEENTH TO EARLY NINETEENTH CENTURIES

Throughout the eighteenth century, the west side of what is now Midtown Manhattan only extended to about Tenth Avenue was farmland. In the early nineteenth century, most of this land was owned by George Rapelje, grandson of Dutch settler, Joris Rapelje, one of the first immigrant workers brought to New Netherlands, as the 17th-century colonial province on the East Coast of North America was known, by the Dutch West India Company. The land in the Project Area vicinity was purchased by the Rapelje family in 1720 from Sir Peter Warren, a British Naval Officer and British Member of Parliament. Later in the century, several additional estates were established around present day 9th Avenue. The area remained largely rural in the early nineteenth century, consisting of market gardens, estates, and unimproved lands, much of which were owned by the municipal government. The Rapelje family started selling off development tracts in the 1820s. These tracts had boundaries that conformed to the street and avenue grid system, adopted by the New York Legislature in 1811, but not approved until 1835.



HUDSON TUNNEL PROJECT

Geomorphological Review of Core Borings

Figure 10

NINETEENTH CENTURY AND DEVELOPMENT OF COASTLINE

Colton's 1836 topographic map of the City of New York and the Island of Manhattan, illustrates that most of the APE for Direct Effects was in the Hudson River (see **Figure 11**). Only the current location of the eastern half of the rail yards, the Eastern Rail Yard, Tenth Avenue, and the location of the Lerner Building were on dry land. Before the mid-nineteenth century landfill projects, the Hudson River shoreline was located in the Project Area, near what is now Eleventh Avenue. Once the grading and filling was completed, the avenues and streets were established north to West 35th Street.

The East River of Manhattan's waterfront played a prominent role in the shipping industry until the early-nineteenth century, when the advent of steam-powered ships forced the focus of New York's trade economy to shift to the deeper waters of the Hudson River in Lower Manhattan. During the nineteenth century the island's western waterfront was intensively developed, resulting in a surge of growth in the city's maritime and shipping industries and making it the most successful port in the country (Albion 1967). The opening of the Erie Canal in 1825 and the development of packet services to distant American and European ports led to expanded reciprocal trade between local merchants, the rest of the country, and the rest of the world. In the years preceding the American Civil War in the mid-nineteenth century, "New York City handled two-thirds of America's imports, and dominated exports and passenger trade" (Novek 1992:24). This in turn attracted merchants to the waterfront areas, resulting in the establishment of a nationally important shipping district. Concentrated commercial development and urbanization in Lower Manhattan fueled a wave of growth that followed the Hudson River coastline northward tapping available land in Midtown.

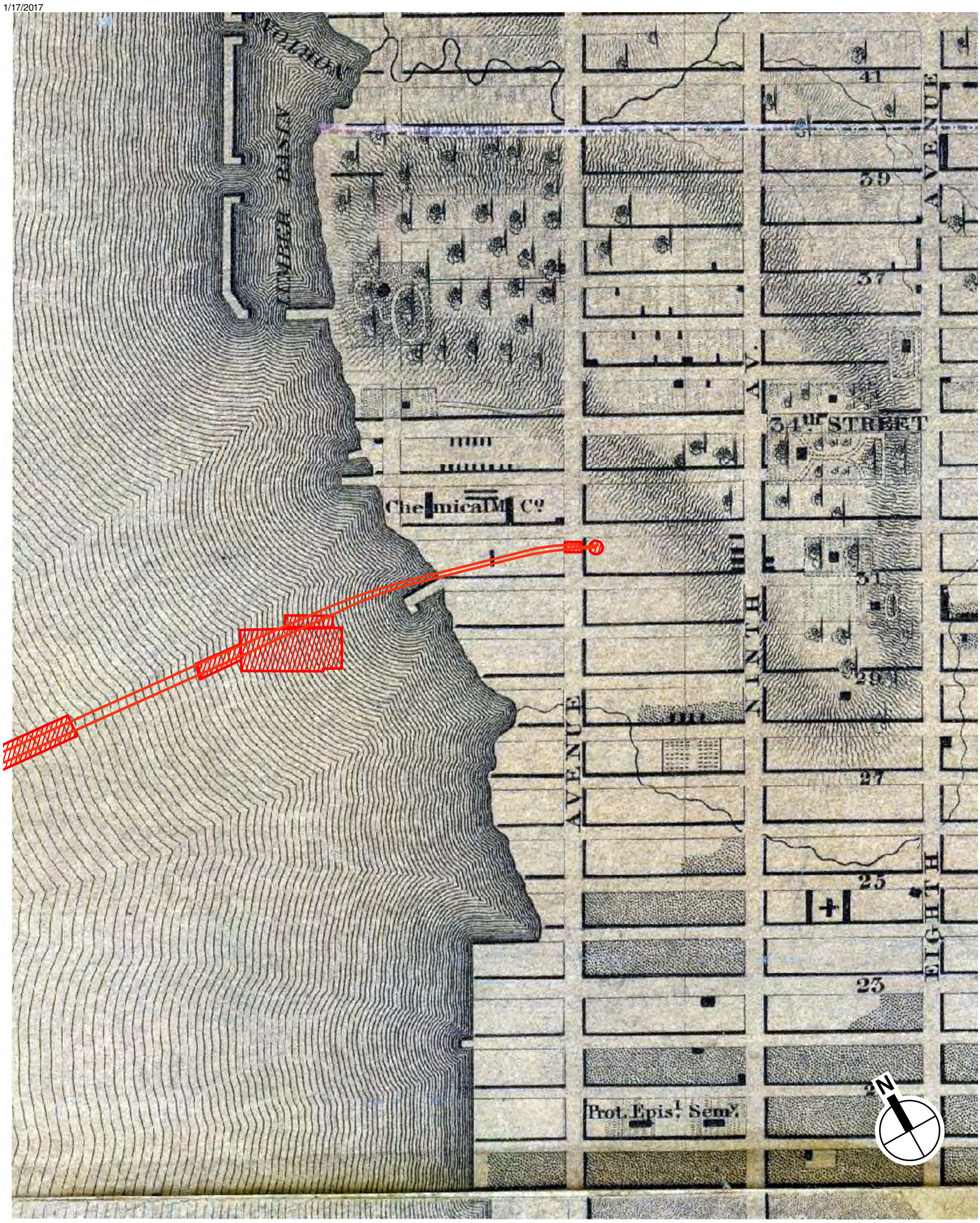
Industrial development of this area occurred in tandem with the establishment of extensive rail capacity beginning in the 1830s. During the late nineteenth century, two dominant regional rail lines, the Hudson River Railroad and the New York Central Railroad, connected and a substantial railyard was established. The rail yard included various car shops and a large roundhouse. Lumber storage, stone yards, coal yards, a limekiln and an iron works surround the two train yard blocks, suggesting the area was principally a freight rail yard for industrial operations.

Midtown soon became home to waves of German and then Irish immigrants and three-to-five story frame and brick tenements were soon constructed throughout the area. Residents dubbed the locality "Hell's Kitchen" and it remained a major health and sanitation threat for many years (AKRF 2014).

The Hudson River Bulkhead and its associated structural systems were constructed between 1871 and 1936 by the New York City Department of Docks. The majority of the construction consisted of masonry walls on a variety of foundation systems, with quarry-faced ashlar granite block forming the visible face along most of the armored frontage. The portion of the bulkhead between approximately West 23rd and West 34th Streets was built between 1876 and 1898. Design of the bulkhead was the responsibility of George B. McClellan, a general during the Civil War who became the first Engineer-in-Chief of the Department of Docks. McClellan's plans contemplated the creation of a 250-foot-wide marginal street, from which 60- to 100-foot-wide piers with cargo sheds would project 400 to 500 feet around 150 to 200-foot-wide slips. Initiated to respond to the deteriorated, congested, and silt-filled condition of the waterfront, the carefully built granite walls created a consistent monumental surface to the waterfront that reinforced an image of the City's commercial prominence. As property was acquired and as commerce warranted, the City built the bulkheads, built or rebuilt pier substructures, and leased redeveloped areas to private companies that were usually responsible for piershed and headhouse construction.

LATE NINETEENTH THROUGH THE MID-TWENTIETH CENTURIES

In the late nineteenth and early twentieth centuries, pier development along the Hudson River waterfront continued to spur industrial development in the vicinity of Eleventh and Twelfth Avenues. These



Area of Potential Effects (APE) Boundary for Direct Effects

HUDSON TUNNEL PROJECT

Colton 1836

Figure 11

industrial facilities mixed with existing residential areas in Hell's Kitchen and Chelsea while fostering additional residential development. The 1908 opening of the New York Improvement and Tunnel Extension of the Pennsylvania Railroad, which included tunneling under the Hudson and East Rivers and through Manhattan, connected the Nation's largest port with the Nation's largest railroad, and greatly changed the character of Midtown. **Figure 17** provides a cross section of the tunnel in the vicinity of the Hudson River Bulkhead.

The region's urban centers, industries, and port facilities continued expanding through two world wars (AD Marble 2005). The rise of the automobile in the twentieth century led to construction of bridges over the Hudson River, beginning with the George Washington Bridge in 1931, followed by the Tappan Zee Bridge in 1955, and tunnels were bored below the river with the Holland Tunnel in 1927 and the Lincoln Tunnel from 1934 to 1957 (AD Marble 2005).

The advent of containerized shipping in the late 1950s led to the dramatic decline of shipping and industrial activity in the ports of New York, including the Project Area. The area has since experienced periods of decline and, more recently, gentrification and re-development.

Chapter 5: Results of Survey

This chapter summarizes the results of this archaeological documentary study. It includes a summary of relevant previous archaeological surveys, a cartographic review for information on the historic development of the area, a site disturbance characterization, a brief summary of the geophysical survey, and it concludes with a sensitivity assessment for prehistoric archaeological resources, shipwrecks, and several classes of historic archaeological resources.

A. PREVIOUS ARCHAEOLOGICAL SURVEYS IN THE VICINITY OF THE APE

The APE for Direct Effects and its vicinity, and much of the west side of Midtown Manhattan around the Western and Eastern Rail Yards, have been the subject of multiple previous archaeological investigations (see **Figure 8** for the area previously surveyed in the vicinity of the Project). In addition, the Hudson River Bulkhead, which extends from west 59th Street to Battery Park, has been previously evaluated in several locations and the bulkhead from Battery Park to West 59th Street has been determined to be S/NRHP eligible under Criterion A, C, and D. Of most relevance are the Phase 1A Archaeological Survey Report (prepared in August 2005/Revised October 2007) and supplemental studies prepared for the ARC Project, which had a similar APE to the current Project, involved a similar level of analysis, and also concluded that potentially significant archaeological resources could be affected. Other relevant surveys include those prepared for the No. 7 Line/Hudson Yards completed in 2004 and numerous studies associated with reconstruction of Route 9A. The current research has sought to minimize duplicative effort by utilizing these previous studies and relying on their interpretations and recommendations as appropriate. Some of the conclusions and interpretations of these previous surveys are contradictory. This is at least partly explained by changing standards of significance over the past decades. For situations where the recommendations of previous projects are in disagreement, the conclusions and recommendations included in this Phase 1A have deferred to the conclusions of the most recent determination, which in this case would be the ARC analyses.

WESTSIDE HIGHWAY

In association with a planned large-scale program by the New York State Department of Transportation (NYSDOT) to redevelop the Westside Highway, HCI (1983) conducted an expansive study and evaluation of a large stretch of the west side of Manhattan Island. The Westside Highway Study Area extended along the Westside Highway and much of the shoreline from Battery Park to West 44th Street. In the vicinity of the current APE, the 1983 Study Area included the affected portion of the Hudson River Bulkhead, Hudson River Park, Twelfth Avenue, 30th Street between Twelfth and Eleventh Avenues, and the portion of Tenth Avenue immediately south of the current APE. This research effort included a substantial evaluation of the paleoarchaeology of the west side of Manhattan, the filling in of the Project area and development of bulkheads, piers, streets, and the current block system, and the process of industrialization and development.

HCI's Westside Highway survey did not identify the portion of Twelfth Avenue extending through the current APE for Direct Effects as sensitive for the presence of archaeological resources. It also

determined that the block directly north of Block 675, the Western Rail Yard, had no archaeological sensitivity, however, it did not include an assessment of Block 675 itself.

The evaluation of the area's paleoarchaeology analyzed the paleoenvironment and the submergence of the coastline following the receding of Holocene ice sheets. The region examined for sensitivity for the presence of prehistoric resources included the area between West 23rd Street and West 39th Street, which includes the portion of the current APE for Direct Effects west of Block 675 (Rutsch et al. in HCI 1983). This analysis identified steeply plunging bedrock depths to the west resulting in inundation for most of prehistory and concluded that the study area had no sensitivity for prehistoric sites.

ROUTE 9A RECONSTRUCTION PROJECT

In 1994, AKRF, Historical Perspectives, Inc. (HPI), and Hartgen Archeological Associates, Inc. (Hartgen) completed another major cultural resources survey of the Westside Highway, this time as part of the Route 9A Reconstruction Project. The APE for the Project largely encompassed areas on both sides of Route 9A between Battery Park in Lower Manhattan to West 59th Street in Midtown Manhattan. As part of this analysis, numerous supplemental cultural resource surveys were prepared to investigate specific aspects of the Project, including:

- A general archaeological assessment of the route (HPI and Hartgen 1990 and 1990a);
- An assessment of the route's sensitivity for prehistoric sites (HPI and Hartgen 1990b, 1992c);
- A sensitivity assessment for wharves and piers (HPI and Hartgen 1992b);
- An assessment for potential sunken ships and landfill retaining devices (HPI and Hartgen 1992a);
- A sensitivity assessment for manufacturing and light industry (Louis Berger and Vollmer 1993); and
- A sensitivity assessment for lumber and building materials yards (HPI and Hartgen 1991).

Of particular relevance to the current APE for Direct Effects are the sensitivity assessments for manufacturing and yards. The reports describe research questions that could be addressed through the archaeological analysis of lumber yards and nineteenth century/early-twentieth century industrial complexes, including soap factories (HPI and Hartgen 1991 and Louis Berger and Vollmer 1993). HPI and Hartgen also identified the joinery or fasteners used in the historic wharves and piers as having archaeological research value, but not the piles themselves.

HUDSON RIVER PARK PROJECT

In May 1998, AKRF et al. completed the Final EIS for the Hudson River Park Project, which included a historic resources survey of that APE, which extended east and west of the proposed park boundaries from Battery Park to West 59th Street. Of note, the Hudson River Bulkhead and relieving platforms, extending from Battery Place to West 59th Street, was determined National Register eligible through the Section 106 process under Criterion A, C, and D. As part of that project, HPI (1994, revised 1997) prepared a survey of the archaeological sensitivity of the Hudson River Park between West 24th and West 40th streets. Aside from the bulkhead, HPI also considered the potential for prehistoric remains, older piers and wharves, including the nineteenth century West 30th Street pier, landfill associated with these piers, and an underground cattle pass at West 38th Street, several blocks north of the APE for Direct Effects. However, through more detailed analysis, HPI concluded that there was little likelihood that these resources possessed sufficient archaeological significance to be considered S/NRHP eligible.

NO. 7 LINE/HUDSON YARDS

In 2004, the Metropolitan Transportation Authority (MTA) and the City of New York City Planning Commission (CPC) prepared the Final Generic EIS for the No. 7 Subway Extension – Hudson Yards

Rezoning and Development Program Project. As part of that project, HPI and Louis Berger, Inc. conducted an Archaeological Documentary Study for an area roughly bounded by West 44th Street to the north, 7th/8th Avenues to the east, West 28th/30th Streets to the south, and the east side of Twelfth Avenue to the west, a study area that included almost the entirety of the APE for the current Project, including Block 675, West 30th Street, Tenth Avenue, and the Lerner Building. The NYCLPC conducted a first-level review of the affected blocks and Block 675 was not included in the blocks to be subject to an archaeological documentary study. Several areas of the No. 7 Line/Hudson Yards APE were identified as archaeologically sensitive. The study did not identify any historic piers, wharfs, or landfill-retaining structures or areas of potential industrial sites as sensitive.

ACCESS TO THE REGION'S CORE/TRANS-HUDSON EXPRESS PROJECT

In 2005 (revised 2007), A.D Marble & Company prepared a Phase 1A Archaeological Survey Report for the ARC Project. The APE included areas approximately 200 to 1,000 feet from the proposed tunnel alignment and associated proposed station entrances, shaft/fan plant sites, and other ancillary facilities, extending from the Hudson River to the west to as far as Madison Avenue to the east, and from as far north as West 36th Street and as far south as West 26th Street.

The ARC Project covered much of the current APE although the tunnel alignment was about a block further to the south than the current alignment and the tunnel was then planned to be significantly deeper at the Manhattan shoreline. Much of that report's conclusions and recommendations are directly relevant to the current evaluation. Specifically, the ARC Phase IA reached the following conclusions regarding the Manhattan portion of the APE:

- This general area of NYC has no reasonable potential for intact prehistoric resources due to having been inundated for most of the prehistoric period and intensive historic and modern period development.
- The material used as landfill in this area during the nineteenth and early-twentieth centuries has no archaeological sensitivity.
- The coastline and filled-in areas have a moderate sensitivity for relic piers, wharves, and landfill-retaining devices.
- The proposed Twelfth Avenue fan plant/construction access shaft site (Block 674, located one block south of the Block 675 fan plant site) has a moderate sensitivity for historic nineteenth century domestic remains and industrial remains and relic piers, wharves, and landfill-retaining devices.

A 2009 Cultural Resources Management Plan and Programmatic Agreement prepared by the THE Partnership (2009b) recommended archaeological testing in advance of construction and/or archaeological monitoring during construction to address the sensitivity of these areas. Also in 2009, the THE Partnership prepared a Documentary Analysis Report of the Twelfth Avenue fan plant/construction access shaft site on Block 674 (2009a), a more detailed analysis of the archaeological sensitivity of the proposed Twelfth Avenue fan plant/construction access shaft site between West 29th Street and West 28th Street. The Documentary Analysis Report details the specific types of expected archaeological features, the depths of sensitivity and their horizontal extent, and general archaeological monitoring and testing methods (this work was never carried out).

EA FOR CONCRETE CASING

In 2013 and 2014, Amtrak and FRA prepared an Environmental Assessment and Supplemental Environmental Assessment for the proposed construction of a concrete casing extension in the Hudson Yards. That APE includes portions of the Eastern and Western Railyards, east and west of Eleventh Avenue, between West 30th and West 33rd Streets (AKRF 2013 and 2014). That EA was completed in

two phases, one for the Western Railyard and one for the Eastern Rail Yard, with Eleventh Avenue dividing the two portions. The project involved preservation of the right-of-way needed for construction of a new rail tunnel from Penn Station across the Hudson River. No areas of archaeological sensitivity were identified in the APE for that project.

B. CARTOGRAPHIC REVIEW

The following is a more detailed description of the historic development of the APE for Direct Effects based on a review of historic maps dating from the early-nineteenth century through the early-twentieth century. For consistency, development will refer to the Project components described in Chapter 2.

COLTON, 1836

During the first decades of the nineteenth century, the west side of midtown Manhattan was still sparsely developed and land use was primarily agricultural (see **Figure 11**). There were no buildings in the APE for Direct Effects and the coastline had only been minimally improved. This portion of Manhattan's coastline is depicted as irregular and corresponds roughly with the midpoint between Tenth and Eleventh Avenues, placing most of the APE in the Hudson River. A small pier extends southwest from the end of 31st Street out into the river. A small industrial site is located along the coastline to the north of the APE, a land use that will become very common later in the century.

PERRIS AND HUTCHINSON, 1850

By 1850 the vicinity of the APE has been transformed into a quickly developing extension of the city's urban core. A rail line has been established along Eleventh Avenue, to the north of the APE, which crosses diagonally to the southeast through the APE to Tenth Avenue (see **Figure 12**). A scattering of buildings are depicted in the location of the Lerner Building, along the tunnel route through the eastern Hudson Railyard, and on Block 675. By this point the coastline has been extended beyond Eleventh Avenue and the 30th Street footprint extends to about the future location of Twelfth Avenue (**Figure 12**).

DRIPPS AND HARRISON, 1852

By 1852 the rail facilities between 30th and 31st Streets between Tenth and Eleventh Avenues, labeled the *Hudson River Rail Road Depot,* has been expanded and there appear to be several sets of rail tracks (**Figure 13**). One of the buildings on Block 675, to the east of the construction staging area, is labeled *Saw Mill* and four or five unlabeled buildings are located within the construction staging area itself. There are also still a small number of unlabeled buildings in the vicinity of the Lerner Building (**Figure 13**).

VIELE, 1865

Although the 1865 Viele Map provides significant detail regarding the topography and natural features of the APE, little information concerning specific development is included (**Figure 14**). It appears that Tenth Avenue in the vicinity of 31st and 32nd Streets was elevated and featured outcroppings of bedrock. This is consistent with the current mapping for the area (see **Figure 7**). The western edge of the Manhattan coastline appears little changed from 1852 although Eleventh Avenue has been established to the north and south of the APE.

BROMLEY, 1879

The industrialization of western midtown continued to expand through the later decades of the nineteenth century. The rail yards were dramatically expanded with dozens of individual rail lines extending to the many piers established along the coast (see **Figure 15**) and dozens of industrial operations and yards have

Area of Potential Effects (APE) Boundary for Direct Effects

HUDSON TUNNEL PROJECT

Perris and Hutchinson 1850

Figure 12

1/17/2017

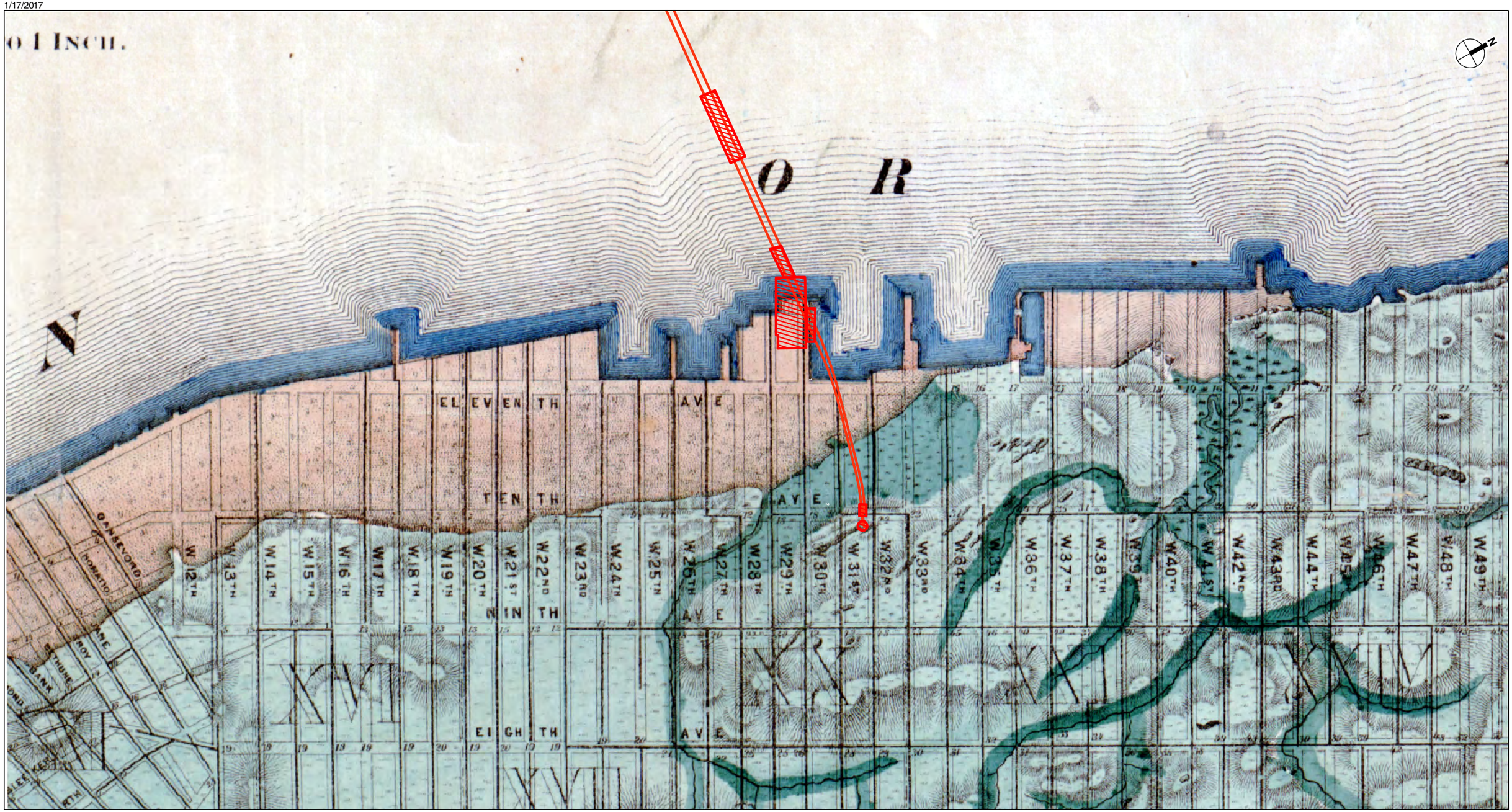
Area of Potential Effects (APE) Boundary for Direct Effects

0 1,000 FEET

HUDSON TUNNEL PROJECT

Dripps Harrison 1852

Figure 13

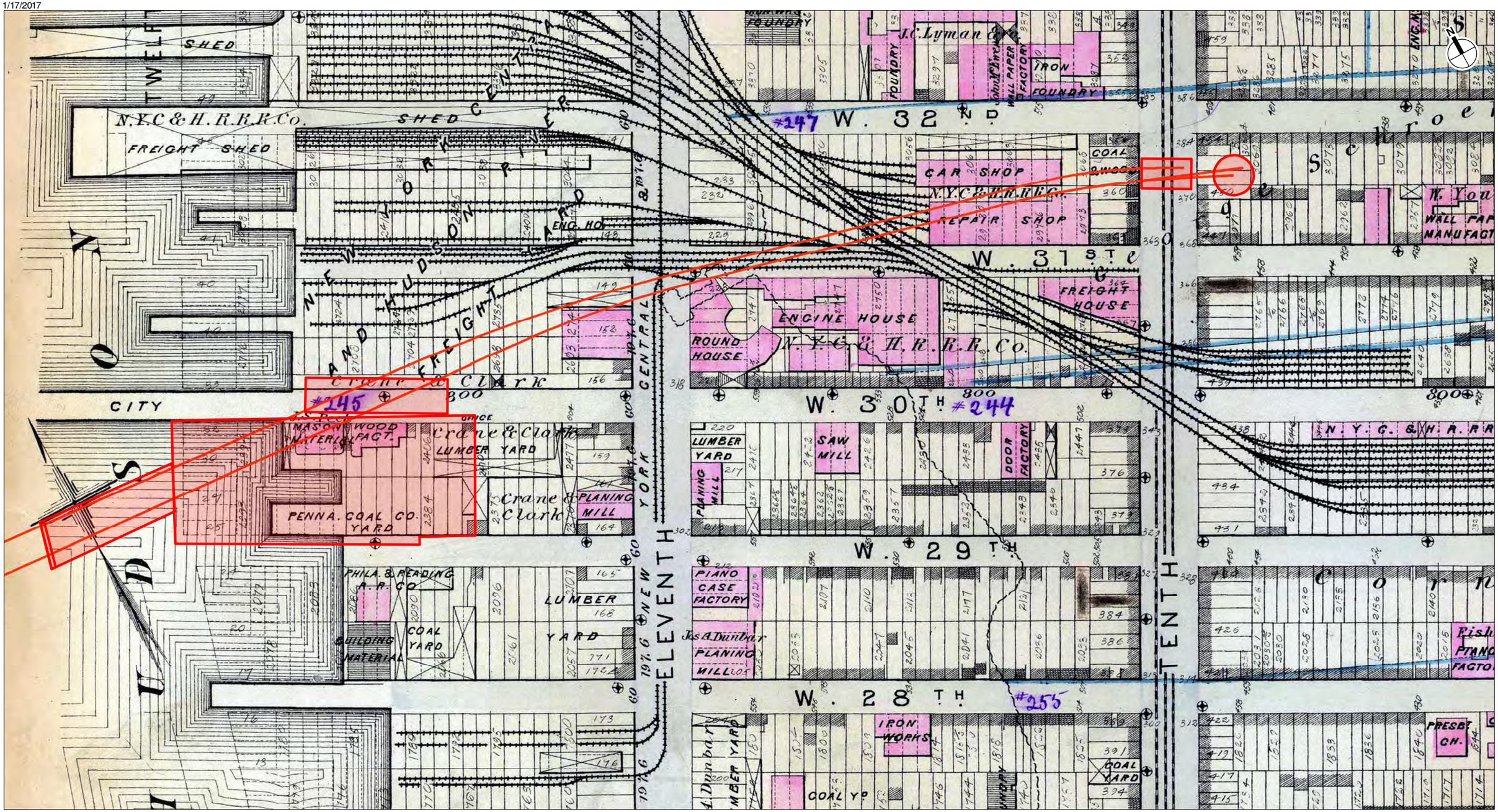


Area of Potential Effects (APE) Boundary for Direct Effects

0 1,000 FEET

HUDSON TUNNEL PROJECT

Viele, 1865
Figure 14



Area of Potential Effects (APE) Boundary for Direct Effects

HUDSON TUNNEL PROJECT

Bromley, 1879
Figure 15

been developed throughout the area. Although by now 30th Street has been extended to about its modern orientation, the western edge of Block 675 is still open water in 1879. Block 675 has been developed with several operations: *Masons Material, Wood Factory, Crane & Clark Lumber Yard, Penna. Coal Co. Yard,* and *Planing Mill* have been labeled on the 1879 Bromley. It also appears that a number of utility lines have been installed along Tenth Avenue.

ROBINSON, 1885

By 1885 the Manhattan coastline has been extended in the APE to Twelfth Avenue and the entirety of Block 675 has been filled in, including completion of the Hudson River Bulkhead (**Figure 16**). Although this block is still only partially developed with industrial businesses at this time, other blocks in the area have become densely developed with a wide range of manufacturing and industrial operations. Businesses on Block 675 include: *Peck Martin & Co. Masons Building Materials, Crane and Clark Lumber Dealers*, and *G.S. Shultz.*

BROMLEY, 1891

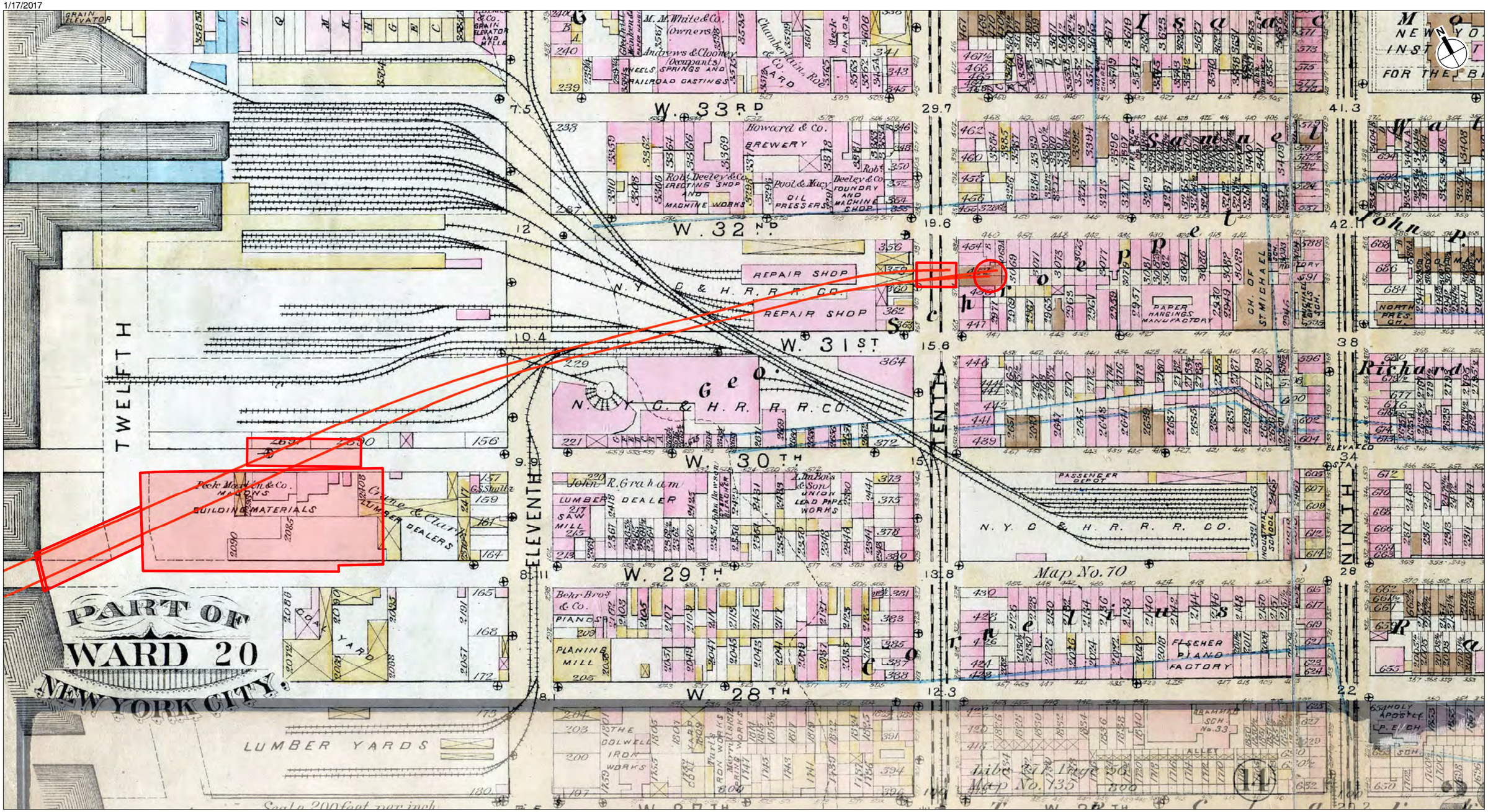
Although little has changed regarding development of the APE for Direct Effects by 1891, additional detail is provided regarding the businesses operating on Block 675. The largest building on the block is along 30th Street at about the center of the block. It is labeled *Peck & Martin Co.,* a seller of building materials. There are also three separate lumber yards on the block and a total of about a dozen individual structures. By this time the streets lining Tenth Avenue in the vicinity of the Lerner Building have been densely developed (**Figure 19**).

SANBORN, 1898

The 1898 Sanborn indicates a wider variety of industrial operations on Block 675 as well as several dwellings (**Figure 20**). By this time a soap factory has been established near the northwest corner of the block along 30th Street by John T. Stanley, who appears to have emigrated from England about 1860 and originally manufactured soaps in locations in lower Manhattan. The John T. Stanley Co. Inc. was opened on 30th Street in 1892 and the operation gradually expanded over time to include manufacturing facilities, wharehouses, and administrative offices. Other structures depicted on the 1898 Sanborn are *Wagon Yards, Stable, Kindling Yard, Lumber yard,* and, in the southeast corner of the block, outside of the construction staging area, an *Iron Works* (**Figure 20**). Despite the large number of businesses, Block 675 is still less developed than any of the adjacent blocks.

EARLY-TWENTIETH CENTURY DEVELOPMENT

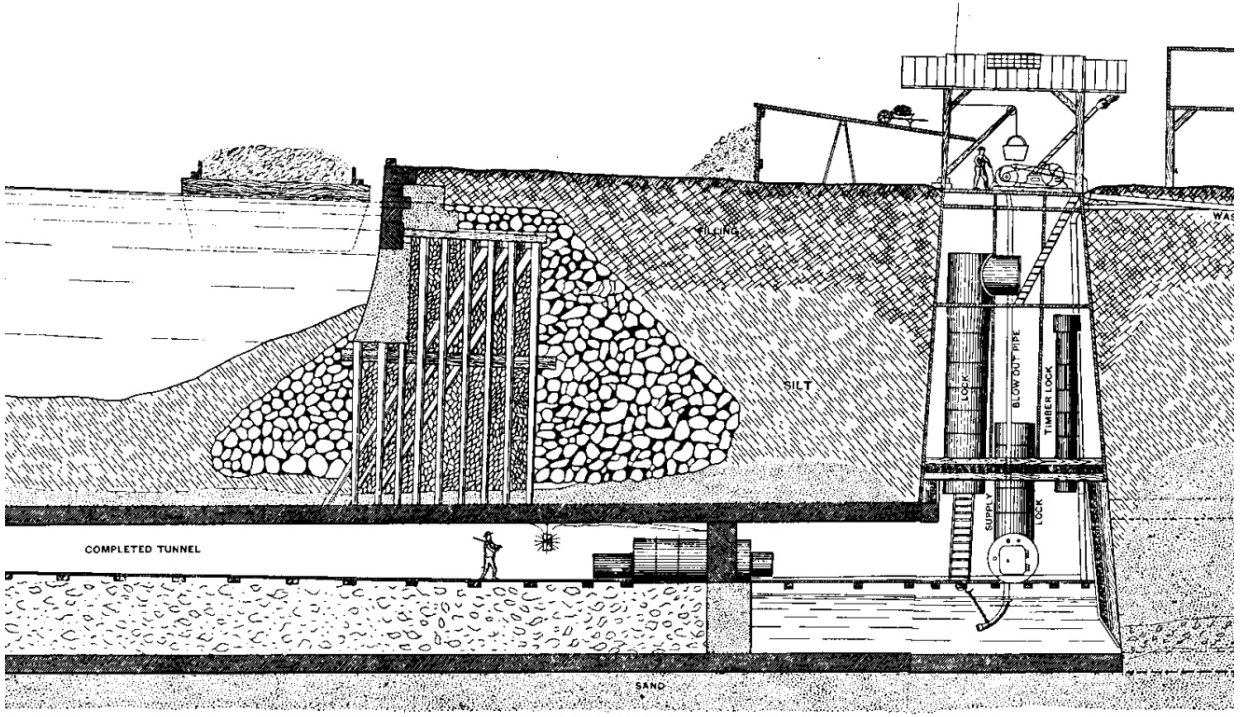
Two historic maps provide detailed information on the expanding industrialization of Block 675 during the early-twentieth century, the 1911 Sanborn (see **Figures 21a** and **Figure 21b**) and the 1920 Bromley (**Figure 23**). These two maps reveal that the John T. Stanley Co. has dramatically expanded its operations along much of West 30th Street in the construction staging area. The soap manufacturing complex now includes, from the corner of Twelfth Avenue heading to the east, a multi-floor storage building, a *Soap Factory*, a coal yard, offices, a building labeled *Truckman*, a *store house*, a group of buildings labeled *Soap Works*, another *office*, another *store house*¸ and a building labeled *Planing Mill*, which may not be part of the soap complex (**Figure 21a**). Other businesses on the block include a large lumber yard and lumber piles along West 29th Street, other lumber yards and piles along west 30th to the east of the soap works, and a *Smelting & Refining works* and a *woodworking and Manuftg. Scenery* in the southeast corner of the block. The soap works apparently continued to expand and the 1920 Bromley indicates another building associated with the *Stanley Soap Wks* on West 29th street (**Figure 23**). The smelting mill also appears to have expanded. Both **Figure 21b** and **Figure 23** indicate rail lines along Tenth Avenue.



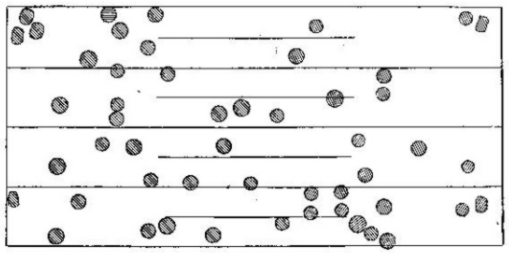
HUDSON TUNNEL PROJECT

Robinson, 1885. Plates 11 and 14

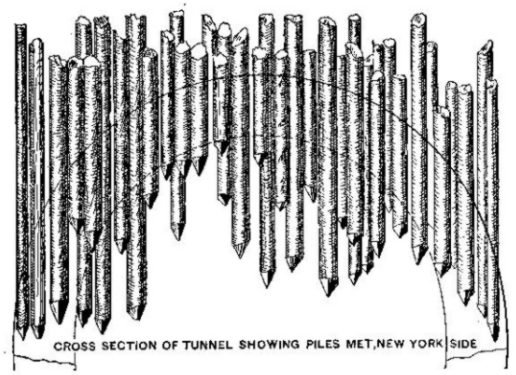
Figure 16



LONGITUDINAL SECTION THROUGH TUNNEL-NEW YORK SIDE. July 1885



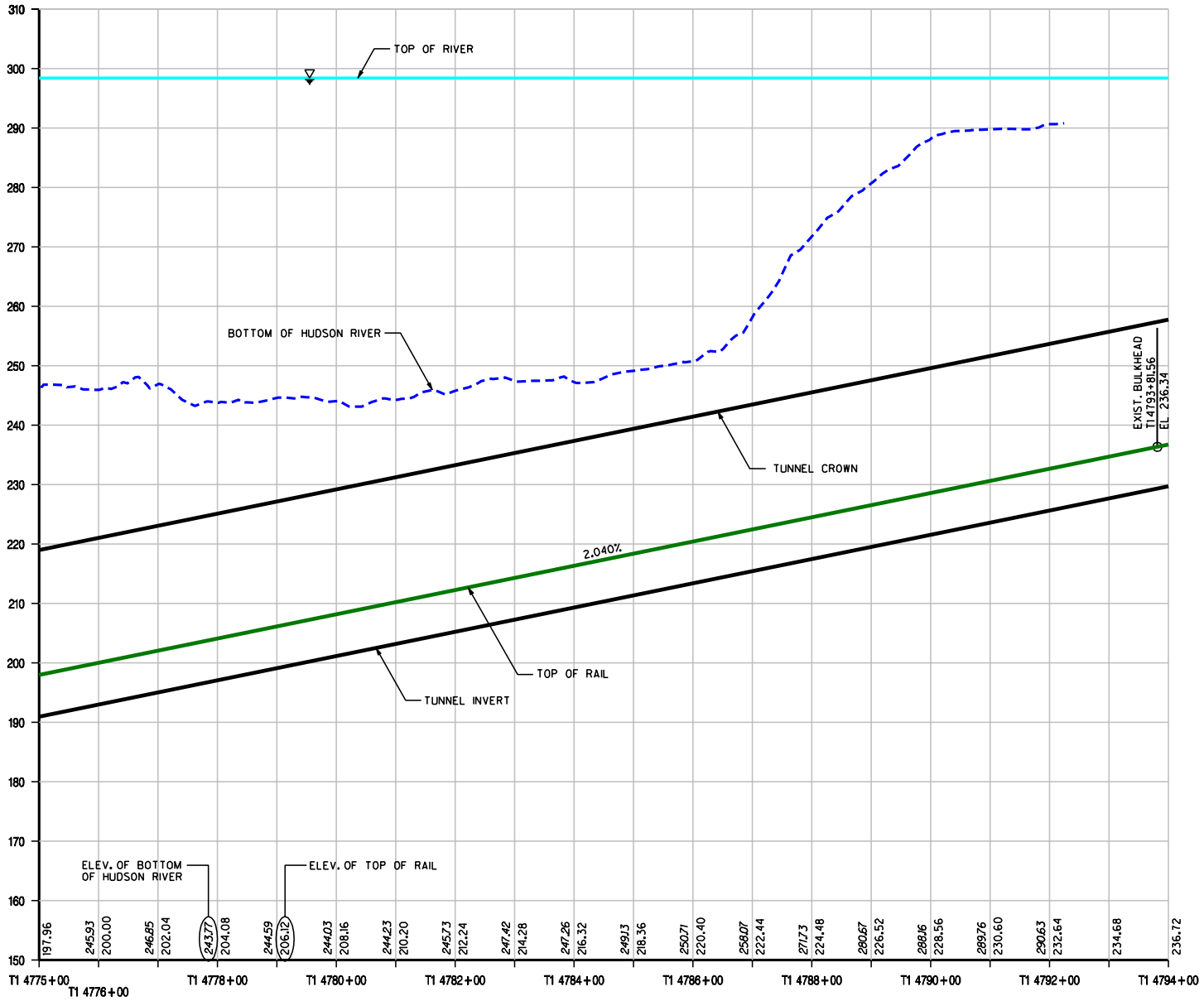
PLAN VIEW



CROSS SECTION OF TUNNEL SHOWING PILES MET, NEW YORK SIDE

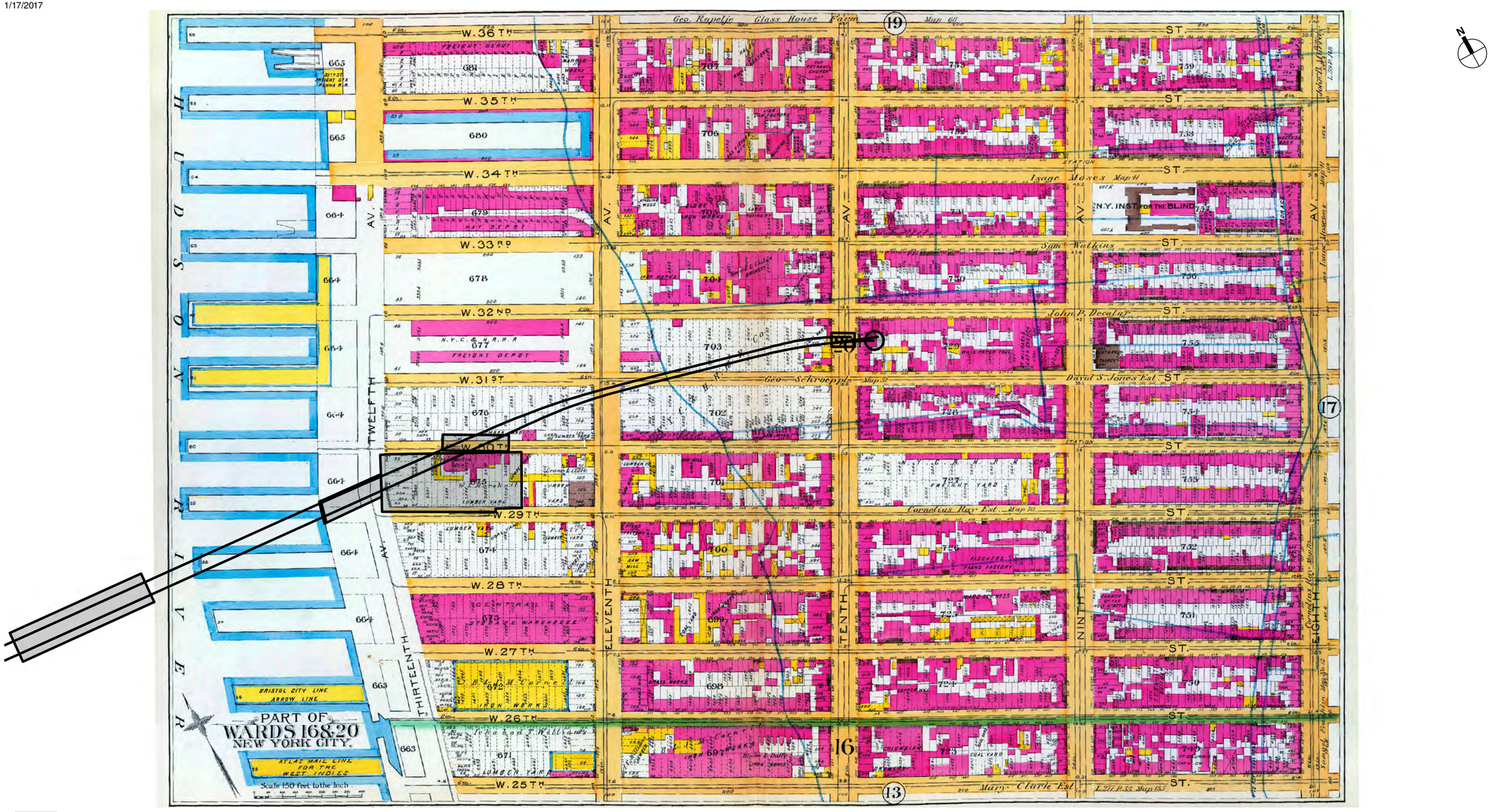
1885 Burr (Tunnel Cross Section)

Figure 17



TRACK 1 PROFILE

Results of Bathymetric Survey at In-water Construction Site, Hudson River

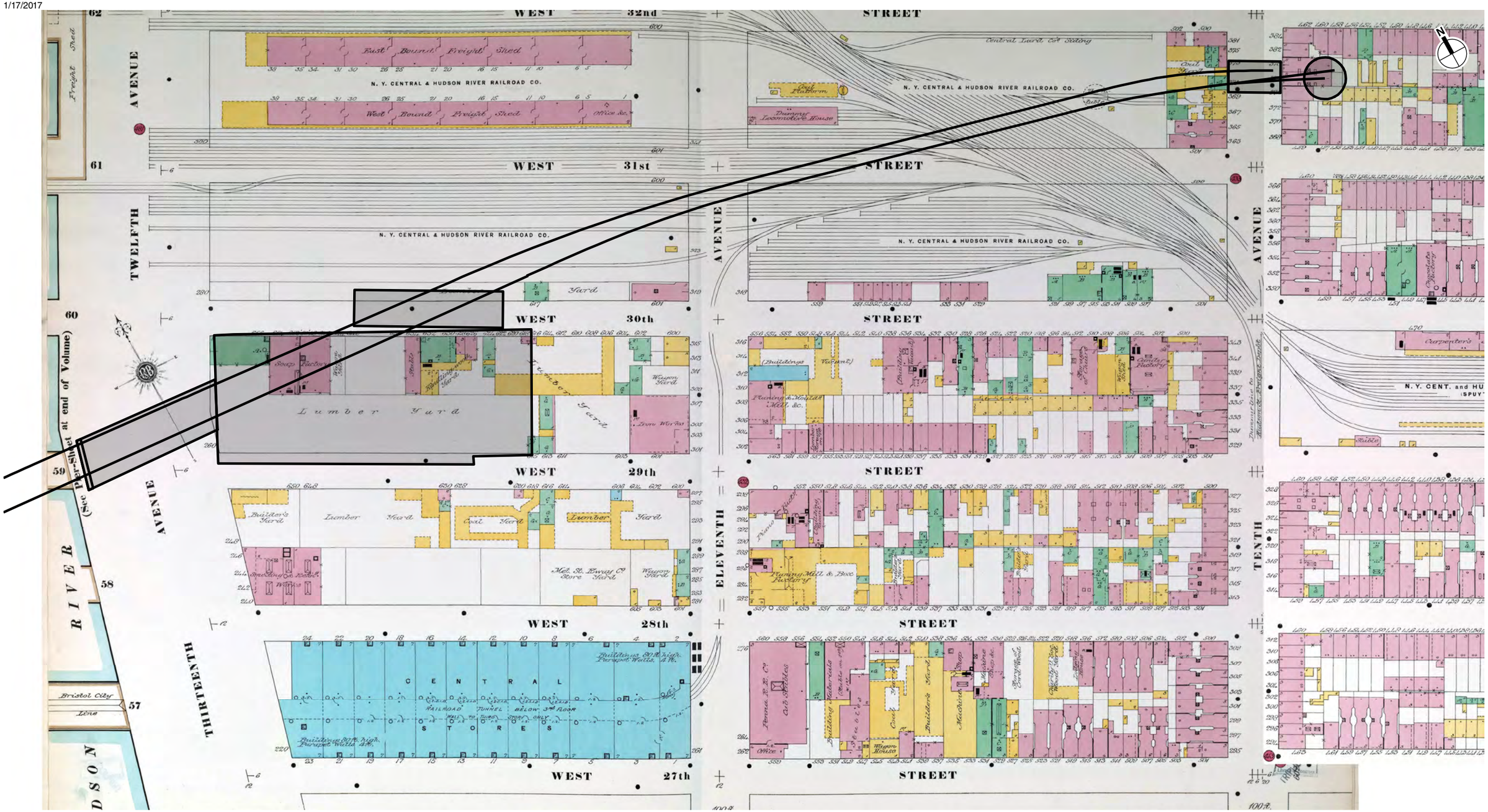


Area of Potential Effects (APE) Boundary for Direct Effects

0 1,000 FEET

HUDSON TUNNEL PROJECT

Bromley, 1891
Figure 19



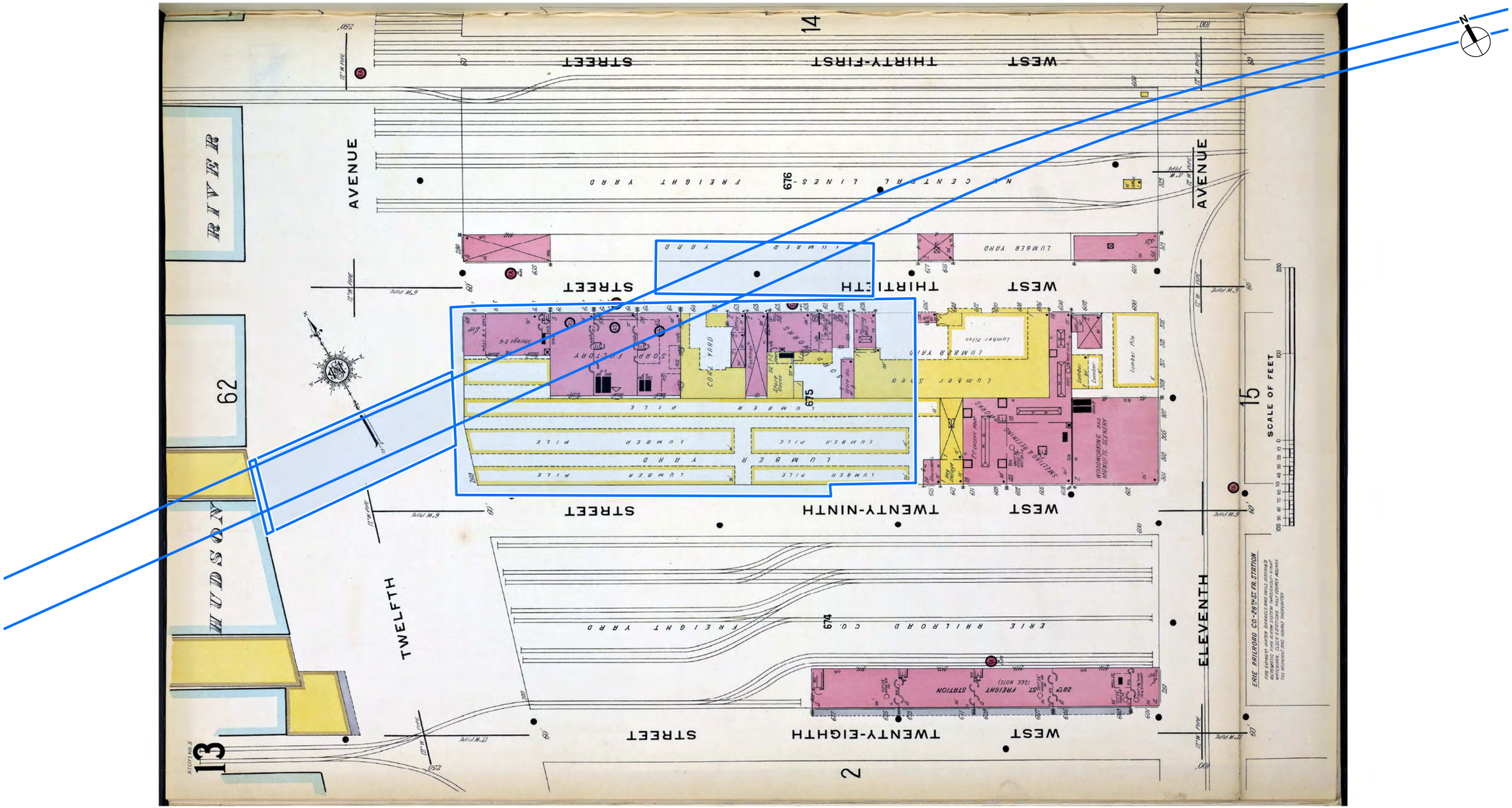
Area of Potential Effects (APE) Boundary for Direct Effects

0 500 FEET

HUDSON TUNNEL PROJECT

Sanborn, 1898

Figure 20

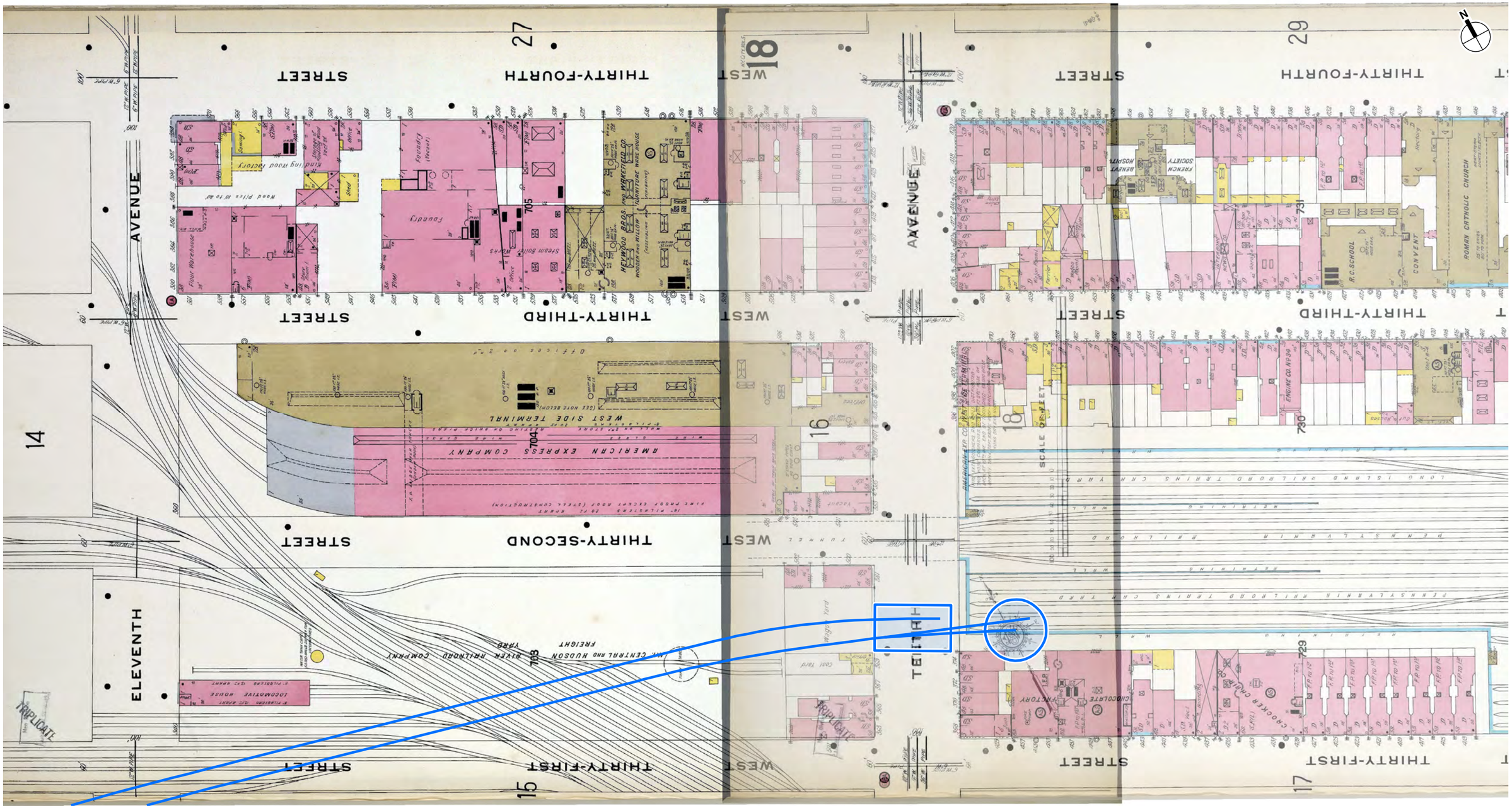


Area of Potential Effects (APE) Boundary for Direct Effects

0 500 FEET

HUDSON TUNNEL PROJECT

Sanborn, 1911
Figure 21a

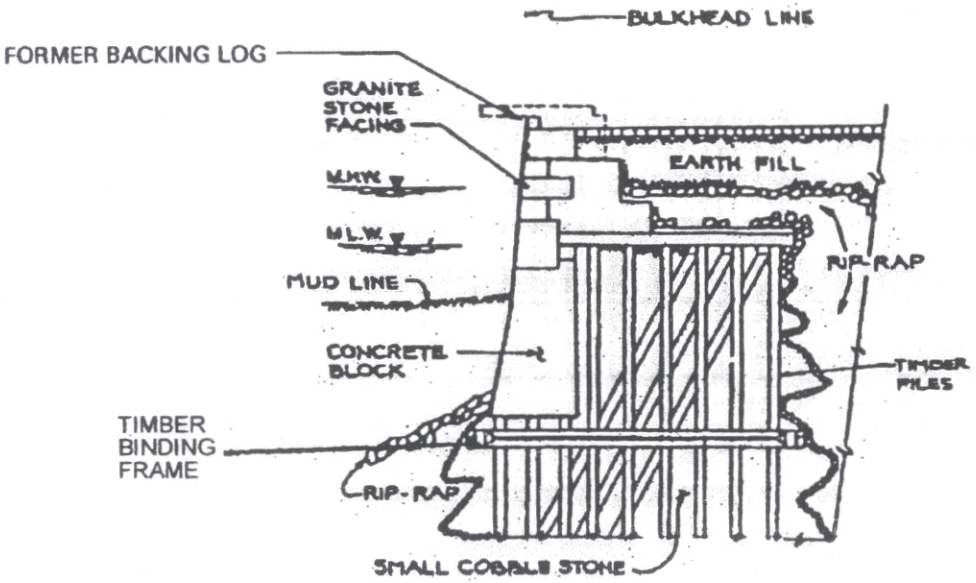


Area of Potential Effects (APE) Boundary for Direct Effects

0 500 FEET

HUDSON TUNNEL PROJECT

Sanborn, 1911
Figure 21b

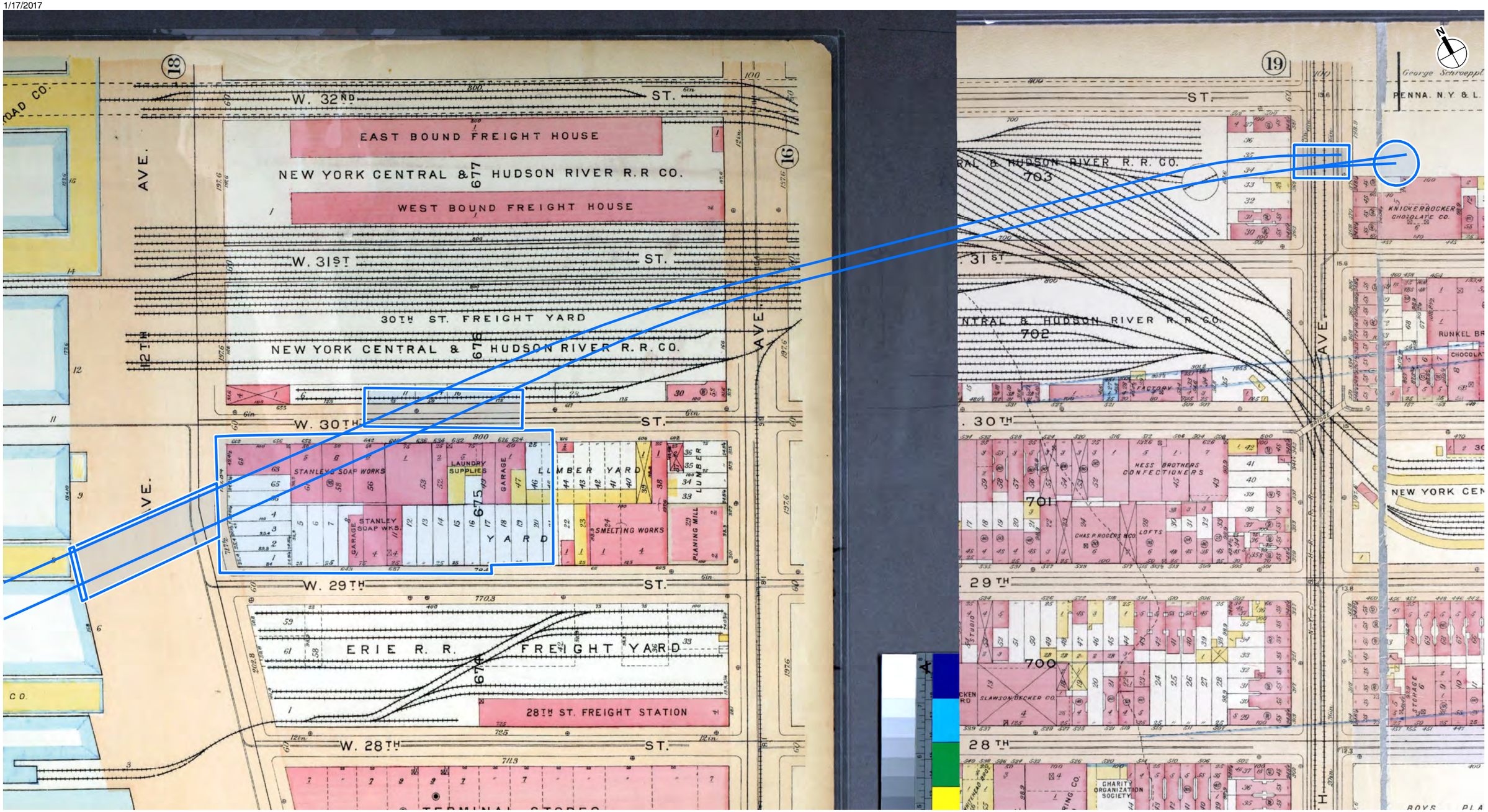


TYPE III-B

Granite wall on narrow concrete block, with inclined bracing piles taking lateral thrusts to below base block, and timber binding frame around piles. Built 1876-1898 in many areas between Warren and 38th Streets.

Type III-B Cross Section Diagram

Figure 22



Area of Potential Effects (APE) Boundary for Direct Effects

0 500 FEET

HUDSON TUNNEL PROJECT

Bromley, 1920
Figure 23

A *New York Times* article dated April 28, 1904 reports a large fire at the soap factory during which three firemen and 20 horses lost their lives. According to the article:

> The main building of the soap factory is six stories high. There is one extension, five stories high, on the North River side, and another, a two-story extension, running along Thirtieth Street for a considerable distance. The fire was most spectacular, shedding a glow over the cliffs on the New Jersey shore, and bringing frightened people from their homes for blocks around (*New York Times* 4/28/1904).

MID-TWENTIETH CENTURY DEVELOPMENT

By the 1960s most industries had relocated from western midtown Manhattan, including the soap works. Since then Block 675 has served as the location for smaller businesses such as gas stations and auto repair, and the construction staging area has been a large parking lot.

C. SITE DISTURBANCE CHARACTERIZATION

As described above, the APE for Direct Effects was primarily located in the open waters of the Hudson River until large-scale landfilling operations extended the shoreline westward, into the Hudson River, beginning around the middle of the nineteenth century. Commensurate with the development of the coastline, this portion of Manhattan experienced a high degree of industrialization and development of the transportation system. Piers extended westward to accommodate the then innovative steam ships, raw materials were offloaded to the many coal and lumber yards, and a wide array of locally-manufactured finished products were put aboard. New roadways and rail lines were established to distribute finished goods and raw materials, and factories, warehouses, and yards were built throughout the vicinity. Regularly during this time, the earlier piers were replaced or built up with newer ones, factories were constructed and replaced, and most of the individual lots were developed. The City's transportation and land use needs changed and many of the roadways were rebuilt and the industrial areas were gradually replaced with office towers or parking lots.

This constant change and redevelopment has likely led to a great deal of subsurface disturbance across the APE vicinity. According to HCI's investigation of the Westside Highway (1983), reconstruction of this roadway led to impacts extending well below the current ground surface. The THE Partnership (2009a) details construction of the piers and wharves and the impacts of later improvements. On the other hand, Block 675 appears to have avoided major development since industries relocated out of the city after the mid-twentieth century. Instead of residential towers, this block has since been used primarily for parking, a land use that does not involve deep impacts, although local disturbances such as buried fuel tanks are likely in locations, particularly along Eleventh Avenue. The THE Partnership has documented the demolition and reconstruction processes of the formerly proposed Twelfth Avenue fan plant location (Block 674) and the likelihood for archaeological resources to remain intact below the current asphalt-covered ground surfaces on that block. Similarly, the local streets such as West 30th Street may also contain, preserved beneath its asphalt and bedding material, the remains of the bulkheads and piers originally constructed during the first half of the nineteenth century (**Figure 12**). The construction of utilities below the road surfaces may have locally disturbed the upper portions of these features, if present.

D. GEOPHYSICAL SURVEY

A river bottom survey consisting of a limited marine geophysical survey of the potential low-cover area on the east side of the Hudson River along the alignment the proposed Hudson Tunnel Project has been

prepared. The location of the geophysical study area includes the area of in-water river bottom improvements (**Figure 2**) and it was about 1,200 feet wide and covered a north-south swath of approximately 2,000 feet. The geophysical included the following methods and analyses:

1. A swath bathymetric survey, providing high-resolution multibeam data to develop contours of water depths and the general shape of the river bottom, and estimated size and location of obstructions on the river bottom, such as shipwrecks and dumped materials.
2. A digital side-scan sonar survey, to provide more detailed information on the character of the river bed, supplementing the multibeam bathymetry data in locating debris on the river bottom as well as scars, old piling, and areas of scour due to past storm surges.
3. A magnetic survey, to identify significant magnetic anomalies caused by metal objects on and beneath the river bed. This information would supplement the information obtained from the side-scan sonar and bathymetry.

Figure 18 provides a depiction of the bathymetry of the river bottom in the area to be improved. According to Richard Flanagan of PB's Geotechnical and Tunneling Team, neither this bathymetric survey or a similar one conducted previously by the Army Corps of Engineers identified significant obstructions (or anomalies), such as shipwrecks and abandoned pipes, anywhere in the vicinity of the in-river ground improvement section (personal electronic communication with Richard Flanagan, December 16, 2016). The geophysical survey report has been included as Appendix B.

E. ARCHAEOLOGICAL SENSITIVITY ASSESSMENT

SENSITIVITY FOR PREHISTORIC ARCHAEOLOGICAL RESOURCES

Those portions of the APE for Direct Effects that were formerly inundated by the Hudson River, from approximately Eleventh Avenue westward, have been inundated for most of prehistory. They are therefore considered to have no potential for prehistoric archaeological resources. The APE for Direct Effects at Tenth Avenue and the Lerner Building have shallow bedrock and have been highly disturbed through development since the mid-nineteenth century. They too are therefore considered to have no potential for prehistoric archaeological resources.

SENSITIVITY FOR SHIPWRECKS IN THE HUDSON RIVER

AD Marble considered the sensitivity of the Hudson River portion of the APE for shipwrecks in 2005. Through a review of data on file at the National Ocean Service, a division of the National Oceanic and Atmospheric Administration, the ARC study identified one potential historic shipwreck in the Hudson River portion of the project. This potential shipwreck is indicated on **Figure 9** as a blue-filled oval located directly above the red tunnel path. AD Marble provided the following important qualifications regarding this potential shipwreck:

> The National Ocean Service chart for New York Harbor, no. 12327, provides precise information on navigation aids, depth soundings, submerged rock formations and wrecks, which allow ships and boats to move safely and avoid shallow waters and navigational hazards. The 1989 edition of chart no. 12327, as does the most current 2003 edition, features the "dangerous wreck [with masts], depth unknown" symbol [which] is mapped as occurring near the middle of the Hudson River channel and may be present in the APE. Immediately adjacent to the wreck is the abbreviation "PD," which means "Position Doubtful" (AD Marble 2005).

However, multiple geophysical surveys have been conducted of the portion of the Hudson River proposed for in-water construction for both previous projects and for the current Project[1] and no shipwrecks or shipwreck-like anomalies have been identified (personal electronic communication with Richard Flanagan, December 16, 2016). Therefore, neither the in-water portion of the APE for Direct Effects nor the shallowly-constructed tunnel beneath the Hudson River river bed are considered to have sensitivity for shipwrecks.

SENSITIVITY FOR HISTORIC ARCHAEOLOGICAL RESOURCES

The APE for Direct Effects has been determined to be sensitive for several classes of historic archaeological resources.

HUDSON RIVER BULKHEAD

The Hudson River Bulkhead (NRHP-eligible) runs between the Battery and West 59th Street including the western shoreline of the APE for Direct Effects. Significant under Criterion A in the areas of commerce or industry, under Criterion C in the area of engineering, and under Criterion D for the potential of the bulkhead to yield information about historic engineering methods, the bulkhead and its associated structural systems were constructed between 1871 and 1936 by the New York City Department of Docks. The majority of the construction consisted of masonry walls on a variety of foundation systems, with quarry-faced ashlar granite block forming the visible face along most of the armored frontage. Built between 1876 and 1898, the bulkhead between approximately West 23rd and West 34th Streets consists of a granite wall on narrow concrete block with inclined bracing piles and timber binding frames around the piles[2].

PIERS, WHARVES, BULKHEADS, AND LANDFILL-RETAINING STRUCTURES

Those portions of the APE for Direct Effects that were formerly inundated by the Hudson River, from approximately Eleventh Avenue westward, are sensitive for the presence of piers, wharves, bulkheads, and landfill-retaining structures. The following are brief definitions of these resource types. A pier is defined as a structure built to project out from the shore over a body of water. It is supported by pillars or piles for ships to lie alongside during loading or unloading. A wharf serves the same purpose as a pier, and may either be marginal (running parallel to the shore line) or projecting, but the term usually refers to a marginal structure. The structure or embankment designed to hold back earth along a coastline is called a bulkhead (THE Partnership 2009a). Finally, landfill-retaining structures are the timber features used to construct landforms in a submerged area.

Waterfront land constructed during the eighteenth and nineteenth centuries in North American cities has increasingly been the focus of archaeological inquiry. The physical structure of landfill-retaining devices and, if information regarding its origin is available, the fill contained within them can be examined to learn a great deal about the social, cultural, and economic contexts of made land. In New York City, several archaeological investigations have examined wharves, slips, and bulkheads along the East River waterfront of Lower Manhattan and Brooklyn. A smaller number of archaeological studies have been conducted along the Hudson River waterfront of Lower Manhattan (AKRF 2011; Lenardi 2011), although an increase in waterfront development in recent years has allowed archaeologists to pay greater attention to historic landfill deposits.

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[1] The geophysical survey report for the Project has been provided as Appendix B.

[2] Archaeologist Michael Lenardi conducted an extensive archaeological monitoring effort for a portion of the bulkhead in lower Manhattan on behalf of the New York State Museum and confirmed its archaeological significance.

In New York City before the mid-nineteenth century, most of the wharves, slips, and bulkheads that made up the waterfront were constructed of wood. As new shoreline structures were constructed progressively further into the water over time, the bulkheads and wharves that previously lined the shoreline became incorporated into Manhattan's landmass. As a result, former waterfront structures are now locked into the landfill, in many cases several blocks away from the current shoreline.

Various sorts of wood landfill retaining structures were used historically to build wharves, bulkheads, and other waterfront infrastructure. Most often, landfill-retaining structures in New York City and throughout North America were built using stacked-log construction methods, similar to the technique used to build log houses. Retaining structures in North America were often built in units exhibiting a "crib" (or box-like) form; however, a frequently encountered alternative to the crib was a linear wall form, braced from the landward side. Braced walls could be arranged to create either three-sided wharves or linear bulkheads. Another stacked-log form type, the "grillage" complex, consisted of continuous courses of perpendicular stacked timbers creating a structural unit that lacks the crib's central void.

Due to the depth of bedrock in the APE for Direct Effects, and the availability of steam-powered drivers at the time of the area's development, the landfill containing structures would have been supported with piles extending as much as 50 to 100 feet below ground surface. Based on the Phase 1A prepared for the ARC Project and the Cultural Resource Management Report and Programmatic Agreement prepared by the THE Partnership, the APE west of Eleventh Avenue is sensitive for landfill containing structures (2009b).

INDUSTRIAL AND MANUFACTORING SITES

The use of Block 675 for industrial purposes extends from the mid-nineteenth to the early-twentieth century. As described in the cartographic review section, the variety of industrial activities that occurred on the block includes: lumber, kindling, and coal yards, wagon yards and stables, saw mills, wood factories, builders and masons materials, a soap factory, a planning mill, and a smelting mill. According to the ARC Phase 1A, the significance of these types of resources is determined by

> their degree of integrity and ability to provide information on the historical transformation of manufacturing processes which occurred during the late-nineteenth and early-twentieth centuries. Physical remains of building foundations and associated features may, if sufficiently intact, provide information on building organization and thereby an indication of shop-floor organization and how productive facilities were organized. Archaeological testing will therefore focus on determining the presence of intact manufacturing plant foundations, the remains of interior divisions within the building, and any architectural or artifactual indications of specific manufacturing activities within the building. Building remains may be considered potentially significant if they can reasonably be expected to supply information of site layout, use of space and technology (AD Marble 2005).

Block 675 therefore has a high sensitivity for the presence of archaeological resources associated with industrial and manufacturing activity. Research designs for the archaeological investigation of manufacturing and light industrial sites and lumber and building materials yards were prepared as part of the Route 9A Project. These documents are of particular relevance to the current APE for Direct Effects and describe research questions that could be addressed through the archaeological analysis of lumber yards and nineteenth century/early-twentieth century industrial complexes, including soap factories (HPI and Hartgen 1991 and Louis Berger and Vollmer 1993).

DOMESTIC/RESIDENTIAL SITES

The development of Block 675 goes back to at least 1850 (**Figure 12**) when multiple structures appear on the block. It is not known if any of these were residences but the area was dominated by industrial and manufacturing type land uses through the early twentieth century. Archaeological resources recovered from the site could produce data about the individuals who resided and/or worked on the project site during the nineteenth century. For historic period archaeological resources, domestic shaft features—such as those that could have been located within the former rear yards of the historic lots—can contain important archaeological resources. These features were frequently filled with domestic refuse after they were no longer used for their original purposes. In the case of privies, such refuse deposition would typically also have occurred during the period of active use, as there were few alternate methods of garbage disposal at the time. As such, filled shaft features often contain valuable information about the daily lives of a site's residents. Domestic refuse can also be buried in backyard areas or accumulate as sheets.

Artifacts recovered from trash or surface deposits are the material remains of what an individual purchases and/or uses on a daily or routine basis and they can provide insight into certain aspects of his or her life. Such consumption patterns are strongly influenced by socioeconomic status, occupation, household composition, and ethnicity. What a person buys and/or uses on a routine basis is behavior that reflects the multiple components of that individual's life. Archaeological evidence from residential lots can provide information on how different characteristics such as socioeconomic status or ethnicity have influenced consumer choice behavior. Information that can be gathered from domestic shaft features can be used to make generalizations about what life was like for the individuals and families that resided on a property. This information can then be compared and contrasted with data associated with similar populations elsewhere in the city. Similarly, if resources associated with the industrial use of the project site are encountered, they can be compared and contrasted with other archaeological sites in the region to identify broader patterns. These comparisons could yield previously unknown insights into the ways of life of the individuals living in working- and lower-class households in Midtown Manhattan during the second half of the nineteenth century.

For residential-related archaeological resources, the dates of construction, occupancy, ownership and how old a dwelling was before access to City sewer and water are important considerations. The likelihood of occupants depending on privies and pits for at least 3 years prior to the advent of municipal sewer and water increases the probability for the presence of associated shafts with the potential for archaeological resources (AKRF 2014).

Chapter 6: Conclusions and Recommendations

This phase 1A Archaeological Documentary Study assessed the potential for the Project to affect archaeological resources in the New York APE for Direct Effects. This study primarily focused on previously conducted archaeological investigations of the APE vicinity and cartographic resources and has identified specific types of archaeological resources that may be present and the Project components that could adversely affect them if they are present. See Chapter 5 for a summary of previous archaeological surveys of the area and a description of the archaeological resources that may be present in the APE for Direct Effects. The following is a summary of the conclusions of this study and recommendations for additional archaeological efforts to determine the presence or absence of historic properties and determine their S/NRHP eligibility in accordance with Section 106 of NHPA.

A. CONCLUSIONS

As discussed earlier, the APE for Direct Effects is comprised of several Project components that have the potential to affect archaeological resources, if such resources are present. These components are described in detail in Chapter 2 and depicted on **Figure 2** and, from west to east, are:

- In-water construction on the Hudson River river bottom;
- Shallowly constructed new tunnel beneath the Hudson River river bottom;
- Shallowly constructed new tunnel from the western face of the Hudson River Bulkhead to 30th Street;
- Ground improvements at Hudson River Bulkhead, Hudson River Park, and Twelfth Avenue;
- Construction of New Ventilation Shaft on Block 675;
- Construction of New Fan Plant Structure on Block 675;
- Construction staging Area on Block 675;
- Cut and Cover Excavation at 30th Street;
- Cut and Cover Excavation at Tenth Avenue; and
- Underpinning and Construction of New Fan Plant at Lerner Building.

The potential for the Project to impact expected archaeological resources are summarized below by Project component.

IN-WATER CONSTRUCTION ON THE HUDSON RIVER RIVER BOTTOM

In-water construction has no potential to impact archaeological resources as the Hudson River river bottom in this area is not sensitive for the presence of archaeological resources. In addition, no shipwrecks have been identified in the vicinity of this portion of the Hudson River.

SHALLOWLY CONSTRUCTED NEW TUNNEL BENEATH THE HUDSON RIVER RIVER BOTTOM

The shallowly constructed new tunnel has no potential to impact archaeological resources as the affected soils in this area are not sensitive for the presence of archaeological resources.

SHALLOWLY CONSTRUCTED NEW TUNNEL FROM THE WESTERN FACE OF THE HUDSON RIVER BULKHEAD TO 30TH STREET

The shallowly constructed tunnel has the potential to impact the Hudson River Bulkhead and historic piers, wharves, and fill-retaining devices. The Hudson River Bulkhead is S/NRHP eligible under Criterion A for its association with commerce and industry, under Criterion C for engineering, and Criterion D for its potential to yield data of archaeological significance (NYOPRHP 1997). In addition, several previous archaeological surveys have concluded that the bulkhead has archaeological sensitivity (Lenardi 2011). The potential for historic piers, wharves, and fill-retaining devices has been well-documented by previous surveys (ARC 2005 and 2009a; HPI 1997 and 2004; HPI and Hartgen 1996; and HCI 1983). These resources are expected below the depth of modern disturbance associated with roadway construction and utilities.

GROUND IMPROVEMENTS AT HUDSON RIVER BULKHEAD, HUDSON RIVER PARK, AND TWELFTH AVENUE

Ground improvements at the Hudson River Bulkhead and Hudson River Park have the potential to impact the Hudson River Bulkhead and historic piers, wharves, and fill-retaining devices. These resources are expected below the depth of modern disturbance associated with roadway construction and utilities. Ground improvements on Twelfth Avenue do not have the potential to impact archaeological resources due to the likelihood that all such possible resources were previously destroyed during construction of and improvements to Twelfth Avenue over the past several decades.

CONSTRUCTION OF NEW VENTILATION SHAFT ON BLOCK 675

Construction of a New Ventilation shaft on Block 675 has the potential to impact industrial and manufacturing sites, domestic sites, and historic piers, wharves, and landfill-retaining devices. These resource types are expected below the depth of modern disturbance, utilities, or buried tanks.

CONSTRUCTION OF NEW FAN PLANT STRUCTURE ON BLOCK 675

Construction of a new fan plant structure on Block 675 has the potential to impact industrial and manufacturing sites, domestic sites, and historic piers, wharves, and landfill-retaining devices. These resource types are expected below the depth of modern disturbance, utilities, or buried tanks.

CONSTRUCTION STAGING AREA ON BLOCK 675

Use of Block 675 as a construction staging area has the potential to impact industrial and manufacturing sites, domestic sites, and historic piers, wharves, and landfill-retaining devices if construction activities have the potential to significantly compress or otherwise disturb the underlying soils. These resource types are expected below the depth of modern disturbance, utilities, or buried tanks.

CUT AND COVER EXCAVATION AT 30TH STREET

Cut and cover excavation at 30th Street has the potential to impact historic piers, wharves, and landfill-retaining devices. These resource types are expected below the depth of modern disturbance, utilities, or buried tanks.

CUT AND COVER EXCAVATION AT TENTH AVENUE

Cut and cover excavation at Tenth Avenue has no potential to impact archaeological resources as this area is not sensitive for the presence of archaeological resources due to previous disturbance and shallow bedrock.

UNDERPINNING AND CONSTRUCTION OF NEW FAN PLANT AT LERNER BUILDING

Underpinning and the construction of a new fan plant at the Lerner Building has no potential to impact archaeological resources as this site is not sensitive for the presence of archaeological resources due to extensive previous disturbance and shallow bedrock.

B. RECOMMENDATIONS

As described above, several components of the Project have the potential to impact archaeological resources. The following recommendations are provided in compliance with Section 106 of NHPA to determine the effects of the Project on archaeological resources. While the present study identified areas of archaeological sensitivity, additional work is necessary to determine the actual presence or absence of archaeological resources, to determine their S/NRHP eligibility, and to mitigate any unavoidable impacts to archaeological resources if any such resources are present. Any archaeological monitoring or testing should be planned in consultation with the NYSHPO and be conducted in concordance with applicable state and federal laws and guidance.

SHALLOWLY CONSTRUCTED NEW TUNNEL FROM THE WESTERN FACE OF THE HUDSON RIVER BULKHEAD TO 30TH STREET

As described above in the previous subsection, the portion of the shallowly constructed new tunnel from the western face of the Hudson River Bulkhead to 30th Street has the potential to impact the Hudson River Bulkhead and any historic piers, wharves, and fill-retaining devices that may be present along the tunnel's path. However, use of a TBM to construct the new tunnel through the bulkhead to 30th Street will not afford an opportunity for archaeologists to directly observe the impacts of construction or to document any resources that may be affected. Furthermore, the Hudson River Bulkhead and any earlier piers, wharves, and fill-retaining devices that may be affected, were constructed with piles due to the depth of bedrock in this area. Tunneling at the proposed depths of between approximately 50 feet and 80 feet below ground surface will impact the deeper supporting piles and rip rap associated with historic development of this area. These types of elements are of little research value and alternative methods of mitigating unavoidable impacts may be appropriate.

To mitigate the adverse effect on the Hudson River Bulkhead, information gathered and drawings prepared in preparation for, and during the construction at the bulkhead structure would be compiled into a report documenting the characteristics of the affected bulkhead location. This information would augment information about the bulkhead as previously documented in the 1989 Building-Structure Inventory Form on file with NYSHPO (see AKRF 2016). In addition, as has been described in Chapter 2, a monitoring plan would be prepared and implemented for the bulkhead.

GROUND IMPROVEMENTS AT HUDSON RIVER BULKHEAD, HUDSON RIVER PARK, AND TWELFTH AVENUE

Ground improvements in the vicinity of the Hudson River Bulkhead and Hudson River Park have the potential to impact the Hudson River Bulkhead and any historic piers, wharves, and fill-retaining devices that may be present. Depending on the construction methods used during implementation of ground improvements, archaeologists could observe and document any affected archaeological resources during construction or implement testing in advance of construction to determine the presence or absence and S/NRHP-eligibility of any such resources. Adverse effects on the Hudson River Bulkhead could be mitigated as described above.

Ground improvements on Twelfth Avenue do not have the potential to impact archaeological resources due to the likelihood that all such possible resources were previously destroyed during construction of and improvements to Twelfth Avenue over the past several decades.

CONSTRUCTION OF NEW VENTILATION SHAFT ON BLOCK 675

Construction of a New Ventilation shaft on Block 675 has the potential to impact industrial and manufacturing sites, domestic sites, and any historic piers, wharves, and fill-retaining devices that may be present. Depending on the construction methods used during construction of the vent shaft, archaeologists could observe and document any affected archaeological resources during construction or archaeological testing could be conducted in advance of construction to determine the presence or absence and S/NRHP-eligibility of any such resources. A thorough analysis of the development of each affected lot is recommended in advance of implementing monitoring or testing in advance of construction to aid in the identification of applicable research questions and sampling strategies.

CONSTRUCTION OF NEW FAN PLANT STRUCTURE ON BLOCK 675

Construction of a new fan plant structure on Block 675 has the potential to impact industrial and manufacturing sites, domestic sites, and historic piers, wharves, and fill-retaining devices. Depending on the construction methods used during construction of the fan plant structure, archaeologists could observe and document any affected archaeological resources during construction or archaeological testing could be conducted in advance of construction to determine the presence or absence and S/NRHP-eligibility of any such resources. A thorough analysis of the development of each affected lot is recommended in advance of implementing monitoring or testing in advance of construction to aid in the identification of applicable research questions and sampling strategies.

CONSTRUCTION STAGING AREA ON BLOCK 675

Depending on the depths of impacts, use of Block 675 as a construction staging area has the potential to impact industrial and manufacturing sites, domestic sites, and historic piers, wharves, and fill-retaining devices, which are expected to be present immediately below the modern pavement and bedding material. If impacts from construction staging activities are expected to extend below the depths of the current paved parking lot and bedding material in this area, archaeologists could observe and document any affected archaeological resources during construction or archaeological testing could be conducted in advance of construction to determine the presence or absence and S/NRHP-eligibility of any such resources. A thorough analysis of the development of each affected lot is recommended in advance of implementing monitoring or testing in advance of construction to aid in the identification of applicable research questions and sampling strategies.

CUT AND COVER EXCAVATION AT 30TH STREET

Cut and cover excavation at 30th Street has the potential to impact historic piers, wharves, and fill-retaining devices, which are expected to be present below the roadway, bedding material, and subsurface utilities. Depending on the construction methods used during implementation of cut and cover excavation at 30th Street, archaeologists could observe and document any affected archaeological resources during construction or implement testing in advance of construction to determine the presence or absence and S/NRHP-eligibility of any such resources. A monitoring plan should be prepared in advance to identify research questions and appropriate field methods.

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Appendices

APPENDIX A:
AGENCY CORRESPONDENCE

HPO Project# 16-1650-9
HPO-L2016-095

State of New Jersey

MAIL CODE 501-04B
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NATURAL & HISTORIC RESOURCES
HISTORIC PRESERVATION OFFICE
P.O. Box 420
Trenton, NJ 08625-0420
TEL. (609) 984-0176 FAX (609) 984-0578

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

December 14, 2016

Amishi Castelli
Environmental Protection Specialist
USDOT Federal Railroad Administration
One Bowling Green
Suite 429
New York, NY 10004-1415

Dear Ms. Castelli:

As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 CFR Part 800: Protection of Historic Properties, as published in the Federal Register on December 12, 2000 (65 FR 77725-77739) and amended on July 6, 2004 (69 FR 40553-40555), I am providing continuing consultation comments on the following proposed undertaking:

Hudson Tunnel Project
Hudson County, Hoboken, Jersey City, North Bergen, Secaucus,
Union City and Weehawken
Federal Railroad Administration
National Environmental Policy Act

These comments were prepared in response to your submission of a cover letter and final *Effects Assessment Methodology: Historic and Archeological Resources* pursuant to the National Environmental Policy Act and received by the Historic Preservation Office (HPO) via email on November 8, 2016 and in hard copy on November 14, 2016.

The HPO appreciates the incorporation of previously requested edits to the final *Effects Assessment Methodology: Historic and Archeological Resources.*

The HPO respectfully requests one further revision of our previously requested edit to the following section:

1.3.3.2 Identification of Archeological Resources

- Page 7, paragraph 2, line 14: Please further revise "A Data Recovery work plan is to be approved by all four agencies: NJHPO, NYSHPO, NJ Transit and FRA." to instead read "A Data Recovery work plan is to be approved by FRA,

NJ Transit and the appropriate State Historic Preservation Office (NJHPO or NYSHPO)".

We look forward to continuing consultation pursuant to 36 CFR 800.4 Identification of Historic Properties and 36 CFR 800.5 Assessment of Effects.

Thank you for providing the opportunity to review and comment on the submitted documentation. Please do not hesitate to contact Jenna Solomon of my staff at jenna.solomon@dep.nj.gov or (609) 984-6018 with any questions regarding historic architecture, historic districts, and historic landscapes or Vincent Maresca of my staff at vincent.maresca@dep.nj.gov or (609) 633-2395 with questions regarding archaeology. Please reference the HPO project number 16-1650 in any future calls, emails, or written correspondence in order to expedite our review and response.

Sincerely,

Katherine J. Marcopul
Acting Administrator and
Deputy State Historic
Preservation Officer

Cc:
Claudia Cooney, AKRF, Inc.
Dara Callender, P.E., NJ Transit

U.S. Department
of Transportation

**Federal Railroad
Administration**

1200 New Jersey Avenue, SE.
Washington, D.C. 20590

December 9, 2016

Ms. Ruth Pierpont
Deputy Commissioner, Historic Preservation
New York State Historic Preservation Office
Peebles Island State Park, P.O. Box 189
Waterford, NY 12188

Re: Hudson Tunnel Project— Hudson County, NJ, and New York County, NY: Submittal of Proposed APE as part of Section 106 Consultation

Dear Ms. Pierpont:

As you know, the Federal Railroad Administration (FRA) and NJ TRANSIT are preparing an Environmental Impact Statement (EIS) for the Hudson Tunnel Project (the "Project") in accordance with the National Environmental Policy Act (NEPA). As per our May 12, 2016 letter, FRA and NJ TRANSIT are concurrently conducting the analyses required pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (54 U.S.C. § 306108). The Project is intended to preserve the current functionality of the Northeast Corridor's (NEC) Hudson River passenger rail crossing between New Jersey and New York and strengthen the resilience of the NEC.

Pursuant to Section 106 and its implementing regulations (36 CFR 800) and following the methodology in the October 2016 *Effect Assessment Methodology for Historic and Archaeological Resources* submitted to your office, FRA and NJ TRANSIT have determined an Area of Potential Effects (APE) in which to assess the Project's potential effects on historic properties. A required step in the Section 106 process is determining the 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 proposed Section 106 APE and the proposed study area for assessing the Project's potential impacts on historic properties pursuant to NEPA in the EIS, are the same.

A description of the proposed APE, including the Project's components and their potential to affect historic properties, a description of the geographic boundaries of the APE, and maps and photographs depicting the APE, are provided in the enclosed December 7, 2016 *Section 106 Documentation: Hudson Tunnel Project: Proposed Area of Potential Effects (APE)* document.

If you agree that the proposed APE is appropriate for the undertaking, please kindly indicate your agreement at your earliest convenience. If you have any questions or need additional information about this undertaking, please contact Ms. Amishi Castelli, Federal Railroad Administration, at Amishi.Castelli@dot.gov or Dara Callender, NJ TRANSIT, dcallender@njtransit.com. FRA looks forward to working with you on this important rail transportation project.

Sincerely,

Laura Shick
Federal Preservation Officer
U.S. Department of Transportation, Federal Railroad Administration
Environmental & Corridor Planning Division
Office of Railroad Policy and Development

Enclosures

cc: Amishi Castelli, Environmental Protection Specialist, USDOT Federal Railroad Administration
Jeremy Colangelo-Bryan, Chief of Planning, NJ TRANSIT Capital Planning
RJ Palladino, AICP, PP, Senior Program Manager, NJ TRANSIT Capital Planning
Dara Callender, P.E., Manager, Environmental Compliance, NJ TRANSIT Environment, Energy and Sustainability Unit

U.S. Department
of Transportation

**Federal Railroad
Administration**

1200 New Jersey Avenue, SE.
Washington, D.C. 20590

December 9, 2016

Ms. Kate Marcopul
Acting Administrator for Historic Preservation Office
New Jersey Historic Preservation Office
501 East State Street
Mail Code 501-04B PO Box 420
Trenton, NJ 08625

Re: Hudson Tunnel Project— Hudson County, NJ, and New York County, NY: Submittal of Proposed APE as part of Section 106 Consultation

Dear Ms. Marcopul:

As you know, the Federal Railroad Administration (FRA) and NJ TRANSIT are preparing an Environmental Impact Statement (EIS) for the Hudson Tunnel Project (the "Project") in accordance with the National Environmental Policy Act (NEPA). As per our May 12, 2016 letter, FRA and NJ TRANSIT are concurrently conducting the analyses required pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (54 U.S.C. § 306108). The Project is intended to preserve the current functionality of the Northeast Corridor's (NEC) Hudson River passenger rail crossing between New Jersey and New York and strengthen the resilience of the NEC.

Pursuant to Section 106 and its implementing regulations (36 CFR 800) and following the methodology in the October 2016 *Effect Assessment Methodology for Historic and Archaeological Resources* submitted to your office, FRA and NJ TRANSIT have determined an Area of Potential Effects (APE) in which to assess the Project's potential effects on historic properties. A required step in the Section 106 process is determining the 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 proposed Section 106 APE and the proposed study area for assessing the Project's potential impacts on historic properties pursuant to NEPA in the EIS, are the same.

A description of the proposed APE, including the Project's components and their potential to affect historic properties, a description of the geographic boundaries of the APE, and maps and photographs depicting the APE, are provided in the enclosed December 7, 2016 *Section 106 Documentation: Hudson Tunnel Project: Proposed Area of Potential Effects (APE)* document.

If you agree that the proposed APE is appropriate for the undertaking, please kindly indicate your agreement at your earliest convenience. If you have any questions or need additional information about this undertaking, please contact Ms. Amishi Castelli, Federal Railroad Administration, at Amishi.Castelli@dot.gov or Dara Callender, NJ TRANSIT, dcallender@njtransit.com. FRA looks forward to working with you on this important rail transportation project.

Sincerely,

Laura Shick
Federal Preservation Officer
U.S. Department of Transportation, Federal Railroad Administration
Environmental & Corridor Planning Division
Office of Railroad Policy and Development

Enclosures

cc: Amishi Castelli, Environmental Protection Specialist, USDOT Federal Railroad Administration
Jeremy Colangelo-Bryan, Chief of Planning, NJ TRANSIT Capital Planning
RJ Palladino, AICP, PP, Senior Program Manager, NJ TRANSIT Capital Planning
Dara Callender, P.E., Manager, Environmental Compliance, NJ TRANSIT Environment, Energy and Sustainability Unit

NEW YORK STATE OF OPPORTUNITY. | Parks, Recreation, and Historic Preservation

ANDREW M. CUOMO
Governor

ROSE HARVEY
Commissioner

December 7, 2016

Ms. Amishi Castelli
Environmental Protection Specialist
U.S Department of Transportation, Federal Railroad Administration
One Bowling Green, Suite 429
New York, NY 10004-1415

Re: FRA
Hudson Tunnel Project
16PR03710

Dear Ms. Castelli:

Thank you for continuing to consult with the New York State Historic Preservation Office (SHPO). We have reviewed the provided documentation 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.

We have reviewed the final Methodology Reports that were submitted to our office on November 9th, 2016. Based upon our review, we find the documents acceptable with the following suggested revisions to the text in the "Effects Assessment Methodology: Historic and Archaeological Resources" section:

1. Bottom of page 6 ("Identification of Architectural Resources"), change submission from "on NYSHPO Historic Structure Inventory Forms" to "upload information on potentially NR-eligible properties through NY SHPO's CRIS as individual submitted resources"; and
2. Bottom of page 7 ("Identification of Archaeological Resources"), "That survey report will address the need for any Phase 1B archaeological survey, potentially including subsurface testing", please add "and underwater survey".

We would appreciate if the requested information could be provided via our Cultural Resource Information System (CRIS) at www.nysparks.com/shpo/online-tools/ Once on the CRIS site, you can log in as a guest and choose "submit" at the very top menu. Next choose "submit new information for an existing project". You will need this project number and your e-mail address. If you have any questions, I can be reached at (518) 268-2182.

Sincerely,

Olivia Brazee
Historic Preservation Technical Specialist olivia.brazee@parks.ny.gov

HPO Project# 16-1650-7
HPO- I2016-109

State of New Jersey

MAIL CODE 501-04B
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NATURAL & HISTORIC RESOURCES
HISTORIC PRESERVATION OFFICE
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CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

September 14, 2016

Michael Johnsen
Acting Division Chief
U.S. Department of Transportation, Federal Railroad Administration
Environmental & Corridor Planning Division
Office of Railroad Policy and Development
1200 New Jersey Avenue, S.E.
Washington, DC 20590

Dear Mr. Johnsen:

As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 CFR Part 800: Protection of Historic Properties, as published in the Federal Register on December 12, 2000 (65 FR 77725-77739) and amended on July 6, 2004 (69 FR 40553-40555), I am providing initial consultation comments on the following proposed undertaking:

Hudson Tunnel Project
Hudson County, Hoboken, Jersey City, North Bergen, Secaucus,
Union City and Weehawken
Federal Railroad Administration
National Environmental Policy Act

These comments were prepared in response to your submission of a cover letter and Draft Effects Assessment Methodology Report pursuant to the National Environmental Policy Act and received by the Historic Preservation Office (HPO) on September 1, 2016.

Given that the proposed methodology uses the previous cultural resource surveys prepared for the Access to the Region's Core (ARC) Project in 2008 as only one of many resources to be consulted and that "additional research will be conducted as appropriate to assess current conditions" (p.5), the HPO concurs with the methodology presented in the *Methodology Report: Historic and Archeological* Resources.

Additional Comments

The HPO respectfully requests the following edits:

1.3.3 Data Sources

- Page 5, paragraph 2, lines 4-5: "State and National Register-listed resources (S/NR-listed); and State and National Register-eligible (S/NR eligible) resources" should read "National Register listed or eligible resources (NR-listed/eligible); and State Register-listed (SR listed) resources"

1.3.3.1 Identification of Architectural Resources

- Page 6, paragraph 1, line 2: "*Guidance for Architectural* Survey" should read "*Guidelines for Architectural Survey*"
- Page 6, paragraph 3, lines 2 and 4: "NJHPO survey forms" should read " NJHPO Intensive Level Survey Forms"

1.3.3.2 Identification of Archeological Resources

- Page 7, paragraph 2, line 14: Please add additional sentence at end as follows "A Data Recovery work plan is to be approved by all four agencies: NJHPO, NYSHPO, NJ Transit and FRA."

We look forward to continuing consultation pursuant to 36 CFR 800.4 Identification of Historic Properties and 36 CFR 800.5 Assessment of Effects.

Thank you for providing the opportunity to review and comment on the submitted documentation. Please do not hesitate to contact Jenna Solomon of my staff at jenna.solomon@dep.nj.gov or (609) 984-6018 with any questions regarding historic architecture, historic districts, and historic landscapes or Vincent Maresca of my staff at vincent.maresca@dep.nj.gov or (609) 633-2395 with questions regarding archaeology. Please reference the HPO project number 16-1650 in any future calls, emails, or written correspondence in order to expedite our review and response.

Sincerely,

Katherine J. Marcopul

Katherine J. Marcopul
Acting Administrator and
Deputy State Historic
Preservation Officer

Cc:
Laura Shick, USDOT Federal Railroad Administration
Rebecca Reyes-Alicea, USDOT Federal Railroad Administration
Amishi Castelli, USDOT Federal Railroad Administration
Jeremy Colangelo-Bryan, NJ Transit
RJ Palladino, AICP,PP, NJ Transit
Dara Callender, P.E., NJ Transit
Ruth L. Pierpont, New York State Historic Preservation Officer
Johnette Davies, Amtrak
Steven Plate, Port Authority of New York and New Jersey

Charlene Dwin Vaughn, Advisory Council on Historic Preservation
Nekole Alligood and Jason Ross, Delaware Nation
Blair Fink and Susan Bachor, Delaware Tribe
Chester Brooks, Chief Delaware Tribe of Indians of Oklahoma
Sherry White, Stockbridge-Munsee Community of Mohican Indians of Wisconsin
Bonney Hartley, Stockbridge-Munsee Community of Mohican Indians of New York
Daniel S. Collins, Sr., Shinnecock Indian Nation
Corrine Remington, Eastern Delaware Nation
Doris Pieschel, Eastern Lenape Nation of Pennsylvania
Mark Gould, Nanticoke Lenni-Lenape Indians of New Jersey
Meenakshi Srinivasan, New York City Landmarks Preservation Commission
Dawn Zimmer, Hoboken Mayor's Office
Dennis English, Hoboken Historic Preservation Commission
Steven M. Fulop, Jersey City Mayor's Office
Robert Cotter, PP, FAICP, Jersey City Historic Preservation Commission
Nicolas Sacco, North Bergen Mayor's Office
Michael J. Gonnelli, Secaucus Mayor's Office
Brian Stack, Union City Mayor's Office
David Spatz, Union City Landmarks Commission
Richard F. Turner, Weehawken Mayor's Office
Weehawken Historical Commission
Noreen Doyle, Hudson River Park Trust
Ilene Grossman-Bailey, Archaeological Society of New Jersey
Jim Mackin, Society for Industrial Archeology
S. Spritzer, Professional Archaeologists of New York City
Walter Hoffman, Anthracity Railroads Historical Society
Michael J. Connor, Erie Lackawanna Historical Society
John E. Barth, National Railway Historical Society, Inc.
Tommy Meehan, Railway & Locomotive Historical Society
Steve Staffieri, Pennsylvania Railroad Technical & Historical Society
Michael Del Vecchio, Tri-State Railway Historical Society, Inc.
Larry Gross, United Railroad Historical Society of New Jersey
Richard Wilson, National Railway Historical Society
Thomas A. DeGise, Hudson County Executive
Charles Enyart, Chief, Eastern Shawnee Tribe of Oklahoma
Shawnee Tribe of Oklahoma
Steve Tettamanti, New Jersey Historical Society
Alex Matthiessen, Hudson Riverkeeper
Bob Foster, Hoboken Historical Museum
Justin Frohwirth, Jersey City Landmarks Conservancy
Weehawken Historical Society
Hoboken Quality of Life Coalition

NEW YORK STATE OF OPPORTUNITY. | Parks, Recreation, and Historic Preservation

ANDREW M. CUOMO
Governor

ROSE HARVEY
Commissioner

August 30, 2016

Ms. Amishi Castelli, Ph.D.
Environmental Protection Specialist
U.S Department of Transportation, Federal Railroad Administration
One Bowling Green, Suite 429
New York, NY 10004-1415

Re: FRA
Hudson Tunnel Project
16PR03710

Dear Ms. Castelli, Ph.D.:

Thank you for continuing to consult with the New York State Historic Preservation Office (SHPO). We have reviewed the provided documentation 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.

We have reviewed the Draft Effects Assessment Methodology Reports that were submitted to our office on August 10th, 2016. Based upon our review, we have no comments at this time and we appreciate the opportunity to comment.

If you have any questions, I can be reached at (518) 268-2182.

Sincerely,

Olivia Brazee
Historic Preservation Technical Specialist
olivia.brazee@parks.ny.gov

via e-mail only

HPO Project# 16-1650-2
HPO- G2016-041

State of New Jersey

MAIL CODE 501-04B
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NATURAL & HISTORIC RESOURCES
HISTORIC PRESERVATION OFFICE
P.O. Box 420
Trenton, NJ 08625-0420
TEL. (609) 984-0176 FAX (609) 984-0578

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

July 6, 2016

Laura Shick
Federal Preservation Officer
U.S. Department of Transportation, Federal Railroad Administration
Environmental & Corridor Planning Division
Office of Railroad Policy and Development
1200 New Jersey Avenue, S.E.
Washington, DC 20590

Dear Ms. Shick:

As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 CFR Part 800: Protection of Historic Properties, as published in the Federal Register on December 12, 2000 (65 FR 77725-77739) and amended on July 6, 2004 (69 FR 40553-40555), I am providing initial consultation comments on the following proposed undertaking:

Hudson Tunnel Project
Hudson County, Hoboken, Jersey City, North Bergen, Secaucus,
Union City and Weehawken
Federal Railroad Administration

These comments were prepared in response to your submission of a cover letter and supporting documentation initiating consultation pursuant to Section 106 of the National Historic Preservation Act and received by the Historic Preservation Office (HPO) on May 18, 2016.

800.3 Initiation of the Section 106 Process

I concur with the list of consulting parties included in the submission. As always, the documentation of public participation in the evaluation of historical resources and project effects will substantially enhance the quality, timeliness, and public value of the Section 106 consultation.

In addition to the list of consulting parties provided by the U.S. Department of Transportation, the NJ HPO would like to recommend that the additional consulting parties included on the list enclosed also be invited to participate.

We look forward to continuing consultation pursuant to 36 CFR 800.4 Identification of Historic Properties and 36 CFR 800.5 Assessment of Effects.

Thank you for providing the opportunity to review and comment on the submitted documentation. Please do not hesitate to contact Jenna Solomon of my staff at jenna.solomon@dep.nj.gov or (609) 984-0176 with any questions regarding historic architecture, historic districts, and historic landscapes or Vincent Maresca of my staff at vincent.maresca@dep.nj.gov or (609) 633-2395 with questions regarding archaeology. Please reference the HPO project number 16-1650 in any future calls, emails, or written correspondence in order to expedite our review and response.

Sincerely,

Katherine J. Marcopul

Katherine J. Marcopul
Acting Administrator and
Deputy State Historic
Preservation Officer

Cc:
Rebecca Reyes-Alicea, USDOT Federal Railroad Administration
Amishi Castelli, USDOT Federal Railroad Administration
Jeremy Colangelo-Bryan, NJ Transit
RJ Palladino, AICP,PP, NJ Transit
Dara Callender, P.E., NJ Transit
Ruth L. Pierpont, New York State Historic Preservation Officer
Johnette Davies, Amtrak
Steven Plate, Port Authority of New York and New Jersey
Charlene Dwin Vaughn, Advisory Council on Historic Preservation
Nekole Alligood and Jason Ross, Delaware Nation
Blair Fink and Susan Bachor, Delaware Tribe
Chester Brooks, Chief Delaware Tribe of Indians of Oklahoma
Sherry White, Stockbridge-Munsee Community of Mohican Indians of Wisconsin
Bonney Hartley, Stockbridge-Munsee Community of Mohican Indians of New York
Daniel S. Collins, Sr., Shinnecock Indian Nation
Corrine Remington, Eastern Delaware Nation
Doris Pieschel, Eastern Lenape Nation of Pennsylvania
Mark Gould, Nanticoke Lenni-Lenape Indians of New Jersey
Meenakshi Srinivasan, New York City Landmarks Preservation Commission
Dawn Zimmer, Hoboken Mayor's Office
Dennis English, Hoboken Historic Preservation Commission
Steven M. Fulop, Jersey City Mayor's Office
Robert Cotter, PP, FAICP, Jersey City Historic Preservation Commission

Nicolas Sacco, North Bergen Mayor's Office
Michael J. Gonnelli, Secaucus Mayor's Office
Brian Stack, Union City Mayor's Office
David Spatz, Union City Landmarks Commission
Richard F. Turner, Weehawken Mayor's Office
Weehawken Historical Commission
Noreen Doyle, Hudson River Park Trust
Ilene Grossman-Bailey, Archaeological Society of New Jersey
Jim Mackin, Society for Industrial Archeology
S. Spritzer, Professional Archaeologists of New York City
Walter Hoffman, Anthracity Railroads Historical Society
Michael J. Connor, Erie Lackawanna Historical Society
John E. Barth, National Railway Historical Society, Inc.
Tommy Meehan, Railway & Locomotive Historical Society
Steve Staffieri, Pennsylvania Railroad Technical & Historical Society
Michael Del Vecchio, Tri-State Railway Historical Society, Inc.
Larry Gross, United Railroad Historical Society of New Jersey
Richard Wilson, National Railway Historical Society
Thomas A. DeGise, Hudson County Executive
Charles Enyart, Chief, Eastern Shawnee Tribe of Oklahoma
Shawnee Tribe of Oklahoma
Steve Tettamanti, New Jersey Historical Society
Alex Matthiessen, Hudson Riverkeeper
Bob Foster, Hoboken Historical Museum
Justin Frohwirth, Jersey City Landmarks Conservancy
Weehawken Historical Society
Hoboken Quality of Life Coalition

Recommended Additional Invitations to Participate as Consulting Parties:

Hudson County
Thomas A. DeGise, Executive
583 Newark Avenue
Jersey City, NJ 07306

Eastern Shawnee Tribe of Oklahoma
Chief Charles Enyart
P.O. Box 350
Seneca, MO 64865

Shawnee Tribe of Oklahoma
P.O. Box 189
Miami, OK 74354

New Jersey Historical Society
Steve Tettamanti, Executive Director
52 Park Pl
Newark, NJ 07102

Hudson Riverkeeper
Alex Matthiessen, Executive Director
P.O. Box 130
Garrisson, NY 10524

Hoboken Historical Museum
Bob Foster, Director
1301 Hudson St
Hoboken, NJ 07030

Jersey City Landmarks Conservancy
Justin Frohwirth, President
P.O. Box 68
Jersey City, NJ 07303-0068

Weehawken Historical Society
212 Dodd Street
Weehawken, NJ 07087

Hoboken Quality of Life Coalition, Inc.
P.O. Box 1195
Hoboken, NJ 07030

Preserving America's Heritage

June 10, 2016

Mr. Michael Johnsen
Acting Division Chief
U.S. Department of Transportation
Federal Railroad Administration
Environmental & Corridor Planning Division
Office of Railroad Policy and Development
1200 New Jersey Avenue, SE
Washington, D.C. 20590

Ref: *Invitation to become a Participating Agency for the Hudson Tunnel Project*
Hudson County, New Jersey and New York County, New York

Dear Mr. Johnsen:

On May 9, 2016, the Advisory Council on Historic Preservation (ACHP) received your invitation to participate in the environmental review process for the referenced undertaking pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 et seq.). The ACHP accepts your invitation to become a participating agency. We do not at this time anticipate attending meetings or providing formal comments at environmental review milestones. However, we would appreciate your keeping us informed of progress, and we may decide to become more actively involved in the future, as warranted. We are also happy to provide the Federal Railroad Administration (FRA) with technical assistance at any time on matters related to historic preservation and Section 106 of the National Historic Preservation Act.

In addition, the ACHP encourages FRA to coordinate the Section 106 process with National Environmental Policy Act (NEPA) compliance by notifying, at your earliest convenience, the appropriate State Historic Preservation Officer (SHPO) and/or Tribal Historic Preservation Officer (THPO), Indian tribes, and other consulting parties pursuant to our regulations, "Protection of Historic Properties" (36 CFR Part 800). Through early consultation, FRA will be able to determine the appropriate strategy to ensure Section 106 compliance is completed in a timely manner for this undertaking.

FRA should continue consultation with the appropriate SHPO/THPO, Indian tribes, and other consulting parties to identify and evaluate historic properties and to assess any potential adverse effects on those historic properties. If FRA determines, through consultation with the consulting parties, that the undertaking will adversely affect historic properties, or that the development of a programmatic agreement is necessary, the federal agency must notify the ACHP and provide the documentation detailed at 36 CFR §800.11(e).

Thank you for inviting our participation in the development of this project. Should you have any questions as to how your agency should comply with the requirements of Section 106, please contact Christopher Wilson at (202) 517- 0229 or by e-mail at cwilson@achp.gov.

Sincerely,

Charlene Dwin Vaughn, AICP
Assistant Director
Office of Federal Agency Programs
Federal Permitting, Licensing, and Assistance Section

NEW YORK STATE OF OPPORTUNITY. | Parks, Recreation, and Historic Preservation

ANDREW M. CUOMO
Governor

ROSE HARVEY
Commissioner

June 8, 2016

Ms. Amishi Castelli, Ph.D.
Environmental Protection Specialist
U.S Department of Transportation, Federal Railroad Administration
One Bowling Green, Suite 429
New York, NY 10004-1415

Re: FRA
Hudson Tunnel Project
16PR03710

Dear Ms. Castelli:

Thank you for requesting the comments of the New York State Historic Preservation Office (SHPO). We have reviewed the provided documentation 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 other 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).

We have reviewed your memoranda initiating consultation and inviting our agency's participation, and also the attached list of potential consulting parties, that were submitted to our office on May 27th, 2016. Based upon our review, we offer the following comment:

1. We confirm our agency's role as a participating agency on the Project

2. Please add the Unkechaug Nation (State recognized) to the list of Potential Consulting Parties. Their contact information is as follows:

   Chief Harry Wallace
   207 Poospansk Lane
   Mastic, NY 11950
   (631)281-4143, ext. 100
   hwal1@aol.com

We look forward to reviewing your next submission for this project. If additional information and correspondence is required regarding this project it should be provided via our Cultural Resource Information System (CRIS) at www.nysparks.com/shpo/online-tools/ Once on the CRIS site, you can log in as a guest and choose "submit" at the very top menu. Next choose "submit new information for an existing project". You will need this project number and your e-mail address.

If you have any questions, I can be reached at (518) 268-2182.

Sincerely,

Olivia Brazee
Historic Preservation Technical Specialist
olivia.brazee@parks.ny.gov

via e-mail only

U.S. Department
of Transportation

**Federal Railroad
Administration**

1200 New Jersey Avenue, SE.
Washington, D.C. 20590

May 12, 2016

Ms. Kate Marcopul
Acting Administrator for Historic Preservation Office
New Jersey Historic Preservation Office
501 East State Street
Mail Code 501-04B PO Box 420
Trenton, NJ 08625

Re: Hudson Tunnel Project, Hudson County, NJ, and New York County, NY
Initiation of Section 106 Consultation

Dear Ms. Marcopul:

By way of this letter, the U.S. Department of Transportation's Federal Railroad Administration (FRA) is initiating consultation with your office pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, (54 U.S.C. § 306108) and its implementing regulations (36 CFR 800) (Section 106) for the Hudson Tunnel Project (Project). FRA and the New Jersey Transit Corporation (NJ TRANSIT) are preparing an Environmental Impact Statement (EIS) to evaluate the Project, pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 et seq.), the Council on Environmental Quality NEPA implementing regulations (40 C.F.R. 1500-1508), and FRA NEPA procedures (64 FR 28545, May 26, 1999, as updated in 78 FR 2713, January 14, 2013). Consistent with Section 11503 of the Fixing America's Surface Transportation Act of 2015 (FAST Act), the EIS will also be prepared in accordance with 23 U.S.C. 139. FRA and NJ TRANSIT intend to coordinate the Section 106 process with the NEPA process for the Project.

The Project is intended to preserve the current functionality of the Northeast Corridor's (NEC) Hudson River rail crossing between New Jersey and New York and strengthen the resilience of the NEC. The Project is located along the New Jersey- and National Register-eligible Pennsylvania Railroad New York to Philadelphia Historic District (Northeast Corridor, Pennsylvania to New York) and includes the North River Tunnel, also New Jersey- and National Register-eligible.

The Notice of Intent announcing the preparation of an EIS, initiation of the scoping period, and the initiation of the Section 106 process for the Hudson Tunnel Project was published in the Federal Register on May 2, 2016. The scoping period will end on May 31st.

Project Background

The existing NEC Hudson River rail tunnel beneath the Hudson River is known as the North River Tunnel. **Figure 1,** attached, illustrates the location of the North River Tunnel and its approach tracks. This tunnel is used by Amtrak for intercity passenger rail service and by NJ TRANSIT for commuter rail service. As shown in the figure, the approach to the existing tunnel begins east of NJ TRANSIT's Frank R. Lautenberg Station in Secaucus, New Jersey (which is 5 miles east of Amtrak and NJ TRANSIT's Newark Penn Station). East of the Secaucus station, the NEC has two tracks that approach the tunnel on a raised embankment through the towns of Secaucus and North Bergen, New Jersey. The existing NEC tracks enter a tunnel portal in North Bergen, passing beneath Union City and Weehawken, New Jersey and the Hudson River before emerging within the Penn Station New York (PSNY) rail complex in New York City. The tunnel has two separate tubes, each accommodating a single track for electrically powered trains, and extends approximately 2.5 miles from the tunnel portal in North Bergen to PSNY. The new tunnel would be located close to, and south of, the existing NEC tracks and existing tunnel.

Superstorm Sandy in October 2012 damaged the North River Tunnel and today the tunnel remains compromised. The North River Tunnel is currently safe for use by Amtrak and NJ TRANSIT trains traveling between New Jersey and New York City and beyond. However, it is in poor condition as a result of the storm and has required emergency maintenance that disrupts service for hundreds of thousands of rail passengers throughout the region. The damage caused by Superstorm Sandy is compounded by the tunnel's age and the intensity of its current use (operating at capacity to meet current demands), resulting in frequent delays due to component failures within the tunnel. Despite the ongoing maintenance, the damage caused by the storm continues to degrade systems in the tunnel and can only be addressed through a comprehensive reconstruction of the tunnel.

Statement of Undertaking

The Project, which is also the undertaking for purposes of Section 106, consists of construction of a new rail tunnel under the Hudson River, including railroad infrastructure in New Jersey and New York connecting the new rail tunnel to the existing NEC, and rehabilitation of the existing NEC tunnel beneath the Hudson River. The project site extends from (in New Jersey) the interlocking east of the Secaucus station where the new tunnel's tracks would connect with the NEC to (in New York) the existing rail complex at PSNY.

The purpose of the Project is to preserve the current functionality of Amtrak's NEC service and NJ TRANSIT's commuter rail service between New Jersey and PSNY by repairing the deteriorating North River Tunnel; and to strengthen the NEC's resiliency to support reliable service by providing redundant capacity under the Hudson River for Amtrak and NJ TRANSIT NEC trains between New Jersey and the existing PSNY. These improvements must be achieved while maintaining uninterrupted commuter and intercity rail service and by optimizing the use of existing infrastructure.

To perform the needed rehabilitation in the existing North River Tunnel, each of the tunnel's two tubes will need to be closed for more than a year. However, rehabilitation needs to be accomplished without unacceptable reductions in weekday train service. Removing one tube in the existing North River Tunnel from operation without new capacity in place would reduce weekday service to volumes well below the current maximum capacity of 24 peak direction trains per hour. Therefore, the Project includes construction of two new rail tubes beneath the Hudson River that can maintain the existing level of train service while the damaged tubes are taken out of service one at a time for rehabilitation.

Identification of Consulting Parties

Section 106 requires that FRA consult with the New Jersey Historic Preservation Office (NJHPO) and New York State Historic Preservation Office (NYSHPO) to identify parties to participate in the Section 106 process ("consulting parties"). Consulting parties may include local governments, Federally recognized Indian tribes, and individuals and organizations with a demonstrated interest in the undertaking due to the nature of their legal or economic relation to the undertaking or affected historic properties, or their concern with the undertaking's effects on historic properties. FRA and NJ TRANSIT have identified entities that may be invited to participate in the Section 106 process for the undertaking as consulting parties, in addition to the NJHPO and NYSHPO. In accordance with 36 C.F.R. §800.3, FRA is providing the attached preliminary list of invited consulting parties for your review (see **Attachment**).

If you have any questions or need additional information about this undertaking, please contact Ms. Amishi Castelli, Federal Railroad Administration, at Amishi.Castelli@dot.gov or Dara Callender, NJ TRANSIT, dcallender@njtransit.com. FRA looks forward to working with you on this important rail transportation project.

Sincerely,

Laura Shick
Federal Preservation Officer
U.S. Department of Transportation, Federal Railroad Administration
Environmental & Corridor Planning Division
Office of Railroad Policy and Development

Enclosures

cc: Rebecca Reyes-Alicea, Northeast Corridor Joint Program Advisor, USDOT Federal Railroad Administration
Amishi Castelli, Environmental Protection Specialist, USDOT Federal Railroad Administration
Jeremy Colangelo-Bryan, Chief of Planning, NJ TRANSIT Capital Planning
RJ Palladino, AICP, PP, Senior Program Manager, NJ TRANSIT Capital Planning
Dara Callender, P.E., Manager, Environmental Compliance, NJ TRANSIT Environment, Energy and Sustainability Unit

4/4/2016

Existing North River Tunnel

Existing Northeast Corridor

Hudson Tunnel Project

Project Location

Figure 1

HUDSON TUNNEL

Hudson Tunnel Project
Section 106 Consultation – Potential Consulting Parties

New Jersey Historic Preservation Officer
Kate Marcopul
Acting Administrator for Historic Preservation Office / Deputy SHPO
New Jersey Historic Preservation Office
New Jersey Department of Environmental Protection
Mail Code 501-04B
P.O. Box 420
Trenton, NJ 08625-0420

New York State Historic Preservation Officer
Ruth L. Pierpont
Deputy Commissioner for Historic Preservation / Deputy SHPO
Peebles Island Resource Center
P.O. Box 189
Waterford, NY 12188

Amtrak
Johnette Davies
Senior Historic Preservation Specialist
Amtrak
30th Street Station
2955 Market Street, Mailbox 55
Philadelphia, PA 19104

Port Authority of New York and New Jersey
Steven Plate
Chief of Major Capital Projects
Port Authority of New York and New Jersey
115 Broadway, 10th Floor
New York, NY 10006

Advisory Council on Historic Preservation (to be invited)
Charlene Dwin Vaughn
Assistant Director, Federal Permitting, Licensing, and Assistance Section
401 F Street NW, Suite 308
Washington, DC 20001

FEDERALLY RECOGNIZED NATIVE AMERICAN TRIBES

Delaware Nation
Nekole Alligood, Tribal Historic Preservation Officer
Jason Ross, Section 106 Manager
Delaware Nation
ATTN: Cultural Preservation Department
P.O. Box 825
31064 State Hwy 281
Anadarko, OK 73005

Delaware Tribe
Blair Fink and Susan Bachor, Historic Preservation Representatives
Delaware Tribe Historic Preservation Office
P.O. Box 64
Pocono Lake, PA 18347

Delaware Tribe of Indians, Oklahoma
Chester Brooks, Chief
Delaware Tribe of Indians, Oklahoma
Delaware Tribal Headquarters
170 N.E. Barbara
Bartlesville, OK 74006

Stockbridge-Munsee Community of Mohican Indians of Wisconsin
Sherry White, Tribal Historic Preservation Officer
Stockbridge-Munsee Community of Mohican Indians of Wisconsin
W13447 Camp 14 Road
Bowler, WI 54416

Bonney Hartley, Tribal Historic Preservation Officer – New York Office
Stockbridge-Munsee Community of Mohican Indians
65 1st Street
Troy, NY 12180

Shinnecock Indian Nation
Daniel S. Collins, Sr., Chairperson and Marguerite A. Smith, Esq., Office of Tribal Trustees/Legal
Shinnecock Indian Nation
Shinnecock Indian Nation Tribal Office
P.O. Box 5006
Southampton, NY 11969-5006

OTHER NATIVE AMERICAN TRIBES

Eastern Delaware Nation
Corrine Remington, Secretary
Eastern Delaware Nation
corrine.remington@yahoo.com

Eastern Lenape Nation of Pennsylvania
Doris Pieschel, Secretary
Eastern Lenape Nation of Pennsylvania
21 Cedar Land
Mountville, PA 17554

Nanticoke Lenni-Lenape Indians of New Jersey (State Recognized, NJ)
Mark Gould, Tribal Chairperson
Nanticoke Lenni-Lenape Indians of New Jersey
P.O. Box 544
Bridgeton, NJ 08302

REPRESENTATIVES OF LOCAL GOVERNMENTS WHERE THE UNDERTAKING MAY TAKE PLACE

New York City

New York City Landmarks Preservation Commission
Meenakshi Srinivasan, Chair
New York City Landmarks Preservation Commission
Municipal Building
1 Centre Street, 9th Floor, North
New York, NY 10007

Hoboken, NJ

Hoboken Mayor's Office
Dawn Zimmer
Mayor of Hoboken
94 Washington Street
Hoboken, NJ 07030

Hoboken Historic Preservation Commission
Dennis English, Chairperson
Hoboken Historic Preservation Commission
Hoboken City Hall
94 Washington Street
Hoboken, NJ 07030

Jersey City, NJ

Jersey City Mayor's Office
Steven M. Fulop
Mayor of Jersey City
280 Grove Street
Jersey City, NJ 07302

Jersey City Historic Preservation Commission
Robert Cotter, PP, FAICP, Director, Division of City Planning
Jersey City Historic Preservation Commission
30 Montgomery Street
14th Floor, Suite 1400
Jersey City, NJ 07302

North Bergen, NJ

North Bergen Mayor's Office
Nicolas Sacco
Mayor of North Bergen
4233 John F. Kennedy Blvd., Room 100
North Bergen, NJ 07047

Secaucus, NJ

Secaucus Mayor's Office
Michael J. Gonnelli
Mayor of Secaucus
Municipal Government Center
1203 Paterson Plank Rd., 2nd Floor
Secaucus, NJ 07094

Union City, NJ

Union City Mayor's Office
Brian Stack
Mayor of Union City
3715 Palisade Avenue, 3rd Floor
Union City, NJ 07087

Union City Landmarks Commission
David Spatz
Union City Landmarks Commission
3715 Palisade Avenue
Union City, NJ 07087

Weehawken, NJ

Weehawken Mayor's Office
Richard F. Turner
Mayor of Weehawken
400 Park Avenue
Weehawken, NJ 07087

Weehawken Historical Commission
Weehawken Public Library
49 Hauxhurst Avenue
Weehawken, NJ 07086

OTHER AFFECTED PARTIES

Hudson River Park Trust
Noreen Doyle
Executive Vice President
Hudson River Park Trust
Pier 40, 2nd Floor
353 West Street
New York, NY 10014

OTHER ARCHAEOLOGICAL AND HISTORIC RESOURCE INTEREST GROUPS

Archaeology Interest Groups
Archaeological Society of New Jersey
Ilene Grossman-Bailey, President
Archaeological Society of New Jersey
c/o New Jersey State Museum Bureau of Archaeology & Ethnography
205 State Street, P.O. Box 530
Trenton, NJ 08625-0530

Society for Industrial Archeology
Jim Mackin, President
Roebling Chapter
Society for Industrial Archeology
370 Riverside Drive, Apt. 2B
New York, NY 10025

Professional Archaeologists of New York City (PANYC)
c/o S. Spritzer
P.O. Box 1503
Murray Hill Station
New York, NY 10156-1503

Railroad History Interest Groups

Anthracite Railroads Historical Society
Walter Hoffmann, President
Anthracite Railroads Historical Society
P.O. Box 519
Lansdale, PA 19446

Erie Lackawanna Historical Society
Michael J. Connor, President
c/o David Start, Membership Chairman
Erie Lackawanna Historical Society
22 Ice Plant Road
Lafayette, NJ 07848-2403

National Railway Historical Society, Inc.
John E. Barth, President
National Railway Historical Society, Inc.
North Jersey Chapter
54 Poplar St
Closter, NJ 07624-1036

Railway & Locomotive Historical Society
Tommy Meehan, Chairman
New York Chapter
Railway & Locomotive Historical Society
42 Portland Pl, Fl 2
Yonkers NY 10703-2206

Pennsylvania Railroad Technical & Historical Society
Steve Staffieri, President
Pennsylvania Railroad Technical & Historical Society
Philadelphia Chapter
P.O. Box 356
Merion Station, PA 19066-9998

Tri-State Railway Historical Society, Inc.
Michael Del Vecchio, President
Tri-State Railway Historical Society, Inc.
P.O. Box 1217
Morristown, NJ 07962

United Railroad Historical Society of New Jersey
Larry Gross, President
United Railroad Historical Society of New Jersey
104 Morris Ave
Boonton Township, NJ 07005

National Railway Historical Society
Mr. Richard Wilson, President
Jersey Central Chapter
National Railway Historical Society
PO Box 700
Clark, NJ 07066

U.S. Department
of Transportation

**Federal Railroad
Administration**

1200 New Jersey Avenue, SE.
Washington, D.C. 20590

May 12, 2016

Ms. Ruth Pierpont
Deputy Commissioner, Historic Preservation
New York State Historic Preservation Office
Peebles Island State Park, P.O. Box 189
Waterford, NY 12188

Re: Hudson Tunnel Project, Hudson County, NJ, and New York County, NY
Initiation of Section 106 Consultation

Dear Ms. Pierpont:

By way of this letter, the U.S. Department of Transportation's Federal Railroad Administration (FRA) is initiating consultation with your office pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, (54 U.S.C. § 306108) and its implementing regulations (36 CFR 800) (Section 106) for the Hudson Tunnel Project (Project). FRA and the New Jersey Transit Corporation (NJ TRANSIT) are preparing an Environmental Impact Statement (EIS) to evaluate the Project, pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. 4321 et seq.), the Council on Environmental Quality NEPA implementing regulations (40 C.F.R. 1500-1508), and FRA NEPA procedures (64 FR 28545, May 26, 1999, as updated in 78 FR 2713, January 14, 2013). Consistent with Section 11503 of the Fixing America's Surface Transportation Act of 2015 (FAST Act), the EIS will also be prepared in accordance with 23 U.S.C. 139. FRA and NJ TRANSIT intend to coordinate the Section 106 process with the NEPA process for the Project.

The Project is intended to preserve the current functionality of the Northeast Corridor's (NEC) Hudson River rail crossing between New Jersey and New York and strengthen the resilience of the NEC. The Project is located along the New Jersey- and National Register-eligible Pennsylvania Railroad New York to Philadelphia Historic District (Northeast Corridor, Pennsylvania to New York) and includes the North River Tunnel, also New Jersey- and National Register-eligible.

The Notice of Intent announcing the preparation of an EIS, initiation of the scoping period, and the initiation of the Section 106 process for the Hudson Tunnel Project was published in the Federal Register on May 2, 2016. The scoping period will end on May 31st.

Project Background

The existing NEC Hudson River rail tunnel beneath the Hudson River is known as the North River Tunnel. **Figure 1,** attached, illustrates the location of the North River Tunnel and its approach tracks. This tunnel is

used by Amtrak for intercity passenger rail service and by NJ TRANSIT for commuter rail service. As shown in the figure, the approach to the existing tunnel begins east of NJ TRANSIT's Frank R. Lautenberg Station in Secaucus, New Jersey (which is 5 miles east of Amtrak and NJ TRANSIT's Newark Penn Station). East of the Secaucus station, the NEC has two tracks that approach the tunnel on a raised embankment through the towns of Secaucus and North Bergen, New Jersey. The existing NEC tracks enter a tunnel portal in North Bergen, passing beneath Union City and Weehawken, New Jersey and the Hudson River before emerging within the Penn Station New York (PSNY) rail complex in New York City. The tunnel has two separate tubes, each accommodating a single track for electrically powered trains, and extends approximately 2.5 miles from the tunnel portal in North Bergen to PSNY. The new tunnel would be located close to, and south of, the existing NEC tracks and existing tunnel.

Superstorm Sandy in October 2012 damaged the North River Tunnel and today the tunnel remains compromised. The North River Tunnel is currently safe for use by Amtrak and NJ TRANSIT trains traveling between New Jersey and New York City and beyond. However, it is in poor condition as a result of the storm and has required emergency maintenance that disrupts service for hundreds of thousands of rail passengers throughout the region. The damage caused by Superstorm Sandy is compounded by the tunnel's age and the intensity of its current use (operating at capacity to meet current demands), resulting in frequent delays due to component failures within the tunnel. Despite the ongoing maintenance, the damage caused by the storm continues to degrade systems in the tunnel and can only be addressed through a comprehensive reconstruction of the tunnel.

Statement of Undertaking

The Project, which is also the undertaking for purposes of Section 106, consists of construction of a new rail tunnel under the Hudson River, including railroad infrastructure in New Jersey and New York connecting the new rail tunnel to the existing NEC, and rehabilitation of the existing NEC tunnel beneath the Hudson River. The project site extends from (in New Jersey) the interlocking east of the Secaucus station where the new tunnel's tracks would connect with the NEC to (in New York) the existing rail complex at PSNY.

The purpose of the Project is to preserve the current functionality of Amtrak's NEC service and NJ TRANSIT's commuter rail service between New Jersey and PSNY by repairing the deteriorating North River Tunnel; and to strengthen the NEC's resiliency to support reliable service by providing redundant capacity under the Hudson River for Amtrak and NJ TRANSIT NEC trains between New Jersey and the existing PSNY. These improvements must be achieved while maintaining uninterrupted commuter and intercity rail service and by optimizing the use of existing infrastructure.

To perform the needed rehabilitation in the existing North River Tunnel, each of the tunnel's two tubes will need to be closed for more than a year. However, rehabilitation needs to be accomplished without unacceptable reductions in weekday train service. Removing one tube in the existing North River Tunnel from operation without new capacity in place would reduce weekday service to volumes well below the current maximum capacity of 24 peak direction trains per hour. Therefore, the Project includes construction of two new rail tubes beneath the Hudson River that can maintain the existing level of train service while the damaged tubes are taken out of service one at a time for rehabilitation.

Identification of Consulting Parties

Section 106 requires that FRA consult with the New York State Historic Preservation Office (NYSHPO) and New Jersey Historic Preservation Office (NJHPO) to identify parties to participate in the Section 106 process ("consulting parties"). Consulting parties may include local governments, Federally recognized Indian tribes,

and individuals and organizations with a demonstrated interest in the undertaking due to the nature of their legal or economic relation to the undertaking or affected historic properties, or their concern with the undertaking's effects on historic properties. FRA and NJ TRANSIT have identified entities that may be invited to participate in the Section 106 process for the undertaking as consulting parties, in addition to the NYSHPO and NJHPO. In accordance with 36 C.F.R. §800.3, FRA is providing the attached preliminary list of invited consulting parties for your review (see **Attachment**).

If you have any questions or need additional information about this undertaking, please contact Ms. Amishi Castelli, Federal Railroad Administration, at Amishi.Castelli@dot.gov or Dara Callender, NJ TRANSIT, dcallender@njtransit.com. FRA looks forward to working with you on this important rail transportation project.

Sincerely,

Laura Shick
Federal Preservation Officer
U.S. Department of Transportation, Federal Railroad Administration
Environmental & Corridor Planning Division
Office of Railroad Policy and Development

Enclosures

cc: Rebecca Reyes-Alicea, Northeast Corridor Joint Program Advisor, USDOT Federal Railroad Administration
Amishi Castelli, Environmental Protection Specialist, USDOT Federal Railroad Administration
Jeremy Colangelo-Bryan, Chief of Planning, NJ TRANSIT Capital Planning
RJ Palladino, AICP, PP, Senior Program Manager, NJ TRANSIT Capital Planning
Dara Callender, P.E., Manager, Environmental Compliance, NJ TRANSIT Environment, Energy and Sustainability Unit

4/4/2016

Existing North River Tunnel

Existing Northeast Corridor

Hudson Tunnel Project

Project Location

Figure 1

HUDSON TUNNEL

Hudson Tunnel Project
Section 106 Consultation – Potential Consulting Parties

New Jersey Historic Preservation Officer
Kate Marcopul
Acting Administrator for Historic Preservation Office / Deputy SHPO
New Jersey Historic Preservation Office
New Jersey Department of Environmental Protection
Mail Code 501-04B
P.O. Box 420
Trenton, NJ 08625-0420

New York State Historic Preservation Officer
Ruth L. Pierpont
Deputy Commissioner for Historic Preservation / Deputy SHPO
Peebles Island Resource Center
P.O. Box 189
Waterford, NY 12188

Amtrak
Johnette Davies
Senior Historic Preservation Specialist
Amtrak
30th Street Station
2955 Market Street, Mailbox 55
Philadelphia, PA 19104

Port Authority of New York and New Jersey
Steven Plate
Chief of Major Capital Projects
Port Authority of New York and New Jersey
115 Broadway, 10th Floor
New York, NY 10006

Advisory Council on Historic Preservation (to be invited)
Charlene Dwin Vaughn
Assistant Director, Federal Permitting, Licensing, and Assistance Section
401 F Street NW, Suite 308
Washington, DC 20001

FEDERALLY RECOGNIZED NATIVE AMERICAN TRIBES

Delaware Nation
Nekole Alligood, Tribal Historic Preservation Officer
Jason Ross, Section 106 Manager
Delaware Nation
ATTN: Cultural Preservation Department
P.O. Box 825
31064 State Hwy 281
Anadarko, OK 73005

Delaware Tribe
Blair Fink and Susan Bachor, Historic Preservation Representatives
Delaware Tribe Historic Preservation Office
P.O. Box 64
Pocono Lake, PA 18347

Delaware Tribe of Indians, Oklahoma
Chester Brooks, Chief
Delaware Tribe of Indians, Oklahoma
Delaware Tribal Headquarters
170 N.E. Barbara
Bartlesville, OK 74006

Stockbridge-Munsee Community of Mohican Indians of Wisconsin
Sherry White, Tribal Historic Preservation Officer
Stockbridge-Munsee Community of Mohican Indians of Wisconsin
W13447 Camp 14 Road
Bowler, WI 54416

Bonney Hartley, Tribal Historic Preservation Officer – New York Office
Stockbridge-Munsee Community of Mohican Indians
65 1st Street
Troy, NY 12180

Shinnecock Indian Nation
Daniel S. Collins, Sr., Chairperson and Marguerite A. Smith, Esq., Office of Tribal Trustees/Legal
Shinnecock Indian Nation
Shinnecock Indian Nation Tribal Office
P.O. Box 5006
Southampton, NY 11969-5006

OTHER NATIVE AMERICAN TRIBES

Eastern Delaware Nation
Corrine Remington, Secretary
Eastern Delaware Nation
corrine.remington@yahoo.com

Eastern Lenape Nation of Pennsylvania
Doris Pieschel, Secretary
Eastern Lenape Nation of Pennsylvania
21 Cedar Land
Mountville, PA 17554

Nanticoke Lenni-Lenape Indians of New Jersey (State Recognized, NJ)
Mark Gould, Tribal Chairperson
Nanticoke Lenni-Lenape Indians of New Jersey
P.O. Box 544
Bridgeton, NJ 08302

REPRESENTATIVES OF LOCAL GOVERNMENTS WHERE THE UNDERTAKING MAY TAKE PLACE

New York City

New York City Landmarks Preservation Commission
Meenakshi Srinivasan, Chair
New York City Landmarks Preservation Commission
Municipal Building
1 Centre Street, 9th Floor, North
New York, NY 10007

Hoboken, NJ

Hoboken Mayor's Office
Dawn Zimmer
Mayor of Hoboken
94 Washington Street
Hoboken, NJ 07030

Hoboken Historic Preservation Commission
Dennis English, Chairperson
Hoboken Historic Preservation Commission
Hoboken City Hall
94 Washington Street
Hoboken, NJ 07030

Jersey City, NJ

Jersey City Mayor's Office
Steven M. Fulop
Mayor of Jersey City
280 Grove Street
Jersey City, NJ 07302

Jersey City Historic Preservation Commission
Robert Cotter, PP, FAICP, Director, Division of City Planning
Jersey City Historic Preservation Commission
30 Montgomery Street
14th Floor, Suite 1400
Jersey City, NJ 07302

North Bergen, NJ

North Bergen Mayor's Office
Nicolas Sacco
Mayor of North Bergen
4233 John F. Kennedy Blvd., Room 100
North Bergen, NJ 07047

Secaucus, NJ

Secaucus Mayor's Office
Michael J. Gonnelli
Mayor of Secaucus
Municipal Government Center
1203 Paterson Plank Rd., 2nd Floor
Secaucus, NJ 07094

Union City, NJ

Union City Mayor's Office
Brian Stack
Mayor of Union City
3715 Palisade Avenue, 3rd Floor
Union City, NJ 07087

Union City Landmarks Commission
David Spatz
Union City Landmarks Commission
3715 Palisade Avenue
Union City, NJ 07087

Weehawken, NJ

Weehawken Mayor's Office
Richard F. Turner
Mayor of Weehawken
400 Park Avenue
Weehawken, NJ 07087

Weehawken Historical Commission
Weehawken Public Library
49 Hauxhurst Avenue
Weehawken, NJ 07086

OTHER AFFECTED PARTIES

Hudson River Park Trust
Noreen Doyle
Executive Vice President
Hudson River Park Trust
Pier 40, 2nd Floor
353 West Street
New York, NY 10014

OTHER ARCHAEOLOGICAL AND HISTORIC RESOURCE INTEREST GROUPS

Archaeology Interest Groups
Archaeological Society of New Jersey
Ilene Grossman-Bailey, President
Archaeological Society of New Jersey
c/o New Jersey State Museum Bureau of Archaeology & Ethnography
205 State Street, P.O. Box 530
Trenton, NJ 08625-0530

Society for Industrial Archeology
Jim Mackin, President
Roebling Chapter
Society for Industrial Archeology
370 Riverside Drive, Apt. 2B
New York, NY 10025

Professional Archaeologists of New York City (PANYC)
c/o S. Spritzer
P.O. Box 1503
Murray Hill Station
New York, NY 10156-1503

Railroad History Interest Groups

Anthracite Railroads Historical Society
Walter Hoffmann, President
Anthracite Railroads Historical Society
P.O. Box 519
Lansdale, PA 19446

Erie Lackawanna Historical Society
Michael J. Connor, President
c/o David Start, Membership Chairman
Erie Lackawanna Historical Society
22 Ice Plant Road
Lafayette, NJ 07848-2403

National Railway Historical Society, Inc.
John E. Barth, President
National Railway Historical Society, Inc.
North Jersey Chapter
54 Poplar St
Closter, NJ 07624-1036

Railway & Locomotive Historical Society
Tommy Meehan, Chairman
New York Chapter
Railway & Locomotive Historical Society
42 Portland Pl, Fl 2
Yonkers NY 10703-2206

Pennsylvania Railroad Technical & Historical Society
Steve Staffieri, President
Pennsylvania Railroad Technical & Historical Society
Philadelphia Chapter
P.O. Box 356
Merion Station, PA 19066-9998

Tri-State Railway Historical Society, Inc.
Michael Del Vecchio, President
Tri-State Railway Historical Society, Inc.
P.O. Box 1217
Morristown, NJ 07962

United Railroad Historical Society of New Jersey
Larry Gross, President
United Railroad Historical Society of New Jersey
104 Morris Ave
Boonton Township, NJ 07005

National Railway Historical Society
Mr. Richard Wilson, President
Jersey Central Chapter
National Railway Historical Society
PO Box 700
Clark, NJ 07066

APPENDIX B:
GEOPHYSICAL SURVEY

VIA ELECTRONIC DELIVERY

December 22, 2016

The Gateway Trans-Hudson Partnership
One Penn Plaza
New York, NY 10119

Attention: Philip Rice, P.E., Project Manager

RE: AMTRAK Contract No. 9500001023 – Preliminary Engineering for Hudson Tunnel Project – Marine Geophysical Survey

Subject: **Marine Geophysical Survey Report**

Mr. Rice,

In accordance with the subcontract executed on September 8, 2016 for the provision of a Marine Geophysical Survey on the Hudson Tunnel Project, SeaVision Underwater Solutions, Inc. (SeaVision) submits the following letter report to supplement the digital deliverable products that have been transferred via AECOM FTP Servers on December 20, 2016 to Ms. Karen Armfield. This letter report briefly discusses the field activities, data acquisition, quality control, processing, and delivery of the requested marine geophysical survey data.

1.0 Work Plan

Attachment A to this letter report is the Work Plan for the requested Marine Geophysical Survey services, submitted by SeaVision to Mr. Philip Rice on September 22, 2016. The Work Plan consisted of the following principal sections that described our methodology for conducting the marine geophysical survey that consisted of a multibeam bathymetric survey, sidescan sonar survey, and marine magnetometer survey:

Staffing
Equipment
Datums

Pre-Survey Activities	Completed September 23, 2016 to October 5, 2016
Field Survey Activities	Completed October 6, 2016 to October 8, 2016
Post-Survey Activities	Completed October 9, 2016
Post-Processing	Completed October 11, 2016 to November 9, 2016
Delivery of Products	Completed November 9, 2016 (Initial Delivery) with Final Delivery December 20, 2016

A full description of the various activities can be found in Attachment A, although specific portions of the Work Plan and Quality Control Plan that directly relate to data quality of final data products will be discussed herein.

2.0 Quality Control Plan

Attachment B to this letter report is the Quality Control Plan for the requested Marine Geophysical Survey services, submitted by SeaVision to Mr. Philip Rice on September 23, 2016. In our plan, we agreed to comply with the overall GTHP Project Quality Management Plan and also offered a supplement to describe our planned QC actions for the different survey modalities.

3.0 Project Survey Datums

All digital data has been collected, processed, and delivered to the following Project Survey Datums:

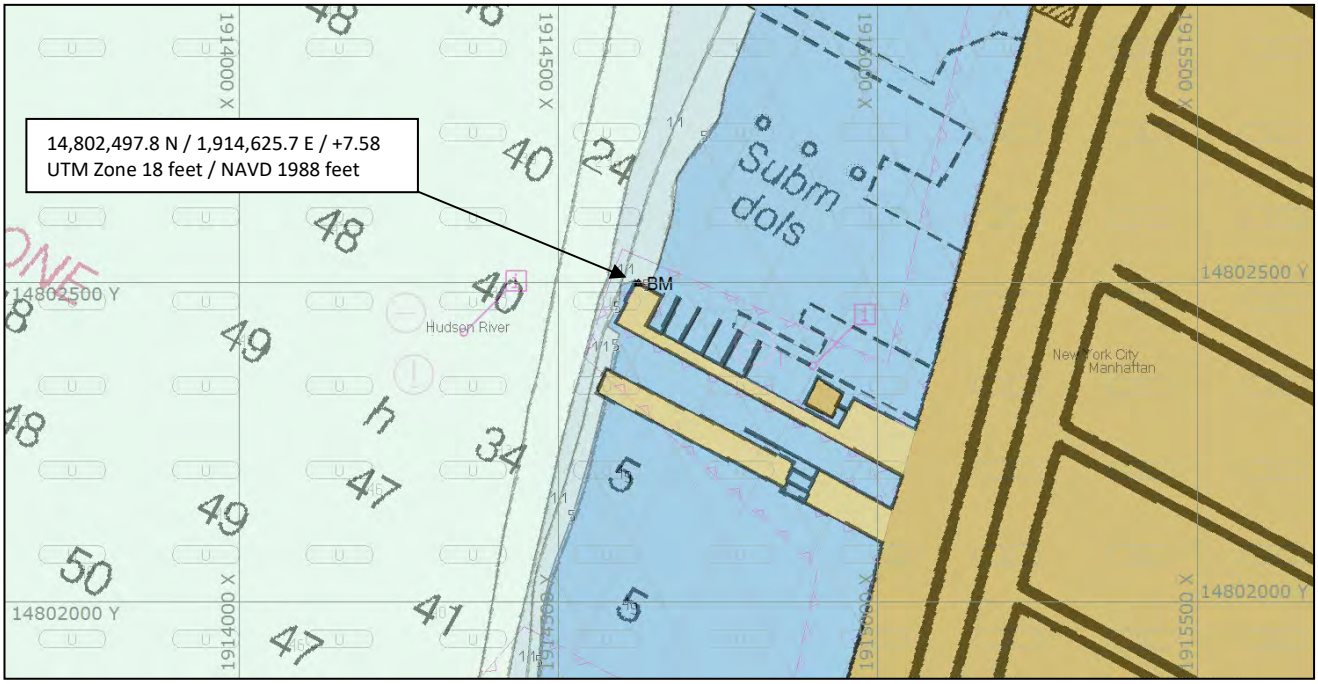
Horizontal:	Universal Transverse Mercator, Zone 18N (feet)
Vertical:	North American Vertical Datum of 1988 (NAVD 1988) feet with final conversion to the Pennsylvania Railroad (PRR) Vertical Datum (feet)
Vertical Conversion:	NAVD 1988 elevation + 298.34 feet = PRR Elevation (feet)

To supplement the primary requested survey deliverables, SeaVision prepared a second set of digital data deliverables to GTHP after a request by GTHP for conversion of all data to a different horizontal datum to allow GTHP to review this data in the context of legacy planning, survey, and design data maintained by GTHP and Amtrak. The secondary deliverable package has been submitted relative to the following supplemental project datums:

Horizontal:	North American Datum of 1983, New Jersey State Plane (feet)
Vertical:	Pennsylvania Railroad (PRR) Vertical Datum (feet)

4.0 Survey Control

Though survey control points suitable for supporting marine bathymetric survey work were not available during our field survey period of October 5, 2016 to October 8, 2016, SeaVision established a control point on-site on a timber piling at Pier 66. By utilizing a HemisphereGPS R320 GNSS Receiver, SeaVision collected two rapid-static (less than 2-hour) Static GPS observation sessions on September 23, 2016 timber piling at the end of Pier 66 that we marked with a stainless steel screw. After processing the data through the National Geodetic Survey Online Positioning User Service (OPUS), on October 5, 2016 we installed a tide board relative to the control point on an adjacent piling. The figure below illustrates the location of the point on the NOAA navigation chart for the area and provides the results coordinates and elevation of the point.



Throughout all survey activities, SeaVision utilized the Hypack 2015 hydrographic survey software to manage all pre-planned survey line navigation, monitor vessel position and orientation, and collect data. The onboard inertial navigation system (INS), an SBG Systems Ekinox-D system, received RTCM 3.0 corrections from the KeynetGPS Virtual Reference Station (VRS) Network Service thereby providing real-time kinematic (RTK) GPS positioning for all survey operations. This solution allowed our field survey team to observe the real-time tide corrections onboard the vessel during the field survey activities and monitor the water levels relative to the site control point by making periodic observations on the tide board to an resolution of 0.05 feet (the marks on the board are to 0.1 feet, but 0.05 feet can be estimated between marks).

5.0 Multibeam Bathymetric Survey – Data Acquisition, Processing, Delivery

Initial calibration and performance testing

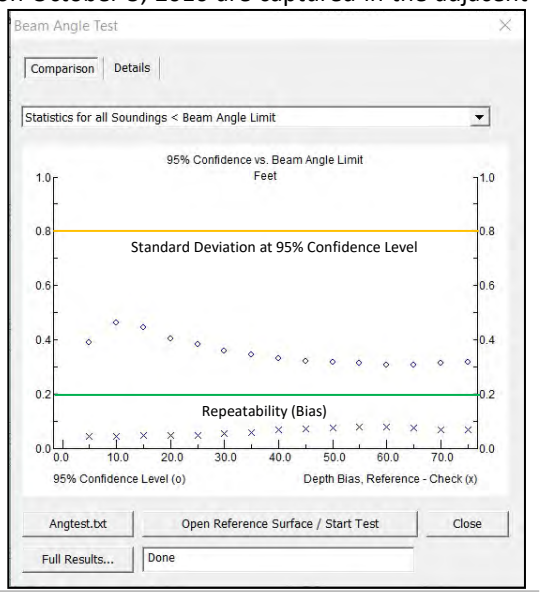
SeaVision conducted the preliminary survey preparations on October 5, 2016 with the actual field survey data collection for the multibeam bathymetric survey on October 6, 2016 and October 7, 2016. The preliminary survey preparations consisted of performance testing of the Norbit WBMS multibeam echosounder paired with the SBG Systems Ekinox-D inertial navigation system onboard our 21-foot survey vessel (pictured at right) at a test area in the Port Jersey Channel in Bayonne, NJ. Performance testing consisted first of conducting patch test calibration procedures to quantify the angular offsets between the inertial navigation system and the multibeam echosounder. **For all survey operations, we utilized the Norbit WBMS multibeam echosounder set at 400 kHz with 512 beams on a 140-degree swath**.

After completing the patch test calibration, SeaVision established a reference surface in a 400-ft by 400-ft box using multiple survey lines to generate complete coverage of the box with over 400% overlap between survey lines. We then compared the reference surface to minimally processed cross-check lines within that box to establish the statistical performance of the combined survey suite using a utility within the Hypack 2015 software package.

The objective of the performance testing was to demonstrate that the combined survey suite could achieve the most stringent hydrographic survey standards required by the U.S. Army Corps of Engineers. Per the USACE Hydrographic Survey Manual (EM 1110-2-1003), Table 3-1 (below, left), the most stringent standards are for Coastal Deep Draft Projects, Dredge Measurement and Payment Surveys, New Work or Rock Cuts. The results of our performance testing on October 5, 2016 are captured in the adjacent image (below, right).

Table 3-1. Recommended Depth Accuracy Standards for Corps of Engineers Surveys of Federal Navigation Projects based on Performance Test Results. [1]

Project	Typical [2] Repeatability (feet)	Typical [3] Standard Deviation (± feet at 95%)
Coastal Deep Draft Projects (15>d<75 ft):		
Dredge measurement & payment surveys		
Channel clearance/acceptance		
Project condition surveys		
Maintenance Dredging (soft sand/silt bottom)	0.3 ft	±0.8 ft
New Work or Rock Cuts [4]	0.2 ft	±0.8 ft
Coastal Shallow Draft Projects (d<15 ft)	0.3 ft	±0.8 ft
Inland Navigation Projects (d<15 ft)	0.3 ft	±0.5 ft



These test results demonstrated that the system performance is well within the referenced, targeted survey standards.

Field Survey Acquisition

On October 6, 2016, SeaVision performed a multibeam bathymetric survey of the Amtrak Hudson River Tunnel Project area between Piers 66 and 76 on the east side of the channel and approaching the shoreline. The overall survey area measured approximately 1400-feet by 2500 feet. **To perform this work, SeaVision configured the survey vessel with an onboard SBG Systems Ekinox-D Inertial Navigation System receiving corrections from the KeyNetGPS Virtual Reference Station system to supply RTK-GPS positioning, and a Norbit WBMS multibeam echosounder.** After performing a patch test calibration and collecting a sound velocity profile on site, SeaVision performed the survey of the project area with line spacing designed to provide between 170% and 200% coverage of the survey area. SeaVision performed periodic checks of the onboard observed tide relative to the tide board throughout the survey and performed periodic sound velocity casts to account for any major changes in the sound velocity profile that can occur (for example, a flooding tide might generate a larger saltwater wedge at depth, thus dramatically increasing the speed of sound at depth). The field surveyor completed the survey activities with a final sound velocity cast and additional patch test calibration lines to check whether any changes may have occurred to the system during survey operations. **For all survey operations, we utilized the Norbit WBMS multibeam echosounder set at 400 kHz with 512 beams on a 140-degree swath.**

On October 7, 2016, SeaVision repeated the multibeam bathymetric survey of the project footprint while performing the sidescan sonar survey of the project area. The final deliverable products utilize the survey data from both days to generate a single bathymetric survey digital terrain model.

Data Processing

Post-processing as described in our Work Plan and QC Supplement in Attachments A and B has been performed to generate the final bathymetric survey deliverable products. The fundamental deliverable product from the bathymetric survey is the ASCII Text XYZ file that is sorted on a grid of 1-foot by 1-foot, where each elevation point is assigned to the center of each 1 x 1 grid cell and it represents the average of any soundings that fell within that cell, and a minimum of 2 soundings were required.

From the 1 x 1 ASCII Text XYZ file, additional files have been generated by sorting the digital terrain model of the 1 x 1 grid to a 4 x 4 grid, a 5 x 5 grid, and a 20 x 20 grid.

Bathymetric Survey Deliverable Products

The bathymetric survey deliverable data files possess file names that reference the date, project, vertical datum, grid sorting, and horizontal datum as follows:

20161007-AmtrakHudsonTunnel-PRR-1x1-UTM

20161007 = Date of Survey
Amtrak Hudson Tunnel = Project
PRR = Vertical Datum
1 x 1 = Grid Spacing of elevations
UTM = Horizontal Coordinates

The different data formats are as follows:

ASCII XYZ Files: Space o comma-delimited files with the easting, northing, and elevation values
AutoCAD DXF: DXF Files where the decimal point of each elevation is the actual location of the elevation from the XYZ file and the point is assigned the elevation as a Z-value.
Microstation DGN: DGN files where the decimal point of each spot elevation is the actual location of the elevation and the point is assigned the elevation as a z-value. The points may actually be placed adjacent to the text label but the points are definitely referencing the XY location of the elevation.
Bathy GeoTIFF: Geographically referenced TIFF images, with associated World Files, that have been prepared as color-shaded relief images generated from the 1 x 1 data. The color ramp references the vertical datum and has been supplied as an associated JPEG. These images help to visualize the bottom character, underwater terrain, and debris that may be present in the project area.
Bathy Google Earth: A Google Earth KMZ file of the color shaded relief image. These KMZ files extend the ability to share the data to non-engineering stakeholders for the purpose of ready visualization by others within the Google Earth platform.

PDF Drawings: Three PDF Drawings, at Architectural D-Size (24 x 36) have been prepared:

SeaVision Figure 16-043-GC-01 is the general condition bathymetric survey data, represented simply as the color shaded relief image overlaid on publicly available digital aerial photographs and a transparency of the NOAA raster navigation chart for this area.

SeaVision Figure 16-043-GC-02 is the general condition bathymetric survey data, represented as the color shaded relief image and the interpolated contours, overlaid on publicly available digital aerial photographs and a transparency of the NOAA raster navigation chart for this area.

SeaVision Figure 16-043-GC-03 is the general condition bathymetric survey data, represented as the color shaded relief image with the discrete text elevation from a 20 x 20 grid, overlaid on publicly available digital aerial photographs and a transparency of the NOAA raster navigation chart for this area.

Bathymetric Survey Findings / Observations

The bathymetric survey data ranges from elevations of approximately 290 PRR down to 240 PRR (or, -8.3 NAVD 1988 to -66.7 NAVD 1988). The shallowest water where we have surveyed equates to about -5.5-feet Mean Lower Low Water.

In the middle of the river in the deepest portions of the survey footprint, sand waves are visible in the color-shaded relief imagery. There are also some shoals of unknown origin that appear in the bathymetry.

On the slope adjacent to the shoreline, there is substantial debris visible in the color-shaded relief, particularly between Pier 66 and the remnants of the now derelict Pier 74. The timber piling fields and debris from derelict/abandoned piers 72 and 74 are also visible. They appear to have been abandoned in place. The depth of the pilings from those piers, below the mudline, is not known.

The slope from the main river channel to the shoreline margin is approximately 1V:10H. Once the river bottom has shoaled from the deeper main channel up the slope to the adjacent mudflat, the river bottom appears to be generally consistent in its elevations of approximately 288 to 290 PRR.

We believe that this additional area between the completed survey footprint and Hudson River Park promenade can be surveyed at high tide – however extreme care must be taken when surveying in the vicinity of the old derelict pier footprints because those footprints have extensive debris fields that can post a hazard to the outboard motor or the sonar head.

6.0 Sidescan Sonar Survey – Data Acquisition, Processing, Delivery

Field Survey Acquisition

On October 7, 2016, SeaVision performed a sidescan sonar survey of the Amtrak Hudson River Tunnel Project area between Piers 66 and 76 on the east side of the channel and approaching the shoreline. The overall survey area measured approximately 1400-feet by 2500 feet. **To perform this work, SeaVision configured the survey vessel with an onboard SBG Systems Ekinox-D Inertial Navigation System receiving corrections from the KeyNetGPS Virtual Reference Station system to supply RTK-GPS positioning, and the EdgeTech 4125 dual frequency digital CHIRP sidescan sonar.** SeaVision performed a supplementary multibeam bathymetry survey simultaneous with the sidescan sonar survey, but primary navigation and vessel handling was conducted with the objective to optimize the sidescan sonar survey. SeaVision performed periodic checks of the onboard observed tide relative to the tide board throughout the survey and performed periodic sound velocity casts to account for any major changes in the sound velocity profile that can occur. The field surveyor completed the survey activities with a final sound velocity cast and additional patch test calibration lines to check whether any changes may have occurred to the system during survey operations.

With the EdgeTech 4125 digital sidescan sonar set to collect data simultaneously at frequencies of 400 kHz and 900 kHz, a range set to 200-feet per channel, and the towfish towed behind the vessel in order to maintain a towfish altitude approximately 15 feet above the river bottom, SeaVision conducted the survey parallel to the shoreline on pre-planned lines spaced 75-feet apart. The end result was a survey with significant overlap between adjacent survey lines so that targets could be illuminated by multiple survey passes and a final image mosaic could be generated with unidirectional illumination and nearly negligible seams.

Data Processing

Post-processing as described in our Work Plan and QC Supplement in Attachments A and B has been performed to generate the final sidescan sonar deliverable products. The fundamental deliverable product from the sidescan sonar survey is a sidescan sonar image mosaic generated from the 900 kHz imagery that is geographically referenced to the project horizontal datum with a geoTIFF world file. Additionally a target report of all targets identified, classified, and measured has also been generated.

Sidescan Sonar Survey Deliverable Products

The sidescan sonar survey deliverable data files possess file names that reference the date, project, survey product, and horizontal datum as follows:

20161007-Amtrak-SSS-NJSP

20161007 = Date of Survey
Amtrak = Project
PRR = Vertical Datum
SSS = Sidescan Sonar Survey
NJSP = New Jersey State Plane

The different data formats are as follows:

GeoTIFF: A geographically referenced TIFF image with associated world file of the final sidescan sonar image mosaic generated from multiple survey passes along the entire project footprint.
Sidescan Google Earth: A Google Earth KMZ file of the sidescan sonar image mosaic. These KMZ files extend the ability to share the data to non-engineering stakeholders for the purpose of ready visualization by others within the Google Earth platform.
Sidescan Target Report PDF: A letter-sized target report in the PDF file format that uses a standardized reporting format to display sample images of targets (or debris fields), their measurements, locations, and classifications.
Sidescan Microstation DGN: DGN files of different target types have been prepared. The different target types, and thus files, are as follows: SSS Targets (analogous to the Target Report PDF tabulation), abandoned piers, debris fields (3), sand waves, and exposed clay.
Sidescan Target Shapefiles: ESRI ArcGIS Shapefiles have been prepared for the tabulation of all targets and the three large debris field areas that have been identified in the survey area. Each shapefile actually consists of an SHP file and several support files.
Sidescan Bottom Classification Shapefiles: ESRI ArcGIS Shapefiles of unique bottom types observed in the imagery. These consists of abandoned pier footprints, debris fields, exposed clay, and sand waves.

PDF Drawings: Three PDF Drawings, at Architectural D-Size (24 x 36) have been prepared:

SeaVision Figure 16-043-SSS-01 is the sidescan sonar image mosaic, overlaid on publicly available digital aerial photographs and a transparency of the NOAA raster navigation chart for this area.

SeaVision Figure 16-043-SSS-02 is the sidescan sonar image mosaic, annotated with interpretations of the bottom type where specific features or characteristics of interest might be observed in the imagery, overlaid on publicly available digital aerial photographs and a transparency of the NOAA raster navigation chart for this area.

SeaVision Figure 16-043-SSS-03 is the sidescan sonar image mosaic, annotated with interpretations of the bottom type where specific features or characteristics of interest might be observed in the imagery, and also overlaid with the target marks and IDs (consistent with the target IDs from the Target Report PDF and the associated comma-delimited text spreadsheet), overlaid on publicly available digital aerial photographs and a transparency of the NOAA raster navigation chart for this area.

Sidescan Sonar Survey Findings / Observations

The sidescan sonar imagery for this project footprint exhibits bottom features that are consistent with the findings from the bathymetric survey. Sand waves are present in the deeper water of the project area, debris fields are presents along the slope, and there are significant abandoned-in-place debris fields from old piers.

The slope of the channel possesses at least three significant debris fields with litter (in the form of timber pilings and/or trees) is scattered along the slope in each of the three fields.

The deeper water appears to have a bottom type that is more likely sand (fine to medium grained sand) that occasionally develops into sand waves on the river bottom. Proceeding up the slope into the shallow are adjacent to the Hudson River Park Promenade, it appears that the sediment type changes to a very soft, organic silt (the smooth, featureless character to the imagery in this area supports the interpretation).

We believe that this additional area between the completed survey footprint and Hudson River Park promenade should not surveyed at high tide with a sidescan sonar because the risk of impact between the sidescan sonar towfish and remnant pier structure is too great. Our field surveyor actually damaged our sidescan sonar at the end of field survey activities when accidentally towing the towfish into one of the derelict pier footprints.

7.0 Marine Magnetometer Survey - Data Acquisition, Processing, Delivery

Field Survey Acquisition

On October 8, 2016, SeaVision performed a marine magnetometer survey of the Amtrak Hudson River Tunnel Project area between Piers 66 and 76 on the east side of the channel and approaching the shoreline. The overall survey area measured approximately 1400-feet by 2500 feet. **To perform this work, SeaVision configured the survey vessel with an onboard SBG Systems Ekinox-D Inertial Navigation System receiving corrections from the KeyNetGPS Virtual Reference Station system to supply RTK-GPS positioning, and a Marine Magnetics SeaSpy Magnetometer towed at a fixed layback aft of the inertial navigation system to collect full magnetic field measurements on each survey line**. Hypack 2015 has been used to monitor navigation relative to the planned survey lines, collect the magnetic field measurements, and calculate the towfish layback during all survey activities.

For the magnetometer survey and sub-bottom profiler survey, survey lines have been performed in the project survey area on a grid spacing of 50-feet, with tracklines spaced 50-feet apart parallel to the shoreline, and tracklines spaced 50-feet apart perpendicular to the shoreline.

Marine magnetometers such as the Marine Magnetics SeaSpy magnetometer deployed by SeaVision measure the total ambient magnetic field through which the magnetometer towfish moves. With the system set to collect observations at between 1 Hz and 4 Hz (in our case, 2 Hz), the system can sense changes in the ambient magnetic field that might be caused by metallic objects that are located in the vicinity of each survey track line through which the magnetometer towfish passes.

Data Processing

Post-processing as described in our Work Plan and QC Supplement in Attachments A and B has been performed to generate the final magnetometer survey data deliverables. All data has been collected so that layback corrections from the survey vessel are applied and the magnetometer towfish position is recorded continuously and time-stamped with full magnetic observations from the magnetometer. The magnetic field observations are recorded in nanoTeslas (nT), with the typical range of observations between 51,000 and 52,000 nT in this area.

After collection, all data is merged and reduced to a comma-delimited XYZT file where each field represents the following:

X = easting
Y = northing
Z = magnetic field
T = time

For post-processing, we further reduce the XYZT file to two separate files – a full-field magnetic observation file, and a time-dependent “delta” observation file.

The full field XYZ file provides the absolute magnetic field observations that consist of the easting, northing, and observed magnetic field values. The second file provides a time-dependent “delta” field observation, such that we calculate the absolute value of the differences between subsequent magnetic field observations. This is done in the cases where the background magnetic field values

appear to fluctuate in a given locality and it might be necessary to highlight changes in the field values that are due to actual targets and not necessarily due to background fluctuations caused by natural phenomena or human activities.

For example – the survey footprint for this project site is over the existing North River Tunnel and directly adjacent to the shoreline of Manhattan. The presence of the North River Tunnel creates a dramatic magnetic anomaly, and the steel (ferrous) construction of infrastructure and commercial buildings on the west side of Manhattan works to generate a gross, large scale magnetic anomalies that can potentially shroud actual ferrous targets. By looking at the relative change of field observations along survey lines, it is possible to suppress the noise caused by the background changes in magnetic field values, and improve the signal caused by actual ferrous targets.

Following generation of the XYZ files, color-shaded relief maps of the survey footprint has been prepared with color ramps for both the absolute magnetic field, and also the absolute value of the change in field from one observation to the next in the "delta" XYZ files. The color shaded relief maps have been overlaid on digital aerial imagery and the NOAA Raster Navigation Chart (RNC) for this section of the Hudson River.

Magnetometer Survey Deliverable Products

The magnetometer survey deliverable data files possess file names that reference the date, project, data type, and horizontal datum as follows:

20161008-Amtrak-Mag-Delta-Model-NJSP

20161008 = Date of Survey
Amtrak = Project
Mag = Magnetometer Data
Delta = Absolute value of the change in subsequent magnetic field values
Model = data has been interpolated to generate a 5' x 5' grid using a Triangulated Irregular Network (TIN) model
NJSP = Horizontal Coordinates in New Jersey State Plane Feet

20161008-Amtrak-MagGamma-UTM
20161008 = Date of Survey
Amtrak = Project
MagGamma = Magnetic Field value in nT
UTM = Horizontal Coordinates in UTM feet
Note: The lack of the suffix "model" in the file name means that these are the direct observations taken from the survey activities and do not consist of interpolated values between observations.

The different data formats are as follows:

ASCII XYZ Files: Space or comma-delimited files with the easting, northing, and magnetic field (or field "delta" values)
AutoCAD DXF: DXF Files of the magnetic field values as contours.
Mag GeoTIFF: Geographically referenced TIFF images, with associated World Files, that have been prepared as color-shaded relief images generated from the 5 x 5 data. The color ramp references either the overall magnetic field value observation or the absolute value of the magnetic field changes between subsequent observations, and has been supplied as an associated JPEG. These images help to visualize the magnetic anomalies and infrastructure that exist in the project area.
Mag Google Earth: A Google Earth KMZ file of the color shaded relief image from the magnetic field data. These KMZ files

extend the ability to share the data to non-engineering stakeholders for the purpose of ready visualization by others within the Google Earth platform.
Mag Targets Shapefile: An ESRI ArcGIS Shapefile of polygon coverages that highlight specific magnetic anomalies/targets that are apparent in either the magnetic field values or the magnetic field delta values. These targets include the North River Tunnels, and remnants of pier structures along the Manhattan Shoreline as well as unknown targets that appeared in the data.
Mag Targets DGN: Microstation DGN files of the magnetic field contours and also the anomaly polygon coverages that highlight specific magnetic anomalies/targets that are apparent in either the magnetic field values or the magnetic field delta values. These targets include the North River Tunnels, and remnants of pier structures along the Manhattan Shoreline as well as unknown targets that appeared in the data.

PDF Drawings: Four PDF Drawings, at Architectural D-Size (24 x 36) have been prepared:

SeaVision Figure 16-043-MAG-01 is a depiction of the overall project area with the magnetic field values represented simply as the color shaded relief image and overlaid on publicly available digital aerial photographs and a transparency of the NOAA raster navigation chart for this area. The color ramp for the field ranges from 50,000 nT to 56,000 nT and highlights the peak anomalies in the survey area.

SeaVision Figure 16-043-MAG-02 is a depiction of the overall project area with the magnetic field values represented simply as the color shaded relief image and overlaid on publicly available digital aerial photographs and a transparency of the NOAA raster navigation chart for this area. The color ramp for the field ranges from 50,000 nT to 56,000 nT and highlights the peak anomalies in the survey area. The polyline contours set at an interval of 500 nT are also overlaid on the figure.

SeaVision Figure 16-043-MAG-03 is a depiction of the overall project area with the magnetic field values represented simply as the color shaded relief image and overlaid on publicly available digital aerial photographs and a transparency of the NOAA raster navigation chart for this area. The color ramp for the field ranges from 50,000 nT to 56,000 nT and highlights the peak anomalies in the survey area. The polyline contours are set at an interval of 500 nT and are also overlaid on the figure. Additionally, polygon features have been added to the figure with descriptions of the magnetic anomalies. If the source of the anomaly is known or suspected (ie, remnant pier debris), then it is described. Otherwise, the targets are described as unknown targets.

SeaVision Figure 16-043-MAG-04 is a depiction of the overall project area with the magnetic field delta values represented simply as the color shaded relief image and overlaid on publicly available digital aerial photographsand a transparency of the NOAA raster navigation chart for this area. The color ramp for the field ranges from 0 nT to 200 nT and the color ramp has been adjusted so that sequential magnetic field values of less than 20 nT are gray, and only the higher delta values receive color so that the drawing highlights the peak anomalies in the survey area. The polyline contours for overall magnetic field values are overlaid on the drawing and set at an interval of 500 nT. Additionally, polygon features have been added to the figure with descriptions of the magnetic anomalies. If the source of the anomaly is known or suspected (ie, remnant pier debris), then it is described. Otherwise, the targets are described as unknown targets.

Magnetometer Findings/Observations

The magnetometer survey data exhibited noticeable changes in the ambient magnetic field values throughout the survey footprint with a range of between 51000 and 52000 nT, with the overall magnetic field increasing in field value on a slope from the river channel towards the shoreline. Typically, a maximum range of 100 nT to 500 nT might be observed in an overall survey footprint,

with the exception of strong magnetic anomalies due to buried submarine infrastructure, subsurface geology, or ferrous/magnetic targets on the river bottom that can create significant range fluctuations at specific locations.

The location of this site near the Manhattan shoreline and the adjacent West Side Yard likely cause the increasing slope in the ambient field that we see in the magnetometer survey data. However, discrete magnetic anomalies appear in the data that are consistent with the cast iron lined North River Tunnel, the remnants of the abandoned pier footprints along the West Side Highway between Piers 66 and 76, and existing intact pier and heliport. Some discrete anomalies also appear in the middle of the survey footprint in the water closer to the channel centerline, but their location does not coincide with any features of that are clearly visible in either the bathymetric survey data set or the sidescan sonar imagery. This would suggest the lack of presence of something potential cultural resource like a shipwreck that must be managed during any future proposed construction activities.

8. Conclusions/Recommendations

The requested marine geophysical survey of the project are for this portion of the Gateway Trans-Hudson Project has been completed in accordance with the original subcontract between GTHP and SeaVision. Bathymetric, sidescan, and magnetometer surveys of the area have been performed in order to characterize the bottom of the Hudson River in the project area that encompasses a proposed route for the Gateway Trans Hudson tunnel program.

Debris fields and various bottom sediment types have been identified in the survey footprint, and piling/debris fields from abandoned/derelict pier structures have been identified adjacent to the survey footprint. High resolution multibeam bathymetry, sidescan sonar imagery, and magnetometer data (when ferrous debris is present) confirm the presence of these debris fields. The location of the North River Tunnel has also been observed in the magnetometer data.

Shallow water and debris from the abandoned derelict piers of the west shoreline of Manhattan pose challenges for future survey activities beyond the requested survey footprint. However, it may be possible to collect bathymetric survey data in this shallow area if the survey work is timed for high tide conditions and the scope of work is confined to vessel-mounted survey operations such as bathymetric surveying. This would allow a proper balance between data collection requirements and protection of equipment so that sidescan sonar towfish and magnetometer towfish are protected from impact or entanglement with the debris fields from the derelict pier footprints.

The GTHP Joint Venture engineering team should determine the requirements for additional bathymetric survey data in that shallow area between this survey footprint and the shoreline, and coordinate with the survey consultant to establish a budget and survey scope if the additional survey data is deemed necessary.

Thank you for your consideration of this report and please do not hesitate to contact the undersigned by phone or email with any questions or comments you may have about the report or the deliverable products that SeaVision had provided to the GTHP during this phase of the project.

Best regards,

SeaVision Underwater Solutions, Inc.

Jeffrey Z. Snyder, President
ACSM Certified Hydrographer, #243

Attachments:

Attachment A: SeaVision Work Plan of September 22, 2016
Attachment B: SeaVision Quality Management Plan of September 23, 2016

SeaVision Figures 16-043-GC-01 through 16-043-GC-03
SeaVision Figures 16-043-SSS-01 through 16-043-SSS-03
SeaVision Figures 16-043-MAG-01 through 16-043-MAG-04

VIA ELECTRONIC DELIVERY

September 22, 2016
The Gateway Trans-Hudson Partnership
One Penn Plaza
New York, NY 10119

Attention: Philip Rice, P.E., Project Manager

RE: AMTRAK Contract No. 9500001023 – Preliminary Engineering for Hudson Tunnel Project – Marine Geophysical Survey

Subject: Work Plan – Marine Geophysical Survey

Dear Mr. Rice:

Please accept the following Work Plan for the upcoming field work and post-processing of the Marine Geophysical Survey for the Hudson Tunnel Project. Also attached you will find an updated Field Activity Plan.

1.0 Summary/Objectives

SeaVision Underwater Solutions, Inc. will perform a three-phase field program to characterize underwater conditions at the project site on the Hudson River. The program will consist of the following principal efforts:

A multibeam bathymetric survey will be performed to characterize water depths in the project area, thereby establishing a baseline using high-resolution, horizontally and vertically referenced data.

A sidescan sonar survey will be performed to better characterize the seafloor project area and to identify geological conditions, debris, objects, etc. The imagery will be geographically referenced, assembled into mosaics, and reviewed to develop targets (with measurements and descriptions) and bottom classifications.

A marine magnetometer survey will be performed using a towed magnetometer to map ferrous/metallic objects in the project area.

2.0 Staffing

SeaVision will mobilize a two (2)-person team that consists a field survey technician and a field surveyor supervisor that is a USCG Licensed Captain and a National Society of Professional Surveyors / Hydrographic Society of America (NSPS/THSOA) Certified Hydrographer. All survey data shall be processed and prepared for delivery under the direct supervision of a Certified Hydrographer with over 12 years' experience performing marine geophysical surveys.

Current field assignments are:

Vessel Captain / Survey Supervisor –	Jeff Snyder, C.H.
Survey Technician -	Erika Young
Field/Office Support Manager -	Zachary Forsberg-Lary

3.0 Equipment Mobilization

Our survey vessel for the project will be a 21-foot aluminum work boat (*R/V Lucille*) fitted with a 150 HP Yamaha 4-Stroke Outboard Motor. The vessel also features an enclosed pilothouse where the survey team operates the vessel and installed survey equipment. All survey and positioning equipment will be deployed from this shallow draft, highly-maneuverable survey vessel. The survey equipment will be mobilized as follows:

a. Norbit WBMS 400 kHz Broadband Multibeam Echosounder
b. EdgeTech 4125 Digital Chirp 400 kHz / 900 kHz Sidescan Sonar
c. Marine Magnetics SeaSpy Marine Magnetometer
d. SBG Systems Ekinox-D Inertial Navigation System
e. HemisphereGPS R320 GNSS/GPS Receiver (RTK Capable)
f. Sontek Castaway CTD Sound Velocity Profiler
g. Data acquisition computers running Hypack 2015 (bathymetry, magnetometer)
h. Data acquisition computer running Edgetech Discover (sidescan sonar)
i. Real-Time Kinematic (RTK) GPS Corrections via KeyNetGPS Virtual Reference Station (VRS)

4.0 Survey Datums

Horizontal: Universal Transverse Mercator, Zone 18N (feet).
Vertical: North American Vertical Datum of 1988 (NAVD 1988) feet

Vertical: Subsequent correction to the Pennsylvania Railroad (PRR) Vertical Datum using the correction:
NAVD 1988 elevation + 298.34 feet = PRR Elevation (feet)

5.0 Pre-Survey Activities [Time to complete: 1 to 2 weeks. Personnel: J. Snyder and Z. Forsberg-Lary]

Several steps must be taken to prepare for the survey effort prior to field deployment. These include:

a. Preparation and submittal of Work Plan.
b. Preparation and submittal of QA/QC Plan (or agreement to comply with GTHP QA/QC plan).
c. Preparation and submittal of Activity Hazard Analysis and Field Activities Plan.
d. Issue Notice to Mariners notification via USCG Activities New York Waterways Management Branch.
e. Establish site-specific survey control point using static GPS observations.
    a. Post-process data via National Geodetic Survey OPUS utility.
f. Install tide board relative to site-specific survey control point.
g. Confirm horizontal and vertical offsets between multibeam echosounder and inertial navigation system and GPS antennas.
h. Measure horizontal offset between INS and tow-point on stern of vessel.
i. Measure and mark all tow cables for sidescan sonar and magnetometer to the nearest foot.
j. Perform multibeam echsounder performance testing in accordance with U.S. Army Corps of Engineers Hydrographic Survey Manual (EM 1110-2-1003).
k. Establish survey line plans for bathymetric survey, sidescan sonar survey, and magnetometer survey. Survey lines to spaced at 75-feet in the north-south direction for bathymetric survey and sidescan sonar survey. Survey lines to be spaced at 50-feet in the north-south direction and 50-feet in the east-west direction for magnetometer surveys.
l. Perform safety/mechanical/operational checks of all vessel systems prior to departure from marina.

6.0 Field Survey Activities [Time to complete: 3 days. Personnel: J. Snyder (field), E. Young (field), and Z. Forsberg-Lary (office)]

The field survey activities will be spread across three (3) field days on-site, based on weather and river conditions. All operations will be conducted during daylight hours. Prior to the commencement of each day of field activities, and at the cessation of each day of field activities, the following notifications will be made:

a. Phone call to USCG Vessel Traffic System, notifying them of pending survey activities (718-354-4088).
b. Email message to GTHP Stakeholder Team.
c. Text message to SeaVision office personnel.
d. Securite calls via VHF 13 and 16.

Additionally, if the SeaVision field team consists of a single person, then text messages with positive confirmation from the SeaVision office personnel will be conducted at 30-minute intervals.

Multibeam Bathymetric Survey [Time to complete: 6 hours. Personnel: J. Snyder and E. Young]

a. Utilize the Hypack 2015 software for all navigation and data collection.
b. Perform sound velocity profiler cast to establish speed of sound in water (on-site).
c. Check vertical and horizontal position performance by recording/observing INS system water elevation for a period of 3-minutes and simultaneously observing water level at tide board. Check horizontal positioning performance by nosing vessel adjacent to local survey control point (on a timber fender piling at Hudson River Park) and observing GPS position of control point with onboard INS. Perform patch test calibration to establish angular offsets between multibeam echosounder and inertial navigation system (on-site).
d. Lower multibeam echosounder into survey position and secure to hull bracket using pre-fabricated clamps and wing-nuts.
e. Perform patch test calibration to establish angular offsets between multibeam echosounder and inertial navigation system (on-site).
f. Perform all pre-planned multibeam bathymetric survey lines at a speed of between 2 and 4 knots. Observe system performance, system coverage, water level measurements, and adjacent vessel traffic during all survey observations.
g. If any features of interest are observed on the seafloor, additional survey lines may be performed with different sonar settings (at the discretion of the survey supervisor) in order to better characterize those features.
h. Perform at least three cross-check lines perpendicular to the primary survey lines for later use in quality control checks.
i. Periodically (every 15 minutes) check and record water level measurement of inertial navigation system with water level observations on tide board.
j. Periodically (every 60 minutes) stop survey operations to perform a sound velocity profiler cast in the survey footprint.
k. At the completion of survey activities, perform a final sound velocity cast.
l. At the completion of survey activities, perform an additional patch test calibration.
m. Retract the sonar pole and secure the sonar to the deck.
n. At completion of survey activities, check vertical and horizontal system performance by recording/observing INS system water elevation for a period of 3 minutes and simultaneously observing water level at the tide board. Check horizontal positioning performance by nosing the vessel adjacent to the local survey control point on the timber fender piling at Hudson River Park, and observing the GPS position of that control point with the onboard INS.
o. Save all data onto USB memory sticks for transfer to office.

Sidescan Sonar Survey [Time to complete: 4 hours. Personnel: J. Snyder and E. Young]

a. Utilize the Hypack 2015 software for navigation. Utilize the EdgeTech Discover software for data acquisition.
b. Perform sound velocity profiler cast to establish speed of sound in water (on-site).
c. Check vertical and horizontal position performance by recording/observing INS system water elevation for a period of 3-minutes and simultaneously observing water level at tide board. Check horizontal positioning performance by nosing vessel adjacent to local survey control point (on a timber fender piling at Hudson River Park) and observing GPS position of control point with onboard INS.
d. Beginning in deep water and with the survey vessel slowly underway, deploy the sidescan sonar towfish from the stern of the survey vessel and pay out cable to a known layback distance (approximately 30-meters). Record the towfish layback distance from the known tow-point measured during pre-survey activities.
e. Observe towfish depth below water line and towfish altitude above seafloor using the Discover software.
f. Set sonar range to between 150-feet and 250-feet for both the 400 kHz and 900 kHz frequencies.
g. Commence recording dual-frequency sidescan sonar imagery on all pre-planned survey lines at survey speeds of 2 to 4 knots, using Hypack 2015 for all navigation monitoring and Discover for all sidescan sonar data acquisition.
h. Monitor towfish depth and altitude during survey activities. Adjust towfish layback, as necessary, in order to maintain safe towfish altitude. Record any changes in towfish layback.
i. At completion of all pre-planned survey lines, recover sidescan sonar towfish.
j. Check vertical and horizontal position performance by recording/observing INS system water elevation for a period of 3-minutes and simultaneously observing water level at tide board. Check horizontal positioning performance by nosing vessel adjacent to local survey control point (on a timber fender piling at Hudson River Park) and observing GPS position of control point with onboard INS.
k. Save all data onto USB memory sticks for transfer to office.

Marine Magnetometer Survey [Time to complete: 8 hours. Personnel: J. Snyder and E. Young]

a. Utilize the Hypack 2015 software for navigation and magnetometer data acquisition.
b. Check vertical and horizontal position performance by recording/observing INS system water elevation for a period of 3-minutes and simultaneously observing water level at tide board. Check horizontal positioning performance by nosing vessel adjacent to local survey control point (on a timber fender piling at Hudson River Park) and observing GPS position of control point with onboard INS.
c. Beginning in deep water and with the survey vessel slowly underway, deploy the magnetometer towfish from the stern of the survey vessel and pay out cable to a known layback distance (approximately 30-meters). Utilize a 15-lb lead downrigger weight to establish a towfish height of approximately 2-meters above the seafloor.
d. Record the towfish layback distance and angle from the known tow-point measured during pre-survey activities.
e. Observe magnetometer readings. Confirm that magnetometer readings are within 1000 nT of the earth's magnetic field for this vicinity (approximately 51,800 nT).
f. Commence surveying all pre-planned survey lines in the north-south and east-west orientation at speeds of approximately 2 knots.
g. Record magnetometer data at a rate of 2 Hz using the Hypack 2015 software.
h. Monitor towfish depth and altitude during survey activities. Adjust towfish layback, as necessary, in order to maintain safe towfish altitude. Record any changes in towfish layback.
i. At completion of all pre-planned survey lines, recover magnetometer.
j. Check vertical and horizontal position performance by recording/observing INS system water elevation for a period of 3-minutes and simultaneously observing water level at tide board. Check horizontal positioning performance by nosing vessel

adjacent to local survey control point (on a timber fender piling at Hudson River Park) and observing GPS position of control point with onboard INS.

k. Save all data onto USB memory sticks for transfer to office.

7.0 Post-Survey Activities [Time to complete: 4 hours. Personnel: Z. Forsberg-Lary]

At the completion of all field survey activities, the survey vessel and equipment should be inspected for proper operation, cleaned, and stored properly with particular attention to cables, cable connections, and physical conditions. All data will be transferred to office computers via USB memory stick. Data will remain on field computers until the completion of processing and the delivery of final products.

8.0 Post-Processing and Delivery of Final Products [Time to complete: 2-weeks. Personnel: J. Snyder and E. Young]

Following acquisition of all field survey data, the following general post-processing and delivery steps will be performed. Note that more detailed information regarding post-processing activities will be supplied in our QA/QC plan supplement (to be submitted separately).

Following acquisition of all geophysical survey data, SeaVision shall assemble all data and process it for data quality, horizontal and vertical datums, and ultimate presentation on drafting products that integrate the project drawings and survey results.

Multibeam Bathymetric Survey [Time to complete: 3 days. Personnel: J. Snyder and E. Young]

To be processed using Hypack 2015 software. Deliverable package to include the following:

ASCII Text XYZ Soundings
AutoCad DXF (Soundings and Contours at 1-foot intervals), without title block
GeoTiff Geographically referenced Tiff Imagery of Color-Shaded Relief Bathymetry
Microstation DGNs, with title block, of bathymetric survey data
Adobe Acrobat PDF Drawings (24” x 36”)

Sidescan Sonar Survey [Time to complete: 4 days. Personnel: E. Young]

To be processed using the Chesapeake Technologies SonarWiz 6 software. Deliverable package to include the following:

GeoTiff Geographically referenced TIFF Imagery of Sidescan Sonar Mosaics
ESRI Arc Raster Files of Sidescan Sonar Mosaics
ESRI Shapefile of Sidescan Sonar Targets
Microsoft Excel spreadsheet of sidescan sonar mosaics
Adobe Acrobat PDF Letter Report of sidescan sonar targets
(with images, measurements, and interpretations/classifications)
Microstation DGNs, with title block, of sidescan sonar image mosaics and target locations.
Adobe Acrobat PDF Drawings (24” x 36”)

Marine Magnetometer Survey [Time to complete: 3 days. Personnel: J. Snyder]

To be processed using: using Hypack 2015, Surfer, and ArcGIS with 3D Analyst.

ASCII Text XYM values that provide easting, northing, and field values
ESRI Arc Raster Files of Magnetic Field Values
GeoTiff Geographically Referenced Tiff Images of Color Shaded magnetic field values
GeoTiff Geographically Referenced Tiff Images of Color Shaded magnetic anomaly values
(discrete field value divided by mean field value)
ESRI ArcGIS Shapefiles of points and/or polygons relating to magnetic anomalies.
Microstation DGNs, with title blocks, of magnetic field measurements
Adobe Acrobat PDF Drawings (24" x 36")

All Surveys [Time to complete: 4 days. Personnel: J. Snyder and Z. Forsberg-Lary]

Work Plan prior to survey work.
Activity Hazard Analysis prior to field survey work.
ESRI Shapefiles of all navigation track lines for each survey
Adobe PDF Letter Report to discuss all survey efforts, methodologies, processing, results, and findings.

We hope this work plan adequately characterizes our proposed activities for the planned Marine Geophysical Survey. Our currently planned commencement for **Item 6.0 Field Survey Activities**, is the week of October 3, 2016. Delivery of all product and completion of **Item 8.0 Post Processing** should be by October 21, 2016.

Best regards,

SeaVision Underwater Solutions, Inc.

Jeffrey Z. Snyder, President
NSPS/THSOA Certified Hydrographer, #243

VIA ELECTRONIC DELIVERY

September 23, 2016

The Gateway Trans-Hudson Partnership
One Penn Plaza
New York, NY 10119

Attention: Philip Rice, P.E., Project Manager

RE: **AMTRAK Contract No. 9500001023 – Preliminary Engineering for Hudson Tunnel Project – Marine Geophysical Survey**

Subject: Quality Control Plan Supplement – Marine Geophysical Survey

Mr. Rice,

This will serve as our acknowledgement that SeaVision Underwater Solutions, Inc. (SeaVision) is in receipt of the Quality Management Plan developed by the Gateway Trans-Hudson Partnership (GTHP) for the Hudson Tunnel Project, dated July 1, 2016. We have reviewed the Quality Management Plan, understand its provisions, and agree to comply with the framework and actions described in the plan.

In reviewing the Quality Management Plan, we have prepared the following document as a supplement to the Plan to address specific items related to the Marine Geophysical Survey Scope of Work, and how internal SeaVision practices comply with the Quality Management Plan by relying on industry best practices to guide our work, implementing management oversight at critical phases in product development, and utilizing redundant checks during deliverable generation.

Practice Reference Standards

For the bathymetric survey, SeaVision will be relying upon the U.S. Army Corps of Engineers (USACE) Hydrographic Survey Manual (EM 1110-2-1003). Referencing that guidance, SeaVision will treat the bathymetric survey of this project area as a "Coastal Deep Draft Project Channel Clearance/Acceptance Survey – New Work or Rock Cut" which represents the highest specification survey defined by the USACE. This is roughly equivalent to the International Hydrographic Organization (IHO) Special Order survey standard that is described in IHO Publication S-44 "Standards for Hydrographic Surveys."

Quality Control in Survey Preparation and Field Activities

<u>Survey Control / System Performance Checks</u>

Prior to survey operations, SeaVision will confirm or establish horizontal and vertical positioning control via nearby survey control points and the NOAA Tide Station at the Battery. These points will be checked from the survey vessel to characterize the accuracy of the positioning system for all survey operations (bathymetric, sidescan, and magnetometer surveying).

Results of the checks shall be recorded and referenced during post-processing, and provided to GTHP as part of the final deliverable package. National Geodetic Survey (NGS) Online Positioning User Service (OPUS) data results for static GPS processing will also be provided to GTHP.

Environmental Conditions (Acoustic Surveys)

Immediately prior to and after acoustic surveys (bathymetric and sidescan sonar), sound velocity checks will be performed by conducting CTD sound velocity profiler casts in the survey area. The results of these casts will be programmed into the acquisition software so that the velocity profile can be applied to the acoustic survey data in real-time during acquisition. The casts will also be retained for use during post-processing.

Sound velocity casts shall be recorded and delivered to GTHP with the final survey products.

System Calibration (Acoustic Surveys)

Prior to survey operations at the site, a patch test calibration of the multibeam echosounder and the inertial navigation system (INS) will be performed in order to measure the angular offsets between the echosounder and the INS. A beam angle performance test will also be performed in the vicinity of the survey area to demonstrate that the combined bathymetric survey system can achieve the accuracy and repeatability standards described in the USACE Hydrographic Survey Manual. A bar check will be performed to confirm the echosounder draft, and three to five separate lead-line soundings will be performed during low current/slack tide conditions to have ground truth support for the overall bathymetric survey.

Results of both the patch test calibration and the performance test results shall be held and provided to GTHP with the final survey products.

System Calibration (Magnetic Surveys)

Prior to the survey, the magnetometer will be tested against a known ferrous object just to check instrument response (ie, eliciting a response deviation from the background earth's magnetic field). Additionally, prior to the survey, SeaVision will survey a different small area with the magnetometer to develop a background magnetic field map, and then SeaVision will seed that area with a known target. (This is referred to as an Instrument Verification Strip, or IVS). The IVS will be surveyed prior to surveying of the actual project site so that proper magnetometer operation can be confirmed.

IVS survey results shall be delivered to GTHP with the final survey products.

Survey Execution – Survey Geometry and Execution

Survey lines will be performed to achieve 200% or better coverage of the survey area. During all survey operations, care will be taken to monitor the performance of the onboard RTK-GPS and inertial navigation system so that positioning remains in the Fixed RTK mode, survey speeds remain under 5 knots, and that the heading, pitch, roll, and heave observed by the inertial navigation system in real-time appears reasonable. Sonar performance will be monitored to provide proper ensonification of the bottom and accurate measurements of the bottom.

For survey operations involving towfish (sidescan sonar and magnetometer surveys), care will be taken to accurately measure the total towfish layback from the positioning system, and the angle of declination of the towfish from the survey vehicle, so that the towfish position can be accurately calculated during post-processing.

ESRI shapefiles of all survey tracklines shall be prepared and delivered to GTHP with the final survey products.

Quality Control During Post-Processing and Deliverable Generation

Acoustic Survey Data Post-Processing

During post-processing, SeaVision utilizes a multiphase approach to processing that incorporates several reviews by supervisory personnel as a critical process for maintaining quality control. Initially, the supervisory hydrographic surveyor reviews all of the bathymetric survey data to check the positioning, motion (heading, pitch, roll, heave), and tide observations of all of the collected data. With the bathymetric survey data (in Hypack), this is considered Phase 1 of the data processing. The fundamental objective of this phase is to confirm that the horizontal and vertical positioning and the motion referencing during the survey is accurate and that the data can be compared accurately against tide observation data and that the data is of sufficient quality to subject to further processing. For the sidescan sonar survey (in Chesapeake Technologies' SonarWiz software), this stage involves initializing the project and applying the appropriate initial gains and layback corrections so that all of the sidescan sonar imagery can be properly viewed and georectified to the project datums,

The second phase of the post-processing effort will be conducted by a geophysical survey technician that will review each bathymetric survey line individually and each sidescan sonar survey line individually. The bathymetric survey data will be reviewed, file by file, so that only effective sweep data is carried through to the final stages of post-processing. The sidescan sonar imagery will be subject to bottom tracking and further gain application to best highlight bottom conditions in the survey area.

The third phase of the post-processing effort will also be conducted by the geophysical survey technician who will review all of the bathymetric survey data within a matrix grid that encompasses the entire survey area such that profiles throughout the entire survey footprint are reviewed and edited for stray data points. During this phase of processing, gross errors (due to angular offsets or vertical positioning errors) can be identified and corrected. With the sidescan sonar imagery, this portion of the processing includes target identification and analysis, and mosaic generation.

The fourth phase of post-processing of all acoustic survey data involves the supervisory hydrographic surveyor reviewing ALL data through all phases of the previously completed post-processing as a quality control check to review the work performed by junior personnel.

Magnetic Survey Data Post-Processing

Magnetometer data will be subject to slightly different quality control measures, drawing upon our experience with UXO surveys. Prior to the survey, the magnetometer will be tested against a known ferrous object just to check instrument response (ie, eliciting a response deviation from the background earth's magnetic field). Additionally, prior to the survey, SeaVision will survey a different small area with the magnetometer to develop a background magnetic field map, and then SeaVision will seed that area with a known target. (This is referred to as an Instrument Verification Strip, or IVS). The IVS will be surveyed prior to surveying of the actual project site so that proper magnetometer operation can be confirmed. Additionally, towfish positioning control, similar to with the sidescan sonar surveys, will be critical to all survey operations and the positioning control can be monitored in real-time within Hypack.

Merging of bathymetric data, sidescan sonar imagery mosaics, and magnetometer field data provides an additional, critical means by which data quality can be reviewed. In relying upon Geographic Information System (GIS) data visualization, SeaVision will check to confirm that horizontal positioning and consistency is maintained between datasets so that the results of the geophysical survey can be combined to maximize their interpretive value and design support value. GTHP will receive all survey products and it is recommended that they, too, perform integrated GIS data visualization utilizing the software platforms adopted by the Joint Venture for Hudson Tunnel Project.

Post-Delivery Quality Control

Client Review and Feedback

Upon delivery of all survey data ***documents***, and delivery of the survey ***record*** report, SeaVision anticipates receiving feedback from GTHP regarding the structure and presentation of the survey data, and the content and findings of the survey report. By engaging in a collaborative dialogue regarding the data and findings, and making changes to deliverable packaging in accordance with a review and comment process governed by the overall project Quality Management Plan, we will be well-positioned to generate final deliverable products that best support the further design requirements of the project

We hope you find this supplement acceptable in describing our proposed efforts to manage quality control when performing the Marine Geophysical Survey. If you have any questions or comments, please do not hesitate to contact us at your earliest convenience.

Best regards,

SeaVision Underwater Solutions, Inc.

Jeffrey Z. Snyder, President
ACSM Certified Hydrographer, #243

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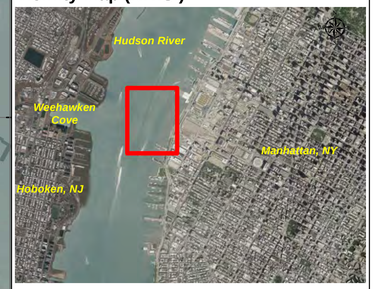
Hudson River

Pier 76

PRR Elevation Color Ramp

230.0 231.0 232.0 233.0 234.0 235.0 236.0 237.0 238.0 239.0 240.0 241.0 242.0 243.0 244.0 245.0 246.0 247.0 248.0 249.0 250.0 251.0 252.0 253.0 254.0 255.0 256.0 257.0 258.0 259.0 260.0 261.0 262.0 263.0 264.0 265.0 266.0 267.0 268.0 269.0 270.0 271.0 272.0 273.0 274.0 275.0 276.0 277.0 278.0 279.0 280.0 281.0 282.0 283.0 284.0 285.0 286.0 287.0 288.0 289.0 290.0 291.0 292.0 293.0 294.0

Vicinity Map (N.T.S.)



Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure GC-01

Hudson River - Vicinity of North River Tunnels
General Condition Bathymetric Survey
Color-Shaded Relief

SeaVision Figure 16-043-GC-01

Drawn By: Jeff Snyder, C.H.
Date: November 8, 2016

Scale

0 100 200 400
Feet

1 inch = 100 feet

Check Graphic Scale

Notes

1. The bathymetry depicted on this drawing represents the results of a survey performed by SeaVision Underwater Solutions, Inc. on October 7, 2016 and can only be considered to indicate the general conditions existing at that time.

2. The multibeam bathymetry depicted on this drawing has been collected with a Norbit 455 kHz CHIRP multibeam echosounder, paired with an SBG Systems Ekinox-D Inertial Navigation System. The system received Real-Time Kinematic Corrections from the KeyNetGPS Virtual Reference Station (VRS) Network.

3. All data has been collected and processed using the Hypack 2015 hydrographic survey software package. The data has been collected and sorted into a grid consisting of 1-ft by 1-ft grid cells, where each sounding represents the average of all soundings collected in each cell. The color-shaded relief map and the contours have been generated from a triangulated irregular network (TIN) terrain model derived from the 1 x 1 grid. Discrete soundings represent soundings selected on a 20-ft x 20-ft grid.

4. Horizontal positioning references the Universal Transverse Mercator - Zone 18N Coordinate System (feet).

5. Vertical elevations are in feet and reference the Pennsylvania Railroad Datum (PRR), which is determined using the conversion 0' North American Vertical Datum of 1988 = 298.34' PRR.

6. Background aerial photographs have been taken from the publicly available 2014 digital imagery available through the NY Statewide Digital Orthoimagery Program (NYSDOP). The background raster navigation chart is NOAA 12335.

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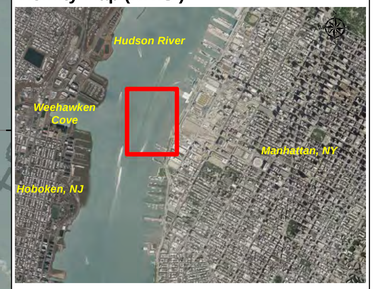
PRR Elevation Color Ramp

230.0 231.0 232.0 233.0 234.0 235.0 236.0 237.0 238.0 239.0 240.0 241.0 242.0 243.0 244.0 245.0 246.0 247.0 248.0 249.0 250.0 251.0 252.0 253.0 254.0 255.0 256.0 257.0 258.0 259.0 260.0 261.0 262.0 263.0 264.0 265.0 266.0 267.0 268.0 269.0 270.0 271.0 272.0 273.0 274.0 275.0 276.0 277.0 278.0 279.0 280.0 281.0 282.0 283.0 284.0 285.0 286.0 287.0 288.0 289.0 290.0 291.0 292.0 293.0 294.0

Hudson River

Pier 76

Vicinity Map (N.T.S.)



Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure GC-02

Hudson River - Vicinity of North River Tunnels
General Condition Bathymetric Survey
Color-Shaded Relief and Contours

SeaVision Figure 16-043-GC-02

Drawn By: Jeff Snyder, C.H.
Date: November 8, 2016

Scale

0 100 200 400
Feet

1 inch = 100 feet

Check Graphic Scale

Notes

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PRR Elevation Color Ramp

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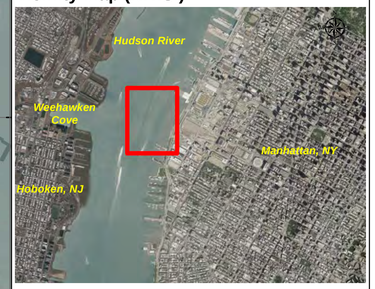
Hudson River

Pier 76

Vicinity Map (N.T.S.)



Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure GC-03

Hudson River - Vicinity of North River Tunnels
General Condition Bathymetric Survey
Color-Shaded Relief and Elevations

SeaVision Figure 16-043-GC-03

Drawn By: Jeff Snyder, C.H.
Date: November 8, 2016

Scale

0 100 200 400
Feet

1 inch = 100 feet

Check Graphic Scale

Notes

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Hudson River

Pier 76

Vicinity Map (N.T.S.)

Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure SSS-01

Hudson River - Vicinity of North River Tunnels
Sidescan Sonar Mosaic
Mosaic Overlaid on Aerial Photo

SeaVision Figure 16-043-SSS-01

Drawn By: Jeff Snyder, C.H.
Date: November 9, 2016

Scale

0 100 200 400
Feet

1 inch = 100 feet

Check Graphic Scale

Notes

1. The sidescan sonar imagery depicted on this drawing represents the results of a survey performed by SeaVision Underwater Solutions, Inc. on October 7, 2016 and can only be considered to indicate the general conditions existing at that time.

2. The sidescan sonar imagery depicted on this drawing has been collected with an EdgeTech 4125 Digital Chirp Sidescan Sonar, paired with an SBG Systems Ekinox-D Inertial Navigation System The system received Real-Time Kinematic Corrections from the KeyNetGPS Virtual Reference Station (VRS) Network.

3. All data has been collected and processed using the Chesapeake Technologies SonarWiz 6 sidescan sonar processing software to generate the image mosaic illuminated from the west, all target selections, measurements, and descriptions.

4. Horizontal positioning references the Universal Transverse Mercator - Zone 18N Coordinate System (feet).

5. Background aerial photographs have been taken from the publicly available 2014 digital imagery available through the NY Statewide Digital Orthoimagery Program (NYSDOP). The background raster navigation chart is NOAA 12335.

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Hudson River

Sand Waves

Sand Waves

Sand Waves

Scattered Debris

Scattered Debris

Possible Exposed Clay

Scattered Debris

Pier Footprint

Pier Footprint

Abandoned Pier Footprint

Abandoned Pier Footprint

Debris

Debris

Abandoned Pier Footprint

Floating Drydock

Pier 76

Vicinity Map (N.T.S.)

Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure SSS-02

Hudson River - Vicinity of North River Tunnels
Sidescan Sonar Mosaic
Mosaic Overlaid on Aerial Photo
General Classifications of Imagery

SeaVision Figure 16-043-SSS-02

Drawn By: Jeff Snyder, C.H.
Date: December 20, 2016

Scale

0 100 200 400
Feet

1 inch = 100 feet

Check Graphic Scale

Notes

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4. Horizontal positioning references the Universal Transverse Mercator - Zone 18N Coordinate System (feet).

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Hudson River

Sand Waves

Sand Waves

Sand Waves

Scattered Debris

Scattered Debris

Scattered Debris

Possible Exposed Clay

Pier Footprint

Pier Footprint

Abandoned Pier Footprint

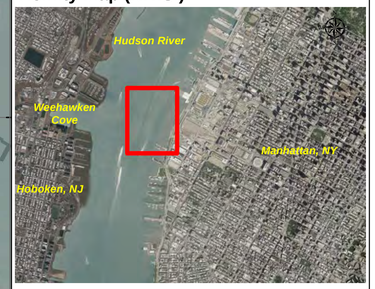
Abandoned Pier Footprint

Abandoned Pier Footprint

Pier 76

GTHP-SSS-0045 GTHP-SSS-0047 GTHP-SSS-0037 GTHP-SSS-0054 GTHP-SSS-0049 GTHP-SSS-0009 GTHP-SSS-0039 GTHP-SSS-0053 GTHP-SSS-0056 GTHP-SSS-0034 GTHP-SSS-0011 GTHP-SSS-0007 GTHP-SSS-0055 GTHP-SSS-0021 GTHP-SSS-0017 GTHP-SSS-0002 GTHP-SSS-0004 GTHP-SSS-0033 GTHP-SSS-0048 GTHP-SSS-0010 GTHP-SSS-0050 GTHP-SSS-0046 GTHP-SSS-0019 GTHP-SSS-0051 GTHP-SSS-0042 GTHP-SSS-0020 GTHP-SSS-0041 GTHP-SSS-0036 GTHP-SSS-0032 GTHP-SSS-0029 GTHP-SSS-0003 GTHP-SSS-0044 GTHP-SSS-0038 GTHP-SSS-0001 GTHP-SSS-0052 GTHP-SSS-0043 GTHP-SSS-0012 GTHP-SSS-0030 GTHP-SSS-0026 GTHP-SSS-0024 GTHP-SSS-0022 GTHP-SSS-0006 GTHP-SSS-0035 GTHP-SSS-0027 GTHP-SSS-0018 GTHP-SSS-0016 GTHP-SSS-0028 GTHP-SSS-0025 GTHP-SSS-0014 GTHP-SSS-0023 GTHP-SSS-0031 GTHP-SSS-0015 GTHP-SSS-0013 GTHP-SSS-0005 GTHP-SSS-0008

Vicinity Map (N.T.S.)



Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure SSS-03

Hudson River - Vicinity of North River Tunnels
Sidescan Sonar Mosaic
Mosaic Overlaid on Aerial Photo
General Classifications of Imagery and Targets

SeaVision Figure 16-043-SSS-03

Drawn By: Jeff Snyder, C.H.
Date: December 20, 2016

Scale

0 100 200 400
Feet

1 inch = 100 feet

Check Graphic Scale

Notes

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3. All data has been collected and processed using the Chesapeake Technologies SonarWiz 6 sidescan sonar processing software to generate the image mosaic illuminated from the west, all target selections, measurements, and descriptions.

4. Horizontal positioning references the Universal Transverse Mercator - Zone 18N Coordinate System (feet).

5. Background aerial photographs have been taken from the publicly available 2014 digital imagery available through the NY Statewide Digital Orthoimagery Program (NYSDOP). The background raster navigation chart is NOAA 12335.

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Hudson River

Pier 76

Magnetic Field Color Ramp (nT)

56000
55500
55000
54500
54000
53500
53000
52500
52000
51500
51000
50500
50000

Vicinity Map (N.T.S.)

Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure MAG-01

Hudson River - Vicinity of North River Tunnels
Magnetometer Survey
Color Shaded Magnetic Contours

SeaVision Figure 16-043-MAG-01

Drawn By: Jeff Snyder, C.H.
Date: November 10, 2016

Scale

0 100 200 400
Feet

1 inch = 100 feet

Check Graphic Scale

Notes

1. The magnetometer contour imagery depicted on this drawing represents the results of a survey performed by SeaVision Underwater Solutions, Inc. on October 8, 2016 and can only be considered to indicate the general conditions existing at that time.

2. The marine magnetometer data depicted on this drawing has been collected with a Marine Magnetics' SeaSpy Magnetometer. paired with an SBG Systems Ekinox-D Inertial Navigation System The system received Real-Time Kinematic Corrections from the KeyNetGPS Virtual Reference Station (VRS) Network.

3. All data has been collected and processed using the Hypack 2015 software and the Surfer 13 data processing software to generate the image mosaic with the color ramp depicted on the drawing.

4. Horizontal positioning references the Universal Transverse Mercator - Zone 18N Coordinate System (feet).

5. Background aerial photographs have been taken from the publicly available 2014 digital imagery available through the NY Statewide Digital Orthoimagery Program (NYSDOP). The background raster navigation chart is NOAA 12335.

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Hudson River

Pier 76

Magnetic Field Color Ramp (nT)

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Vicinity Map (N.T.S.)

Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure MAG-02

Hudson River - Vicinity of North River Tunnels
Magnetometer Survey
Color Shaded Magnetic Contours with Major Contours

SeaVision Figure 16-043-MAG-02

Drawn By: Jeff Snyder, C.H.
Date: November 10, 2016

Scale

0 100 200 400
Feet

1 inch = 100 feet

Check Graphic Scale

Notes

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Hudson River

Possible Weak Anomaly

Anomaly from Intact Pier

Anomaly from Debris Target

Anomaly from Debris Field

Ferrous Debris from Derelict Piers

Anomaly - Partially buried

Anomaly from Debris Target

Anomaly from Debris Field

Ferrous Debris from Derelict Piers

Anomaly from Debris Target

North River Tunnel

Anomaly from Debris Field

Anomaly from Debris Target

Anomaly - Buried

Pier 76

Magnetic Field Color Ramp (nT)

56000
55500
55000
54500
54000
53500
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52500
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51000
50500
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Vicinity Map (N.T.S.)

Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure MAG-03

Hudson River - Vicinity of North River Tunnels
Magnetometer Survey
Color Shaded Magnetic Contours with
Major Contours and Annotations

SeaVision Figure 16-043-MAG-03

Drawn By: Jeff Snyder, C.H.
Date: November 10, 2016

Scale

0 100 200 400
Feet

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Check Graphic Scale

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Hudson River

Possible Weak Anomaly

Anomaly from Intact Pier

Anomaly from Debris Target

Anomaly from Debris Field

Ferrous Debris from Derelict Piers

Anomaly - Partially buried

Anomaly from Debris Target

North River Tunnel

Anomaly from Debris Field

Anomaly from Debris Target

Ferrous Debris from Derelict Piers

Anomaly from Debris Field

Anomaly from Debris Target

Anomaly - Buried

Pier 76

Magnetic Field Change Absolute Value Color Ramp (nT)

200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0

Vicinity Map (N.T.S.)

Hudson Tunnel Project
Marine Geophysical Survey
Manhattan, NY

Client: Gateway Trans-Hudson Partnership, JV

Figure MAG-04

Hudson River - Vicinity of North River Tunnels
Magnetometer Survey
Color Shaded Magnetic Contours
Based on Change in Field Value

SeaVision Figure 16-043-MAG-04

Drawn By: Jeff Snyder, C.H.
Date: December 20, 2016

Scale

0 100 200 400
Feet

1 inch = 100 feet

Check Graphic Scale

Notes

1. The magnetometer contour imagery depicted on this drawing represents the results of a survey performed by SeaVision Underwater Solutions, Inc. on October 8, 2016 and can only be considered to indicate the general conditions existing at that time.

2. The marine magnetometer data depicted on this drawing has been collected with a Marine Magnetics' SeaSpy Magnetometer. paired with an SBG Systems Ekinox-D Inertial Navigation System The system received Real-Time Kinematic Corrections from the KeyNetGPS Virtual Reference Station (VRS) Network.

3. All data has been collected and processed using the Hypack 2015 software and the Surfer 13 data processing software to generate the image mosaic with the color ramp depicted on the drawing.

4. "Delta" or field change values have been determined by calculating the absolute value of the change in the magnetic field with adjacent observations in the time domain. For example, the observation at 13:10:57 is subtracted from the observation at 13:10:58 and the absolute value of the difference is recorded for the XY location at the 13:10:58 observation. This approach helps to minimize background noise and isolate changes in field values that may be due to objects or infrastructure.

5. Horizontal positioning references the Universal Transverse Mercator - Zone 18N Coordinate System (feet).

6. Background aerial photographs have been taken from the publicly available 2014 digital imagery available through the NY Statewide Digital Orthoimagery Program (NYSDOP). The background raster navigation chart is NOAA 12335.

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