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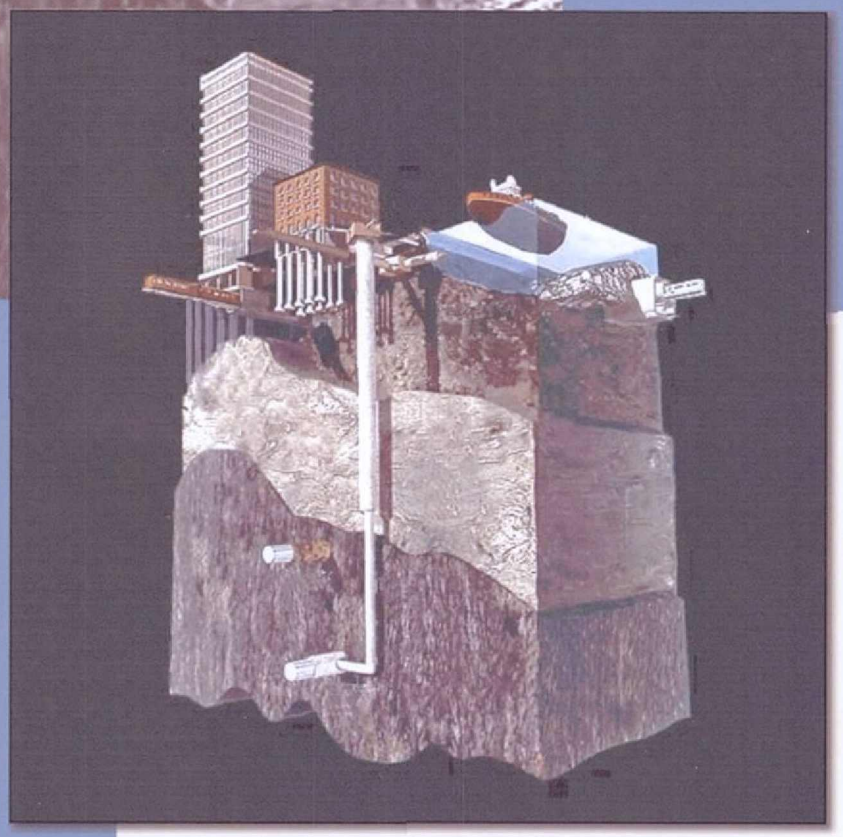

PHASE 1A ARCHEOLOGICAL SENSITIVITY STUDY
NYCDEP WATER TUNNEL #3
SHAFTS 25B, 28B, AND 29B
New York, New York

prepared for
Schiavone Construction Co., Inc.,
J.F. Shea Construction, Inc.
Frontier-Kemper Constructors, Inc.,
A Joint Venture
and the
New York City Department of Environmental Protection

by
John Milner Associates, Inc.
Croton-on-Hudson, New York

January 2005

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Schiavone Construction Co., Inc.,
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And the

New York City Department of Environmental Protection

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January 2005

MANAGEMENT SUMMARY

John Milner Associates, Inc. (JMA) conducted a Phase 1A archeological survey of three proposed new shaft sites (25B, 28B, and 29B) located along the previously excavated South Leg of Stage 2 of the Manhattan portion of City Tunnel No. 3. The Phase 1A survey was conducted for the New York City Department of Environmental Protection (DEP) under a subcontract with the Joint Venture firm of Schiavone Construction Co. Inc, J.F. Shea Construction, Inc., Frontier-Kemper Constructors, Inc. Shaft site 25B is located northwest of the intersection of Tenth Avenue and West 48th Street, and occupies a portion of Lot 29 on Block 1077. Shaft site 28B is located northeast of the intersection of Hudson and West Houston Streets, and occupies a portion of Lot 45 on Block 581. Shaft site 29B is located southeast of the intersection of Laight and Hudson Streets, and occupies a portion of Block 213.

Shaft 25B is located completely within the building footprints of the late-nineteenth-century, five-story tenements that formerly occupied Historical Lots 29–31. Recent geo-technical borings document the presence of bedrock within five feet of the existing ground surface within the proposed shaft site. Based on these factors, it is the opinion of JMA that there is very little likelihood that undisturbed archeological deposits are present within the proposed location of Shaft 25B. No additional archeological work is recommended for this location.

Shaft 28B is located on what was once a bluff overlooking the Minetta Brook, in the vicinity of a historically recorded Native American village. The limits of excavation associated with Shaft 28B are located within the building footprint of a late-nineteenth-century, five-story, commercial structure – the construction of which likely destroyed archeological deposits associated with previous historical-period occupation(s) of the lot. However, geo-technical boring logs document the presence of potentially intact alluvial and wetland soil horizons between 15 and 24 feet below the existing surface of the adjacent streets. These horizons are buried beneath deep deposits of fill. In the opinion of JMA, these buried soils have the potential to included intact deposits associated with the Native American occupation of the area. JMA recommends a program of archeological monitoring during the excavation of the proposed shaft to determine whether intact soil horizons are present.

The vicinity of Shaft 29B has experienced dramatic episodes of disturbance throughout its history. In the opinion of JMA, the cumulative effect of each of these episodes (most significantly construction of the eastbound exit ramps from the Holland Tunnel) preclude the possibility that intact archeological deposits are present at the proposed location of Shaft 29B. No additional archeological work is recommended for this location.

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1.0 INTRODUCTION

1.1 PURPOSE AND GOALS OF THE INVESTIGATION

John Milner Associates, Inc. (JMA) conducted a Phase 1A archeological survey of three proposed new shaft sites (25B, 28B, and 29B) located along the previously excavated South Leg of Stage 2 of the Manhattan portion of City Tunnel No. 3. The Phase 1A survey was conducted for the New York City Department of Environmental Protection (DEP) under a subcontract with the Joint Venture firm of Schiavone Construction Co. Inc, J.F. Shea Construction, Inc., Frontier-Kemper Constructors, Inc.

The information and recommendations contained in this report are intended to assist the DEP in complying with the requirements of the New York City Environmental Quality Review Act (CEQR), and/or Section 14.09 of the New York State Parks, Recreation, and Historic Preservation Law. It is JMA's understanding that no federal funds, permits, or approvals are associated with the construction of the three shafts and that therefore Section 106 of the National Historic Preservation Act (NHPA) is not applicable.

The purpose of the Phase 1A investigation is to identify previously recorded archeological or historic resources and assess the likelihood for there to be previously unrecorded archeological resources within the area of potential effect associated with each of the three shaft sites. The information contained in this report is intended to help assess whether or not construction and/or operation of the shafts could potentially affect significant archeological resources. All research and report preparation were conducted in accordance with the following:

- the New York City Landmarks Preservation Commission's *Guidelines for Archaeological Work in New York City;*
- *Section* 3F *of* the New York City Environmental Quality Review Technical Manual; and
- the New York Archaeological Council's *Standards for Cultural Resources Investigations and the Curation of Archaeological Collections* recommended for use by the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP).

1.2 PROJECT DESCRIPTION AND LOCATION

In 1954, New York City recognized the need for a third water tunnel to meet the growing demand on the more than 150-year old water supply system. Planning for City Tunnel No. 3 began in the early 1960s and actual construction commenced nearly a decade later in 1970. City Tunnel No. 3 is the largest capital construction project in New York City's history. The tunnel will eventually span more than 60 miles and is expected to be complete in 2020.

The three shaft locations discussed in this report are located along Stage 2 of Tunnel No. 3 (Figure 1). Stage 2 will provide water to the lower west side of Manhattan and sections of Queens, Brooklyn and Staten Island. The nine-mile long Manhattan section begins at the Stage 1 valve chamber in Central Park and run south along the west side of Manhattan, east to the vicinity of South Street Seaport and north along the east side of Manhattan to 34th Street.

Shaft site 25B (Figure 2) is located northwest of the intersection of Tenth Avenue and West 48th Street, and occupies a portion of Lot 29 on Block 1077. Shaft site 28B (Figure 3) is located northeast of the intersection of Hudson and West Houston Streets, and occupies a portion of Lot 45 on Block 581. Shaft site 29B (Figure 4) is located southeast of the intersection of Laight and Hudson Streets, and occupies a portion of Block 213.

2.0 ENVIRONMENTAL AND CULTURAL CONTEXTS

2.1 ENVIRONMENTAL SETTING AND HISTORY

The bedrock geology of New York City consists of Manhattan schist, a hard metamorphic rock, and Inwood dolomite that formed during the Archeozoic period (ca. 5,000 to 1,500 million years ago). Erosion processes during the late Mesozoic period (ca. 220 to 70 million years ago) resulted in the formation of many present features of the landscape, including incising the Hudson River and shaping the Palisades (Homberger 1994:14). During the last 20,000 years, both natural and cultural processes have dramatically altered the contemporary surfacial geology and topography of Manhattan.

At the height of the Wisconsin glaciation, ca. 21,000 B.P. (Before Present), the New York Metropolitan area was covered by ice. Around 18,000 B.P. global temperatures gradually warmed and the glaciers began the slow process of melting and retreating northward. The Ronkonkoma Moraine, an enormous deposit of mixed sands, silts, clays, and boulders deposited ca. 15,300 B.P., marks the final advance of the glaciers. The Ronkonkoma Moraine forms the southern side of Long Island extending from Lake Success at the border of Queens and Nassau Counties to Montauk Point (Snow 1980; Wolfe 1995:460). A few centuries later the retreating ice paused again, depositing a second band of sediments identified as the Harbor Hill Moraine. The Harbor Hill Moraine extends southwest across Queens from Little Neck Bay, across Brooklyn and Staten Island and into New Jersey.

During the Pleistocene vast quantities of water were trapped as ice in the glaciers. As a result, sea levels were considerably lower than at present and large tracts of the continental shelf were exposed as dry land (Cantwell and Wall 2001:37; Snow 1980:105). At the height of the glaciation, sea levels were at least 90 meters below their present level (Funk 1991:52) and the coast was located as much as 120 miles east of its current position (Cantwell and Wall 20001:14). The post-glacial environment supported a diversity of flora and fauna. Paleontological remains recovered on Manhattan include the remains of mammoth, giant bison, saber-tooth tigers, giant ground sloth, mastodon, and prehistoric horse (Wolfe 1995:461).

The retreat of the glaciers initiated a period of dramatic topographic and ecological change, including a rapid rate of sea-level rise beginning ca. 14,000 B.P. By 6,000 years ago sea levels were only about 9 meters below their current position, and continued to rise at a slower rate reaching about 2 meters below present by 2,000 B.P. (Funk 1991:52). After 12,000 B.P., the tundra environment gradually came to include more cold-adapted evergreen species. This environment has been characterized as 'open park-like woodlands', constituted primarily of spruce, pine, and later fir with a ground cover of lichens, and small quantities of deciduous species such as oak and hornbeam. Palynological evidence indicates that vegetative and corresponding faunal communities changed concurrently with the warming climate. A pine-birch-adler forest complex was established by 9,000 B.P. and was followed by generally more temperate deciduous forest complexes (Snow 1980:114). These forests achieved an essentially modern character, with corresponding faunal communities, by about 4,000 B.P. (Funk 1991:52).

In the past three centuries, the landscape of Manhattan has been dramatically altered by various activities associated with the urban development of the island. Significant changes during this time include the expansion of the island by filling shoreline areas and numerous episodes of

excavation, grading, and filling various areas of Manhattan to facilitate construction of residential, industrial, and commercial buildings and spaces (Cantwell and Wall 2001:224-227).

2.2 PREHISTORIC (NATIVE AMERICAN) CULTURAL CONTEXT

Evidence from known archeological sites reveals dramatic cultural changes occurred throughout the long period of human occupation in coastal New York. Environmental changes and technological innovations influenced subsistence practices and choices of settlement location of prehistoric Native American groups. The availability and changing importance of ecological resources affected the distribution of camp sites, special activity sites, and village locations across the landscape. Settlement locations and cultural practices were also affected by increasing exchange and social contact between Native American groups in the later prehistoric periods and the influence of Europeans in the Contact and Colonial periods.

The prehistory of Eastern North America is commonly divided into three major temporal periods: Paleo-Indian, Archaic, and Woodland. These periods are each characterized by distinctive subsistence practices, social organization, settlement systems, and material culture. The definition of these cultural systems and an explanation for changes in culture through time provide a structure upon which archeological research questions can be framed. Archeologists continually debate many details regarding chronology, adaptation, and culture change but a generally accepted outline of regional prehistory is presented here.

2.2.1 THE PALEO-INDIAN PERIOD, CA. 12,500 TO 10,000 B.P.

Based on radiocarbon age estimates of sites associated with Paleo-Indian fluted points, it appears that human beings first occupied the northeastern United States about 13,000 B.P. (Levine 1990). The distinctive lithic components of Paleo-Indian assemblages consist of long, fluted projectile points and a variety of end scrapers, side scrapers, knives, gravers, and perforators (Fiedel 2000; Funk 1976; Ritchie 1971). This tool-kit is superbly designed for hunting, butchering, and animal processing activities. The association of fluted Clovis points with extinct megafauna such as mammoth and mastodon at sites in the western and southern United States suggests that Paleo-Indians were largely dependent on big game hunting for subsistence (Fiedel 2000). However, there is no clear evidence for Paleo-Indians hunting Pleistocene fauna other than caribou in the northeastern United States. Like historically documented hunters and gatherers, Paleo-Indian subsistence patterns were likely very dependent on the collection of a variety of fruit and vegetable resources (Funk 1976; Levine 1990; Ritchie 1980; Snow 1980:150). Paleo-Indian peoples probably lived in small, mobile bands and their choice of settlement seems to have been conditioned by access to upland forest resources, low-lying swamp areas, medium to large sized drainages, and high-quality lithic sources (Fiedel 2000; Funk 1976).

Evidence for Paleo-Indian occupations in the New York City region comes from scattered surface finds of fluted projectile points on Staten Island and Long Island. Artifacts recovered from the Port Mobil Site on Staten Island include at least 21 fluted points and more than 120 stone tools. The site is now located in a extensively disturbed oil-tank farm that in the early Holocene would have been a high point of land overlooking the Arthur Kill (Cantwell and Wall 2001:41). Fishermen have recovered a large number of mammoth and mastodon teeth from the continental shelf, indicating that the exposed portions of the continental shelf were inhabitable in the early post-glacial period (Snow 1980:105). Archeologists assume that numerous Paleo-Indian and

Early Archaic period sites in the New York City area were located off of the present coastline, and were subsequently inundated by the post-glacial rise in sea levels (Funk 1991:57; Cantwell and Wall 2001:38).

2.2.2 THE ARCHAIC PERIOD, CA. 10,000 TO 2,700 B.P.

The Archaic Period subsumes a diverse group of hunting and gathering cultures that occupied North America throughout the dramatic environmental changes of the early Holocene. Archaic cultures in the Northeast are generally characterized as small, mobile social groups, and their sites are usually small and lacking permanent structures, fortifications, extensive storage pits, and elaborate mortuary remains (Ritchie 1980:32). Archaic settlement and subsistence practices in southeastern New York were organized around seasonal movements between coastal and inland riverine areas with a reliance on both woodland and aquatic resources (Tuck 1978).

The Early Archaic Period (ca. 10,000 to 8,000 B.P.) is poorly represented in the Northeast generally (Snow 1980:157), perhaps due to relatively unfavorable or inhospitable climactic conditions during the period (Funk 1976). Very few Early Archaic sites have been excavated or radiocarbon dated in the Northeast; as a result these sites are usually identified by the presence of projectile points that resemble types found in better-documented, stratified sites in the southeastern United States. Early Archaic sites are identified based on the presence of diagnostic Kanawha, Le Croy, Stanly, Hardaway, and Palmer projectile points, in association with a variety of scrapers, choppers, and ground stone woodworking tools (Ritchie and Funk 1971; Snow 1980:161-163).

The Middle Archaic (ca. 8,000 to 6,000 B.P.) is often characterized as a period of adaptation to the emerging temperate climactic conditions of the Holocene, including the exploitation of a wide variety of floral and faunal species similar to those of the modern era (Snow 1980:182-183). Middle Archaic sites in the Northeast are identified by diagnostic Neville, Stark, and Merrimack projectile points. Several new technological innovations appeared during this period including stone gouges and axes, large ground stone semi-lunar knives, notched net-sinkers and plummets, and ground stone spear-thrower (or atatl) weights (Dincauze 1971; Snow 1980:184).

The Late Archaic Period (ca. 6,000 to 3,000 B.P.) in southeastern New York is identified by the presence of distinctive narrow stemmed projectile points (Tuck 1978). Local variants of this tradition include Lamoka, Wading River, Sylvan Lake or Sylvan Stemmed, Taconic, and Bare Island projectile points (Fiedel 1986; Ritchie 1971). The foraging economy of the Late Archaic was based on the scheduled exploitation of specific seasonally available resources, including an emphasis on marine resources as evident from large shell middens on coastal and riverine sites (Funk 1991:54-55; Ritchie 1980:142). The significantly greater numbers of sites in the area, the larger size of some sites, and the diversification of exploited environments suggest that substantial population growth occurred during this period.

The Terminal Archaic (or Transitional Period, ca. 3,500 to 2,700 B.P.) is characterized by technological innovations and subsistence practices that are often viewed as precursors to developments that occurred in the subsequent Woodland Period. In southeastern New York, distinctive Orient Fishtail projectile points serve as a diagnostic marker of this period, along with carved steatite (or soapstone) vessels and elaborate mortuary practices (Ritchie 1971, 1980; Snow 1980:239-244).

Archaic Period sites in New York City tend to be located along the East and Hudson Rivers, and Archaic Period sites have been identified in Lower Manhattan, the Bronx, and on Ellis Island. During the Archaic Period, sea levels were lower than present and many sites are located on uplands adjacent to areas that would have been estuarine marsh but have been subsequently inundated (Lenik 1992). Late Archaic occupations have been investigated in northern Manhattan at the Tubby Hook and Inwood sites (Cantwell and Wall 2001:57-58).

2.2.3 THE WOODLAND PERIOD, CA. 3,000 B.P. TO EUROPEAN CONTACT

The Woodland Period is often distinguished from earlier prehistoric periods by significant changes in technology (notably the widespread production and use of ceramics), more intensive subsistence practices (often including the domestication of plants), increasing trends towards sedentism and larger settlements, and changes in social organization (Ritchie 1980:179-180; Versaggi 1999). Woodland sites are distinguished from earlier periods by the appearance of fired clay ceramic vessels in the archeological record.

During the Early Woodland Period (ca. 2,700 to 2,000 B.P.) Native American groups continued the hunting, gathering, and fishing practices of the Terminal Archaic, supplemented by an increase in shellfish collecting as evidenced by large shell middens located on sites near the coast or estuaries (Funk 1976; Snow 1980:283). The Early Woodland in New York State has traditionally been identified by the presence of diagnostic Meadowood and Adena projectile points (Ritchie 1971, 1980). The distribution of these points, and related evidence for elaborate mortuary ceremonialism, within the state is generally restricted to central and western New York (Ritchie 1980; Snow 1980:266; Tuck 1978). Many researchers have recently begun to question whether Adena and Meadowood are appropriate diagnostics of the Early Woodland in the Hudson Valley and southeastern New York, and argued that projectile point chronologies for the Terminal Archaic and Early Woodland need to be reevaluated (Versaggi 1999). Rossville points serve as another diagnostic marker of Early Woodland occupations in the region, and are usually recovered in association with coastal shell middens. Vinette I pottery, a thick grit-tempered ware decorated on interior and exterior surfaces with impressed cordage or fabrics, represents one of the earliest ceramic traditions in the region (Ritchie 1980; Tuck 1978).

The Middle Woodland Period (ca. 2,000 to 1,000 B.P.) in eastern New York is characterized by changes in social and economic organization, including increasing trends towards sedentism and long-distance exchange of smoking pipes and lithic materials. Diagnostic artifacts from the Middle Woodland include Fox Creek stemmed and lanceolate projectile points, Jack's Reef points, Greene points, and a variety of decorated pottery styles (Funk 1976; Kostiw 1995; Ritchie 1971; Snow 1980:276).

In southeastern New York, the Late Woodland Period (ca. 1,000 to 400 B.P.) is divided into the Bowman's Brook and subsequent Clasons Point Phases. These cultures are known from large village sites near tidal pools and small coves, often characterized by numerous pits for cooking, storage, and the disposal of refuse (Ritchie 1980:269), as well as smaller activity sites. The Late Woodland economy in coastal New York seems to have been primarily oriented to marine resources, supplemented by horticulture and seasonal hunting and gathering (Ritchie 1980:268-270). Diagnostic artifacts for the period include Levanna and Madison style points (Ritchie 1971) and distinctive types of pottery including Bowman's Brook Incised and Stamped, East River Cord Marked, Munsee Incised, Castle Creek Beaded, and Wickham Punctate and Incised (Ritchie 1980:270-272).

Sites with Middle and Late Woodland components are the most numerous types of sites identified in New York City. Late Woodland settlements were dispersed throughout the city, at locales such as Archery Range, Ward's Point, Washington Heights-Inwood, Clasons Point, Bowman's Brook, and Aqueduct. Many of these locations continued to be occupied throughout the early period of European Contact (Cantwell and Wall 2001:114-116).

2.3 HISTORIC PERIOD CULTURAL CONTEXT

In the Late Woodland and Early Contact Periods, the Lower Hudson Valley and coastal areas of New York were inhabited by Munsee-speaking groups of the larger Lenape (or Delaware) cultural group of Native Americans (Burrows and Wallace 1999; Cantwell and Wall 2001:120; Goddard 1978; Snow 1980:96). The Munsee generally lived in multi-family longhouse structures about 20 feet wide and up to 100 feet long. These houses were usually arranged as loose clusters in hamlets as opposed to nucleated villages. In addition to speaking a similar dialect of the Eastern Algonkian language, Munsee groups generally shared similar modes of subsistence, settlement, social organization, and forms of material culture (Goddard 1978; Grumet 1995:26; Snow 1980:97-99). In the early-seventeenth century, the fur trade served as the primary motivation for Dutch colonization of the Lower Hudson Valley. Interactions with the Dutch and participation in the fur trade resulted in rapid and dramatic changes in the economy, social relations, and material culture of local Delaware groups (Burrows and Wallace 1999:11-13; Goddard 1978).

2.3.1 CONTACT AND COLONIAL PERIODS

Contact Period settlements are recognized in the archeological record by small quantities of European manufactured goods, such as metal kettles, tools, projectile points, ornamental brass cones, glass beads, bottles, jugs, and cloth among larger quantities of Native American material culture and refuse (Cantwell and Wall 2001:122-123). Within New York City, close to eighty Lenape habitation sites have been documented, along with the locations of agricultural fields and a network of trails that connected the individual settlements (Burrows and Wallace 1999:6). On Manhattan, Late Woodland and Contact Period Native American settlements were mostly clustered at the southern and northern ends of the island. These settlements were connected by a trail (or network of trails) that ran along the upland spine of the island from Battery Park to Inwood (Burrows and Wallace 1995:6; Homberger 1994:17).

The government of Holland formally established the colony of New Netherlands in 1614, claiming exclusive rights to trade on all lands between the Connecticut and Delaware Rivers. The seat of government for this new colony was at New Amsterdam, a small Dutch fort located in Lower Manhattan. In 1621 the charter for the colony was transferred to the Dutch West India Company, an armed mercantile association formed to serve as the agents of Dutch colonialism in the New World. Dutch colonists began to settle in increasing numbers at New Amsterdam in 1624 (Burrows and Wallace 1999:19-21). Throughout the New Amsterdam colony, the growth of the European population and encroachment upon Native American lands lead to increasing tensions between the two groups. The introduction of European diseases in the early-seventeenth century resulted in the decimation of Native American populations. These losses were compounded by casualties in wars both among Native groups and with the colonists (Brasser 1978; Goddard 1978).

The Dutch West India Company surrendered the New Netherlands colony to the English in 1664. Throughout the seventeenth and eighteenth centuries, urban development and settlement expansion was largely confined to Lower Manhattan (Burrows and Wallace 1999:206; Homberger 1994:41-47). Those areas in Manhattan north of Houston Street were primarily occupied by rural farms and remained sparsely settled into the early-nineteenth century (Homberger 1994:69; Winslow 1995:538).

2.3.2 THE NINETEENTH AND TWENTIETH CENTURIES

Proposed Shafts 25B, 28B, and 29B are located near the west (Hudson River) shoreline of Manhattan in the neighborhoods of Clinton (Hell's Kitchen), Greenwich Village, and Tribeca. Each of these neighborhoods experienced different phases of residential and commercial development as the city spread northward during the nineteenth century. In the eighteenth and nineteenth centuries, the coastline and landscape of the West Side was extensively altered by episodes of filling and pier construction (HCI 1983:101-102,262). Eleventh Avenue (north of 23rd Street) marked the western shoreline of Manhattan until the 1870s. The present shoreline, and all areas west of Eleventh Avenue consist of "made land" that has been formed by filling and grading activities in the late-nineteenth and twentieth centuries (Cantwell and Wall 2001:224).

The neighborhood now known as Tribeca was part of a large land grant made by Queen Anne to Trinity Church in 1705. Through the end of the eighteenth century, this area was part of the Lipsenard Meadows – a broad tract of salt marsh and pasture located where the *Kalch Hoek* (i.e., the western outlet of the Collect Pond, now Canal Street) drained into the Hudson River (Hill and Waring 1879; Gold 1995). Trinity Church sponsored much of the early land filling in the area, and by the 1820s the former marshland was a fashionable and wealthy residential district. Proximity to the Hudson River and the construction of railroads and other infrastructure along the West Side encouraged the gradual transformation of the neighborhood to a commercial district.

Greenwich Village has historically maintained a unique character distinct from the rest of the city. During the seventeenth and eighteenth centuries, Dutch (and later English) colonists and freed black slaves established farms in this rural area. Greenwich Village retained its pastoral, suburban character through the early part of the nineteenth century. Outbreaks of epidemic diseases in the city resulted in mass emigrations to the Village, which fueled development. Between the 1820s and 1840s, speculators subdivided larger farms, rerouted the Minetta Brook, filled swamps, and leveled hills to construct blocks of row houses (Ramirez 1995). Throughout the nineteenth century, the western portion of the neighborhood adjacent to the Hudson River was largely a commercial district populated by breweries, warehouses, coal yards, and lumberyards.

Hell's Kitchen was not intensely developed until after the 1851, when the New York Central & Hudson River Railroad (NYCHRR) was constructed along present-day Eleventh Avenue (Burrows and Wallace 1999:655). The neighborhood developed as an industrial area with rail yards, factories, warehouses, lumberyards, slaughterhouses, and gas works as well as residential tenements housing a growing impoverished immigrant population (Burrows and Wallace 1999:991; Winslow 1995). The Irish were the largest ethnic group in the neighborhood, along with Scots, Germans and African-Americans.

More detailed historical background information related to these neighborhoods is presented within the results of historical research associated with each of the proposed shaft sites (see Section 4).

3.0 RESEARCH METHODS

Primary and secondary sources were examined in order to document the environmental setting and history of the area, develop historic contexts for understanding potential cultural resources at each proposed shaft site, and assess the likelihood for each proposed shaft site to contain archeological resources. These sources included both written and cartographic documents relating to the past and present environmental conditions and human occupation of the region.

3.1 PREHISTORIC SENSITIVITY STUDY

In the early-twentieth-century, archeologists recorded the former locations of Native American sites in New York City (e.g., Bolton 1934; Skinner 1920). It was recognized at the time that many of these sites were being (or would be) destroyed by urban development and construction activities. These early references provide the best documentation of Native American settlements in Manhattan. Contemporary archeologists working in New York typically assume that historic and modern development, construction, and urban landscaping activities have destroyed any prehistoric sites that may have been located in the areas they investigate (Lenik 1992:20). Of the 17 major archeological data recovery projects undertaken in Manhattan in the 1980s, prehistoric materials were recovered during only four of these projects. For example, excavations at the seventeenth-century Augustine Heerman Warehouse on the East River (Grossman 1985, cited in Lenik 1992:22-24) recovered a large assemblage of Native American objects and Dutch trade goods dating to the Contact Period. In each case where archeologists identified Native American materials at these sites, all materials recovered were isolated finds recovered from areas of historic landfill or other disturbed contexts (Lenik 1992:24).

Sources and repositories reviewed by JMA to investigate the prehistoric archeological potential of the proposed shaft sites included:

- The site files of the New York State Museum (NYSM);
- The site files of the NYS Office of Parks, Recreation and Historic Preservation (OPRHP);
- The archeological reports bibliography of the New York City Landmarks Preservation Commission (NYC LPC 2003);
- Early-twentieth-century references concerning the archeology of New York City (e.g., Beauchamp 1900; Bolton 1920, 1922, 1934; Parker 1920; Skinner 1915, 1920);
- Previous cultural resources reports from other projects in the vicinity (e.g., HAA 1990; HCI 1983; HPI/LBG 2004; JMA 2001);
- And, regional syntheses of prehistory (e.g., Cantwell and Wall 2001; Funk 1976; Ritchie 1980; Snow 1980).

For each of the proposed shaft sites, JMA reviewed the available information concerning previously recorded Native American archeological sites in the vicinity, and examined nineteenth-century maps (e.g., Colton 1836; Viele 1865) that depict the pre-development topography of Manhattan. The 1865 Viele *Sanitary & Topographical Map of the City and island of New York* was drawn to identify former watercourses and wetlands to assist in planning sewer and sanitary facilities (Stokes 1918:777–778); accordingly, the map presents a detailed reconstruction of the pre-development topography and landscape.

Based on these sources, JMA evaluated the potential for Native American archeological sites to have once existed at each of the proposed shaft sites. This baseline potential was then re-

evaluated based on evidence for the extent of construction-related disturbance at each shaft site. Evidence for previous disturbance included both the results of historical and cartographic research that provided a record for construction episodes at each proposed shaft sites as well as a review of geo-technical boring logs prepared for the Project (Appendix A).

3.2 HISTORICAL RESEARCH

The goals of historical research conducted for each of the proposed shaft sites were to:

- Identify previous uses of each property;
- Document the size, location, construction date, descriptive characteristics, and demolition date of structures or other features that previously occupied the proposed shaft sites;
- Evaluate the likelihood that potentially informative archeological features associated with previous use and/or occupation of the lot may be present;
- And, evaluate the likelihood that potential archeological features may have remained undisturbed during nineteenth-and-twentieth-century episodes of construction, renovation, and/or demolition that have occurred at each shaft location.

For New York City, there is a wealth of cartographic and archival information detailing the development and occupation of blocks and lots throughout Manhattan. Archival sources and repositories that were examined for the project included:

- The New York Public Library, Maps Division and Local History and Genealogy Division;
- The City of New York Department of Records, Municipal Archives (DOR);
- The City of New York Department of Buildings (DOB);
- The City of New York Office of the City Register (OCR);
- The City of New York Department of Environmental Protection, Bureau of Sewer and Water Operations (DEP);
- The Library of Congress Geography and Maps Division;

More detailed research concerning the occupants of the lots, including Census and Directory reviews, was conducted as a second phase of research after the potential for archeological deposits to be present at each shaft location was established. Occupancy for each lot was only researched if a finite period could be established from when associated archeological deposits were likely to be present.

4.0 RESULTS

4.1 SHAFT 25B (BLOCK 1077, LOT 29)

Proposed Shaft 25B is located on Block 1077, Lot 29. Lot 29 fronts on Tenth Avenue (to the east) between 48th and 49th Streets, and is bounded by the Pennsylvania Central Railroad right-of-way to the west. Contemporary Lot 29 includes ten (10) Historical Lots, which are identified as lot numbers 28–37 in municipal records and on historical atlases (e.g., Robinson 1885). City records also identify the property as 705–719 Tenth Avenue and 507–513 West 48th Street (NYC DOB n.d., 2005; NYC OCR n.d., 2005). Within Lot 29, the proposed Shaft 25B is located in the southeast portion of the lot at the corner of Tenth Avenue and West 48th Street. Project plans depict the limits of disturbance associated with Shaft 25B (Figure 2) as an area extending 50 feet west (into the lot) from Tenth Avenue and 60 feet north from West 48th Street. The proposed shaft location falls within Historical Lots 29 and 30, and the southern portion of Historic Lot 31.

Lot 29 is currently an asphalt-paved, vacant lot (Plates 1–4). A chain link fence defines the southern, northern, and western perimeters of the property. The surface of the lot slopes gently to the northwest, which likely reflects the original topography of the area. The former Penn Central Railroad tracks (currently used by Amtrak) are located in a depressed open-cut located immediately west of the lot.

4.1.1 PREHISTORIC ARCHEOLOGICAL POTENTIAL, SHAFT 25B

Prior to the arrival of the Europeans, the vicinity of Shaft 25B area would have been an attractive locale for Native American occupation or resource-procurement activities. The 1865 Viele (Figure 5) and 1836 Colton (Figure 6) topographic maps depict the pre-development landscape in the vicinity of Block 1077 as a highland ridge with bedrock outcrops overlooking streams and broad, level areas descending to the Hudson. This type of setting would have attracted Native American people due to the proximity of streams and wetlands for hunting and fishing purposes. The level areas descending to the Hudson may have also been utilized for crop cultivation. The 1836 Colton map (Figure 6) depicts the area as open fields, orchards, hills and larger farms, with numerous small springs and tributaries that flow both north and south from the vicinity of Block 1077.

JMA did not identify any previously recorded Native American sites located in or near the proposed location of Shaft 25B. The nearest recorded archeological site is NYSM 4061, which is described as "traces of occupation" extending between (approximately) 42nd and 72nd Streets on the East Side (Harlem River shoreline) of Manhattan. Early-twentieth-century archeologists documented many more prehistoric archeological sites along the northern tip of the island, in the vicinity of Inwood. Previously recorded sites in this area include small campsites, shell middens, rockshelters, and burial grounds (Beachamp 1900:107; Bolton 1934:134-135; Parker 1922:626-628). Many of these sites are recorded in the OPRHP files as Sites A061.01.0114, A061.01.0116, A061.01.0117, A061.01.0119, A061.01.0121, A061.01.0123, A061.01.0532, A061.01.0533, and A061.01.0536. Other sites were recorded to the northeast along the Harlem River, including numerous shell middens and small campsites (Beachamp 1900:107; Bolton 1934:134; Parker 1922:626).

Geo-technical borings conducted in association with the Project (Appendix A) provide information concerning current subsurface soil stratigraphy at the proposed location of Shaft 25B.

Five borings were excavated at Shaft 25B; three of which were taken in the western portion of the proposed shaft site and two of which were taken within (or adjacent to the curb of) Tenth Avenue. All boring samples taken within the proposed shaft location encountered bedrock within 5 feet of the existing ground surface. *Boring* W48 St-W (located at the eastern edge of Lot 29, north of the proposed shaft site) documented fill material with brick, sand, and concrete (interpreted as building demolition and basement fill) to a depth of 11.3 feet underlain by bedrock. The results of the geo-technical investigation confirm the historical topography depicted for this location on the 1865 Viele map (Figure 5), which shows the pre-development landscape in this vicinity as hilly uplands with bedrock outcrops.

4.1.2 LOT HISTORY, SHAFT 25B

Block 1077 is located within one of the numerous speculative real estate holdings acquired by John Jacob Astor during the early-nineteenth century (NYC DOR 1917); this property is variously referred to as the Eden Farm tract or Astor-Cutting tract. Astor significantly increased his family's wealth by buying farmland and waterlots at low prices and holding onto the properties until the city's expansion extended into formerly rural or idle areas (Anon. 1930; Homberger 1994:66; Weiss 1995). Block 1077 was originally part of the Wolfert Webbers Upper Farm (ca. 1690s), and was included within Lots 1 and 3 of that property deeded to Medcef Eden in 1784 (NYC DOR 1917; Stokes 1928:171). The Eden Farm included the area between 42nd and 46th Street along *Bloomingdale Road* (Broadway) and the tract extending northwest to the Hudson River. Astor acquired this tract for $25,000 in 1803 by obtaining a one-third interest in an outstanding mortgage and foreclosing on the property (Anon. 1930; exploreNYC 2000).

Prior to the extension of the street grid in the early-nineteenth century, the nearest local thoroughfare was "Verdant Lane" (also called Feitner's Lane), which ran on a northwesterly course from Bloomingdale Road (later Broadway) and crossed Tenth Avenue along the northern border of Block 1077 - close to the present course of 49th Street (Stokes 1918:Plate 176, 1928:1011; Colton 1836)(Figure 6). The 1836 Colton map (Figure 6) depicts two structures located on the north side of Verdant Lane within the northern portion of Block 1077, Lot 29. The 1852 Dripps map (Figure 7) also depicts these two structures, but places the westernmost of the two structures further to the northwest, outside of the Astor property (and outside of Block 1077) and within the adjacent estate (the Frances Hendricks Tract, see below) to the northwest. The easternmost structure was located within the Astor-Cutting tract, in the northwestern corner of Lot 29 immediately south of the current course of 49th Street and immediately west of Tenth Avenue. According to the 1852 Dripps survey, this early-nineteenth-century building was located approximately 150 feet north of the proposed location for Shaft 25B (Figure 7).

The 1836 Colton (Figure 6) and 1852 Dripps (Figure 7) maps also depict a large farm or estate located on the north side of Verdant Lane, immediately west of Tenth Avenue and north of Block 1077. This estate was located within the Frances Hendricks property, deeded by Astor to John Wilkes and subsequently bought by Harman Hendricks ca. 1819. Hendricks passed away in 1838, leaving the property to his widows and children (NYC DOR 1917). The estate depicted on the Colton and Dripps surveys is likely the former Hendricks residence; and the westernmost structure described in the preceding paragraph was likely the gatehouse or servants quarters associated with the estate.

The Hendricks estate was demolished during the 1860s or 1870s (Figures 8–9) and subdivided into smaller lots as the Common Council's grid plan for development replaced the earlier layout

of rural roads such as Verdant Lane. During the 1860s, William Backhouse Astor developed most of the lots within the Astor-Cutting Tract. While tenements populated most of Hell's Kitchen, Astor constructed brownstone townhouses in an attempt to create more refined areas within the neighborhood – examples of which survive at 412–414 West 47th Street (exploreNYC 2000).

Bureau of Sewer and Water records indicate that sewers were installed in the streets adjacent to Block 1077, Lot 29 in 1861 (NYC DEP n.d.), although the eastern portion of Block 1077 remained undeveloped until the 1880s (Dripps 1852; Bromley 1879; Galt & Hoy 1879)(Figures 7 and 8). The 1885 Robinson atlas (Figure 9) shows the subdivision of Historic Lots 28–37 within Block 1077 and depicts the structures built on each of these lots. These buildings that fronted along Tenth Avenue (Historic Lots 29–36) extended 50 feet in depth within 100-foot-deep lots. These structures are also depicted on the 1890 Sanborn and 1891 Bromley maps (Figure 10), which indicate that all of these structures were five-story, brick tenement buildings occupied by both stores (typically on the first floor) and apartments (on the upper floors). The 1890 NYC Police Census documents multiple households at each of these addresses; for instance, at least six families are listed for 581 West 48th Street (also 705 Tenth Avenue, or Historic Lot 29). The 1911 Sanborn atlas indicates that a "confec'y" (confectionary) occupied Lot 32, a Dryer and Cleaner occupied Lot 33, and a roofer occupied Lot 35. No structures or additions are depicted within the rear half of these lots through 1911.

The 1930 Sanborn atlas (Figure 11) depicts a single-story addition off the rear (west) wall of 705 Tenth Avenue (Historic Lot 29); the addition extended 50 feet to fill the entire rear portion of the lot. The rear yards of the other seven structures fronting on Tenth Avenue remained undeveloped. However, the rear yard of 719 Tenth Avenue (Historic Lot 36) was in use as a parking lot. The single-story addition in Historic Lot 29 is depicted in the ca. 1940 tax assessment photographs for Block 1077 and appears to have housed an unidentified commercial enterprise fronting on West 48th Street (NYC DOR 1940). The ca. 1940 photographs also identify storefronts along Tenth Avenue including a chemist (Historic Lot 29), butcher/bakery/grocery (Historic Lot 30), and "U.S. Tires" (Historic Lot 31).

The 1930 atlas also defines the right-of-way for the Penn Central Railroad through the middle of the block. The eight structures located within the right-of-way (Historic Lots 24–27 and 38–41) were subsequently demolished. The 1951 Sanborn atlas (Figure 12) indicates that the structures on Historic Lots 30-36 were demolished by this time, but that the tenement on Historic Lot 29 (including the single-story rear addition) was still standing. According to Department of Buildings records, this building was also demolished by 1961. Certificates of Occupancy (NYC DOB 2005) issued for Lot 29 indicate that the lot was occupied by a parking lot with single-story attendant's booth (ca. 1961, 1971) and a gasoline service station and carwash (with buried gasoline tanks) at 707 Tenth Avenue (ca. 1962).

4.2 SHAFT 28B (BLOCK 581, LOT 45)

Proposed Shaft 28B is located within Lot 45 in the southwest corner of Block 581. Lot 45 fronts on Hudson Street (to the west) and extends the full block between West Houston Street (to the south) to Clarkson Street (to the north). A school defines the western perimeter of the property. Contemporary Lot 45 includes nine (9) Historical Lots, which are identified as lot numbers 45–52 and 83 in municipal records. These lot numbers correspond to 388–402 Hudson Street, 262 West Houston Street, and 22 Clarkson Street (NYC DOB n.d., 2005; NYC OCR n.d., 2005). Within

Lot 45, the proposed Shaft 28B is located in the southwest portion of the lot at the corner of Hudson and West Houston Streets. Project plans depict the limits of excavation associated with Shaft 28B (Figure 3) as an area extending 75 feet east from Hudson Street and 55 feet north from West Houston Street. Block 81, Lot 45 is currently a paved, level, vacant parking lot surrounded by a chain link fence (Plates 5–6).

4.2.1 PREHISTORIC ARCHEOLOGICAL POTENTIAL, SHAFT 28B

The 1865 Viele map (Figure 13) depicts the pre-development landscape and topography in the vicinity of proposed Shaft 28B. Block 581 occupies what was once the top of a bluff located adjacent to and overlooking (to the south) the Minetta Brook and associated wetlands:

> ... between Charlton and West Houston Streets, lay a small, swampy tract, through which the 'Manetta Water' flowed to its outlet in the Hudson. Until demoralized by this near approach to the slothful stream in the marshy valley below, the brook was a brisk little affair, hurrying along in its well-defined channel, apparently as full of business as it was certainly full of trout... Indian, Dutch, and English boys caught them, and so did American boys who had the good – or bad luck to be born in the last century (Hill and Waring 1897:228).

This location would likely have been very attractive to Native American people because of the abundant natural resources in the immediate vicinity. The area would have been ideally suited for many economic activities including fishing in the Minetta Brook, collecting clams and oysters from the Hudson River estuaries, and planting food and tobacco crops within the fertile floodplain soils. Early-twentieth-century archeologists reported a Native American village site located in what is now Greenwich Village known as Sapokanikan (OPRHP Site A061.01.0502). Native Americans used this area for fishing, planting fields of crops and tobacco, and a landing place for canoes bringing goods over from New Jersey (Bolton 1920:240, 1922, 1934:133; Burrows and Wallace 1999:6; Skinner 1915:51). An important trail ran northeast from this area to Hell's Gate Bay.

Geo-technical borings taken at the proposed location of Shaft 28B (Appendix A) provide information concerning subsurface soil stratigraphy at this location. Eleven borings were excavated in the vicinity of Shaft 28B; all of these borings were taken in the adjacent roadbeds of Hudson and West Houston Street, and therefore depict subsurface conditions in the areas immediately adjacent to (but not within) Lot 45. Eight of the boring logs record the presence of disturbed fill materials to depths between 15 and 19 feet underlain by glacial till. In three of the boring logs (27B-A, Houston-A, and soil testing well 28B-GEO-05), samples recovered from between 15 and 24 feet below the existing surface included peat and organic deposits or lenses in association with moist to wet fine silt to medium and coarse sands. These samples may indicate the presence of intact Holocene alluvial deposits associated with the Minetta Brook and adjacent wetlands, which may represent intact land surfaces in an area sensitive for prehistoric archeological remains.

JMA was contacted on January 12, 2005 to conduct monitoring at the proposed site of Shaft 28B. On January 13, 2005 JMA personnel monitored the excavation of a trench and the installation of shoring along the eastern perimeter of the limits of excavation for Shaft 28B. The shoring trench was excavated to variable depths between 4 and 9 feet below the ground surface; JMA observed sections of basement walls (with footings at approximately 9 feet below ground) within the trench. All soils observed within the trench consisted of demolition debris with brick fragments,

timbers, concrete, and asphalt fragments. These field observations confirm the depth of fill and debris reported in the logs for borings taken in the adjacent roadways (see above; Appendix A).

4.2.2 LOT HISTORY, SHAFT 28B

Hudson Street was extended north to Hamersley Street (now West Houston Street) in 1815 (Stokes 1928:1003). The 1836 Colton map indicates that Block 581 was developed soon after; however, the Colton map does not depict individual structures within the urbanized portions of the city. The 1852 Dripps survey (Figure 14) depicts the early layout of lots and structures within Block 581. In 1852, the proposed location of Shaft 28B was occupied by three small buildings in shallow (approximately 60-foot-deep) lots that fronted on Hudson Street and two small buildings also built within irregular, undersized lots that fronted on Hamersley (West Houston) Street. All five of these structures had vacant rear lots or backyard areas. Municipal sewers were installed in the adjacent streets in 1854 (NYC DEP n.d.). In the absence of later development and disturbances, it is very likely that historic shaft features (such as privies and cisterns) would have been located within the backyards associated with these five early-nineteenth-century structures.

By the end of the 1870s, the smaller structures built within undersized, irregular lots that were depicted on the 1852 survey (Figure 14) within the proposed location of Shaft 28B were demolished and replaced with a single, five-story commercial structure (Bromley 1879, 1891; Galt & Hoy 1879; Robinson 1885; Figures 15–17). The late-nineteenth-century maps identify the proposed location of Shaft 28B as Historic Lot 1345, although twentieth-century municipal records refer to Historical Lot 45. Regardless, the five-story building occupied almost the entirety (excluding a narrow alley in the northeast portion) of the consolidated lot that measured approximately 75 feet along Hudson Street by 100 feet along West Houston. The large commercial building is labeled as having been used for "Storage" (Bromley 1891; Figure 17). The 1895, 1904, and 1921 Sanborn atlases (Figure 18) indicate that the building was a single, five-story, brick structure that may have had separate street entrances at 388, 390, and 392 Hudson Street. 392 Hudson Street is identified as housing a "stock of carpets" on the 1904 Sanborn atlas (Figure 18), although it is unclear whether this function applies to the entire building.

Department of Buildings records include a demolition permit for Block 581, Lot 45 from 1938 (NYC DOB n.d.). A 1941 Certificate of Occupancy indicates that Lot 45 (including Historical Lots 45, 48–52, and 83) was in use as a parking lot (NYC DOB 2005). The 1951 Sanborn atlas (Figure 19) depicts Lot 45 as a vacant lot and documents the presence of the adjacent school. A 1960 Certificate of Occupancy documents the lot's continued use for parking and indicates the presence of a small shed for an attendant (NYC DOB 2005).

Throughout the nineteenth century, historical maps depict the presence of the Trinity Church Cemetery (later St. John's Cemetery) located on the block immediately north of Block 581 (Colton 1836; Dripps 1852; Bromley 1879, 1891; Galt & Hoy 1879; Robinson 1885; Figures 14–17). The cemetery was in use by Trinity Church parishes between 1799 and 1851, whose records indicate that approximately 10,000 people were buried within this one-acre cemetery. In the 1890s the City of New York annexed the cemetery for use as a park and playground; however, available records indicate that the bodies were not removed and that the graveyard was buried beneath several feet of fill (Inskeep 2000:159). The former cemetery is depicted on historical maps after 1895 as Hudson Park (Sanborn 1895, 1904, 1921, 1951; Figures 18–19).

4.3 SHAFT 29B (BLOCK 213, LOT 1)

Proposed Shaft 29B is located on Block 213, Lot 1. Block 213 is bounded by Hudson Street (west), Laight Street (north), Varick Street (east), and Ericsson Place (south). Lot 1 occupies the entirety of the block, and is identified as 21 Laight Street in city government records (NYC DOB. 2005; NYC OCR 2005). Block 213 has always been a single property and was never subdivided into separate parcels. Certificates of Occupancy from the mid-twentieth century variously designate the property as 21 and 23 Laight Street, or 61, 67, and 69 Varick Street – however, all of these street addresses refer to the same, single property (NYC DOB 2005). Proposed Shaft 29B is located at the northwest corner of the block, approximately 41 feet south of the intersection of Hudson and Laight Streets. The limits of excavation associated with the shaft extend approximately 80 feet (north-to-south) along Hudson Street and 30 feet east into the lot (Figure 4). The proposed location for Shaft 29B is currently a traffic island bordering the circle of ramps at the exit of the Holland Tunnel (Plates 7-8).

4.3.1 PREHISTORIC ARCHEOLOGICAL POTENTIAL, SHAFT 29B

Prior to the urban development of the area, the site of proposed Shaft 29B was within the Lipsenard Meadows – a broad tract of salt marsh and pasture located where the *Kalch Hoek* (i.e., the western outlet of the Collect Pond, now Canal Street) drained into the Hudson River (Hill and Waring 1879). The 1865 Viele topographic map (Figure 20) depicts the original extent of the marshland that stretched along Canal Street and from West Broadway to the Hudson between Duane and Broome Streets. Historical accounts describe the pre-development landscape in the vicinity of Block 213:

> A less attractive location could hardly have been found. It was at the junction of the West Broadway and the Canal Street swamps, and the outlook was over a dreary waste of rushes and brambles, unshaded by a single large tree... (Hill and Waring 1879:222).

The nearest previously recorded Native American site in the vicinity of Shaft 29B is Shell Point (NYSM Site 4059), described as a village site located on a small upland overlooking a pond (the Collect Pond) near Canal Street (Beauchamp 1900:107; Parker 1922:630). The site was located farther inland in the vicinity of Broadway. Early-twentieth-century archeologists recorded numerous other habitation and shell midden sites that once existed in Lower Manhattan. These sites include shell mounds on the southern tip of the island (OPRHP Site A061.01.0508), and the village of Werpoes (OPRHP Site A061.01.0507) in the vicinity of Elm, Duane, and Worth Streets. The Native American name of the area was preserved in a 1651 Dutch land grant that referred to "the land called Werpoes" which included approximately 50 acres in Lower Manhattan. Another Contact Period village known as Rechtanck (A061.01.0509) was located at Corlears Hook and was the site of a Dutch massacre of Native Americans in 1643 (Bolton 1934:133).

Geo-technical borings taken at the proposed location of Shaft 29B provide information concerning subsurface soil stratigraphy at this location. All of the thirteen samples taken within or in the vicinity of proposed Shaft 29B document deposits of disturbed soils and fill associated with previous episodes of construction and demolition. The profiles recorded within the soil borings in this area consist of 10 to 15 feet of fill and demolition debris material overlying glacial drift or till material. For instance, boring log 25M (Appendix A) records the presence of modified glacial drift material probably used as artificial fill to depths of approximately 17 feet underlain by

glacial lakebed sediments. Soils that included identifiable traces of the pre-development marshlands in this area are not apparent in the boring logs.

4.3.2 LOT HISTORY, SHAFT 29B

In the early-nineteenth century, Trinity Church built St. John's Chapel (ca. 1807) on the east side of Varick Street and invested in additional development in the area, which entailed filling and grading many of the adjacent marsh areas, including Block 213:

> Having completed the chapel, the Vestry of Trinity turned their attention to the neighborhood, and laid out as a park the whole block bounded by Varick, Beach, Hudson, and Laight Streets, which was called Hudson Square or St. John's Park. It was carefully graded, planted, and fenced in (Hill and Waring 1879:222).

During the early-nineteenth century, Hudson Square/St. John's Park occupied Block 213 (Colton 1836; Dripps 1852; Viele 1865; Gold 1995; Stokes 1918:Plate 106-a; Figures 20–23). Hudson Square was a private park leased and maintained by the owners of the elegant brick row houses that faced the park. Historical accounts indicate that the square and immediately surrounding neighborhood were very fashionable in the early-to-mid-nineteenth century:

> 'Old Cisco', a former slave, who was made [Hudson Square's] keeper, cared for it with such fidelity that the locality soon became one of the most attractive parts of the city. Substantial brick houses arose around it, and the value of property in the vicinity rapidly increased... The gates of the Park were kept locked, to prevent the intrusion of strangers, but each resident of the square had his own key, and enjoyed its privileges with certainty that he would meet no objectionable person inside its limits (Hill and Waring 1879:222–223).

> Dr. Dix describes Hudson Square at that time as one of the finest, if not *the* finest, in the city. It contained specimens of almost every American tree, with others of foreign sorts; and Dr. Francis, in 1857, said that the variety of trees there was greater than on any other ground of equal size in the known world (Stokes 1918:609).

Numerous other public squares and parks in Manhattan were previously used as burial grounds in the nineteenth-century (e.g., Washington Square, Bryant Park). Concern over the possibility of burials within Block 213 was perhaps heightened due to the association of the park with the early-nineteenth-century St. John's Chapel. JMA reviewed historical accounts and indices of New York cemeteries (e.g., Inskeep 2000; Stokes 1918). None of the records, maps, or secondary sources reviewed by JMA indicates that Hudson Square/St. John's Park (Block 213) was ever used as a burial ground. There are burials located at the "other" Hudson Park, coincidentally also referred to as St. John's Cemetery, located on Hudson and Clarkson Streets one block north of the proposed site for Shaft 28B (Inskeep 2000:159–160).

The neighborhood surrounding Hudson Square became increasingly commercial in character through the middle of the nineteenth century. After 1840, five- and six-story commercial buildings constructed with marble, sandstone, and cast iron facades came to dominate the neighborhood (Gold 1995). In the 1860s, Hudson Square was demolished in association with the construction of a railroad freight depot. According to historical accounts, this act seems to have finalized the transformation of the neighborhood:

> The further history of that beautiful spot was a melancholy one. As time passed on and the character of the neighborhood changed, the owners of the property fronting on the Park were filled with the usual desire to sell for business purposes... Then followed a shocking scene: the felling of

> the trees, the uprooting and upturning of the whole place, and the erection of an unsightly and vast freight depot, covering the whole extent of the square. And so before the rolling car of the Business-Juggernaut, the grace and beauty passed away forever (Stokes 1918:609).
>
> Facing this park lived the families of Alexander Hamilton, General Schuyler and General Morton, the Aymars, Drakes, Coits, Delafields, and others of equal fame; and here lived many of their descendants until the Hudson River Railroad Company tore down the protecting fence, invaded the sacred precincts with axe and shovel, and blotted St. John's Park out of existence with four acres of freight station. Fashion fled precipitately (Hill and Waring 1879:223).

The New York Central & Hudson River Railroad (NYCHRR) constructed a freight depot on the former site of St. John's Park in 1867 (Stokes 1918:975). The NYCHRR depot is depicted on an 1879 "bird's eye" perspective map of Manhattan (Galt & Hoy 1879; Figure 24). This drawing depicts the freight depot as a large, three-story building that occupies all of Block 213, with a central, vacant courtyard. The same size and shape of the depot is depicted on the 1885 Robinson, 1891 Bromley, and the 1894, 1904, and 1922 Sanborn maps of Manhattan (Figures 25–28a).

The 1894 Sanborn atlas identifies the NYCHRR depot as a three-story "building of superior construction", and includes an inset detail of the building's storage cellars, which encompassed the complete area of Block 213 (Figure 27). The 1905 and 1922 Sanborn maps provide additional detail. These maps show the arrangement of rail tracks and raised platforms on the first floor (street level) of the building (Figure 28). A detail plate of the structure (Figure 28) indicates that the basement of the building was 8.5 feet high, accessible only by elevator, with floors of planking overlying brick (Sanborn 1922). Department of Buildings records indicate that the foundation was built of stone with 28-inch-thick walls and the superstructure constructed of brick (NYC DOB n.d.).

The freight depot was demolished during the 1920s in association with the construction of the Holland Tunnel. The latest description of the depot within the Department of Buildings 'Block and Lot Folder' is dated 1923, although these records do not include an application for demolition (NYC DOB n.d.). The NYCHRR relocated their station and opened the St. John's Park Freight Terminal, a three-story structure that covered three city blocks between Charlton and Clarkson Streets, in 1934. The new terminal was the end of the NYCHRRR West Side line and served as the principal delivery station for dairy products in the city (FWP 1939:70).

Construction for the Holland Tunnel began in 1920 and was completed by 1927 (Gray and Hagen 1930; Shanor 1995). Due to concerns over traffic congestion, the exit and entrance ramps on the New York side of the Tunnel are widely separated. The eastbound exit ramp emerges in New York within Block 213, with a traffic circle of exit ramps allowing access to the adjacent surface streets (Figure 29). The approaches to the Tunnel (presumably including the exit ramps) were "built by the cut and cover method as usually employed in subway construction" (Gray and Hagen 1930:595).

Subsequent to the construction of the Tunnel exit ramp, the perimeters of the block continued to be used as traffic islands, with service stations and parking facilities. The ca. 1940 tax assessment photograph of Block 213 (NYC DOR 1940) depicts a large, single-story temporary structure located on the block. The structure is semi-circular in profile and apparently constructed of heavy fabric (possibly canvas) stretched over a frame. This temporary structure is likely the one-story, non-fireproof, "dining and recreational" building located at 25–57 Varick Street that is described in a 1943 Certificate of Occupancy for Block 213, Lot 1 (NYC DOB 2005).

The 1948 Certificate of Occupancy for Block 213, Lot 1inidicates that a single-story metal structure was located at 23–41 Laight Street, which was approved for use as a "garage for more than five motor vehicles" (NYC DOB 2005). The 1952 Certificate of Occupancy indicates that three single-story buildings were located on the lot, including a gasoline service station and two motor vehicle repair shops. The certificate also documents that a "grease pit" and "gasoline tank" were present, and that the lot continued to be used for parking (NYC DOB 2005). The locations of these service stations are depicted on the 1951 Sanborn map of Block 213 (Figure 30).

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY AND CONCLUSIONS

5.1.1 ARCHEOLOGICAL SENSITIVITY EVALUATION, SHAFT 25B

Historic cartographic sources depict the pre-development topography of Block 1077 as an upland ridge location with bedrock outcrops. The 1836 Colton and 1852 Dripps maps depict an unidentified structure located on the north side of an early-nineteenth-century road (Verdant Lane) within the northern portion of Lot 29, immediately south of the current course of 49th Street and immediately west of Tenth Avenue. The early-nineteenth-century structure was located approximately 150 feet north of the proposed location for Shaft 25B. Urban development of Lot 29 (Historical Lots 28–37) did not occur until the 1880s, when five-story brick tenements were constructed along the lots fronting on Tenth Avenue. These tenements were 50-foot-deep structures within 100-foot-deep lots. Although the backyards of Historical Lots 30–36 remained undeveloped through the twentieth century, the construction date for these tenements post-date the (ca. 1861) installation of municipal sewers on the adjacent streets. Therefore, it is highly unlikely that backyard shaft features (e.g., privies or cisterns) are present in the associated backyard areas. Geo-technical boring logs document the presence of bedrock at depths ranging from 2 feet to 11 feet below the current ground surface (Appendix A). The only soils recorded consist of basement demolition debris/fill deposits overlying bedrock in one of the boring logs.

Proposed Shaft 25B is located completely within the building footprints of the five-story tenements that occupied Historical Lots 29–31. Recent geo-technical borings document the presence of bedrock within five feet of the existing ground surface within the proposed shaft site. Based on these factors, it is the opinion of JMA that there is very little likelihood that undisturbed archeological deposits are present within the proposed location of Shaft 25B.

5.1.2 ARCHEOLOGICAL SENSITIVITY EVALUATION, SHAFT 28B

Historic cartographic sources depict the pre-development landscape of Block 581 as a bluff located adjacent to and overlooking (to the south) the Minetta Brook and associated wetlands. This location would have been an attractive area for prehistoric habitation, and previous archeologists and historians recorded the presence of the Native American village of Saponikan within present-day Greenwich Village. The 1852 Dripps survey depicts three small buildings in shallow (approximately 60-foot-deep) lots that fronted on Hudson Street and two small buildings also built within irregular, undersized lots that fronted on West Houston Street within the proposed location of Shaft 28B. Municipal sewers were not installed in the adjacent streets until 1854, and in the absence of later development and disturbances, it is very likely that historic shaft features (such as privies and cisterns) would have been located within the backyards associated with these five early-nineteenth-century structures. By the end of the 1870s, these smaller structures were demolished and replaced with a single, five-story commercial structure that occupied almost the entirety (excluding a narrow alley in the northeast portion) of the consolidated lot. The limits of excavation for proposed Shaft 28B are located entirely within the building footprint for this later five-story structure. In the opinion of JMA, it is highly unlikely that potential earlier historic shaft features are intact within the basement area of the later five-story structure.

Geo-technical borings excavated in the streets adjacent to Shaft 28B document the presence of fill deposits to depths of approximately 15 feet. In three of the borings, these fill deposits were underlain by potentially intact strata of silts and sands containing samples of organic material and peat. These samples may indicate the presence of intact Holocene alluvial deposits associated with the Minetta Brook and adjacent wetlands. These deposits may represent intact land surfaces in an area sensitive for prehistoric archeological remains.

5.1.3 ARCHEOLOGICAL SENSITIVITY EVALUATION, SHAFT 29B

Prior to the urban development of the vicinity of Block 213, the proposed location of Shaft 29B was within a large wetland. Historical accounts refer to the filling and grading of the marsh in association with the early-nineteenth-century construction of Hudson Square or St. John's Park. The private park was razed in the 1860s in association with the construction of the NYCHRR freight depot. The freight terminal was a massive three-story stone and cement structure with a basement that occupied the entirety of Block 213. The depot was demolished ca. 1920 in association with the construction of the eastbound exit ramps for the Holland Tunnel. According to historical accounts, the approaches to the tunnel were built via cut-and-cover methods. Geo-technical boring logs record the presence of disturbed fill deposits overlying glacial sediments, and do not indicate the presence of buried organic or wetland deposits.

Block 213 has experienced a dramatic sequence of disturbance episodes including the filling and grading of the marsh, razing of the park, construction and demolition of the freight depot, and excavation of the approaches for the Holland Tunnel. In the opinion of JMA, the cumulative effect of these episodes (and most significantly the excavations associated with the Holland Tunnel) preclude the possibility that intact archeological deposits are present at the proposed location of Shaft 29B.

5.2 RECOMMENDATIONS

Shaft 25B is located completely within the building footprints of the late-nineteenth-century, five-story tenements that formerly occupied Historical Lots 29–31. Recent geo-technical borings document the presence of bedrock within five feet of the existing ground surface within the proposed shaft site. Based on these factors, it is the opinion of JMA that there is very little likelihood that undisturbed archeological deposits are present within the proposed location of Shaft 25B. No additional archeological work is recommended for this location.

Shaft 28B is located on what was once a bluff overlooking the Minetta Brook, in the vicinity of a historically recorded Native American village. The limits of excavation associated with Shaft 28B are located within the building footprint of a late-nineteenth-century, five-story, commercial structure – the construction of which likely destroyed archeological deposits associated with previous historical-period occupation(s) of the lot. However, geo-technical boring logs document the presence of potentially intact alluvial and wetland soil horizons between 15 and 24 feet below the existing surface of the adjacent streets. These horizons are buried beneath deep deposits of fill. In the opinion of JMA, these buried soils have the potential to include intact archeological deposits associated with the Native American occupation of the area. JMA recommends a program of archeological monitoring during the excavation of the proposed shaft to determine whether intact soil horizons are present. Monitoring by professional archeologists should begin when construction/excavation reaches a depth of ten feet in any portion of the shaft site, and

should continue until sub-fill deposits have been exposed, examined, and (if necessary) sampled over the entire area of the proposed shaft site.

The vicinity of Shaft 29B has experienced dramatic episodes of disturbance throughout its history. In the opinion of JMA, the cumulative effect of each of these episodes (most significantly the excavations associated with the Holland Tunnel) preclude the possibility that intact archeological deposits are present at the proposed location of Shaft 29B. No additional archeological work is recommended for this location.

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FIGURES

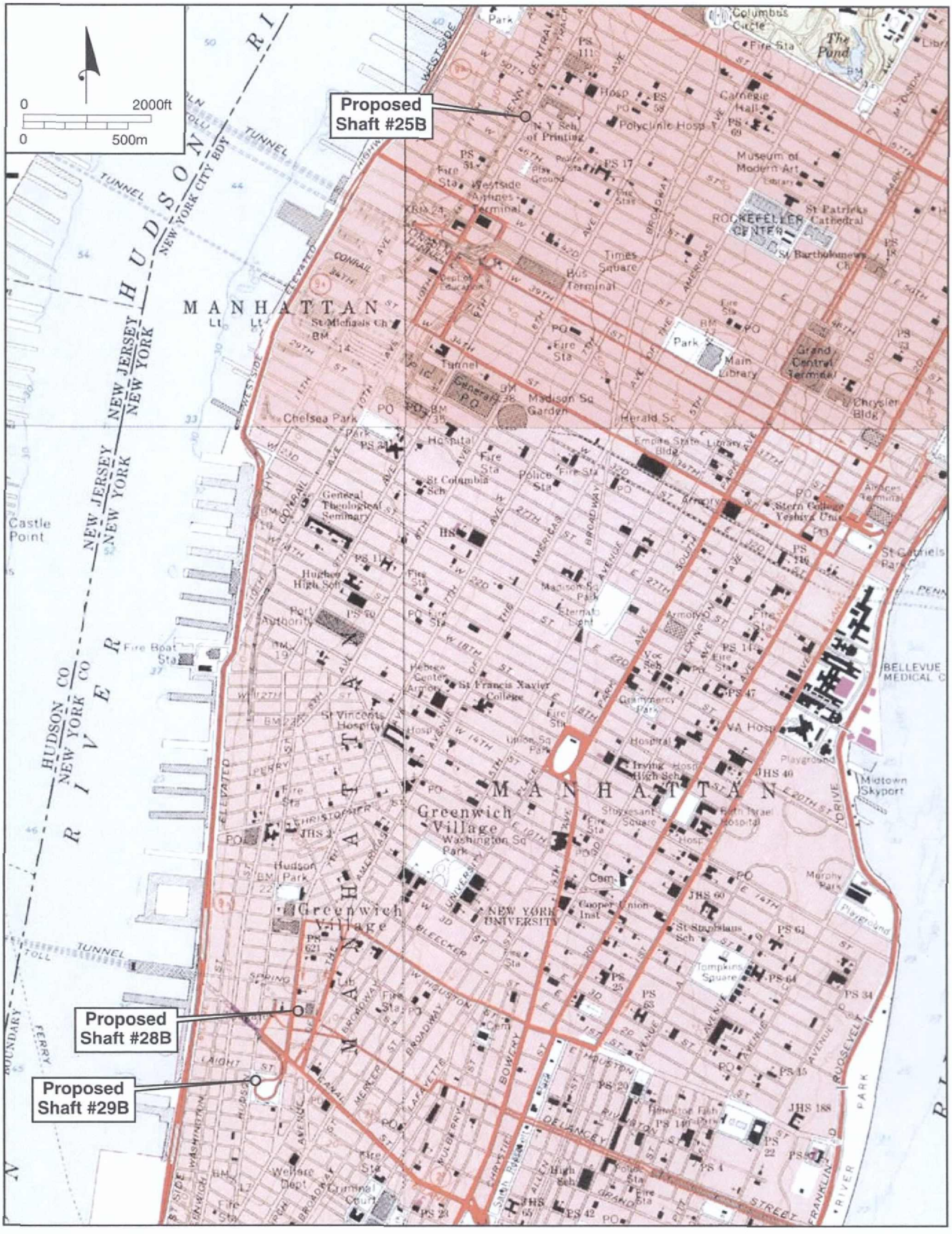


Figure 1. Detail of the *Central Park, N.Y.* and *Brooklyn, N.Y.* 7.5-minute USGS topographic quadrangles showing the proposed locations of the NYC Water Tunnel #3 Uptake Shafts 25B, 28B, and 29B.

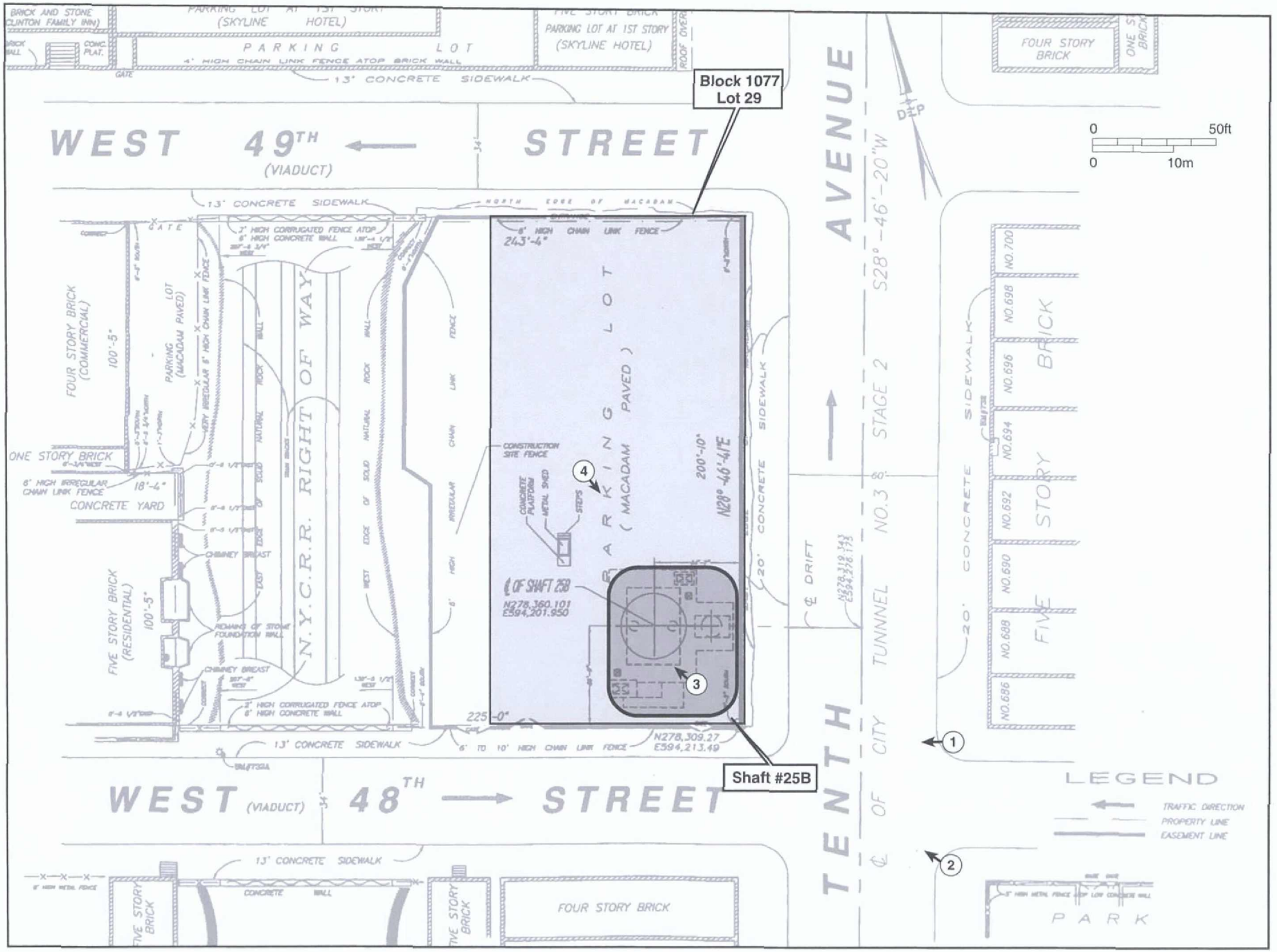


Figure 2. Project plans showing the location of proposed Shaft 25B within Block 1077; photographic views are indicated by Plate Number.

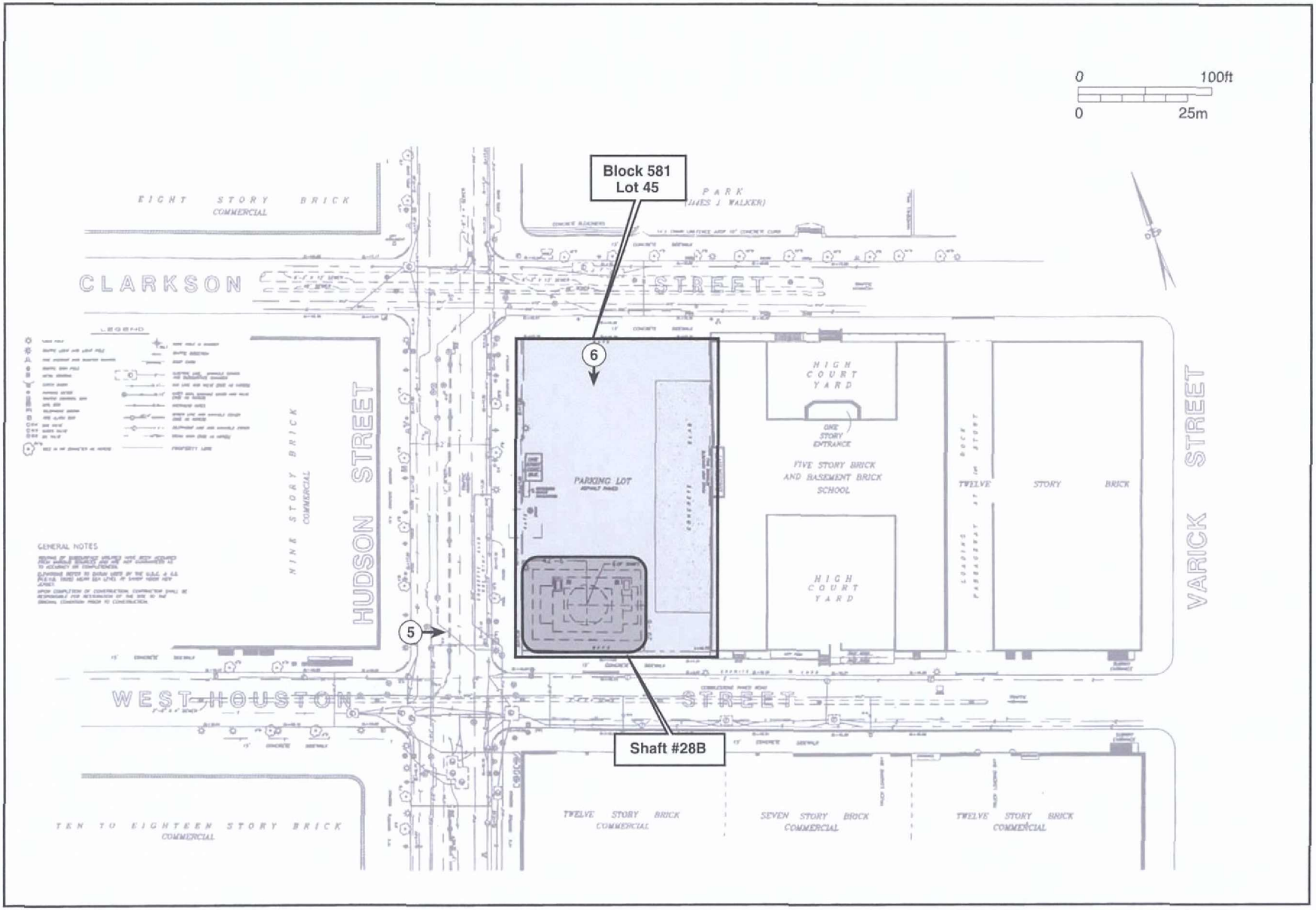


Figure 3. Project plans showing the location of proposed Shaft 28B within Block 581; photographic views are indicated by Plate Number.

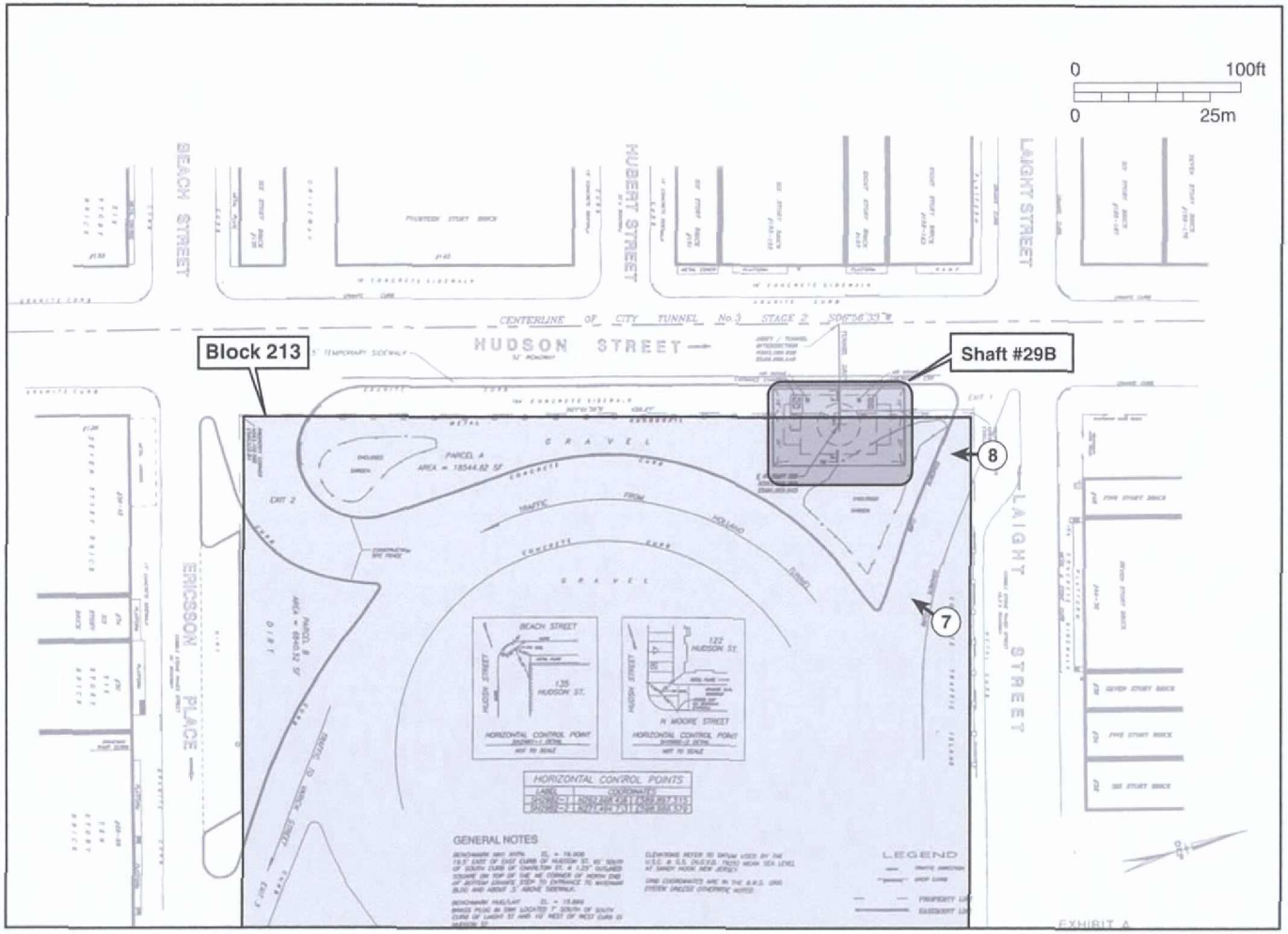


Figure 4. Project plans showing the location of proposed Shaft 29B within Block 213; photographic views are indicated by Plate Number.

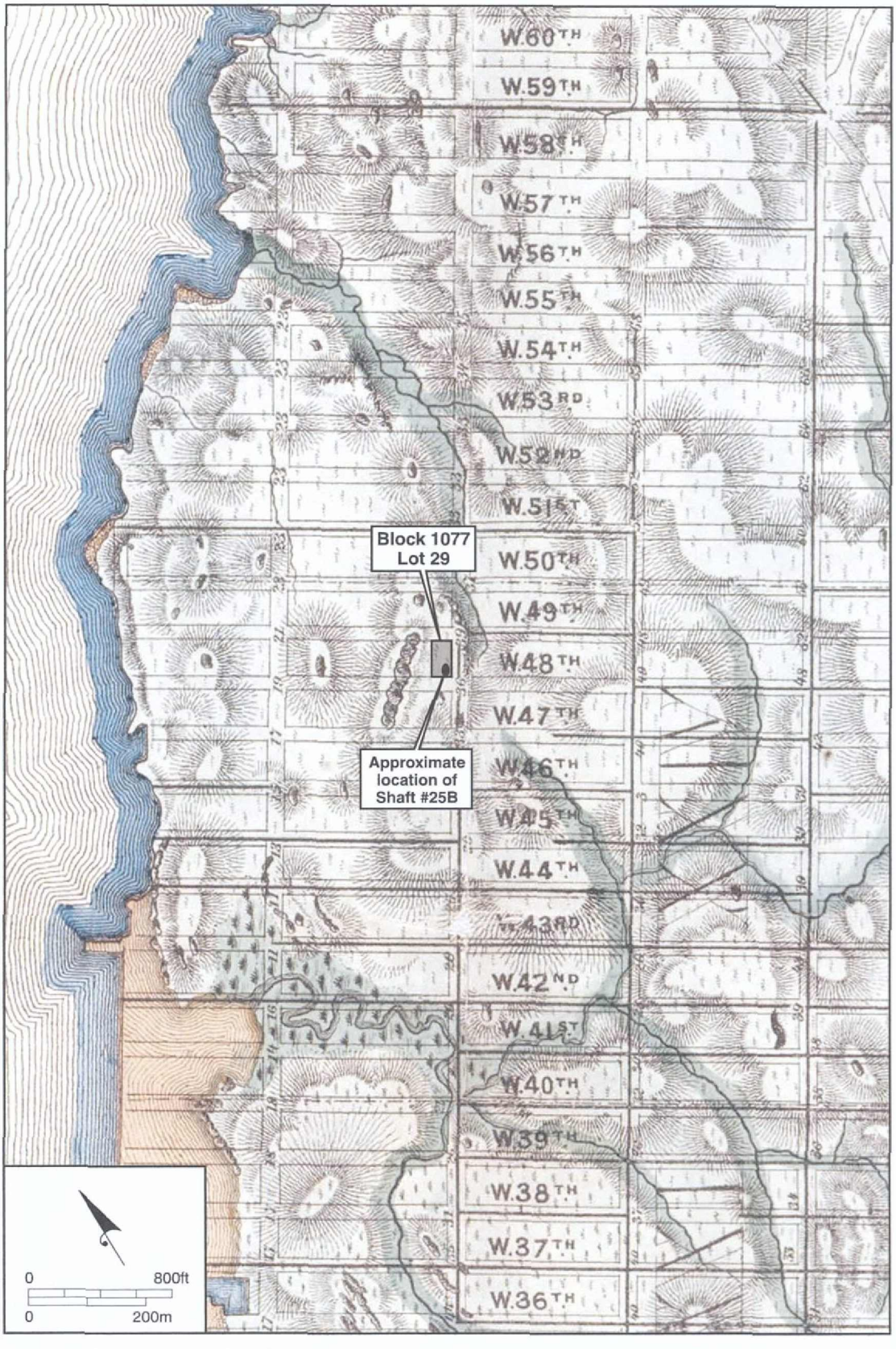


Figure 5. Detail of the 1865 Viele *Sanitary & Topographical Map of the City and Island of New York* showing the pre-development topography in the vicinity of Block 1077 (Shaft 25B).

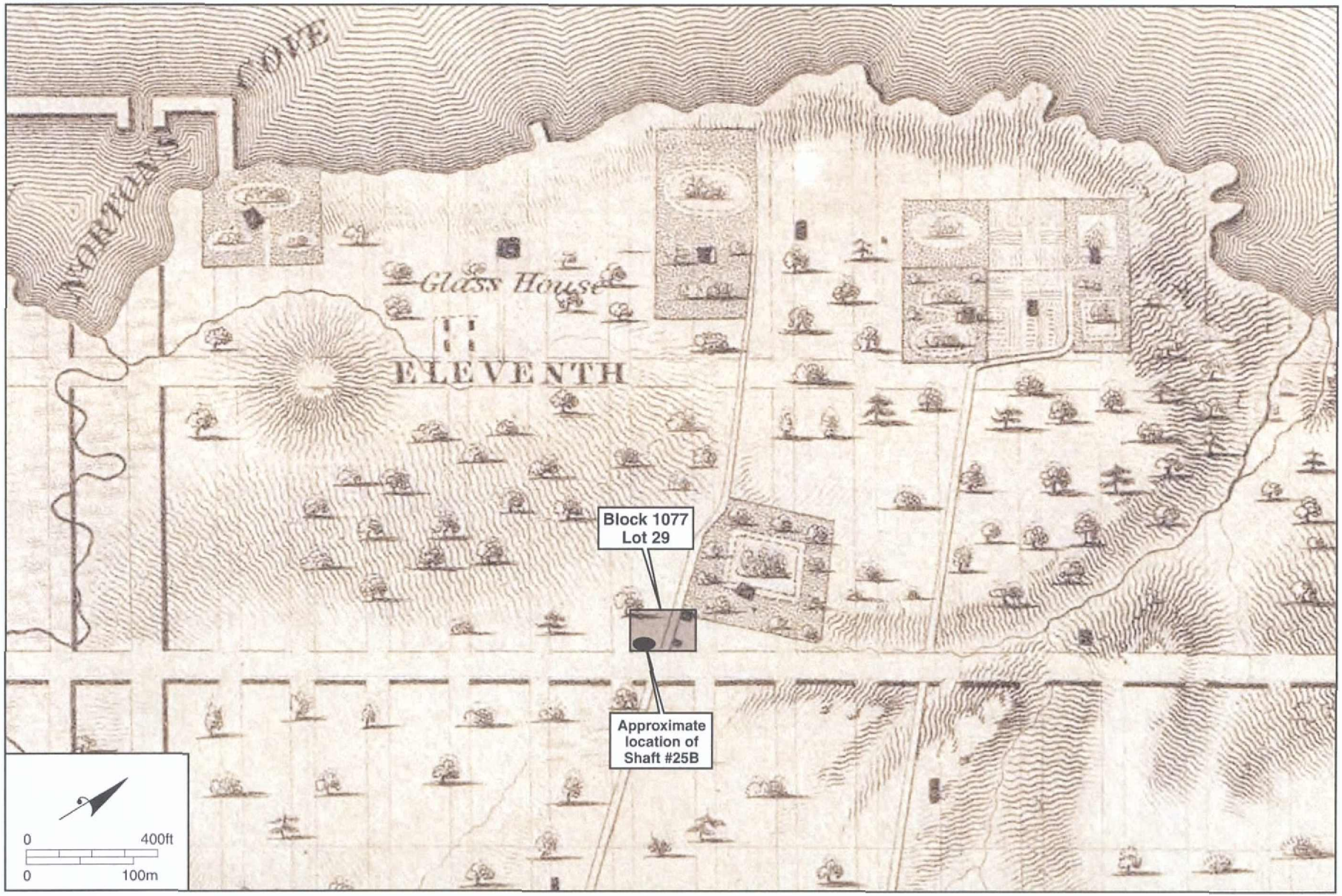


Figure 6. Detail of the 1836 Colton *Topographical Map of the City and County of New York* showing the vicinity of Block 1077 (Shaft 25B).

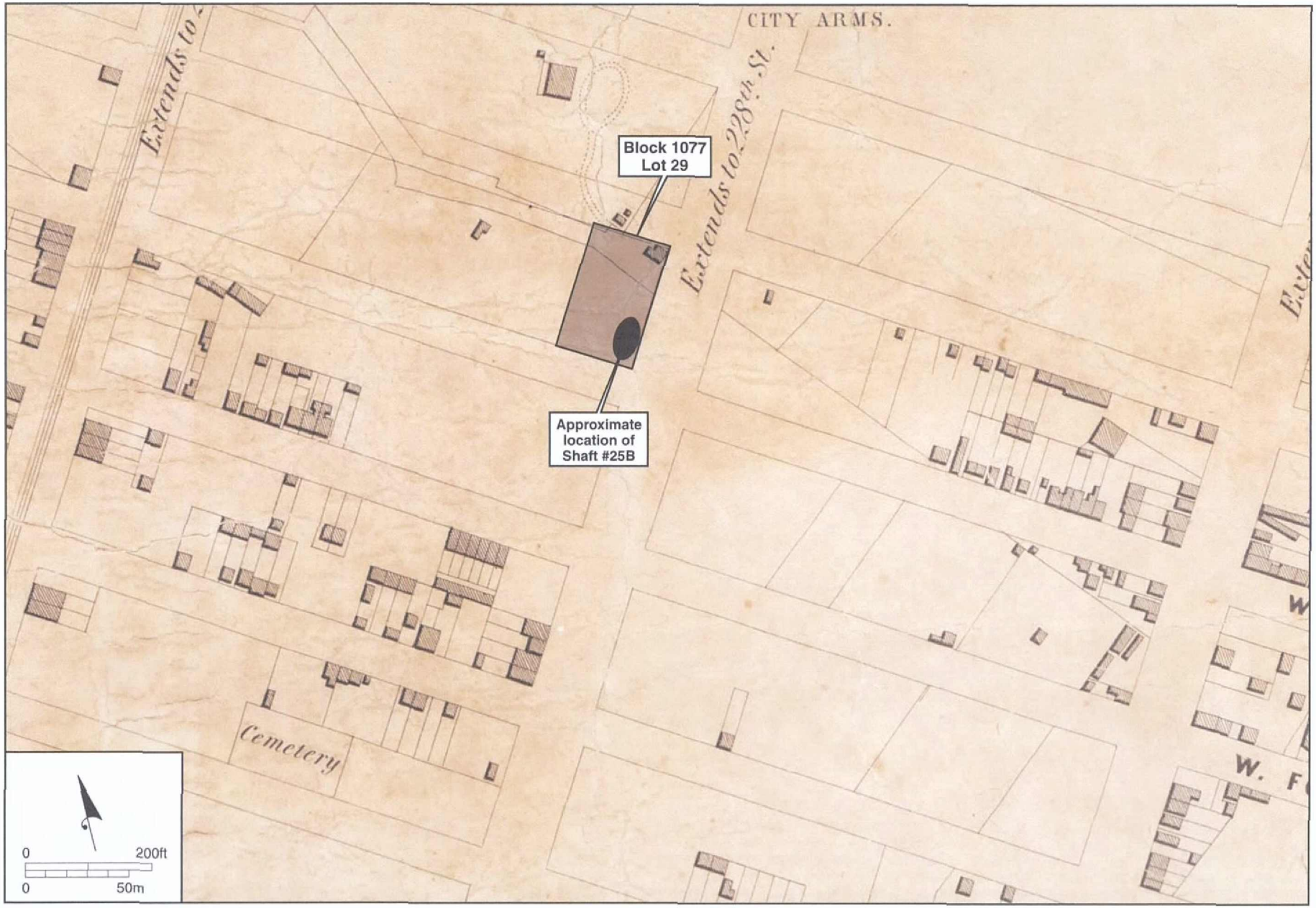


Figure 7. Detail of the 1852 Dripps *Map of the City of New York* showing the vicinity of Block 1077 (Shaft 25B).

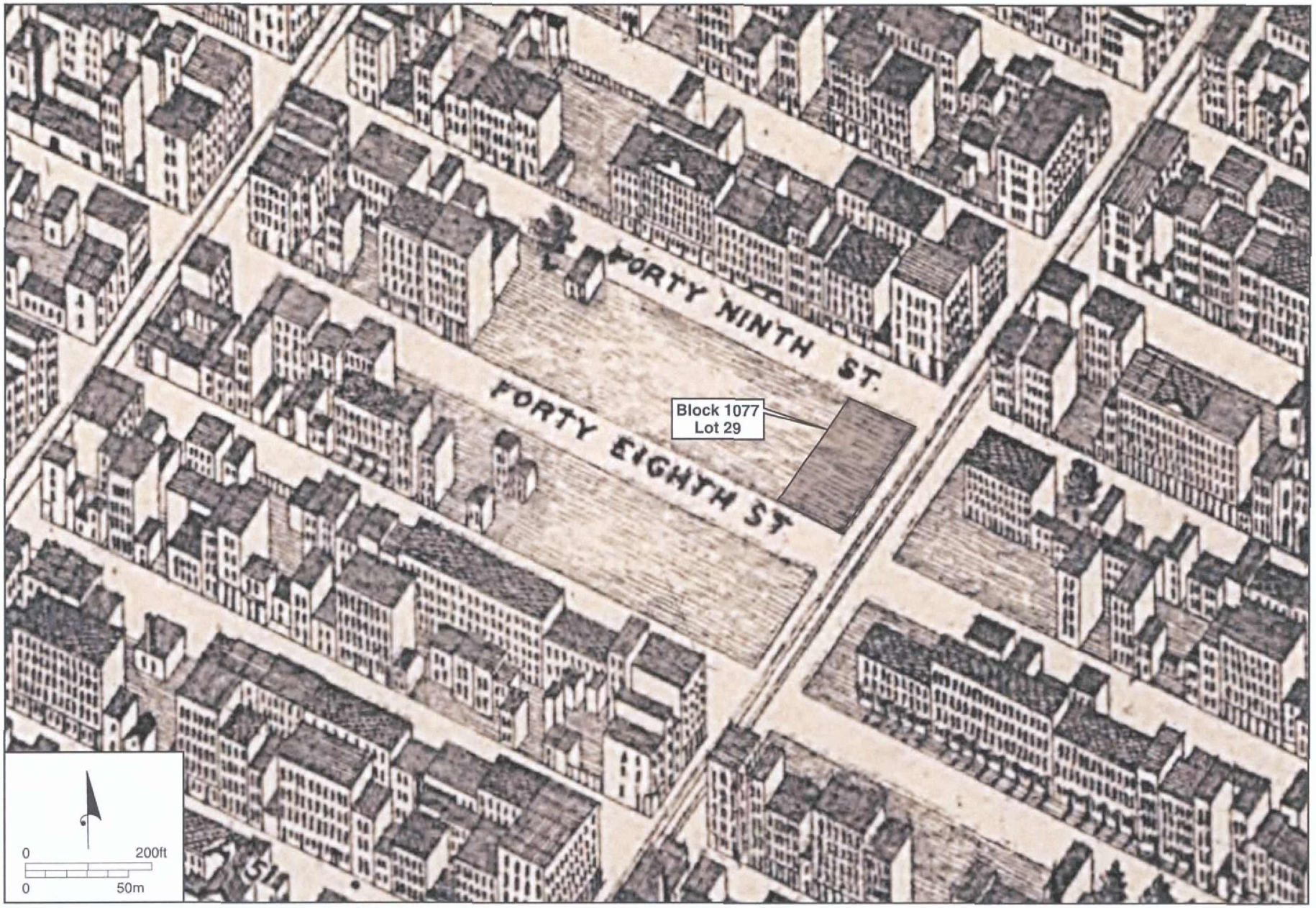


Figure 8. Detail of the 1879 Galt & Hoy perspective drawing/"bird's eye" map showing the vicinity of Block 1077 (Shaft 25B).

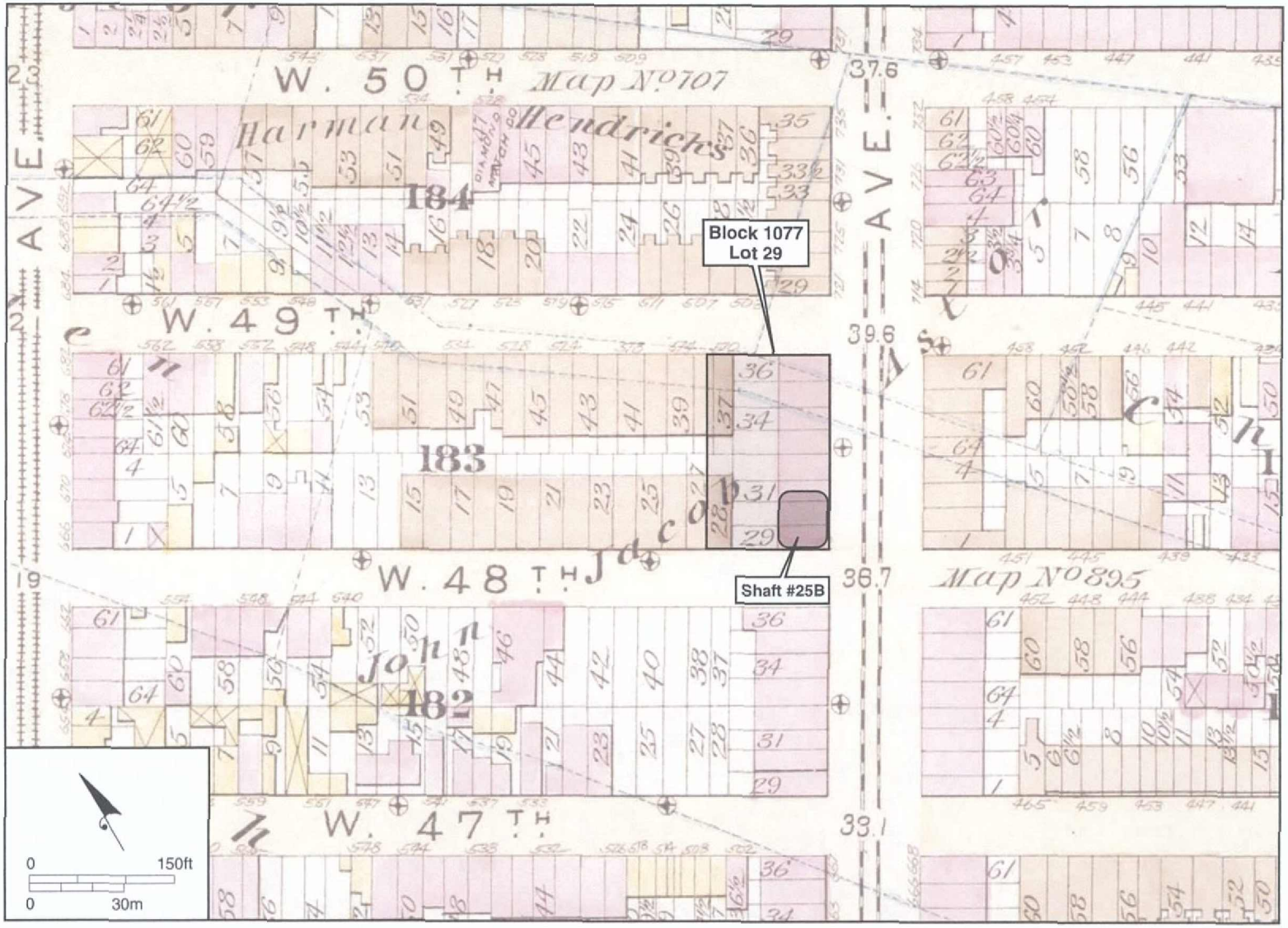


Figure 9. Detail of the 1885 Robinson *Atlas of the City of New York* showing the vicinity of Block 1077 (Shaft 25B).

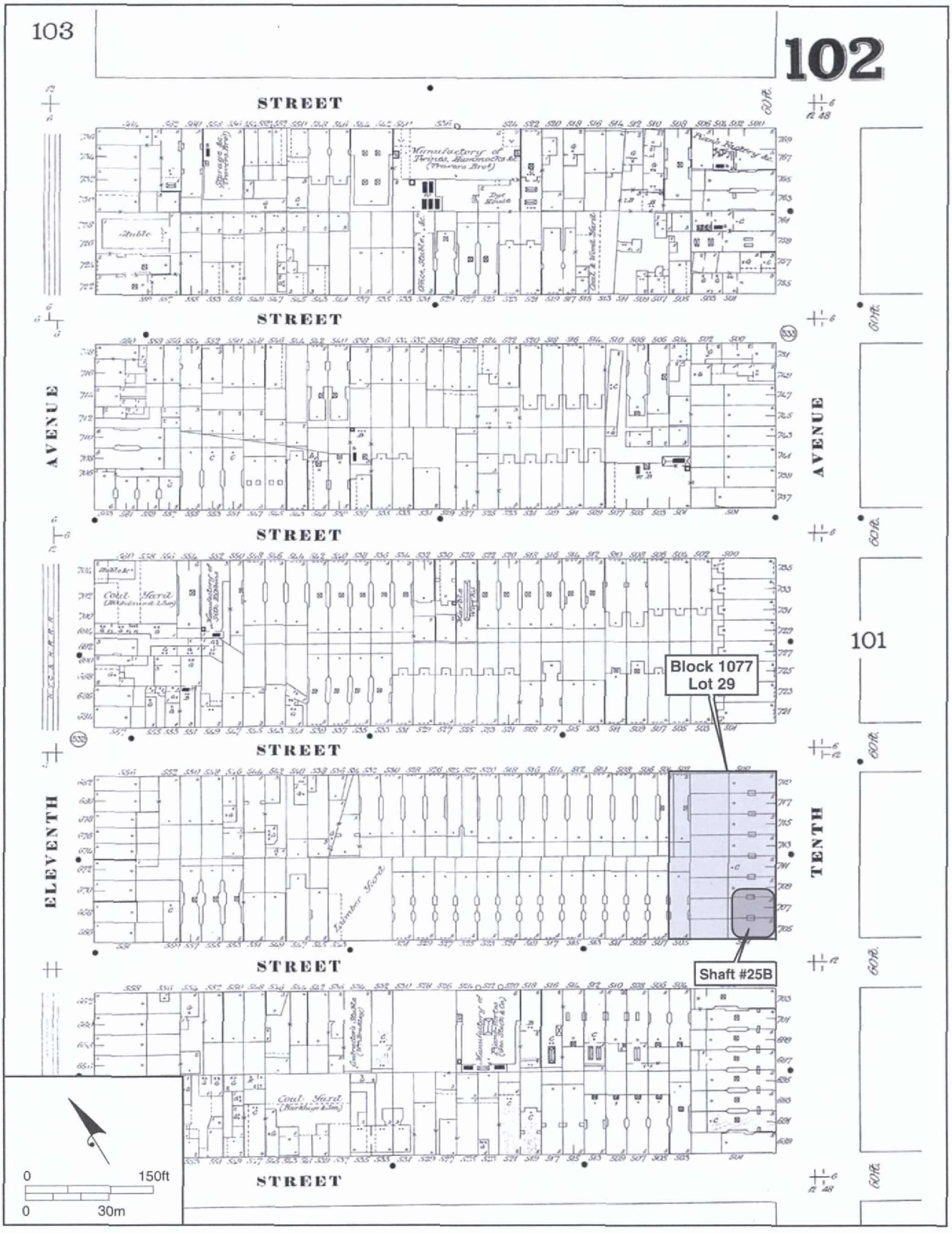


Figure 10. Detail of the 1890 Sanborn *Insurance Maps of the City of New York* showing the vicinity of Block 1077 (Shaft 25B).

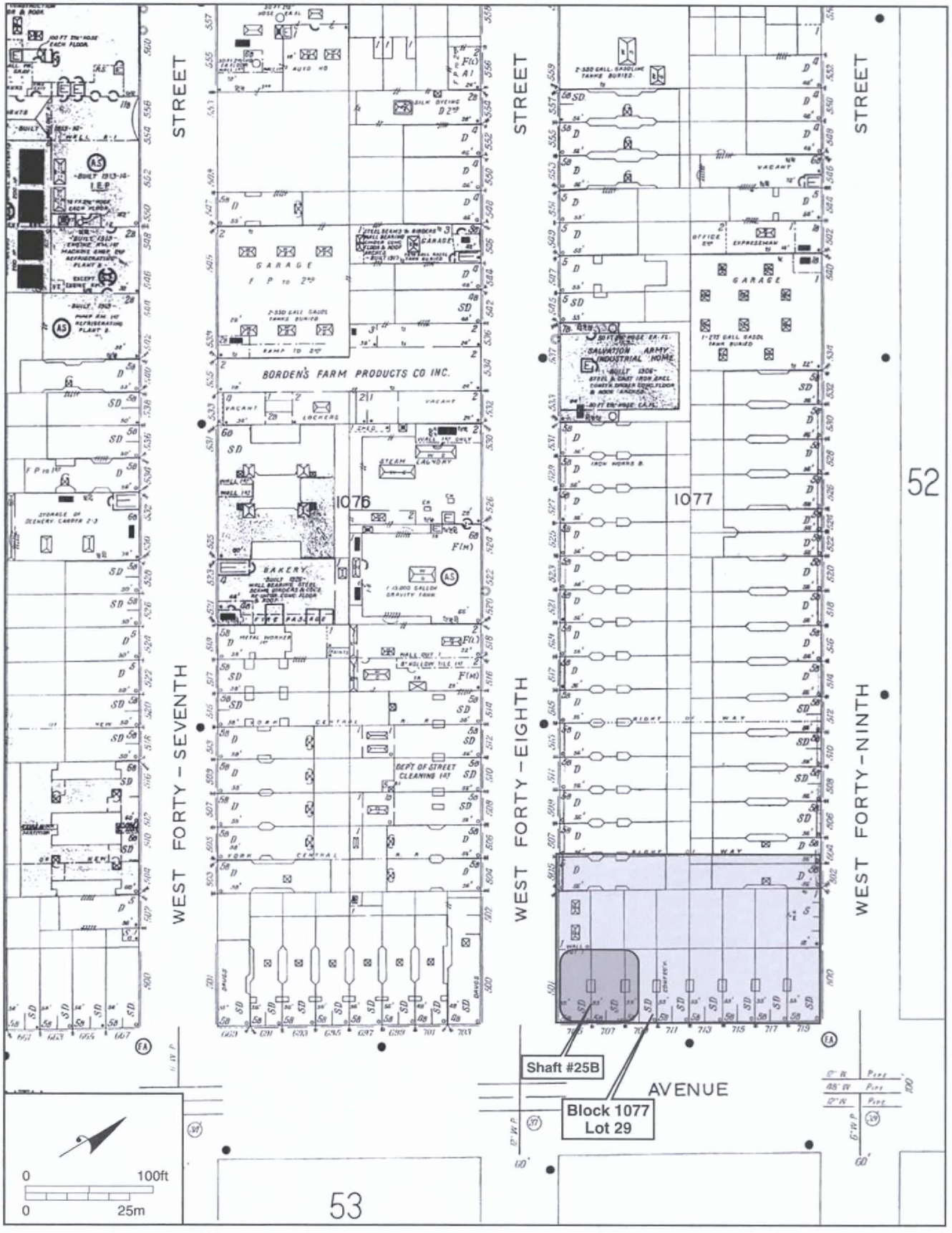


Figure 11. Detail of the 1930 Sanborn *Insurance Maps of the City of New York* showing the vicinity of Block 1077 (Shaft 25B).

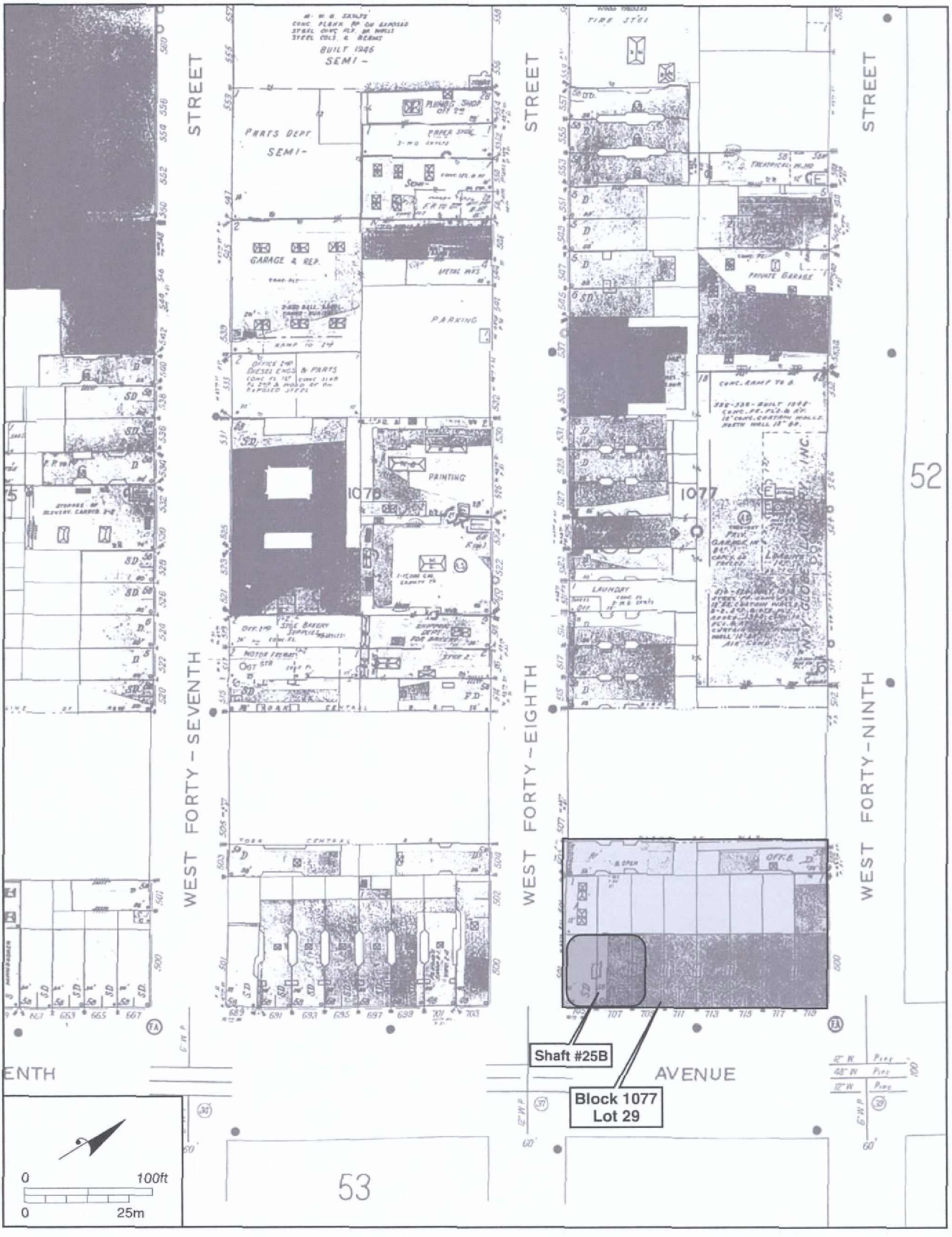


Figure 12. Detail of the 1951 Sanborn *Insurance Maps of the City of New York* showing the vicinity of Block 1077 (Shaft 25B).

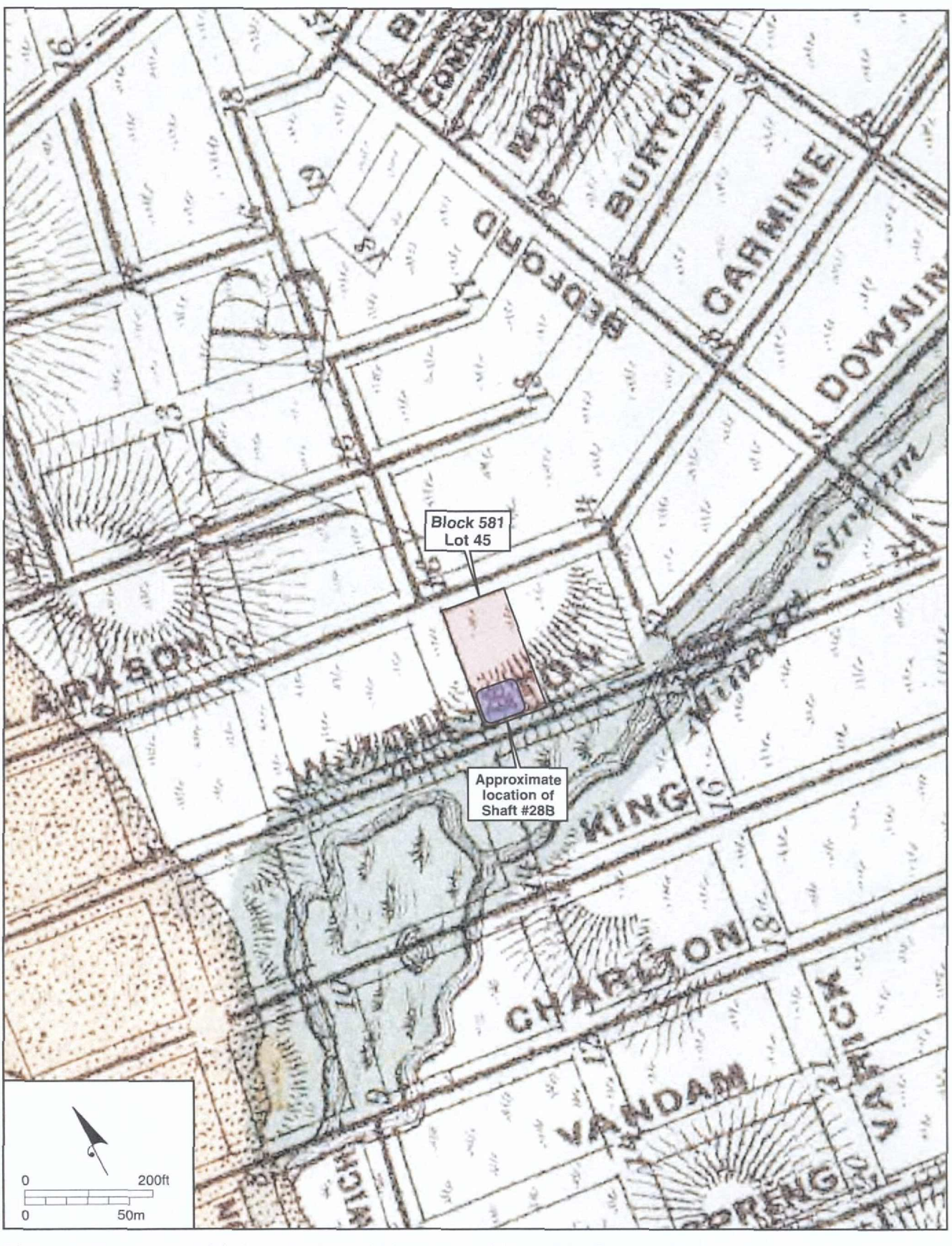


Figure 13. Detail of the 1865 Viele *Sanitary & Topographical Map of the City and Island of New York* showing the pre-development topography in the vicinity of Block 581 (Shaft 28B).

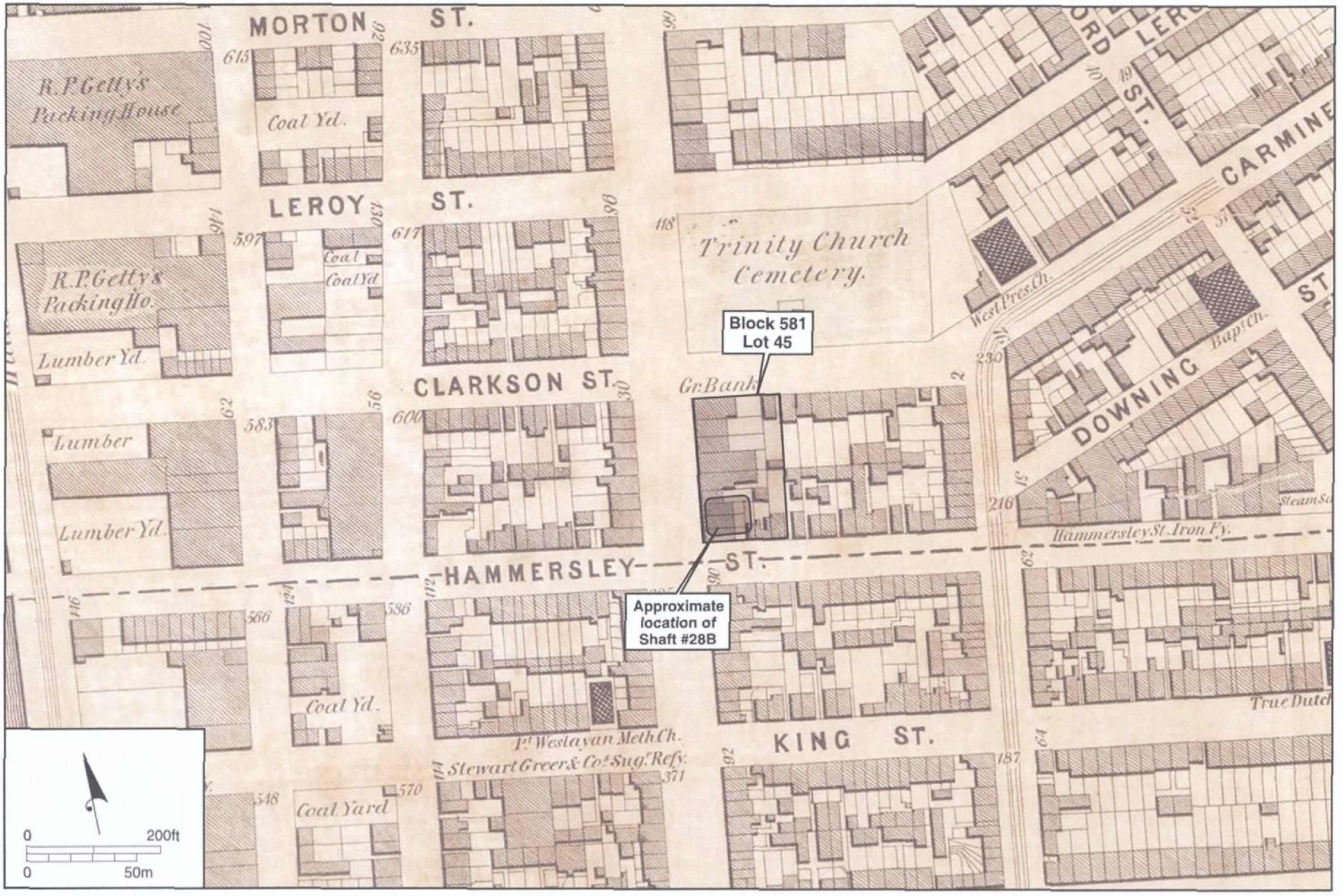


Figure 14. Detail of the 1852 Dripps *Map of the City of New York* showing the vicinity of Block 581 (Shaft 28B).

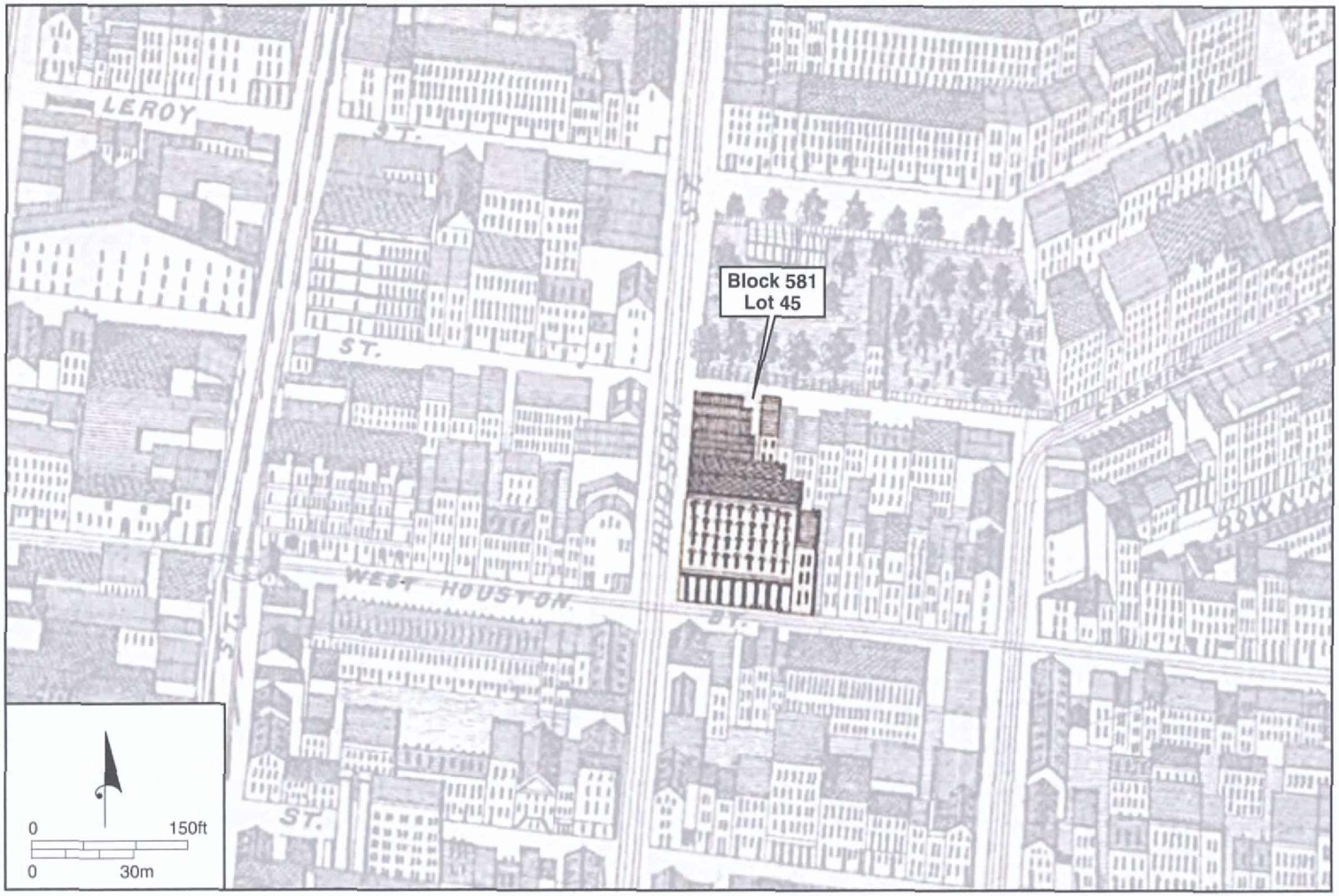


Figure 15. Detail of the 1879 Galt & Hoy perspective drawing/'bird's eye" map showing the vicinity of Block 581 (Shaft 28B).

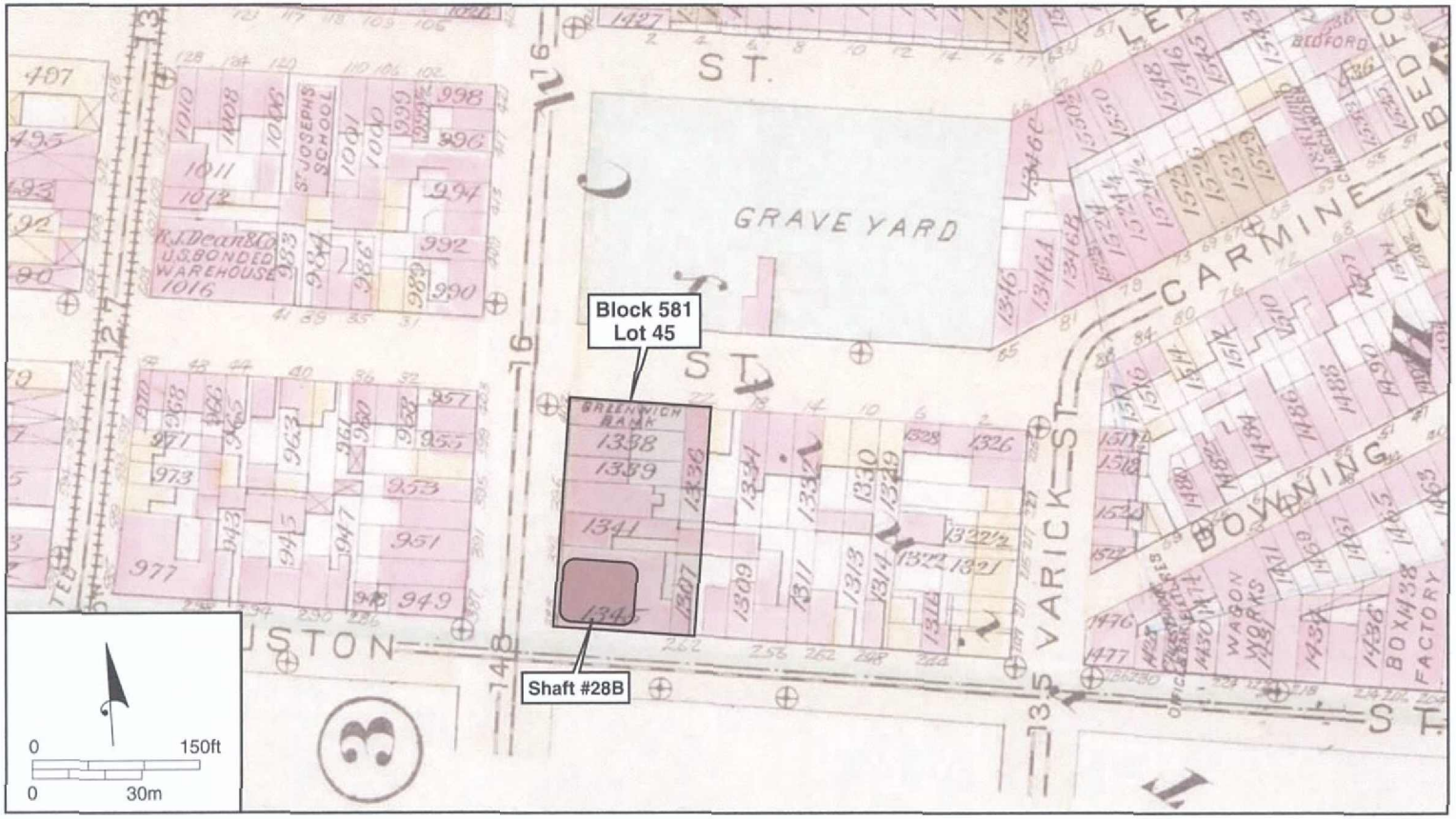


Figure 16. Detail of the 1885 Robinson *Atlas of the City of New York* showing the vicinity of Block 581 (Shaft 28B).

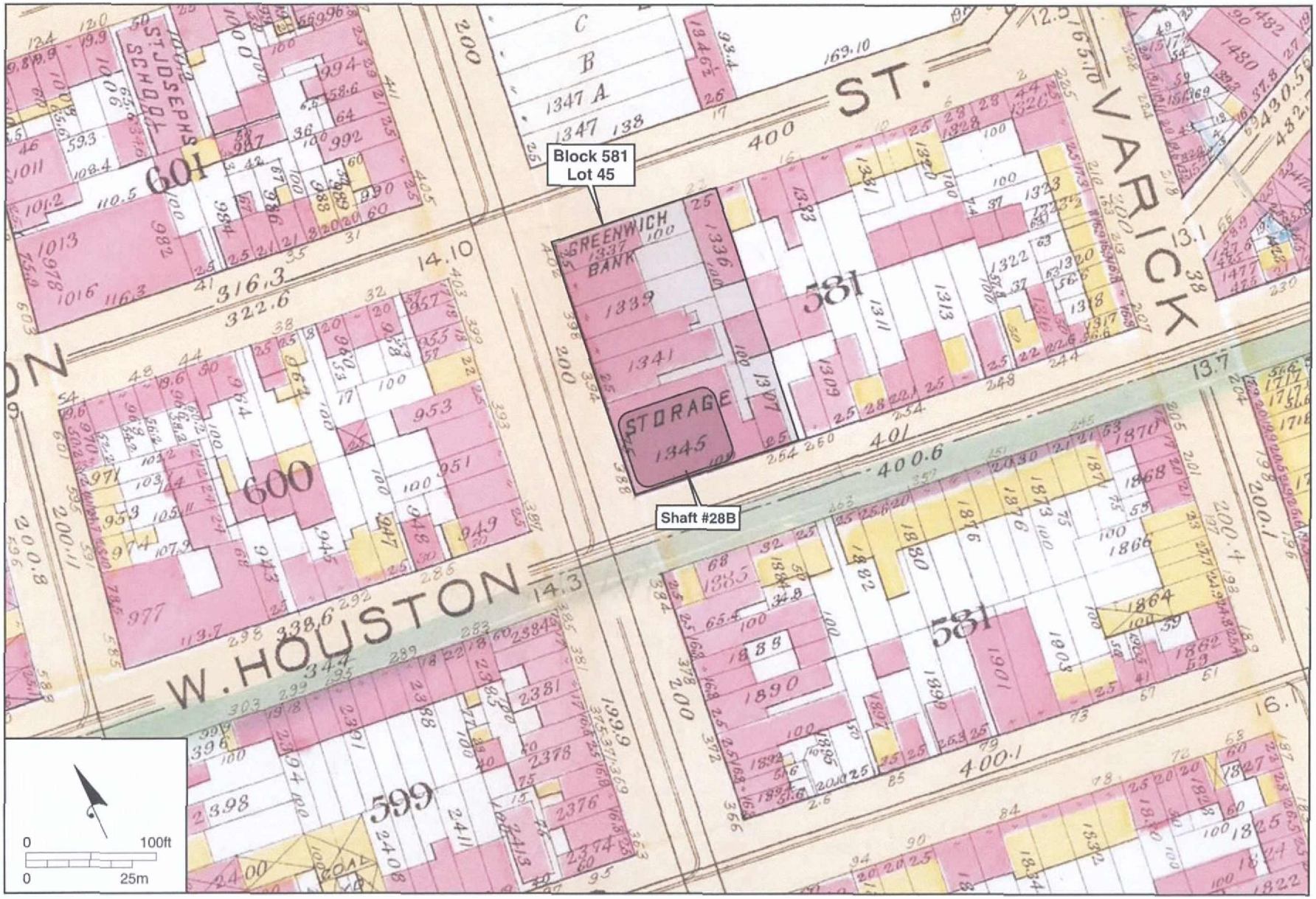


Figure 17. Detail of the 1891 Bromley *Atlas of the City of New York* showing the vicinity of Block 581 (Shaft 28B).

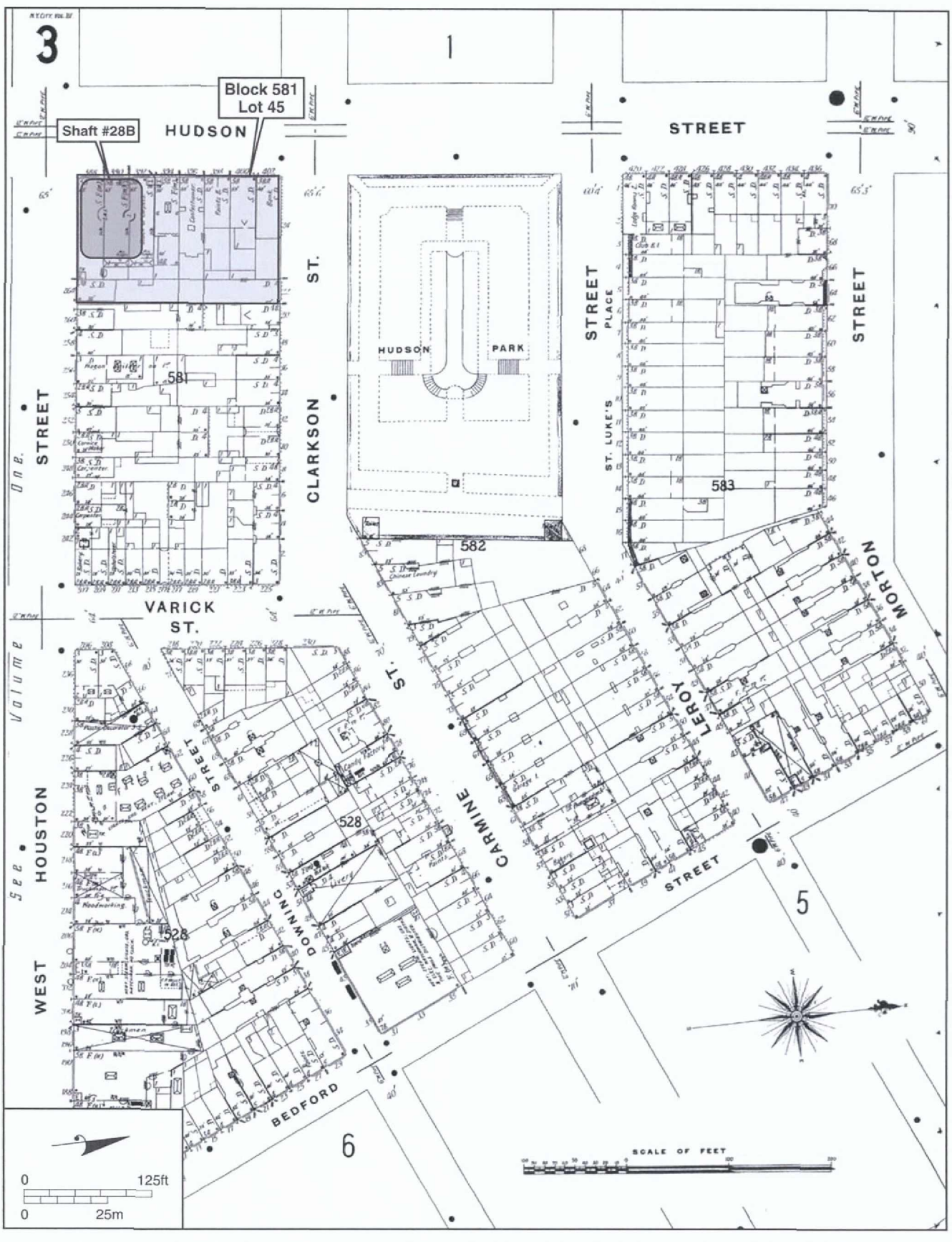


Figure 18. Detail of the 1904 Sanborn *Insurance Maps of the City of New York* showing the vicinity of Block 581 (Shaft 28B).

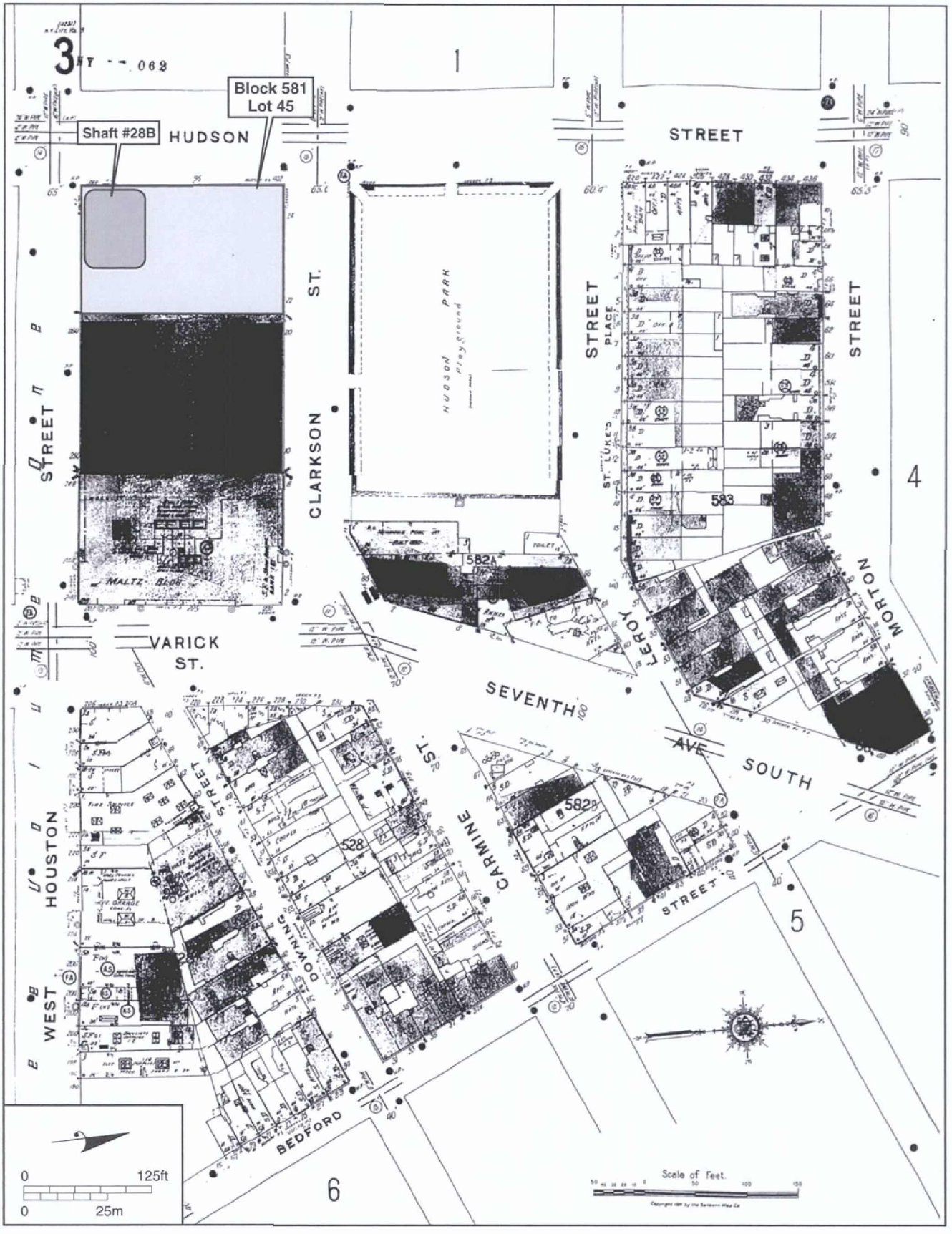


Figure 19. Detail of the 1951 Sanborn *Insurance Maps of the City of New York* showing the vicinity of Block 581 (Shaft 28B).

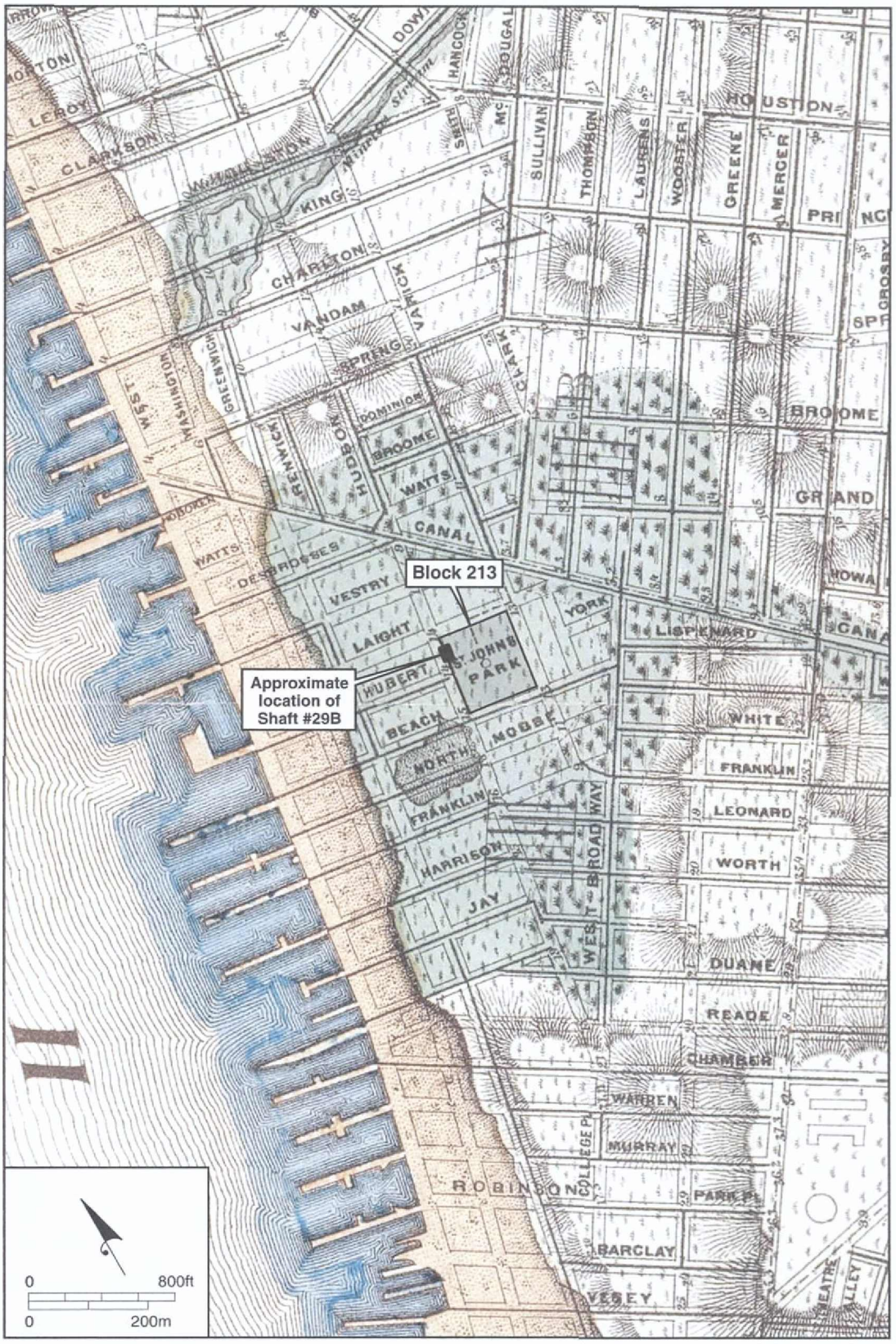


Figure 20. Detail of the 1865 Viele *Sanitary & Topographical Map of the City and Island of New York* showing the pre-development topography in the vicinity of Block 213 (Shaft 29B).

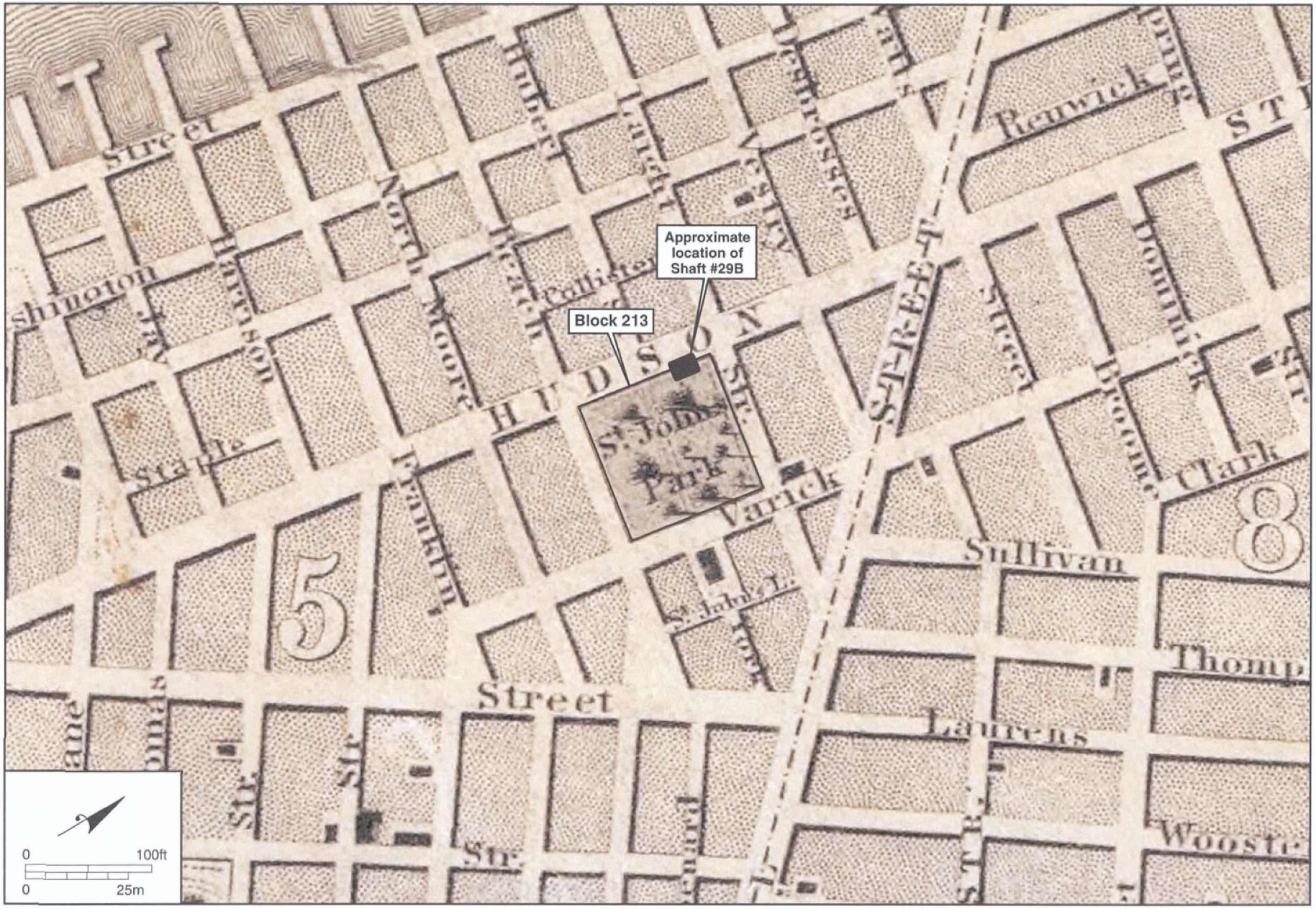


Figure 21. Detail of the 1836 Colton *Topographical Map of the City and County of New York* showing the vicinity of Block 213 (Shaft 29B).

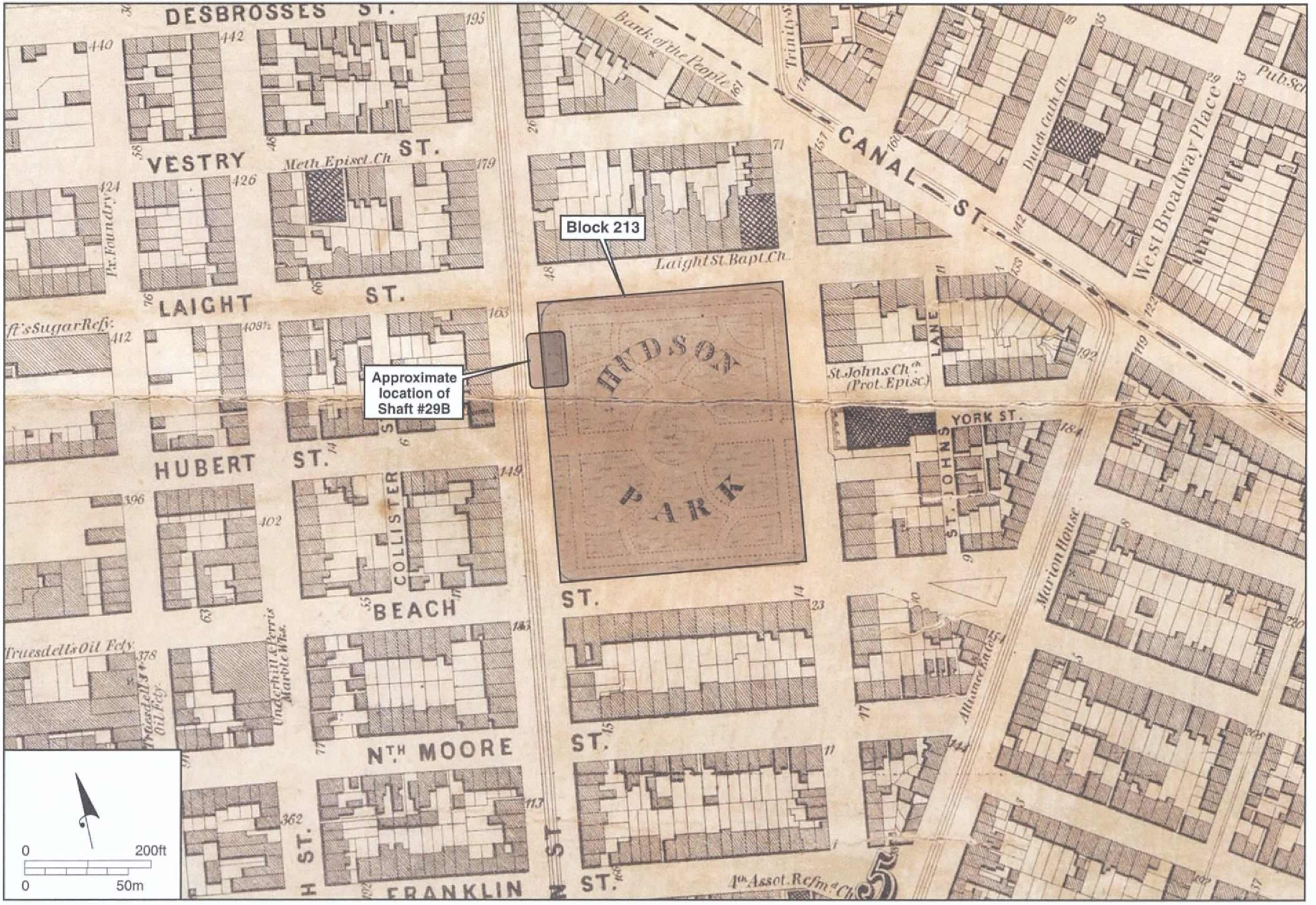


Figure 22. Detail of the 1852 Dripps *Map of the City of New York* showing the vicinity of Block 213 (Shaft 29B).

Figure 23. Early-nineteenth-century engraving of St. John's Chapel from within Hudson Square (Block 213)(Stokes 1918:Plate 106-a).

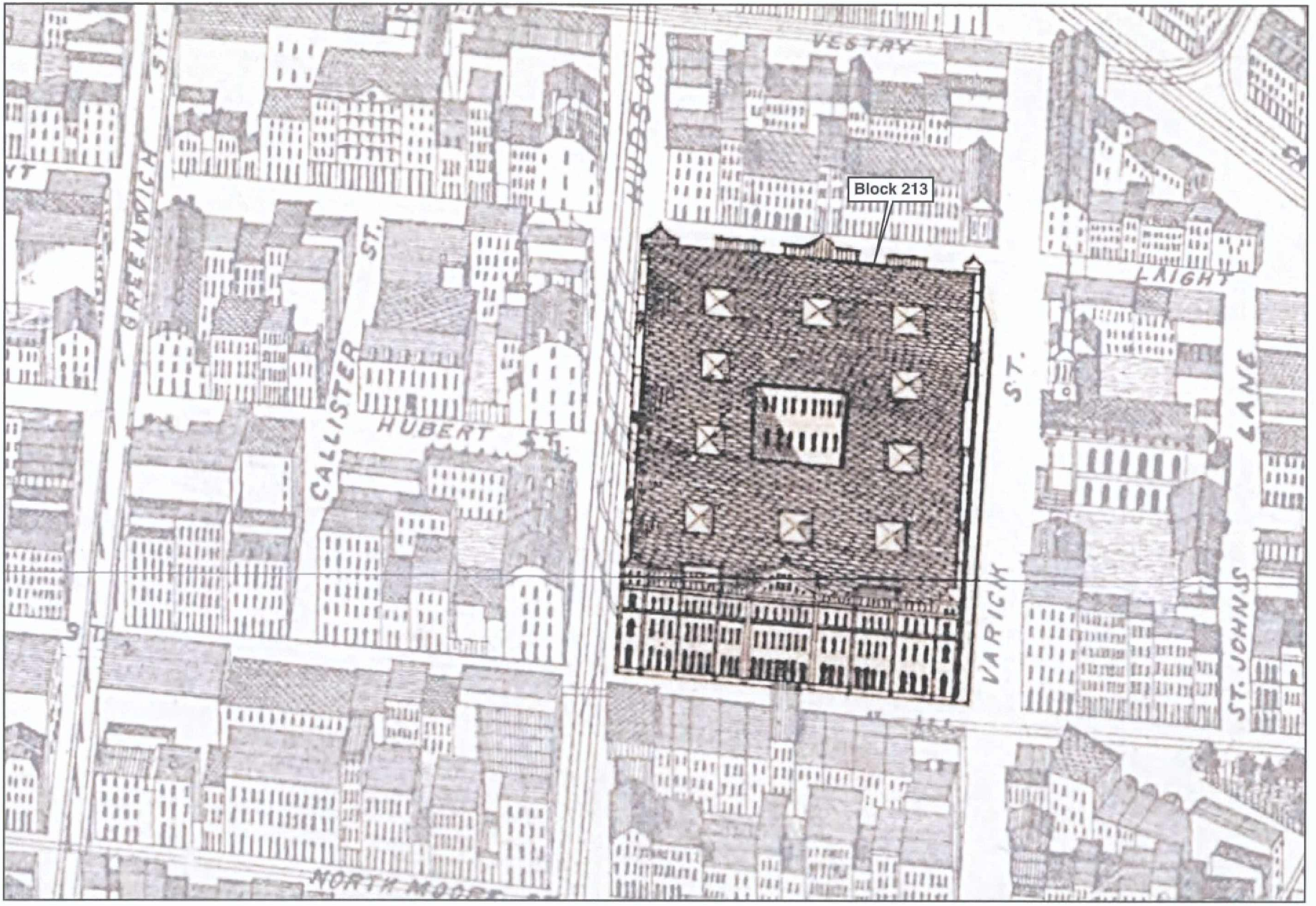


Figure 24. Detail of the 1879 Galt & Hoy perspective drawing/"bird's eye" map showing the vicinity of Block 213 (Shaft 29B).

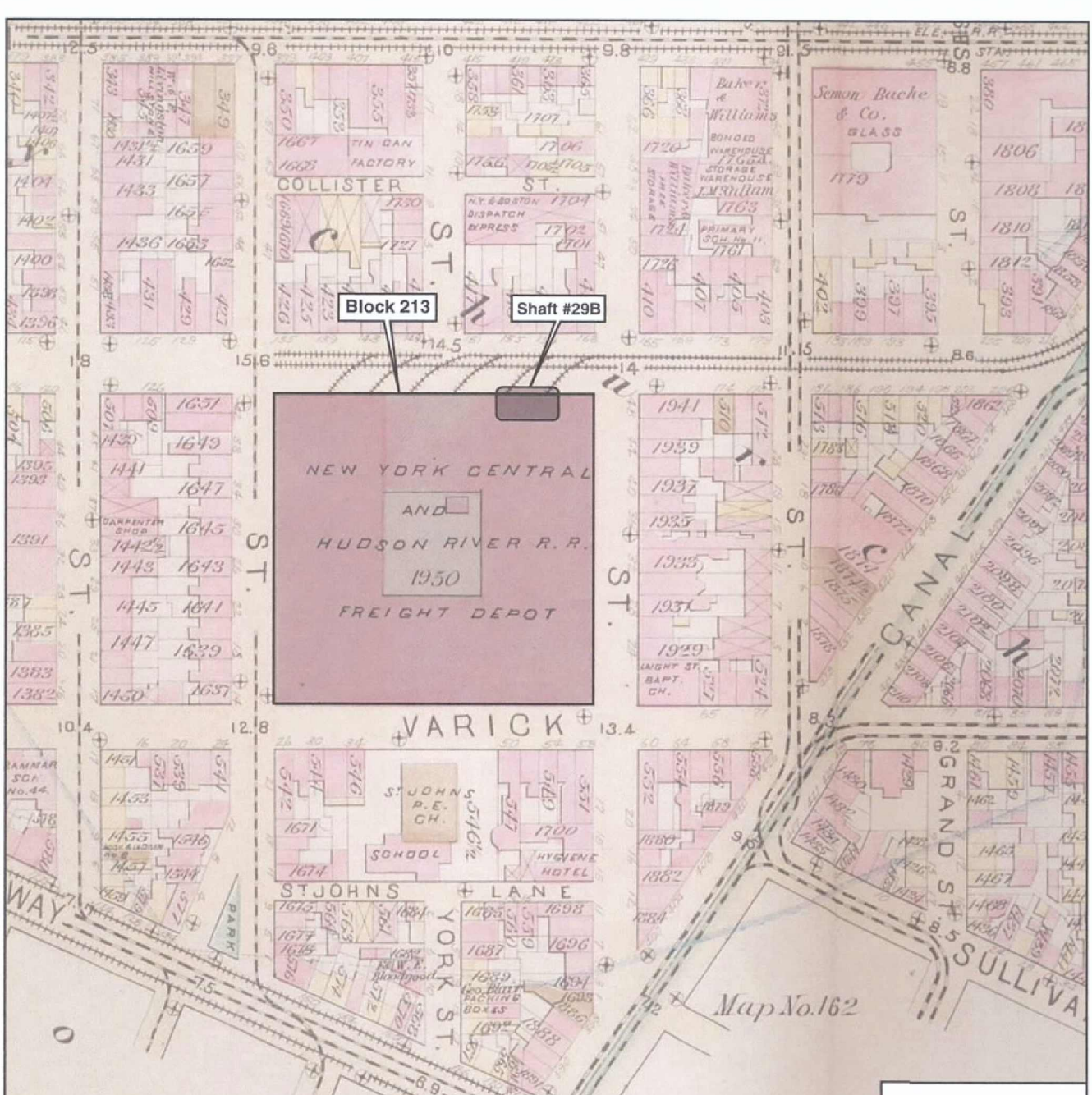


Figure 25. Detail of the 1885 Robinson *Atlas of the City of New York* showing the vicinity of Block 213 (Shaft 29B).

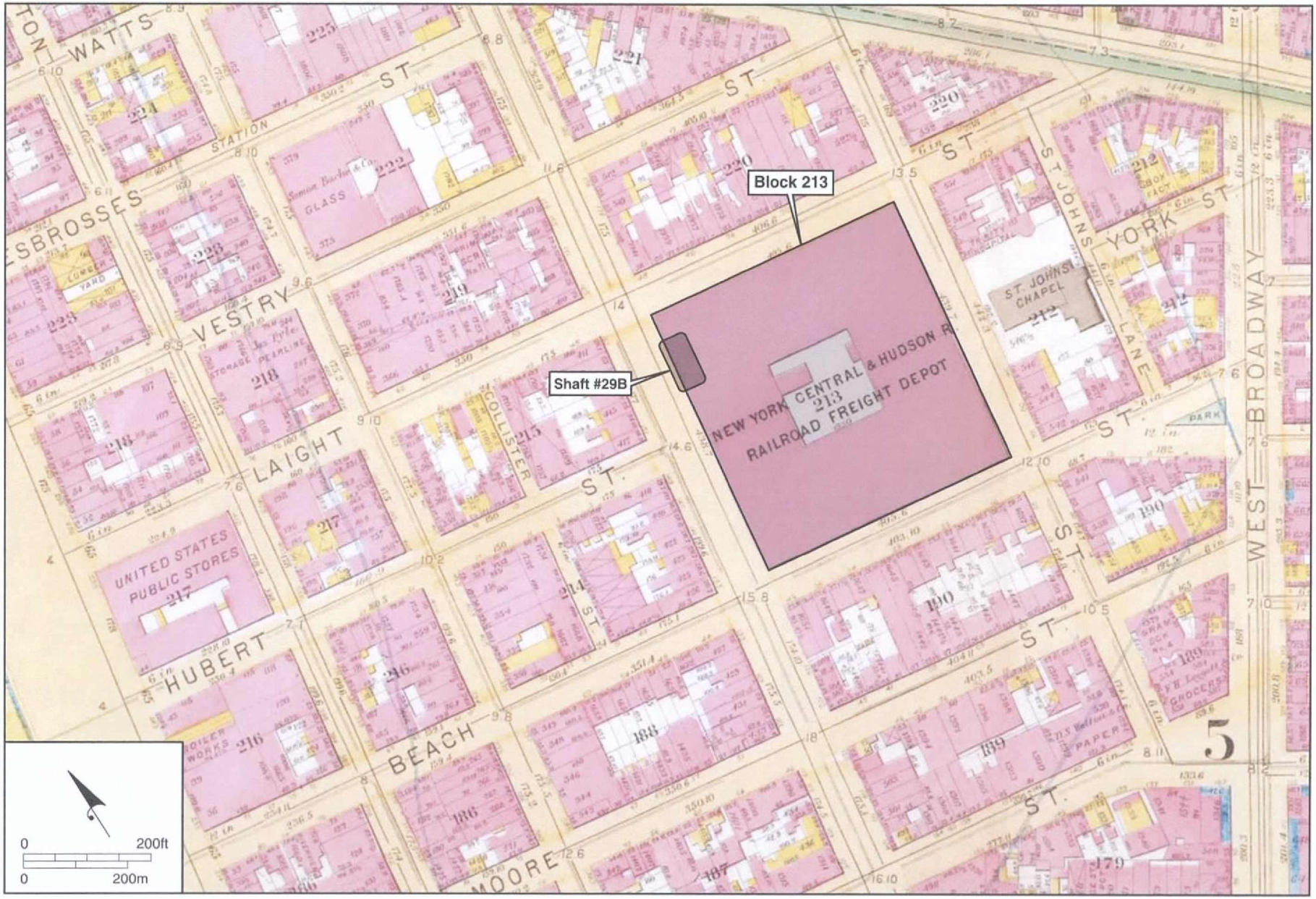


Figure 26. Detail of the 1891 Bromley *Atlas of the City of New York* showing the vicinity of Block 213 (Shaft 29B).

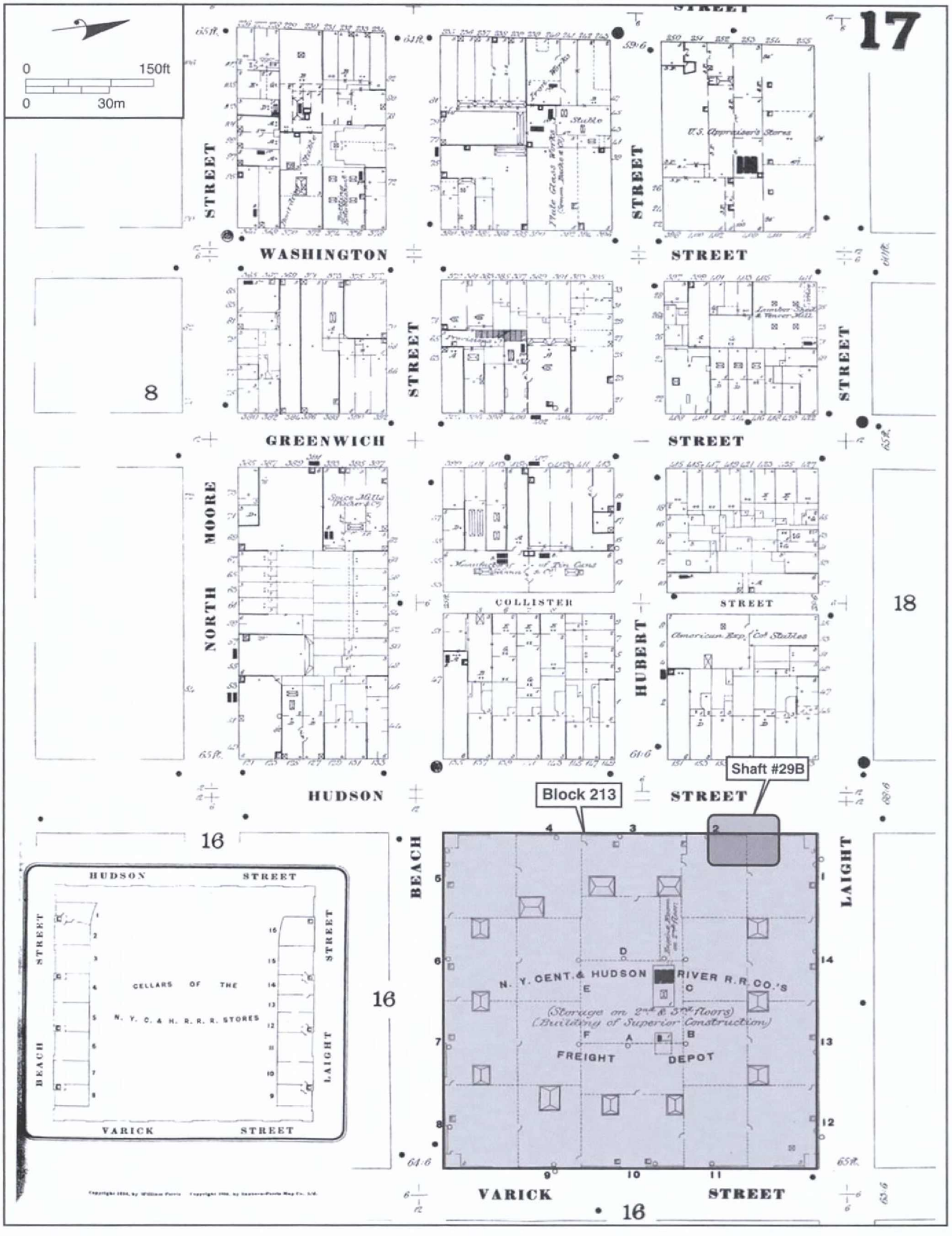


Figure 27. Detail of the 1894 Sanborn *Insurance Maps of the City of New York* showing the vicinity of Block 213 (Shaft 29B).

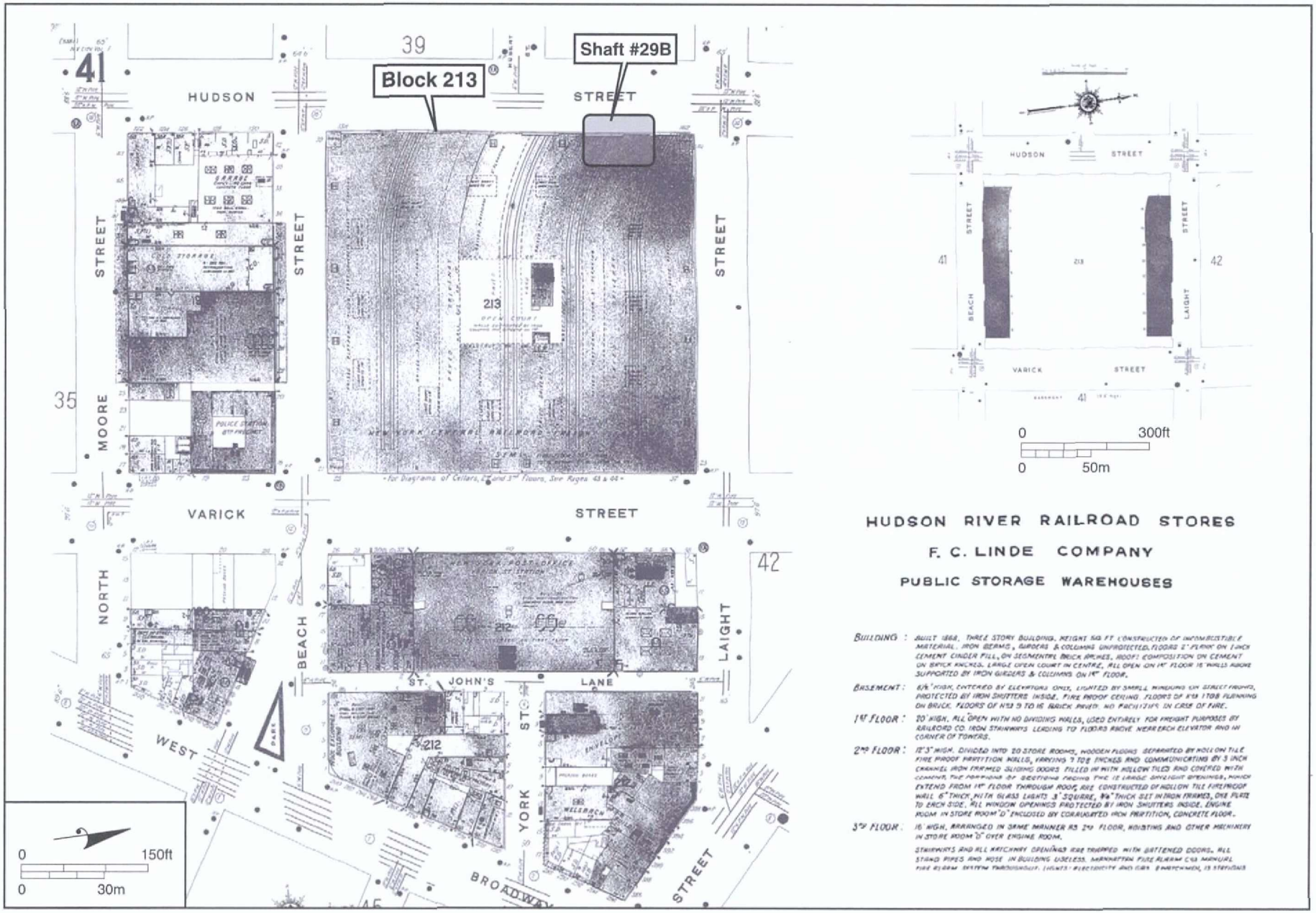


Figure 28. Detail of the 1922 Sanborn *Insurance Maps of the City of New York* showing the vicinity of Block 213 (Shaft 29B).

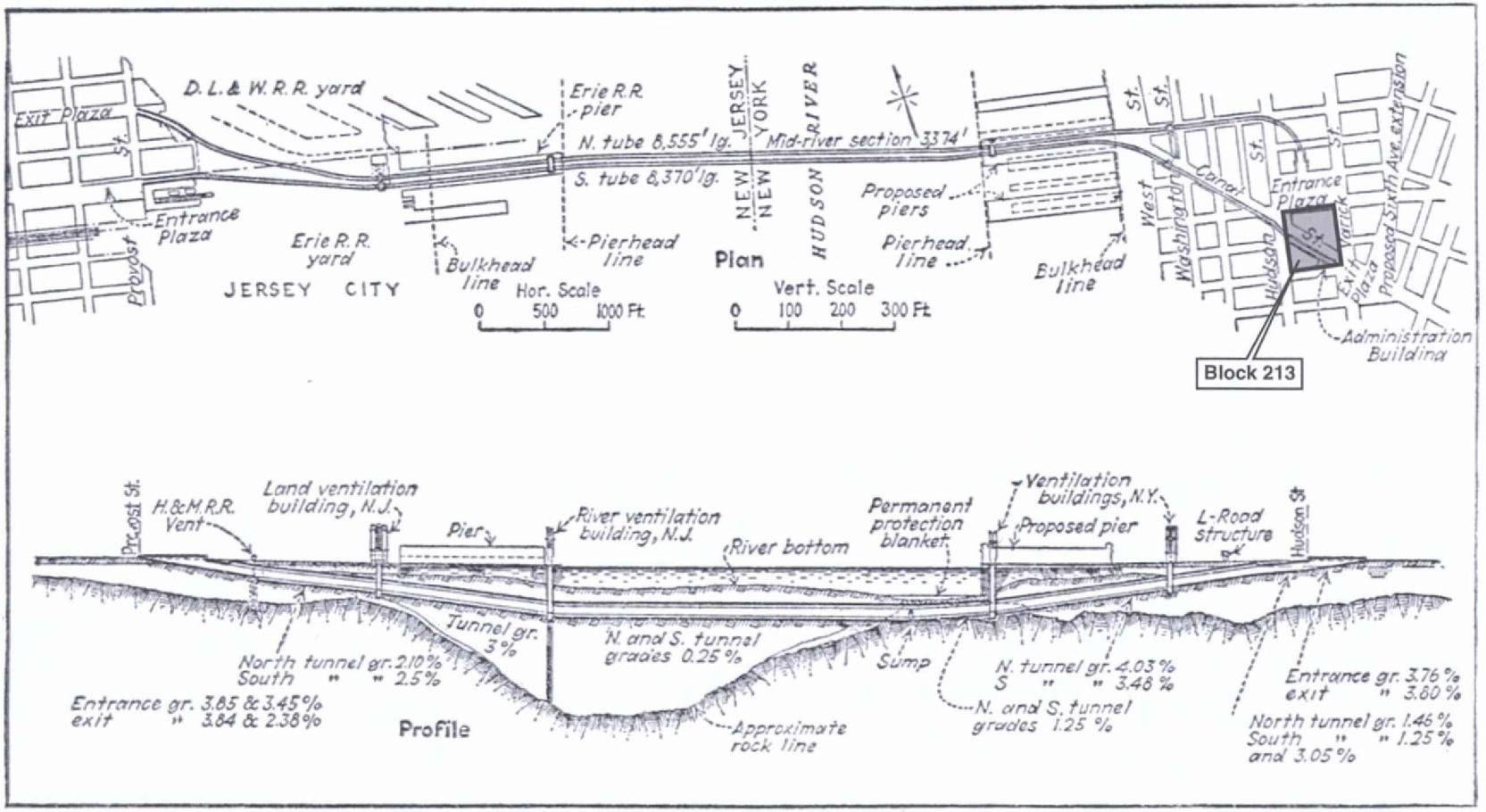


FIGURE 1.—Plan and profile of the Holland Tunnel

Figure 29. Schematic plan and profile drawing of the Holland Tunnel (from Gray and Hagen 1930) showing the exit plaza at Block 213 (Shaft 29B).

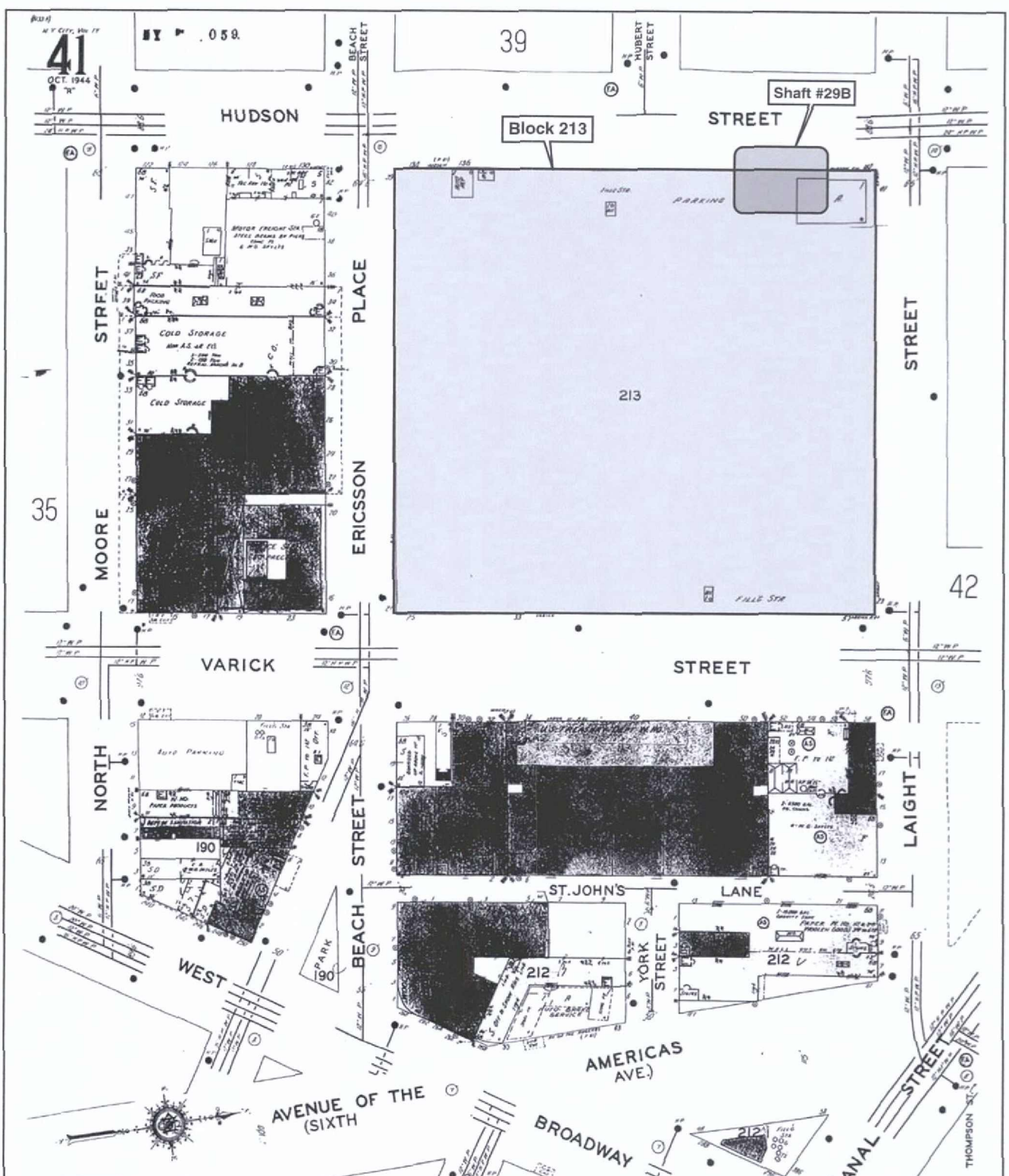


Figure 30. Detail of the 1951 Sanborn *Insurance Maps of the City of New York* showing the vicinity of Block 213 (Shaft 29B).

PLATES

Plate 1. Block 1077, Lot 29 (proposed Shaft 25B) from the corner of Tenth Avenue and West 49th Street; view to the west.

Plate 2. Block 1077, Lot 29 (proposed Shaft 25B) from the corner of Tenth Avenue and West 49th Street; view to the northwest.

Plate 3. The proposed location of Shaft 25B; view to the northwest.

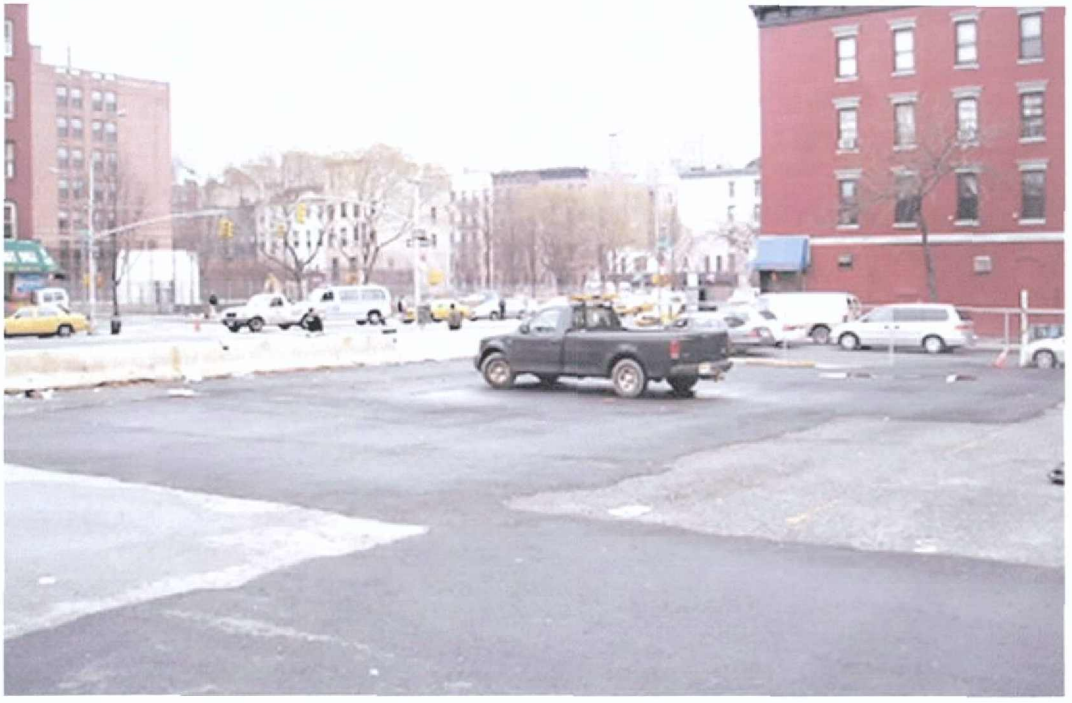


Plate 4. The proposed location of Shaft 25B; view to the southeast.

Plate 5. Block 581, Lot 45 (proposed Shaft 25B) from the corner of Hudson and West Houston Streets; view to the east.

Plate 6. The proposed location of Shaft 28B; view to the south.

Plate 7. The proposed location of Shaft 29B (Block 213); view to the southwest.

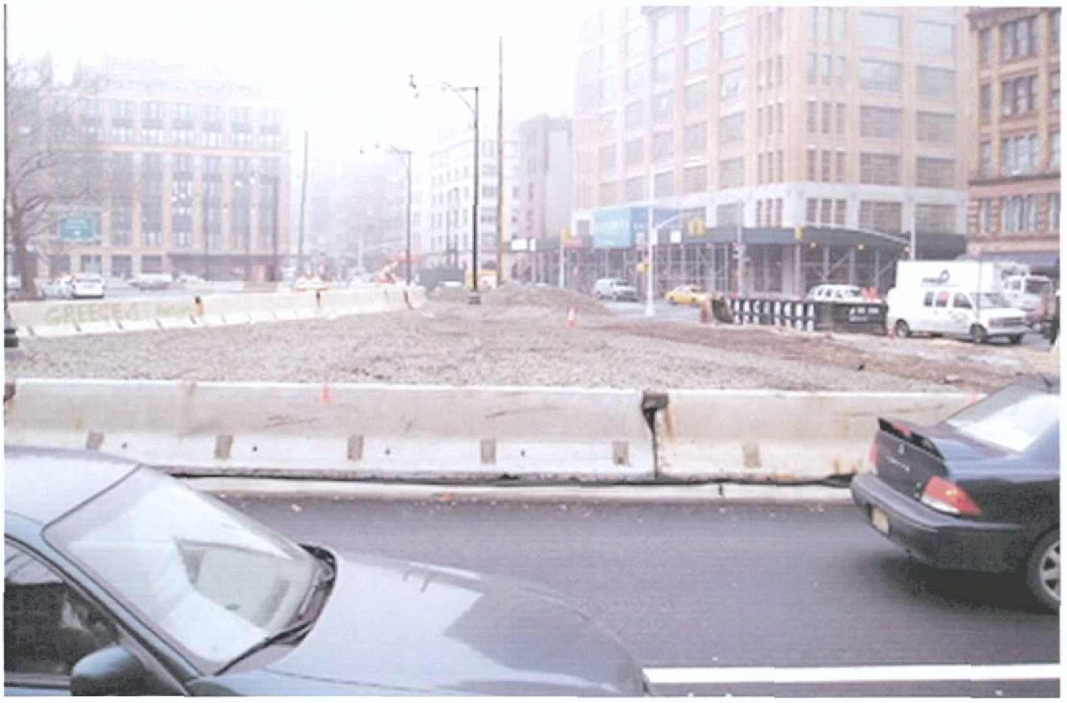
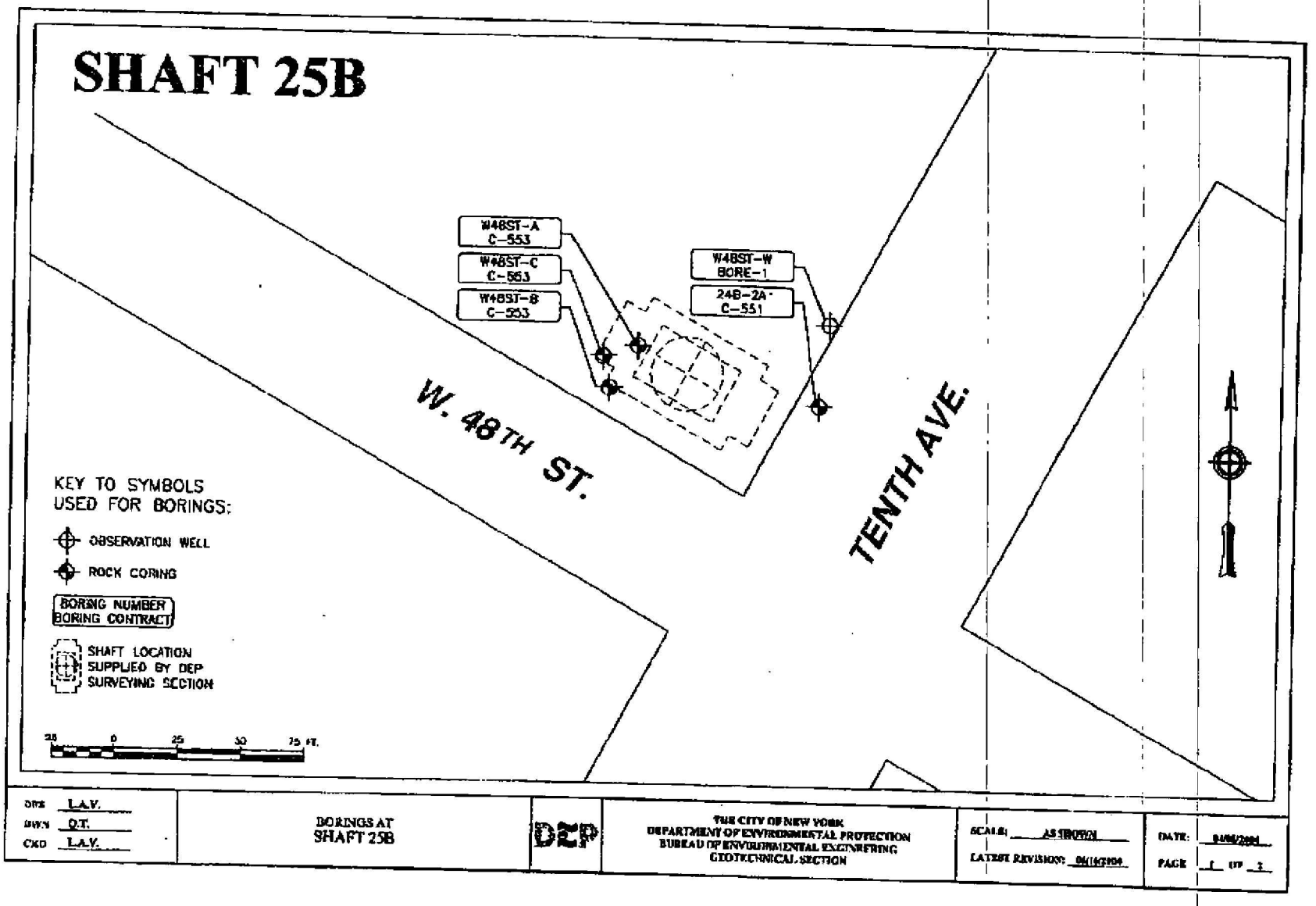


Plate 8. The proposed location of Shaft 29B (Block 213); view to the south.

APPENDIX A:

GEO-TECHNICAL BORING LOGS

SHAFT 25B



DES L.A.V. DWN Q.T. CKD L.A.V.	BORINGS AT SHAFT 25B	DEP	THE CITY OF NEW YORK DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF ENVIRONMENTAL ENGINEERING GEOTECHNICAL SECTION	SCALE: AS SHOWN LATEST REVISION: 08/16/2004	DATE: 8/08/2004 PAGE 1 OF 2

SHAFT 2B

BORING NUMBER	CONTRACT	COORDINATES		ELEVATIONS		
		NORTH	EAST	O.S.	T.O.R.	B.O.H.
SHAFT 25B	538C	278,356.549	594,188.684			
24B-2A	C551	278,344.929	594,241.166	+40.58	+32.58	-489.82
W48ST-A	C553	278,367.200	594,169.000	+40.98	+38.48	-541.04
W48ST-B	C553	278,350.713	594,157.714	+40.53	+37.53	-388.47
W48ST-C	C553	278,362.971	594,155.097	+40.75	+37.75	-520.59
W48ST-W	BORE-1	278,376.773	594,244.834	+41.32	-	+9.82

NOTES:

1. ELEVATIONS REFER TO DATUM USED BY USC&GS (NGVD 1929), MEAN SEA LEVEL AT SANDY HOOK, NEW JERSEY.
2. ALL COORDINATES ARE IN THE B.W.S. GRID SYSTEM UNLESS OTHERWISE NOTED.
3. ALL BORING COORDINATES WERE SUPPLIED BY THE DEP SURVEYING SECTION.

LEGEND:

O.S. ORIGINAL SURFACE

T.O.R. TOP OF ROCK

B.O.H. BOTTOM OF HOLE

DES L.A.V. DWN Q.T. CKD L.A.V.	BORINGS AT SHAFT 25B	DEP	THE CITY OF NEW YORK DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF ENVIRONMENTAL ENGINEERING GEOTECHNICAL SECTION	LATEST REVISION: 10/18/2004	DATE: 04/21/2004 PAGE 2 OF 2

BORING NUMBER: 24B-2A

By: WARREN GEORGE
Under: CONTRACT 551

LOCATION: West side of 10th. Ave. 57.5 ft North of 48th. St., Manhattan.

Coordinates:
North: 278,344.929
East: 594,241.166

Date Started: 11/20/91
Date Completed: 12/26/91

Miscellaneous	Depth (Feet)	Run #	Rec %	Blows %	Description of Material Recovered
Soil Sample No. 1		140	100	1/12"	Decomposed schist with some fine
Depth: 0.5 to 2.5 ft.				11	to coarse rounded gravel, brown
Elev.: +40.08 to +38.08 ft.				15	sand and trace to some silt. Moist.
	5				
Soil Sample No. 2		140	10	7	Weathered hornblende-biotite schist.
Depth: 5.00 to 7.00 ft.				6	Foliation present. Dipsp.
Elev.: +35.58 to +33.58 ft.				3/12"	** ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS
					LOG ARE BASED ON VISUAL EXAMINATION ONLY **
	10				** TOP OF ROCK DEPTH 8.0 FT. ELEVATION +32.58 FT. **

	Depth (Feet)	Run #	Rec %	RQD %	
Rock Core Run No. 1		1	96	65	Fine to coarse grain muscovite-biotite schist (sl. weath.) w/quartz bands.
Depth: 12.00 to 15.40 ft.					Dull to H&R. (Weathered: 12.40'to12.60'). Fol.: 70° to 90° LP.: 0.68' SP.: frag.
Elev.: +28.58 to +25.18 ft.	15				Fl.: 1.2 4 jts. No. pieces: 6+ NOTE: Core tends to break along foliation on mica.
Rock Core Run No. 2		1	99	80	Fine to medium grain muscovite-biotite schist w/qtz. bands. H&R.
Depth: 15.40 to 25.40 ft.					NOTE: Numerous healed joints throughout run.
Elev.: +25.18 to +15.18 ft.					10° crossjt.: 15.85'(min.), 18.15', 18.43'(parallel to a healed jt.
Box: 1					at 18.40'), 19.40 (weathered). Weathered 60° crossjt.: 19.80' to 20.05'.
	20				Weathered horizontal crossjts. :22.52', 23.15'.
					Weathered 40° crossjt.: 24.55'.
					Fol.: 70° to 90°
					LP.: 1.15' SP.: 20'
					Fl.: 0.8
	25				No. pieces: 16
Rock Core Run No. 3		1	100	100	Medium grain muscovite-biotite-qtz. schist with some quartzofeldspathic
Depth: 25.40 to 35.40 ft.					bands:25.40' to 28.30'. Pegmatite: 28.30' to 31.40', 32.50' to 33.40'. Biotite
Elev.: +15.18 to +5.18 ft.					gneiss, 31.40' to 32.50', 33.40' to 35.40'. Both sections H&R.
Box: 1,2					Fol.: 50° to 90°
	30				LP.: 1.30' SP.: 0.40'
					Fl.: 0.6 (All mechanical breaks)
					No. pieces: 17
	35				
Rock Core Run No. 4		1	94	59	Fine to medium grain biotite-muscovite schist w/ some 70° to 80° healed
Depth: 35.40 to 45.40 ft.					jts. t/o run. H&R. Disk: 36.40'to 36.42'. Broken rock: 39.40' to
Elev.: +5.18 to -4.82 ft.					42.90'(associated with three 80° crossjts. & two 45°crossjts. All are
Box: 2					weathered.). 70° crossjt.: 42.65' to 43.00'(weath.).
	40				10° xjt: 38.68'; 60° xjt. 38.30' to 38.55' (closed 38.55' to 38.67).
					Fol.: 60°to 85°
					LP.: 1.10' SP.: frag.
					Fl.: 1.0
					No. pieces: 15 + 15 frags.
	45				

BORING NUMBER: W48 St-A

By: WARREN GEORGE
Under: CONTRACT 553

Date Started: 10/15/96
Date Completed: 11/15/96

LOCATION: In side property on NW corner of 10th. Ave. and W48th. St. (42.3 ft. north of W48th. St. and 86.6 ft. west of 10th Ave.), Manhattan.

Coordinates:
North: 278,367.200
East: 594,169.000

Drilling Remarks	Depth (ft)	Run	Rec %	RQD %	Description of Materials Encountered
					Surface Elevation: +40.98 ft
ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON VISUAL EXAMINATIONS ONLY					Rock Elevation: -38.48 ft
					Bottom Elevation: -541.04 ft
	0				Depth in Earth: 2.50 ft
					Depth in Rock: 579.52 ft
					TOTAL DEPTH: 582.02 ft
					ASSUMED TOP OF SOUND ROCK
					DEPTH = 2.5 FT. ELEVATION = +38.48 FT.
	5				
Rock Core Run No. 1			100	20	Broken and weathered medium to coarse grain muscovite-biotite-larb.
Depth: 8.00 to 16.00 ft.	10				schist: 8.00' to 12.40'. Aplite: 12.40' to 16.00'.
Elev.: +32.98 to +24.98 ft.					Schist: Dull to H&E. Aplite: H&E.
Box 1					Instr. jts.: 13.45'. Subvert. foljt. and subhor. cross jt.
					70° foljt.: 13.65' to 14.45'. Subhorz. cross jts.: 14.00', 14.84', 15.57',
					and 15.82'. 80° healed jt.: 15.57' to 15.82', then open to 16.00'.
	15				Broken rock: 8.00' to 12.60' Fol.: 85°
					LP.: 0.85' SP.: frag FL: 0.8' No. pieces: 15++.
Rock Core Run No. 2			100	95	Aplite. H&E
Depth: 16.00 to 26.00 ft.					Subhorizontal jt.: 20.90' (min.).
Elev.: +24.98 to +14.98 ft.					20° cross jt.: 21.20' (oxidized). Subhor. cross jt.: 23.00', 24.58',
Box 1	20				80° healed jt.: 16.00' to 16.35'.
					Fol.: Indeterminate.
					LP.: 2.05' SP.: frag.
					FL.: 0.4 No. pieces: 13+
	25				
Rock Core Run No. 3			100	100	Aplite. H&E
Depth: 26.00 to 36.00 ft.					Fol.: Indeterminate.
Elev.: +14.98 to +4.98 ft.					LP.: 3.40' SP.: 0.35'
Box 2	30				FL.: 0.0 (All mechanical breaks)
					No. pieces: 5 (Pulled in 3)
	35				
Rock Core Run No. 4			100	95	Aplite. H&E
Depth: 36.00 to 46.00 ft.					25° cross jt.: 41.30'. (min.).
Elev.: +4.98 to -5.02 ft.					Dike: 41.18' and 44.23' (0.05' thick).
Box 2	40				70° cross jt.: 44.45' to 44.70' (healed).

BORING NUMBER: W48St-B

By: WARREN GEORGE
Under: CONTRACT 553

LOCATION: In parking lot 88.50 ft. west of curb of 10th. Ave. and 22.10 ft. north of W48th. St.

Coordinates:
North: 278,350.713
East: 594,157.714

Date Started: 11/18/96
Date Completed: 12/12/96

Drill Run	Depth (feet)	Run	Rec %	Req'd %	Description of Materials Encountered
ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON					Surface Elevation: +40.53 ft
VISUAL EXAMINATIONS ONLY to					Rock Elevation: +37.53ft
TOP OF ROCK - DEPTH 3.00 FT. ELEVATION +37.53 FT.					Bottom Elevation: -368.47ft
					Depth in Earth: 3.00 ft
Rock Core Run No. 1	5	↑	100	30	Fine to medium grain muscovite-
Depth: 4.00 to 10.00 ft.					biotite-hnb. schist weathered to chlorite: 4.00' to7.00'.
Elev.: +36.53 to +30.53 ft.					Fine to med. grain hornblende-biotite schist: 7.00' to 8.55'. Dull ring. Fine to med. grain
Boc 1					muscovite-granite gneiss: 8.55' to 10.00.' Drill to H&B. Broken rock: 4.95' to 7.10',
					associated with five (5) 80° folits, 30°folit.: 7.85', 45° folit.: 8.45'.
	10	↓	Fol.: 40° to 90°		LP.: 1.45' SP.: 0ne Fl.: 1.2 No. Pieces: 11+
Rock Core Run No. 2		↑	100	90	Fine to medium grain muscovite-biotite gneiss. H&B.
Depth: 10.00 to 20.00 ft.					60° crossjt.: 11.45' to 11.65', 30° crossjt.: 14.04' (min.)
Elev.: +30.53 to +20.53 ft.					20° crossjt.: 18.50' oxidized. 45° crossjts.: 18.87'oxidized;
Boc 1					18.90' (healed). Disk: 12.54' to 12.60'.
	15				Fol.: 70° to 80° where visible
					LP.: 1.85' SP.: 0.07'
					Fl.: 0.6 (EXCEPTION NOTED BELOW) No. pieces: 14+disk
					NOTE: More than 50% of Rock core is missing. Some taken for testing.
					Therefore unable to ascertain locations of all joints.
	20	↓			
Rock Core Run No. 3		↑	99	95	Fine to medium grain hornblende-muscovite-biotite schist.
Depth: 30.00 to 30.00 ft.					Pegmatite intrusion: 28.00' to 30.00'. H&B.
Elev.: +20.53 to +10.53 ft.					20° crossjt.: 28.90' (min.)
Boc 1 & 2					Two (2) 30° incip. jts.: 28.50'.
	25				Fol.: 75° to 85°
					LP.: 2.05' SP.: 0ne
					Fl.: 0.1
					No. pieces: 8+
	30	↓			
Rock Core Run No. 4		↑	100	95	Fine to medium grain pegmatite intruded schist: 30.00' to 33.30'
Depth: 30.00 to 40.00 ft.					Medium to coarse grain pegmatite with K-feldspar : 33.30' to 40.00'. H&B
Elev.: +10.53 to +0.53 ft.					15° crossjt.: 31.50' oxidized.
Boc 2					25° crossjt.: 33.25' (min.)
	35				Fol.: 60° to 80° in Schist. Indeterminate in pegmatite.
					LP.: 1.70' SP.: 0.15'
					Fl.: 0.2
					No. pieces: 17
	40	↓			
Rock Core Run No. 5		↑	99	99	Medium to coarse grain pegmatite: 40.00' to 43.00'
Depth: 40.00 to 50.00 ft.					Fine to med. grain garnetiferous muscovite-biotite schist: 43.00' to
Elev.: -0.53 to -9.47 ft.					44.40'. Medium to coarse grain pegmatite-intruded garnetiferous
Boc 3					muscovite-biotite schist: 44.40' to 50.00'. All H&B.
	45				Fol.: 50° to 80°

By: WARREN GEORGE
Under CONTRACT 553

BORING NUMBER: W48St-C

Date Started: 12/13/96
Date Completed: 01/27/97

LOCATION: Inside property on NW corner of 10th. Ave. and W48th. St. (31.9 ft. north of W48th. St. and 97.0 ft. west of 10th Ave.), Manhattan.

Coordinates:
North: 270,361.971
East: 594,155.097

Misc Remarks	Depth (feet)	Run	Rec in	RQD in	Description of Materials Encountered
					Surface Elevation: +40.75 ft
ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS					Rock Elevation: +37.75 ft
LOG ARE BASED ON VISUAL EXAMINATIONS ONLY					Bottom Elevation: -520.59 ft
					Depth in Earth: 3.00 ft
	5				Depth in Rock: 558.34 ft
					TOTAL DEPTH: 561.34 ft
					ASSUMED TOP OF ROCK - DEPTH 3.00 FT. ELEVATION +37.75 FT.
Rock Core Run No. 1	10		100	81	Fine to medium grain hornblende-biotite schist, slightly weathered,
Depth: 3.50 to 16.75 ft.					Dull to H&B.
Elev.: +32.25 to +24.00 ft.					30° cross joint: 10.45' (oxidized). Broken Rock: 8.50' to 9.20' (partly
Box 1					oxidized).
					Fol.: 50° to 90°
	15				LP: 4.00' SP: fragment
					FI: 1.0 (Excluding broken rock) No. pieces: 8+
Rock Core Run No. 2			100	95	Fine to medium grain hornblende-biotite schist with quartzofeldspathic
Depth: 16.75 to 26.75 ft.					intrusions. Dull to H&B.
Elev.: +24.00 to +14.00 ft.	20				Healed cross joint: 19.70'.
Box 1					Fol.: 0° to 90°
					LP: 1.20' SP: fragment
					FI: 0.0 (All mechanical breaks)
					No. pieces: 15+
	25				
Rock Core Run No. 3			100	99	Fine to medium grain hornblende-biotite-muscovite schist with
Depth: 26.75 to 36.95 ft.					quartzofeldspathic intrusion (26.75' to 35.05'). Aplite: 35.05' to 36.95'.
Elev.: +14.00 to +3.80 ft.	30				H&E.
Box 2					20° cross joint: 29.55' (incipient).
					Core tends to break along crystal faces and foliation.
					Fol.: 45° to 90°
					LP: 1.20' SP: fragment
	35				FI: 0.0 (All mechanical breaks).
					No. pieces: 12+
Rock Core Run No. 4			100	96	Aplite: 36.95' to 45.10'. Coarse grain granite: 45.10' to 46.70'. H&E
Depth: 36.95 to 46.70 ft.					20° cross joints: 38.05', 44.94' (both incipient)
Elev.: +3.80 to -5.95 ft.	40				50° cross joint: 43.85' to 44.05' (mineralized).
Box 2 & 3					Fol.: Indeterminate, 30° to 80° where visible
					LP: 2.40' SP: fragment
					FI: 0.1
					No. pieces: 10+
	45				

By: Aquifer Drilling and Testing
Under: Contract Bore-1

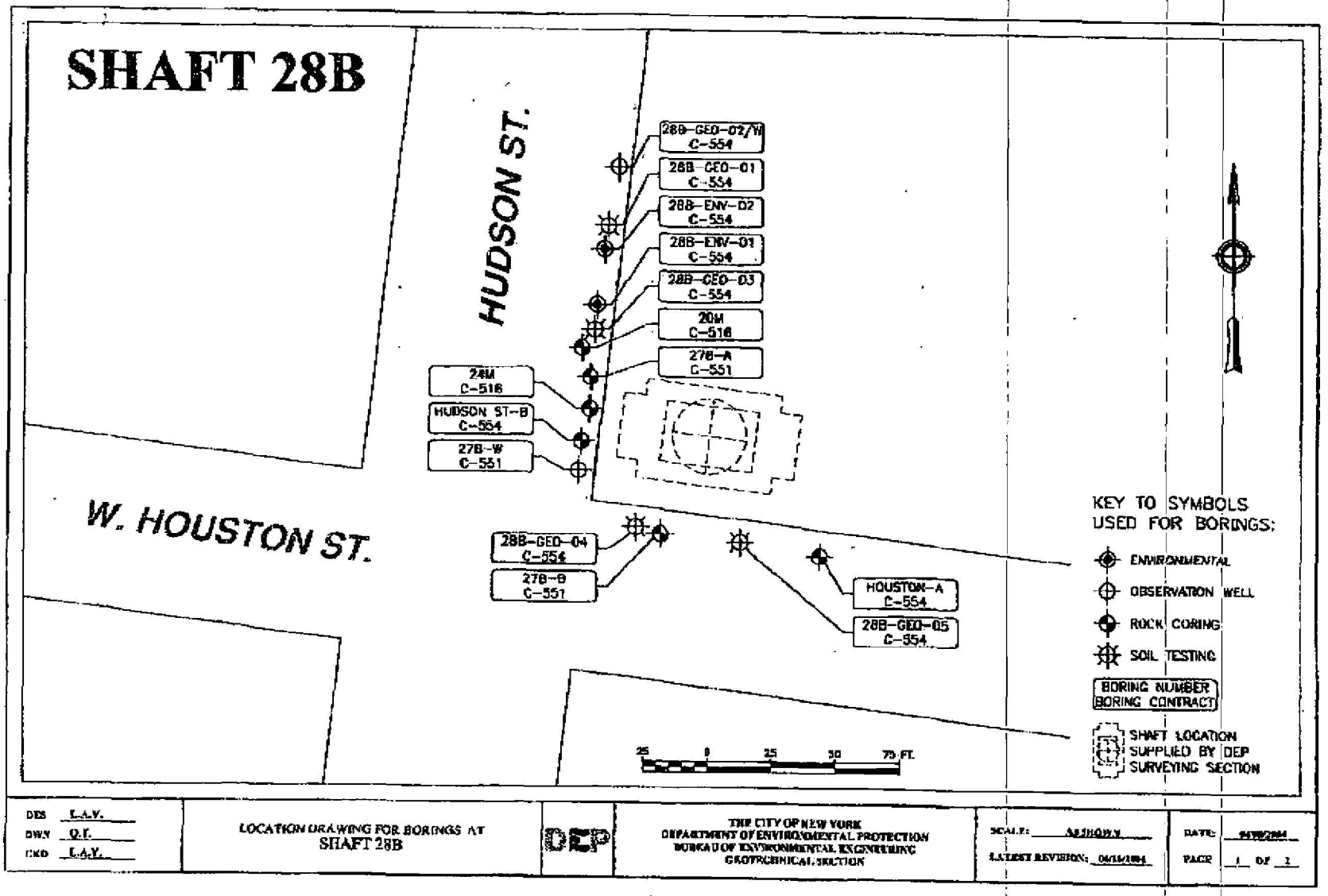
Date Started: 03/31/04
Date Completed: 03/31/04

BORING NUMBER: W48 St-W

LOCATION: On West side of 10th Ave., 25.10 ft. West from the West curb of 10th Ave and 87.00 ft. North from the North curb of W48th St., Manhattan.

Coordinates:
North: 278,376.773
East: 594,244.934

Material Symbols	Depth Drill ft	Run	Rec ft	RQD ft	Description of Materials Encountered
					ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON FIELD INSPECTOR'S OBSERVATIONS AND NOTES.
					Surface Elevation: +41.31 ft.
					Rock Elevation: +30.02 ft.
					Bottom Elevation: +9.82 ft.
					Depth in Earth: 11.30 ft.
					Depth in Rock: 20.20 ft.
					TOTAL DEPTH: 31.50 ft.
	5				
					Note: Drilled with 3 7/8" tri-cone roller bit through fill material, brick, sand and concrete from 0.00 to 11.30 ft. depth. Possible filled in basement and footing.
	10				
					TOP OF SOUND ROCK AT 11.30 ft. (Elev.: +30.02 ft.).
Rock Core Run No. 1		**	100	76	Fine to medium grain quartzite with some biotite and muscovite mica.
Depth: 11.30 to 16.30 ft.		**			Subhor. to 10° jts.: 11.64', 12.33' (sl. wash), 13.19', 13.38',
Elev.: +30.02 to +25.02 ft.		**			13.87', 14.15', 14.52', 14.68', 15.13', 15.34', 15.65' and 16.30'.
Box 1	15	**			Note: All jts. appear fresh. Fol.: N/A LP.: 0.68' SP.: fog.
		**			No. jts.: 12 No. pcs.: 13 +frags. (pulled as 13 +frags.).
Rock Core Run No. 2		**	100	94	Fine to medium grain quartzite with some biotite and muscovite schist.
Depth: 16.30 to 20.98 ft.		**			Subhor. jts.: 17.50', 18.43', 19.01', 20.05', 20.88' and 20.98'.
Elev.: +25.02 to +20.34 ft.		**			Note: All jts. appear fresh. Fol.: N/A LP.: 1.20' SP.: N/A
Box 1	20	**			No. jts.: 5 No. pcs.: 6 (pulled as 6).
Rock Core Run No. 3		**	96	30	Fine to medium grain quartzite with biotite and muscovite mica; 20.98'
Depth: 20.98 to 24.48 ft.		**			to 21.58'. Fine to medium grain hornblende biotite-muscovite schist (near vertical
Elev.: +20.34 to +16.84 ft.		**			foliation): 21.58' to 24.33', 70° to 90° fol. jt.: 21.18' to 23.33', 0° to 20° xjts.: 21.38',
Box 1		**			21.58', 21.73', 21.83', 21.93', 21.98', 22.23', 22.63', 23.28' and 24.33'. Cont. on page 1
Rock Core Run No. 4	25	**	100	81	Fine to medium grain hornblende-biotite-muscovite schist.
Depth: 24.48 to 29.58 ft.		**			Subhor. xjts.: 24.93', 25.86', 26.90', 27.38', 27.63', 28.42', 28.53', 29.05', 29.18' and
Elev.: +16.84 to +11.74 ft.		**			29.26'. Irreg. 0° to 90° xjt.: 25.73' to 25.93'. Irreg. 30° to 90° fol. jt.: 26.15' to 26.95'.
Box 2		**			10° xjts.: 28.55' and 28.58'. Irreg. 0° to 90° fol. jt.: 29.05' to 29.41'. Broken Rock: 27.91'
		**			to 28.03'. Fol.: 0° to 90° LP.: 0.90' SP.: fog. Cont. on page 2
Rock Core Run No. 5	30	**	100	89	Fine to medium grain hornblende-biotite-muscovite mica schist.
Depth: 29.58 to 31.50 ft.		**			Subhor. xjts.: 30.50', 31.30' and 31.50'. 30° xjt.: 30.98'. Cont. on page 2
					BOTTOM OF WELL AT 30.16 ft. (Elev.: +11.16 ft.).



By : Sprague & Henwood
Under Contract 516

BORING NUMBER: 20M

Date Started: 8-19-71
Date Completed: 9-2-71

LOCATION: 77.0' ± N. and 3.7' ± E. of curb lines at NE. corner of Hudson St. and W. Houston St. Manhattan

Coordinates:
North:
East:

Description	Depth (ft)	Wt	Rec %	Blows	Description of Material Encountered
This Boring Lithology log is released as a typed version of the original handwritten log from 1971. Those using this log are forewarned that this log may contain information of highly variable quality. ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON VISUAL EXAMINATION ONLY					Surface Elevation: +17.50 ft Rock Elevation: -40.50 ft Bottom Elevation: Depth in Earth: 98.00 ft Depth in Rock: 313.50 ft TOTAL DEPTH: 411.50 ft
Soil Sample No: 1				3/	Very fine sand.
Depth: 5.00 to 7.00 ft.				3/	Gray-moist-soft-permeable.
Elev: +12.20 to +10.50 ft.				4/	Looks like glacial lake bed sediment
				5/	(Artificial fill).(1)
	10				
Soil Sample No: 2				4/	Fine sand trace gray silt.
Depth: 10.00 to 12.00 ft.				5/	Brown-moist-soft-permeable.
Elev: +7.50' to +5.50 ft.				9/	Glacial lake bed sediment
				7/	(Artificial fill) (1)
	15				
Soil Sample No: 3				2/	DK gray silt, Brown fine to coarse sand
Depth: 15.00 to 17.00 ft.				3/	Moist-soft-perm
Elev: +2.50 to +0.50 ft.				3/	(Artificial fill). (1)
				4/	
	20				
Soil Sample No: 4				14/	Fine sand
Depth: 20.00' to 22.00ft				17/	Light gray-moist-med-firm-permeable
Elev: - 2.50' to -4.50 ft				23/	Recent stream deposit
				24/	
	25				
Soil Sample No: 5				6/	Silt fine sand clay
Depth: 25.00 to 27.00 ft				6/	Light gray-damp-soft-plastic-impermeable.
Elev: - 7.50 to -9.50 ft				7/	Recent lake deposit
				8/	
	30				
Soil Sample No: 6				28/	Small sample
Depth: 30.00 to 32.00 ft				33/	Disturbed No good
Elev: -12.50 to -4.50 ft				39/	
				42/	
	35				
Soil Sample No: 7				87/	Only 1 jar half full N.G.
Depth: 35.00' to 36.00 ft				150/	Small gravel
Elev: -17.50 to -19.50 ft					Looks like washed material
	40				
Soil Sample No: 8				79/	Coarse sand, small gravel, small rock fragments
Depth: 40.00 to 42.00 ft				107/	Variegated- wet- firm-very permeable
Elev: -22.50 to -24.50 ft				123/	Mod Glac drift (3)
				167/	
	45				

By: WARREN GEORGE
Under CONTRACT 551

Date Started: 03\14\91
Date Completed: 05\28\91

BORING NUMBER: 27B-A

LOCATION: 61 Ft. North of West Houston Street on East Side of Hudson Street, Manhattan.

Coordinates:
North: 265,690.252
East: 590,150.247

Surface Elevation:	+17.41 ft
Rock Elevation:	-79.59 ft
Bottom Elevation:	-441.59 ft
Depth in Earth:	97.00 ft
Depth in Rock:	358.00 ft
TOTAL DEPTH:	459.00 ft

Miscellaneous	Depth (Feet)	[illegible]	Rec %	Blows	Description of Materials Encountered
Soil Sample No. 1		140		0\11\	Concrete to 0.5 ft. Mxtr. of red s.st.,
Depth: 0.50 to 2.00 ft.			75	27\26\	concrete & tan sand. Fill. N= 38
Soil Sample No. 2			100	35\100\3"	Mxtr. of red s.st. with tan and brown
Depth: 2.00 to 2.75 ft.					dense sand. Fill N= Refusal.
Soil Sample No. 3			80	100\3"	Red sandstone shards in nose of
Depth: 4.00 to 4.25 ft.					spoon. Fill. Dry N= Refusal.
Soil Sample No. 4			66	31\97\100\3"	Red sandstone (weathered) mixed with tan gravelly sand.
Depth: 6.00 to 6.75 ft.					Fill. Dry. N= 132 ☞ ALL CLASSIFICATIONS DESCRIPTIONS
Soil Sample No. 5			0	100\4"	Gravel in spoon tip. IN THIS LOG ARE BASED
Depth: 8.00 to 8.30 ft.	10				N= Refusal. ON VISUAL EXAMINATION ONLY ☜
Soil Sample No. 6			75	13\5\	10.5' to 12.0': Red-brown coarse grain sand with trace of fine to coarse grain gravel,
Depth: 10.00 to 12.00 ft.				4\4	poorly sorted, loose. Damp N= 9
Soil Sample No. 7			60	5\6\11	Red-brown coarse grain sand with trace of fine to coarse grain gravel.
Depth: 12.00 to 14.00 ft.				12	Thin layer of stained (black) fine grain sand. Moist. N= 17.
Soil Sample No. 8			25	7\5\	Red-brown fine to medium grain sand, trace gravel. Moist
Depth: 14.00 to 16.00 ft.				6\7	N = 11
Soil Sample No. 9			100	5\6\	16.00' to 17.20': Red-tan coarse grain sand with some fine to coarse grain
Depth: 16.00 to 18.00 ft.				6\9	gravel. Moist. 17.20' to 18.00': Black organic material (peat). N = 12
Soil Sample No. 10			2	4\3\	Grey fine silty sand, trace of clay. Dry to damp. Compact. *(Unc. str. = 1.25 kg/cm²)*. Damp. N = 8
Depth: 18.00 to 20.00 ft.				5\7	
Soil Sample No. 11			90	8\8\2	Lt. grey fine silty sand, trace clay. Damp. *(Unc. str. = 0.5 kg/cm²)*.
Depth: 20.00 to 22.00 ft.				3\27	N = 31
Soil Sample No. 12			50	19\11	23.00' to 24.00': Light grey fine silty sand, trace clay
Depth: 22.00 to 24.00 ft.				15\20	Damp. *(Unc. str. = 2.75 kg/cm²)*, N= 26
Soil Sample No. 13			50	10\16	Light grey fine grain silty clayey sand.
Depth: 24.00 to 26.00 ft.				20\26	Damp. *(Unc. str. = 0.5 to 2.25 kg/cm²)*, N = 36
Soil Sample No. 14			90	24\27	Light grey fine grain silty clayey sand.
Depth: 26.00 to 28.00 ft.				23\24	Damp wet. *(Unc. str. = 0 to 1.0 kg/cm²)* N = 50
Soil Sample No. 15			75	11\10\	28.00' to 29.20': Lt. grey fine grn. silty clayey sand. 29.20' to 29.40': Tan-brn very v. fine sand.
Depth: 28.00 to 30.00 ft.				20\31	[illegible]
Soil Sample No. 16			50	21\33\	Orange-brwn fine grain gravelly silty sand. Dense.
Depth: 30.00 to 32.00 ft.				41\47	Damp. N = 74 ➔ *Note: Soils information italicized within*
Soil Sample No. 17			0	36\100\6"	No recovery. *() for Soil Samples No. 10-14 is reproduced*
Depth: 32.00 to 34.00 ft.					N = Refusal. *from 1991 field notes, without independent*
Soil Sample No. 18		300	20	9\12\	Orange-brown coarse *corroboration nor additional information.*
Depth: 34.00 to 36.00 ft.				12\10	gravelly sand. Wet, N= 24
Soil Sample No. 19		140	55	18\18	Red-brown fine grain gravelly sand.
Depth: 36.00 to 37.75 ft.				33\R	Damp. Dense Boulder at depth: 38.00'.
					N = 51
Soil Sample No. 20		140	80	9\14\	Red-brown gravelly fine to coarse silty sand. Wet
Depth: 39.00 to 41.00 ft.				10\12	N = 26
Soil Sample No. 21		140	25	19\100\6"	Red-brown gravelly fine to coarse silty sand. Wet.
Depth: 41.00 to 42.00 ft.					N = Refusal.
Soil Sample No. 22		300	40	26\28	Sandy gravel. Wet.
Depth: 43.00 to 45.00 ft.				28\11	N = 56

By: WARREN GEORGE
Under: CONTRACT 551

Date Started: 05/08/91
Date Completed: 06/14/91

BORING NUMBER: 27B-B

LOCATION: 46.35 ft. east of Hudson Street on North side of West Houston Street, Manhattan.

Coordinates:
North: 265,630.262
East: 590,377.495

Miscellaneous	Depth (feet)	Wt. #	Tons ft	Blows	Description of Materials Encountered
** ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON VISUAL EXAMINATION ONLY **					Surface Elevation: +17.28 ft Rock Elevation: -86.23 ft Bottom Elevation: -443.12 ft Depth in Earth: 103.50 ft Depth in Rock: 356.90 ft TOTAL DEPTH: 460.40 ft
	5				
Soil Sample No. 1	⇑		35	3/3/	Tan fine silty sand.
Depth: 5.00 to 7.00 ft.	⇓			5/2/	Pinkish-brown medium sand in spoon tip.
Elev.: +12.28 to +10.28 ft.					Damp.
					N = 8
	10				
Soil Sample No. 2	⇑		20	1/1/	Mixture of tan very fine to fine sand and silt, with trace gravel and red-
Depth: 10.00 to 12.00 ft.	⇓			0/1/	brown medium sand.
Elev.: +7.28 to +5.28 ft.					Damp.
					N = 1
	15				
Soil Sample No. 3	⇑		0	1/1/	No Recovery.
Depth: 15.00 to 17.00 ft.	⇓			2/2/	Grey fine sandy silt in spoon tip.
Elev.: +2.28 to +0.28 ft.					N = 3
	20				
Soil Sample No. 4	⇑		90	28/28/	Grey-brown fine silty sand. Trace of clay. Brittle.
Depth: 20.00 to 22.00 ft.	⇓			30/22/	Dry to damp.
Elev.: -2.72 to -4.72 ft.					N = 58
	25				
Soil Sample No. 5	⇑		40	18/25/	Pinkish-brown fine to medium grain silty sand, trace gravel:
Depth: 25.00 to 27.00 ft.	⇓			10/6/	25.00' to 26.60'. Red and grey clayey silt, trace of fine sand.: 26.60' to
Elev.: -7.72 to -9.72 ft.					27.00'. N = 35
					Moist to damp. Sand and Gravel layer: 27.50' to 32.00'.
	30				
Soil Sample No. 6	⇑		100	40/18/	Red-brown and yellow medium sand, trace gravel: 32.00' to 33.00'.
Depth: 32.00 to 34.00 ft.	⇓			20/13/	Red-brown coarse sand with some fine to medium gravel: 33.00' to 36.00'.
Elev.: -14.72 to -16.72 ft.					Damp. N = 38
	35				
Soil Sample No. 7	⇑		30	51/38/	Mixture of red and purple fine to coarse sands, trace gravel.
Depth: 35.00 to 37.00 ft.	⇓			40/29/	Damp.
Elev.: -17.72 to -19.72 ft.					N = 78
	40				
Soil Sample No. 8	⇑		0	19/19/	No Recovery.
Depth: 40.00 to 42.00 ft.	⇓			22/21/	Pinkish-brown sand in spoon tip.
Elev.: -22.72 to -24.72 ft.					N = 41
	45				

By: Warren George, Inc.
Under: Contract 554
Date Started: 03/06/02
Date Completed: 04/12/02

BORING NUMBER: Houston-A

LOCATION: 109.80 ft. East from the curb of Hudson St. and 5.20 ft. North from the curb of Houston St., Manhattan

Coordinates:
North: 265,622.245
East: 590,439.769

Miscellaneous	Depth (feet)	Wt #	Rec %	Blows	Description of Materials Encountered	
	ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS					Surface Elevation: +16.57 ft.
	LOG ARE BASED ON VISUAL EXAMINATION ONLY.					Rock Elevation: -80.03 ft.
	ALL SOIL COLORS ARE DETERMINED BY COMPARISON					Bottom Elevation: -647.27 ft.
	WITH THE MUNSELL SOIL COLOR CHARTS					Depth in Earth: 96.60 ft.
	(YEAR 2000 REVISED EDITION).					Depth in Rock: 567.24 ft.
						TOTAL DEPTH: 663.84 ft.
	5					
Soil Sample No. 1		140	20	3/6"	Fine grain, dark brown (7.5YR 3/3), well graded, micaceous, silty	
Depth: 5.00 to 7.00 ft.				2/6"	Sand; trace clay, medium gravel-sized disk shaped quartzite.	
Elev.: +11.57 to +9.57 ft.				1/6"	Wet. Poorly plastic.	
				2/6"	S.P.T. "N" - 3	
	10					
Soil Sample No. 2		140	40	3/6"	Fine to coarse grain, light brown to dark brown (7.5YR 6/3 to 3/3), well	
Depth: 10.00 to 12.00 ft.				7/6"	graded, micaceous, silty Sand; trace clay, fine to medium gravel-sized	
Elev.: +6.57 to +4.57 ft.				8/6"	quartzite and red siltstone. Wet. Poorly plastic.	
				6/6"	S.P.T. "N" - 15	
	15					
Soil Sample No. 3		140	60	3/6"	Fine grain, very dark gray (5YR 3/1), silty Clay; contains	
Depth: 15.00 to 17.00 ft.				1/6"	abundant rootlets. Wet. Organic. Medium plastic.	
Elev.: +1.57 to -0.43 ft.				2/6"	S.P.T. "N" - 3	
				2/6"		
	20					
Soil Sample No. 4		140	60	4/6"	Fine grain, dark gray (5YR 4/1), well graded, micaceous, silty	
Depth: 20.00 to 22.00 ft.				4/6"	Sand; trace clay, fine to medium gravel-sized limonitic crust and	
Elev.: -3.43 to -5.43 ft.				10/6"	sandstone. Wet. Poorly plastic.	
				14/6"	S.P.T. "N" - 14	
	25					
Soil Sample No. 5		140	60	4/6"	Fine to coarse grain, dark gray (5YR 4/1), well graded, silty Sand	
Depth: 25.00 to 27.00 ft.				10/6"	with clay; contains fine to medium gravel-sized quartzite, sandstone and	
Elev.: -8.43 to -10.43 ft.				15/6"	schistose gneiss. Wet. Medium plastic.	
				16/6"	S.P.T. "N" - 25	
	30					
Soil Sample No. 6		140	50	9/6"	Medium to coarse grain, reddish brown (5YR 4/3), well graded,	
Depth: 30.00 to 32.00 ft.				9/6"	micaceous Sand; contains fine to medium gravel-sized quartzite, siltstone	
Elev.: -13.43 to -15.43 ft.				10/6"	and gneiss. Moist. Non-plastic.	
				14/6"	S.P.T. "N" - 19	
	35					
Soil Sample No. 7		140	55	7/6"	Fine to coarse grain, reddish brown (5YR 5/3), well graded,	
Depth: 35.00 to 37.00 ft.				6/6"	micaceous Sand; trace silt, fine gravel-sized quartzite and gneiss.	
Elev.: -18.43 to -20.43 ft.				7/6"	Moist. Non-plastic.	
				8/6"	S.P.T. "N" - 13	
	40					

By: WARREN GEORGE
Under: CONTRACT 554

Date Started: 05/03/01
Date Completed: 05/29/01

BORING NUMBER: Hudson St-B

LOCATION: East side of Hudson St., 35.40 ft. North of West Houston St., Manhattan

Coordinates:
North: 265664.083
East: 590346.921

Miscellaneous	Depth (Feet)	Wt. #	Rec %	Blows	Description of Material Encountered
					Surface Elevation: +17.32 ft
					Rock Elevation: -90.68 ft
					Bottom Elevation: -633.38 ft
					Depth in Earth: 108.00 ft
	5				Depth in Rock: 542.70 ft
					TOTAL DEPTH: 650.70 ft

ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON VISUAL EXAMINATION ONLY

10

NO SOIL SAMPLES.
TUNNEL LINE BORING.

15

20

25

30

NO SOIL SAMPLES.
TUNNEL LINE BORING.

35

40

45

BORING NUMBER: 24M

By: Sprague & Henwood
Under: CONTRACT 516

LOCATION: 50.0' ± N. of N. Curb Line of W. Houston St. and 9.0' ± E. of E. Curb Line of Hudson St., Manhattan

Coordinates: North: 165,670.000 East: 590,350.000

Date Started: 9/1/71
Date Completed: 9/13/71

Stratification	Depth (feet)	WL ft	Rec %	Blows	Description of Materials Encountered
→ This Boring Lithology Log is released as a typed version of the original handwritten log from 1971. Those using this log are forewarned that this log may contain information of highly variable quality. ←					Surface Elevation: +17.00 ft Rock Elevation: -81.00 ft Bottom Elevation: -124.00 ft Depth in Earth: 98.00 ft Depth in Rock: 43.00 ft TOTAL DEPTH: 141.00 ft
←ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON VISUAL EXAMINATION ONLY→					
Soil Sample No. 1	1	300		2/3/	Small sample.
Depth: 5.00 to 7.00 ft.	4			3/3/	Fine to coarse grain sand and small gravel.
Elev: +12.00 to + 10.00 ft.					Brown-Wet-Loose-Permeable.
					Artificial fill (0).
	10				
Soil Sample No. 2	1	300		3/6/	Small sample.
Depth: 10.00 to 12.00 ft.	4			7/7/	Fine to coarse sand, gravel.
Elev: +7.00 to + 5.00 ft.					Dirty brown-Wet-Loose-Permeable.
					Artificial fill (1).
	15				
Soil Sample No. 3	1	300		6/8/	Silt. Plant root in it.
Depth: 15.00 to 17.00 ft.	4			7/4/	Gray-Moist-Soft-Impermeable.
Elev: +2.00 to + 0.00 ft.					Recent lake or stream deposit (1).
	20				
Soil Sample No. 4	1	300		10/19	Silt, very fine sand.
Depth: 20.00 to 22.00 ft.	4			25/31	Gray-Moist-Medium firm-Impermeable.
Elev: -3.00 to -5.00 ft.					Recent lake deposit (2).
	25				
Soil Sample No. 5	1	300		12/16	Different in 2 jars.
Depth: 25.00 to 27.00 ft.	4			23/24	Gray silt.
Elev: -8.00 to -10.00 ft.					Gray sand with gravel.
					Damp-Medium firm-Impermeable.
	30				Transition recent to glacial ? (2).
Soil Sample No. 6	1	300		16/19	Fine to coarse sand, gravel.
Depth: 30.00 to 32.00 ft.	4			19/24	Dirty gray-Wet-Medium firm-Permeable.
Elev: -13.00 to -15.00 ft.					This looks like artificial fill.
					If so all above should be artificial fill.
	35				
Soil Sample No. 7	1	300		19/23	Coarse sand, large gravel.
Depth: 35.00 to 37.00 ft.	4			20/22	Variegated-Wet-Medium firm-Permeable.
Elev: -18.00 to -20.00 ft.					Modified glacial drift (3).
	40				
Soil Sample No. 8	1	300		18/29	Coarse sand, fine to small gravel
Depth: 40.00 to 42.00 ft.	3			34/41	Variegated-Moist-Medium firm-Permeable.
Elev: -23.00 to -25.00 ft.					Modified glacial drift (3).
	45				

By: Warren George, Inc.
Under: Contract 551

Date Started: 03/25/91
Date Completed: 03/25/91

BORING NUMBER: 27B-W

LOCATION: 31.00 ft. North from the North sidewalk curb of W. Houston St. on the East sidewalk of Hudson St., Manhattan.

Coordinates:
North: 265,659.836
East: 990,346.905

Blow/Increment	Depth (feet)	Rec	Rec %	RQD %	Description of Material Encountered
					ALL DESCRIPTIONS IN THIS LOG ARE BASED ON FIELD INSPECTOR'S OBSERVATIONS AND NOTES.
					Surface Elevation: +17.36 ft.
					Rock Elevation: N/A
					Bottom Elevation: -7.64 ft.
					Depth in Earth: 25.00 ft.
					Depth in Rock: N/A
					TOTAL DEPTH: 25.00 ft.
					Note: Last water level reading recorded in 1991. Subsequently, well destroyed.
	15				Observation/Monitoring Well Construction Data
					Observation/Monitoring well constructed to 25.00 ft. depth (Elev.: -7.64 ft.). Bored with 4 3/4" tri-cone roller bit through sidewalk then cont. with 3 7/8" roller bit through overburden to 25.00 ft. depth (Elev.: -7.64 ft.). 2.0" inside diameter, schedule 80 PVC riser pipe
	20				installed from 0.00 to 15.00 ft. depth (Elev.: +17.36 to +2.36 ft.).
					2.0" inside diameter schedule 80 PVC well screen, 20 slots per inch,
					installed from 15.00 to 25.00 ft. depth (Elev.: +2.36 to -7.64 ft.).
					Flush mount monitoring well cap installed over well.
	25				BOTTOM OF WELL AT 25.00 ft. (Elev.: -7.64 ft.).
					Observation/Monitoring Well Installation
					Drilling Rig: Failing 1500
					Drillers: G. Kurzynowski, J. Gomm
					Inspector: P. Marks
					Reviewed By: C. Morris, C. Dozier

By: Warren George, Inc.
Under: Contract 584

Date Started: 03/10/03
Date Completed: 03/10/03

BORING NUMBER: 28B-ENV-01

LOCATION: 86.00 ft. North from the North curb of W. Houston St. and 13.00 ft. East from the East curb of Hudson St., Manhattan.

Coordinates:
North: 265,715.018
East: 590,362.766

Misc/Signs/etc	Depth (feet)	Wt #	Rec %	Blows	Description of Materials Encountered
	ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG				Surface Elevation: +17.58 ft.
	ARE BASED ON FIELD INSPECTOR'S OBSERVATIONS				Rock Elevation: N/A
	AND NOTES				Bottom Elevation: +0.58 ft.
					Depth in Earth: 17.00 ft.
					Depth in Rock: N/A
					TOTAL DEPTH: 17.00 ft.
	5				
Soil Sample No. 1		140	45	4/6"	Fill materials, medium grain reddish brown Sand, shale and gravel
Depth: 5.00 to 7.00 ft.				6/6"	Moist. S.P.T. "N" - 16
Elev.: +12.58 to +10.58 ft.				10/6"	
				10/6"	
	10				
	15				
Soil Sample No. 2		140	35	4/6"	Fill material, medium to coarse grain Sand, some rock fragments. Wet.
Depth: 15.00 to 17.00 ft.				3/6"	S.P.T. "N" - 6 END OF BOREHOLE AT 17.00 ft. (Elev.: +0.58 ft.).
Elev.: +2.58 to +0.58 ft.				3/6"	
				4/6"	
					Environmental Sampling Data
					Two soil samples were collected by Peter Diglio of PDM
					Environmental Services Inc. for soil contaminent testing.
					Boring was started using 3 7/8" tri-cone roller bit, Drilling to 5.00 ft. depth
					Sample No.1 was collected using the split spoon sampler from 5.00 to
					7.00 ft. depth.
					Borehole was again advanced using 3 7/8" tri-cone roller bit to
					15.00 ft. depth. Sample No. 2 was collected from 15.00 to 17.00 ft. depth.
					Borehole was grouted upon completion of drilling and sampling
					activities.
					To view the results please refer to the Environmental Site Summary
					Report by PDM dated March 2003, PDM Project No. 1270-00.
					Enviro Boring #1 (SB-1).
					Environmental Boring
					Drilling Rig: Acker Wireline
					Drillers: R. Bridgepal, J. Williams
					Inspector: M. Caranica, M. Burton
					Environmental Inspector: P. Diglio
					Reviewed By: C. Morris, C. Dozier

By: Warren George, Inc.
Under: Contract 534

Date Started: 03/10/03
Date Completed: 03/10/03

BORING NUMBER: 28B-ENV-02

LOCATION: 116.00 ft. South from the South curb of Clarkson St. and 11.00 ft. East from the East curb of Hudson St., Manhattan.

Coordinates:
North: 205,742,367
East: 590,355,538

Miscellaneous	Depth (feet)	Wt #	Rec %	Blows	Description of Material Encountered
					ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON FIELD INSPECTOR'S OBSERVATIONS AND NOTES.
					Surface Elevation: +17.66 ft.
					Rock Elevation: N/A
					Bottom Elevation: +0.66 ft.
					Depth in Earth: 17.00 ft.
					Depth in Rock: N/A
					TOTAL DEPTH: 17.00 ft.
	5				
Soil Sample No. 1		140	N/A	2/6"	Fill materials, fine to medium grain reddish brown Sand, some
Depth: 5.00 to 7.00 ft.				3/6"	aggregates.
Elev.: +12.66 to +10.66 ft.				2/6"	Moist. S.P.T. "N" - 5
				2/6"	
	10				
	15				
Soil Sample No. 2		140	N/A	3/6"	Medium to coarse grain Sand, some pebbles. Wet. S.P.T. "N" - 12
Depth: 15.00 to 17.00 ft.				5/6"	END OF BOREHOLE AT 17.00 ft. (Elev.: +0.66 ft.).
Elev.: +2.66 to +0.66 ft				7/6"	
				3/6"	
					Environmental Sampling Data
					Two soil samples were collected by Peter Diglio of PDM
					Environmental Services Inc. for soil contaminant testing.
					Boring was started using 3 7/8" tri-cone roller bit, Drilling to 5.00 ft. depth.
					Sample No.1 was collected using the split spoon sampler from 5.00 to
					7.00 ft. depth. Borehole was again advanced using 3 7/8" tri-cone roller bit
					to 15.00 ft. depth. Sample No. 2 was collected from 15.00 to 17.00 ft.
					depth. Borehole was grouted upon completion of drilling
					and sampling activities.
					To view the results please refer to the Environmental Site Summary
					Report by PDM dated March 2003, PDM Project No. 1270-00,
					Enviro Boring #2 (SB-2).
					Environmental Boring
					Drilling Rig: Acker Wireline
					Drillers: R. Bridgepal, J. Williams
					Inspector: M. Caranica, M. Burton
					Environmental Inspector: P. Diglio
					Reviewed By: C. Morris, C. Dozier

By: Warren George, Inc.
Under: Contract 554
Date Started: 02/24/03
Date Completed: 02/27/03

BORING NUMBER: 28B-GEO-01

LOCATION: 113.61 ft. South from the South curb of Clarkson St. and 12.79 ft. East from the curb on East sidewalk of Hudson St., Manhattan

Coordinates:
North: 265,745.109
East: 590,357.013

Miscellaneous	Depth (Feet)	Wt #	Rec %	Blows	Description of Materials Encountered
	ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS				Surface Elevation: +17.75 ft.
	LOG ARE BASED ON VISUAL EXAMINATION ONLY.				Rock Elevation: -81.25 ft.
	ALL SOIL COLORS ARE DETERMINED BY				Bottom Elevation: -81.75 ft.
	COMPARISON WITH THE MUNSELL SOIL CHARTS				Depth in Earth: 99.00 ft.
	(YEAR 2000 REVISED EDITION).				Depth in Rock: 0.50 ft.
					TOTAL DEPTH: 99.50 ft.
					Note: Wash cutting samples may not be representative of the particular depth.
	5				
Soil Sample No. 1		140	60	13/6"	Fill materials: mostly composed of red brick, set in a matrix of fine to
Depth: 5.00 to 7.00 ft.				18/6"	coarse grain, light brown (7.5YR 6/4), well graded, partially
Elev.: +12.75 to +10.75 ft.				13/6"	ferruginous Sand with some fine to medium gravel sized granite gneiss,
				6/6"	sandstone, and quartzite; trace silt.
	10				Dry. Non-plastic. S.P.T. "N" - 31
Soil Sample No. 2		140	15	5/6"	Fill materials: mostly composed of concrete, cement, and red brick;
Depth: 10.00 to 12.00 ft.				3/6"	trace silt and fine to medium gravel sized granite gneiss, diabase, and
Elev.: +7.75 to +5.75 ft.				3/6"	quartzite. Dry. Non-plastic. S.P.T. "N" - 6
				2/6"	
	15				
Soil Sample No. 3		140	70	4/6"	Fine grain, pale brown (10YR 6/3), poorly graded silty Sand with
Depth: 15.00 to 17.00 ft.				3/6"	some clay; trace fine gravel sized siltstone; scattered presence of
Elev.: +2.75 to +0.75 ft.				2/6"	slender like plant roots.
				2/6"	Dry. Organic. Low plastic. S.P.T. "N" - 5
	20				
Soil Sample No. 4		140	68	4/6"	Fine to coarse grain, brown (7.5YR 4/3), well graded, partially
Depth: 20.00 to 22.00 ft.				11/6"	ferruginous, slightly micaceous Sand with some silt, and fine to
Elev.: -2.25 to -4.25 ft.				37/6"	medium gravel sized quartzite and sandstone; at places contains light
				19/6"	brown (7.5YR 6/4), silty clay with motting structure.
	25				Dry. Non-plastic. S.P.T. "N" - 48
Soil Sample No. 5		140	40	7/6"	Medium to coarse grain, light brown (7.5YR 6/4), well graded,
Depth: 25.00 to 27.00 ft.				6/6"	ferruginous, micaceous, gravelly Sand mixed with fine to medium
Elev.: -7.25 to -9.25 ft.				21/6"	gravel sized quartzite, chert, and granite fragments; trace silt and clay.
				28/6"	Dry. Non-plastic. S.P.T. "N" - 27
	30				
Soil Sample No. 6		140	0	13/6"	No Recovery. S.P.T. "N" - 30
Depth: 30.00 to 32.00 ft.				15/6"	
Elev.: -12.25 to -14.25 ft.				15/6"	
				17/6"	
	35				
Soil Sample No. 7		140	35	57/6"	Mixed assemblages of fine to medium gravel sized quartzite, red
Depth: 35.00 to 37.00 ft.				29/6"	sandstone, granite gneiss, and chert, with a subordinate amount of
Elev.: -17.25 to -19.25 ft.				47/6"	medium to coarse grain, brown (7.5YR 4/3), well graded, ferruginous
				28/6"	Sand; trace silt.
	40				Dry. Non-plastic. S.P.T. "N" - 76

By: Warren George, Inc.
Under: Contract 554
Date Started: 02/27/03
Date Completed: 03/04/03

BORING NUMBER: 28B-GEO-02/W

LOCATION: 88.31 ft. South from the South curb of Clarkson St. and 13.92 ft. East from the curb on East sidewalk of Hudson St., Manhattan

Coordinates:
North: 265,770.038
East: 590,361.161

Miscellaneous	Depth (feet)	Wt #	Rec %	Blows	Description of Materials Encountered	
	ALL CLASSIFICATION AND DESCRIPTIONS IN THIS					Surface Elevation: +17.82 ft.
	LOG ARE BASED ON VISUAL EXAMINATION ONLY.					Rock Elevation: -80.18 ft.
	ALL SOIL COLORS ARE DETERMINED BY					Bottom Elevation: -82.18 ft.
	COMPARISON WITH THE MUNSELL SOIL CHARTS					Depth in Earth: 98.00 ft.
	(YEAR 2000 REVISED EDITION).					Depth in Rock: 2.00 ft.
						TOTAL DEPTH: 100.00 ft.
					Note: Wash cutting samples may not be representative of the	
					particular depth.	
	5					
Soil Sample No. 1		140	15	15/6"	Fill materials: mostly composed of red brick, and concrete mixed	
Depth: 5.00 to 7.00 ft.				15/6"	with coarse grain Sand.	
Elev.: +12.82 to +10.82 ft.				12/6"	Moist. Non-plastic. S.P.T. "N" - 27	
				10/6"		
	10					
Soil Sample No. 2		140	30	6/6"	Upper: Fine grain, dark reddish gray (5YR 4/2), well graded,	
Depth: 10.00 to 12.00 ft.				9/6"	ferruginous, silty Sand with some clay and trace fine gravel sized chert	
Elev.: +7.82 to +5.82 ft.				11/6"	and quartzite. Lower: Mixed assemblages of fine to medium gravel	
				6/6"	sized, fragmented, variably shaped granite, quartzite and sandstone set-	
	15				in a matrix of fine to medium grain Sand. Moist. Medium-plastic. S.P.T. "N" - 20	
Soil Sample No. 3		140	0	19/6"	No Recovery. S.P.T. "N" - 29	
Depth: 15.00 to 17.00 ft.				14/6"		
Elev.: +2.82 to +0.82 ft.				15/6"		
				16/6"		
	20					
Soil Sample No. 4		140	28	13/6"	Fine to coarse grain, light reddish brown (5YR 6/4), ferruginous, well	
Depth: 20.00 to 22.00 ft.				14/6"	graded, gravelly Sand with some silt and trace clay; contains fine to	
Elev.: -2.18 to -4.18 ft.				17/6"	medium gravel sized arkose, quartzite, granite and chert.	
				25/6"	Dry. Non-plastic. S.P.T. "N" - 31	
	25					
Soil Sample No. 5		140	23	25/6"	Mixed assemblages of fine to medium gravel sized, highly fragmented,	
Depth: 25.00 to 27.00 ft.				28/6"	variably shaped granite, arkose, sandstone, quartzite and diabase set-	
Elev.: -7.18 to -9.18 ft.				32/6"	in a matrix of fine to medium grain, light reddish brown (2.5YR 6/4),	
				30/6"	well graded, ferruginous Sand with trace silt and clay.	
	30				Dry. Non-plastic. S.P.T. "N" - 60	
Soil Sample No. 6		140	30	34/6"	Mixed assemblages of fine to medium gravel sized, highly fragmented,	
Depth: 30.00 to 32.00 ft.				21/6"	variably shaped granite, arkose, quartzite and chert set-in a matrix of	
Elev.: -12.18 to -14.18 ft.				20/6"	coarse grain Sand. Possible glacial origin.	
				20/6"	Moist. Non-plastic. S.P.T. "N" - 41	
	35					
Soil Sample No. 7		140	33	13/6"	Mixed assemblages of fine to medium gravel sized, highly	
Depth: 35.00 to 37.00 ft.				11/6"	fragmented, variably shaped granite, gneiss, quartzite, chert and	
Elev.: -17.18 to -19.18 ft.				12/6"	sandstone set-in a matrix of medium to coarse grain, dark reddish	
				19/6"	brown (5YR 3/4) Sand; trace silt. Possible glacial origin.	
	40				Wet. Non-plastic. S.P.T. "N" - 23	

By: Warren George, Inc.
Under: Contract 554

Date Started: 03/05/03
Date Completed: 03/07/03

BORING NUMBER: 28B-GEO-03

LOCATION: 150.49 ft. South from the South curb of Clarkson St. and 12.14 ft. East from the curb on East sidewalk of Hudson St., Manhattan

Coordinates:
North: 265,706.571
East: 590,351.948

Miscellaneous	Depth (Feet)	Wt #	Rec %	Blows	Description of Materials Encountered	
	ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS					Surface Elevation: +17.51 ft.
	LOG ARE BASED ON VISUAL EXAMINATION ONLY.					Rock Elevation: -81.99 ft.
	ALL SOIL COLORS ARE DETERMINED BY COMPARISON					Bottom Elevation: -81.99 ft.
	WITH THE MUNSELL SOIL COLOR CHARTS					Depth in Earth: 99.50 ft.
	(YEAR 2000 REVISED EDITION).					Depth in Rock: N/A
						TOTAL DEPTH: 99.50 ft.
					Note: Wash cutting samples may not be representative of	
					the particular depth.	
	5					
Soil Sample No. 1		140	55	70/6"	Fill materials; mostly composed of brick and fragmented, fine to	
Depth: 5.00 to 7.00 ft.				30/6"	medium gravel sized arkose with some fine to medium grain, reddish	
Elev.: +12.51 to +10.51 ft.				25/6"	brown (5YR 4/4), highly calcareous Sand; trace silt and clay.	
				35/6"	Dry. Non-plastic. S.P.T. "N" - 55	
	10					
Soil Sample No. 2		300	5	N/A	Fill materials: mostly composed of concrete, brick, arkose and	
Depth: 10.00 to 12.00 ft.					fragmented, fine to medium gravel sized arkose with some fine to	
Elev.: +7.51 to +5.51 ft.					medium grain, reddish brown (5YR 4/4), highly calcareous Sand; trace	
					silt and clay. Note: Blow counts were not recorded.	
	15				Dry. Non-plastic. S.P.T. "N" - N/A	
Soil Sample No. 3		140	35	6/6"	Medium to coarse grain, variegated dark reddish gray (5YR 4/2) to	
Depth: 15.00 to 17.00 ft.				3/6"	pinkish white (5YR 8/2), well graded, ferruginous, micaceous Sand	
Elev.: +2.51 to +0.51 ft.				4/6"	with some fine to medium gravel sized, partially decomposed granite,	
				5/5"	phyllite, quartzite, and arkose; trace silt. Possible glacial origin.	
	20				Dry. Non-plastic. S.P.T. "N" - 7	
Soil Sample No. 4		140	85	4/5"	Gray (10YR 6/1), clayey Silt with trace fine grain, micaceous sand,	
Depth: 20.00 to 22.00 ft.				4/6"	and fine gravel sized quartzite.	
Elev.: -2.49 to -4.49 ft.				13/6"	Dry. Medium plastic. S.P.T. "N" - 17	
				17/6"		
	25					
Soil Sample No. 5		140	70	15/6"	Gray (10YR 6/1), clayey Silt to silty Clay with trace fine grain,	
Depth: 25.00 to 27.00 ft.				10/6"	micaceous Sand, and fine to medium gravel sized granodiorite and	
Elev.: -7.49 to -9.49 ft.				9/6"	siltstone. Dry. Plastic. S.P.T. "N" - 19	
				6/6"		
	30					
Soil Sample No. 6		140	50	29/5"	Fine to medium grain, light brown (7.5YR 6/4), well graded,	
Depth: 30.00 to 32.00 ft.				39/5"	ferruginous, micaceous Sand with some silt, and fine to medium gravel	
Elev.: -12.49 to -14.49 ft.				49/5"	sized, partially decomposed granite, granodiorite, and sandstone; trace	
				33/6"	clay. Minor magnetic susceptibility has been noted in the sand fraction.	
	35				Possible glacial origin. Dry. Non-plastic. S.P.T. "N" - 88	
Soil Sample No. 7		300	50	15/6"	Medium to coarse grain, reddish brown (5YR 4/4), well graded,	
Depth: 35.00 to 37.00 ft.				19/6"	ferruginous, micaceous Sand with a subordinate amount of fine to	
Elev.: -17.49 to -19.49 ft.				22/6"	medium gravel sized, fragmented mica schist, sandstone, quartzite,	
				22/6"	arkose, and granodiorite; trace silt and clay. Minor magnetic	
	40				susceptibility has been noted in the sand fraction. Dry. Non-plastic. Cont. on page 3	

By: Warren George, Inc.
Under: Contract 554

Date Started: 04/07/04
Date Completed: 04/14/04

BORING NUMBER: 28B-GEO-04

LOCATION: 40.60 ft. East from the East curb of Hudson St. and 6.50 ft. North from the curb on the North sidewalk of W. Houston St., Manhattan

Coordinates:
North: 265,631.835
East: 590,371.501

Miscellaneous	Depth (feet)	Wt. #	Rec %	Blows	Description of Materials Encountered	
	ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS					Surface Elevation: +17.16 ft.
	LOG ARE BASED ON VISUAL EXAMINATION ONLY.					Rock Elevation: -87.84 ft.
	ALL SOIL COLORS ARE DETERMINED BY					Bottom Elevation: -92.67 ft.
	COMPARISON WITH THE MUNSELL SOIL CHARTS					Depth in Earth: 105.00 ft.
	(YEAR 2000 REVISED EDITION).					Depth in Rock: 4.83 ft.
						TOTAL DEPTH: 109.83 ft.
	5					
Soil Sample No. 1		140	23	15/6"	Fill materials: mostly composed of concrete, red bricks, quartz and fine	
Depth: 5.00 to 7.00 ft.				13/6"	to medium grain Sand.	
Elev.: +12.16 to +10.16 ft.				10/6"	Dry. Non-plastic. S.P.T. "N" - 23	
				6/6"		
	10					
Soil Sample No. 2		140	40	7/6"	Fill materials: mostly composed of red bricks, concrete, arkose and fine	
Depth: 10.00 to 12.00 ft.				7/6"	to medium grain Sand.	
Elev.: +7.16 to +5.16 ft.				7/6"	Dry. Non-plastic. S.P.T. "N" - 14	
				5/6"		
	15					
Soil Sample No. 3		140	38	7/6"	Fine grain, light gray (10R 7/1), moderately graded, micaceous, silty	
Depth: 15.00 to 17.00 ft.				8/6"	Sand with trace to some fine to medium gravel sized quartzite, sandstone	
Elev.: +2.16 to +0.16 ft.				6/6"	and siltstone; scattered presence of plant roots t/o the sample.	
				5/6"	Dry. Non-plastic. S.P.T. "N" - 14	
	20					
Soil Sample No. 4		140	65	6/6"	Fine to medium grain, light gray (7.5YR 7/1), poorly graded, micaceous	
Depth: 20.00 to 22.00 ft.				14/6"	Sand; trace silt.	
Elev.: -2.84 to -4.84 ft.				15/6"	Moist. Non-plastic. S.P.T. "N" - 29	
				19/5"		
	25					
Soil Sample No. 5		140	50	8/6"	Fine grain, light gray (10YR 7/2), moderately graded, micaceous, silty	
Depth: 25.00 to 27.00 ft.				10/5"	Sand with trace fine gravel sized quartzite.	
Elev.: -7.84 to -9.84 ft.				12/5"	Dry. Non-plastic. S.P.T. "N" - 22	
				29/6"		
	30					
Soil Sample No. 6		140	35	10/6"	Medium to coarse grain, yellowish brown (10YR 5/8), well graded,	
Depth: 30.00 to 32.00 ft.				14/6"	micaceous Sand with subordinate amount of fine gravel sized quartzite,	
Elev.: -12.84 to -14.84 ft.				44/5"	arkose and gneiss; trace silt.	
				24/6"	Dry. Non-plastic. S.P.T. "N" - 58	
	35					
Soil Sample No. 7		140	55	17/6"	Fine to medium grain, gray (10YR 4/1), well graded, ferruginous,	
Depth: 35.00 to 37.00 ft.				16/5"	micaceous Sand with subordinate amount of fine to medium gravel sized	
Elev.: -17.84 to -19.84 ft.				17/6"	quartzite, basalt, sandstone and schist; trace silt.	
				15/6"	Dry. Non-plastic. S.P.T. "N" - 33	
	40					

By: Warren George, Inc.
Under: Contract 554

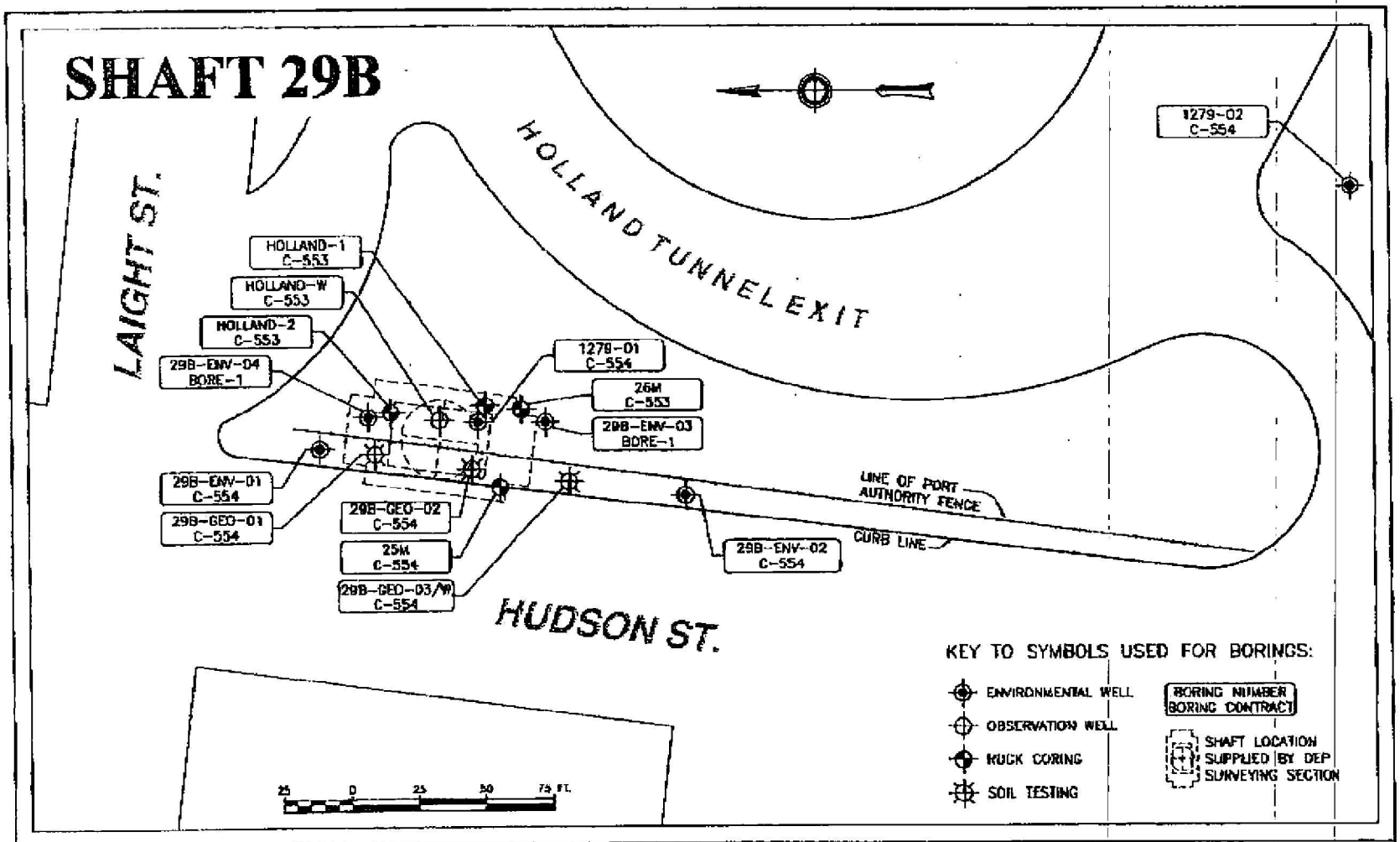
Date Started: 03/31/04
Date Completed: 04/09/04

BORING NUMBER: 28B-GEO-05

LOCATION: 78.30 ft. East from the East curb of Hudson St. and 6.20 ft. North from the curb on the North sidewalk of W. Houston St., Manhattan

Coordinates:
North: 265,626.819
East: 599,408.534

Miscellaneous	Depth (feet)	Wt #	Rec %	Blows	Description of Materials Encountered
					ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON VISUAL EXAMINATION ONLY. ALL SOIL COLORS ARE DETERMINED BY COMPARISON WITH THE MUNSELL SOIL CHARTS (YEAR 2000 REVISED EDITION).
					Surface Elevation: +17.24 ft.
					Rock Elevation: -87.76 ft.
					Bottom Elevation: -92.26 ft.
					Depth in Earth: 105.00 ft.
					Depth in Rock: 4.50 ft.
					TOTAL DEPTH: 109.50 ft.
	5				
Soil Sample No. 1		140	65	3/6"	Light reddish brown (2.5YR 6/4), micaceous, ferruginous sandy Silt;
Depth: 6.00 to 8.00 ft.				2/6"	trace clay and fine to medium gravel sized quartzite.
Elev.: +11.24 to +9.24 ft.				1/6"	Wet. Low plastic. S.P.T. "N" - 3
				4/6"	
	10				
Soil Sample No. 2		140	25	4/6"	Medium to coarse grain, dark reddish brown (5YR 3/4), well graded,
Depth: 10.00 to 12.00 ft.				7/6"	ferruginous Sand, trace silt, clay and fine to medium gravel sized
Elev.: +7.24 to +5.24 ft.				4/6"	arkose, quartzite, chert and K-spar.
				5/6"	Wet. Non-plastic. S.P.T. "N" - 11
	15				
Soil Sample No. 3		140	0	6/6"	No Recovery. S.P.T. "N" - 6
Depth: 15.00 to 17.00 ft.				3/6"	
Elev.: +2.24 to +0.24 ft.				3/6"	
				3/6"	
	20				
Soil Sample No. 4		140	65	18/6"	Fine grain, grayish brown (2.5Y 5/2), micaceous, silty Sand; trace
Depth: 20.00 to 22.00 ft.				21/6"	fine gravel sized quartzite and chert; scattered presence of dark gray
Elev.: -2.76 to -4.76 ft.				23/6"	(5YR 4/1), plastic clay lenses t/o the sample.
				22/6"	Moist. Organic. Plastic. Slightly organic odor. S.P.T. "N" - 44
	25				
Soil Sample No. 5		140	60	20/6"	Coarse grain, pale brown (10YR 6/3), well graded, micaceous Sand
Depth: 25.00 to 27.00 ft.				34/6"	with a subordinate amount of fine to medium gravel sized quartzite,
Elev.: -7.76 to -9.76 ft.				36/6"	partially decomposed granite, arkose, and chert; trace silt and clay.
				33/6"	Possible glacial origin.
	30				Wet. Non-plastic. S.P.T. "N" - 70
Soil Sample No. 6		140	55	9/6"	Coarse grain, pale brown (10YR 6/3), well graded, micaceous Sand
Depth: 30.00 to 32.00 ft.				15/6"	with some fine gravel sized quartzite, chert and K-spar; trace silt and
Elev.: -12.76 to -14.76 ft.				21/6"	clay. Possible glacial origin.
				20/6"	Wet. Non-plastic. S.P.T. "N" - 36
	35				
Soil Sample No. 7		140	35	10/6"	Medium to coarse grain, light reddish brown (5YR 6/4), ferruginous,
Depth: 35.00 to 37.00 ft.				12/6"	well graded, micaceous Sand with some fine gravel sized K-spar,
Elev.: -17.76 to -19.76 ft.				17/6"	quartzite, chert and arkose; trace silt and clay. Possible glacial origin.
				10/6"	Wet. Non-plastic. S.P.T. "N" - 29
	40				



DES L.A.V. DRN Q.T. CKD L.A.V.	LOCATION DRAWING FOR BORINGS AT SHAFT 29B	DEP	THE CITY OF NEW YORK DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF ENVIRONMENTAL ENGINEERING GEOTECHNICAL SECTION	SCALE: AS SHOWN LATEST REVISION: 08/18/04	DATE: 04/2004 PAGE 1 OF 2

Boring Number: 25M

By: Sprague and Henwood
Under: Contract 516
Date Started: 9/3/71
Date Completed: 9/16/71

LOCATION: 89.9' N. of N. Curb line of Hubert St. and 1.7' E. Curb line of Hudson St., Manhattan

Coordinates:
North: 263,000.000
East: 590,010.000

Stratification	Depth (Feet)	Well	Rec %	Blows	Description of Materials Encountered
→ This Boring Lithology Log is released as a typed version of the handwritten log from 1971.					Surface Elevation: +16.90'
These using this log are forewarned that this log may contain information of					Rock Elevation: -80.60'
highly variable quality ←					Bottom Elevation:
**"ALL DESCRIPTIONS AND CLASSIFICATIONS IN THIS LOG					Depth in Earth: 97.50'
ARE BASED ON VISUAL EXAMINATION ONLY"**					Depth in Rock: 294.40'
					TOTAL DEPTH: 391.90'
Soil Sample No. 1	⇑			4/	Fine to medium sand, gravel.
Depth: 5.00' to 7.00'	⇓			3/	Brown-wet-medium firm-permeable.
Elev. : +11.90' to +9.90'				2/	Mod. glacial drift (probably glacial drift used as artificial fill).
				4/	
	10				
Soil Sample No. 2	⇑			4/	(Small sample.)
Depth: 10.00' to 12.00'	⇓			4/	Coarse sand, fine gravel.
Elev. : +6.90' to +4.90'				5/	Variegated-wet-medium firm-permeable.
				5/	Mod. glacial drift (2).
	15				
Soil Sample No. 3	⇑			6/	Silt.
Depth: 15.00' to 17.00'	⇓			7/	Brown-damp-firm-impermeable.
Elev. : +1.90' to -0.10'				11/	Glacial lake bed sediment (2).
				10/	
	20				
Soil Sample No. 4	⇑			7/	Fine micaceous sand.
Depth: 20.00' to 22.00'	⇓			8/	Brown-damp-firm-permeable.
Elev. : -3.10' to -5.10'				8/	Coarse glacial lake bed sediment (2).
				9/	
	25				
Soil Sample No. 5	⇑			5/	Fine sand, trace coarse sand, trace fine gravel.
Depth: 25.00' to 27.00'	⇓			3/	Brown-wet-medium firm-impermeable.
Elev. : -8.10' to -10.10'				4/	Glacial lake bed sediment (2).
				15/	
	30				
Soil Sample No. 6	⇑			9/	Very fine micaceous sand.
Depth: 30.00' to 32.00'	⇓			12/	Brown-wet-medium firm-slightly permeable.
Elev. : -13.10' to -15.10'				12/	Glacial lake bed sediment (2).
				10/	
	35				
Soil Sample No. 7	⇑			11/	Fine sand.
Depth: 35.00' to 37.00'	⇓			12/	Brown-wet-medium firm-permeable.
Elev. : -18.10' to -20.10'				15/	Glacial lake bed sediment (2).
				12/	
	40				
Soil Sample No. 8	⇑			5/	Very fine micaceous sand.
Depth: 40.00' to 42.00'	⇓			11/	Brown-wet-medium firm-poorly permeable.
Elev. : -23.10' to -25.10'				10/	Glacial lake bed sediment (2).
				19/	
	45				

BORING NUMBER: 26M

By: Sprague and Henwood
Under: Contract 516

Date Started: 09/22/71
Date Completed: 10/05/71

LOCATION: 30' +/- East of East curb and 84.9' +/- North of Northwest corner at Hudson Street and Hubert Street, Manhattan

Coordinates:
North: 262,992.000
East: 590,038.000

Miscellaneous	Depth (Feet)	Wt#	Rec %	Blows	Description of Materials Encountered
9-22-71 → This Boring Lithology Log is realized as a typed version of the original handwritten log from 1971. Those using this Log are forewarned that this Log may contain information of highly variable quality. ←					Surface Elevation: +17.70 ft Rock Elevation: -81.30 ft Bottom Elevation: -375.00 ft Depth in Earth: 99.00 ft Depth in Rock: 293.70 ft TOTAL DEPTH: 392.70 ft
ALL DESCRIPTION AND CLASSIFICATIONS IN THIS LOG ARE BASED ON VISUAL EXAMINATION ONLY					
Soil Sample No. 1	⇑			3/	Small sample.
Depth: 5.00' to 7.00'	⇓			2/	Coarse sand, rock fragments.
Elev. : +12.70' to +10.70'				3/	Gray-moist-loose-permeable.
				4/	Artificial fill (0).
	10				
Soil Sample No. 2	⇑			2/	Medium sand.
Depth: 10.00' to 12.00'	⇓			2/	Gray-moist-loose-permeable, probably artificial fill.
Elev. : +7.70' to +5.70'				3/	
				4/	
	15				
Soil Sample No. 3	⇑			4/	Silt. Grey-wet-soft-plastic-impermeable.
Depth: 15.00' to 17.00'	⇓			4/	Glacial lake bed sediment (1).
Elev. : +2.70' to +0.70'				9/	
				15/	
	20				
Soil Sample No. 4	⇑			6/	Medium sand, trace small gravel.
Depth: 20.00' to 22.00'	⇓			6/	Brown-moist-soft-permeable.
Elev. : -2.30' to -4.30'				8/	Mod. glacial drift. (1)
				6/	
	25				
Soil Sample No. 5	⇑			6/	Medium sand, small gravel, trace silt.
Depth: 25.00' to 27.00'	⇓			8/	Brown-moist-soft-permeable.
Elev. : -7.30' to -9.30'				12/	Mod glacial drift (2).
				11/	
	30				
Soil Sample No. 6	⇑			15/	Medium fine sand, gravel.
Depth: 30.00' to 32.00'	⇓			17/	Brown-wet-medium-firm-permeable.
Elev. : -12.30' to -14.30'				20/	Mod. glacial drift (3).
				29/	
	35				
Soil Sample No. 7	⇑			15/	Fine sand, micaceous. Red-damp-medium firm, poorly permeable.
Depth: 35.00' to 37.00'	⇓			13/	Transition to glacial lake bed sediment.
Elev. : -17.30' to -19.30'				12/	
				16/	
	40				
Soil Sample No. 8	⇑			12/	Fine sand, micaceous.
Depth: 40.00' to 42.00'	⇓			13/	Brown-damp-medium firm-permeable.
Elev. : -22.30' to -24.30'				19/	Mod. glacial drift (2).
				20/	
	45				

By: WARREN GEORGE
Under CONTRACT 553

Date Started: 06/24/96
Date Completed: 07/11/96

BORING NUMBER: HOLLAND-1

LOCATION: Exit ramp of Holland Tunnel: south of Laight St.; east of Hudson St., Manhattan.

Coordinates:
North: 163,005.384
East: 590,039.458

Miscellaneous	Depth (Feet)	Wt. #	Rec %	Blows	Description of Material Encountered
					** ALL CLASSIFICATIONS AND
					DESCRIPTIONS IN THIS LOG
					ARE BASED ON VISUAL
					EXAMINATION ONLY**
	5				
Soil Sample No. 1		140	40	4,4,	Reddish-brown fine to coarse sand, trace of silt & fine gravel. Damp.
Depth: 8.00 to 10.00 ft.				5,6	N= 9
Elev.: +9.80 to +7.80 ft.	10				
Soil Sample No. 2	15	140	70	7,6,	Greenish-brown clayey silt w/microscopic laminations, some roots,
Depth: 15.00 to 17.00 ft.				8,16	and w/ some medium brown sand. Damp.
Elev.: +2.80 to +0.80 ft.					N = 14
Soil Sample No. 3	20	140	75	14,10,	Very fine to coarse reddish-brown sand w/ traces of clay & silt
Depth: 20.00 to 22.00 ft.				8,9	(speckled w/ small highly weathered garnets & biotite grains). Some
Elev.: -2.20 to -4.20 ft.					threading. Moist.
					N = 18
Soil Sample No. 4	25	140	90	4,5,	Very fine reddish-brown sand & silt w/ trace of clay. Reddish-brown
Depth: 25.00 to 27.00 ft.				6,5	to tan microscopic laminations of sand , silt, and trace of clay.
Elev.: -7.20 to -9.20 ft.					Barely threads. Wet.
					N = 11
Soil Sample No. 5	30	140	90	22,20,	Reddish-brown to tan microscopic laminations of very fine sand, silt,
Depth: 30.00 to 32.00 ft.				15,20	and traces of clay & gravel. Barely to no threads. Damp.
Elev.: -12.20 to -14.20 ft.					N = 35
Soil Sample No. 6	35	140	65	14,16,	Greenish-brown laminated fine sand & silt, reddish-brown microscopic
Depth: 35.00 to 37.00 ft.				20,23	laminations of very fine sand and silt w/trace of clay and fine gravel.
Elev.: -17.20 to -19.20 ft.					Moist.
					N = 36
Soil Sample No. 7	40	140	93	13,15,	Reddish-brown very fine sand & silt, microscopic laminations of very fine
Depth: 40.00 to 42.00 ft.				20,23	sand and silt, trace of clay. Moist.
Elev.: -22.20 to -24.20 ft.					N = 35
Soil Sample No. 8	45	140	95	14,14,	Reddish-brown very fine to fine sand and some silt w/ traces of

By: WARREN GEORGE
Under: CONTRACT 553

BORING NUMBER: Holland-2

LOCATION: Holland Tunnel exit ramp, south of Leight St., east of Hudson St., Manhattan.

Coordinates:
North: 202,040.527
East: 590,077.039

Date Started: 07/19/96
Date Completed: 07/29/96

Miscellaneous	Depth (feet)	#	Rec %	Blow s	Description of Materials Encountered
ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON VISUAL EXAMINATION ONLY					
Soil Sample No. 1	5	140	40	15, 23,	Reddish-brown fine to coarse sand
Depth: 5.00 to 7.00 ft.				12,1.	and silt to tan silty fine sand, with
Elev.: +12.28 to +10.28 ft.					broken schist & gravel, trace of clay, fine gravel & organics. Moist.
					S.P.T. "N" value = 35
Soil Sample No. 2	10	140	25	12,16,	Reddish-brown to reddish-gray fine to coarse sand, some silt, trace
Depth: 10.00 to 12.00 ft.				19,22	of gravel & clay. Clayey section threads barely to easily. Moist.
Elev.: +7.28 to +5.28 ft.					S.P.T. "N" value = 35
Soil Sample No. 3	15	140	42	8,8,	Green to tan silt & very fine sand, some organics, laminated
Depth: 15.00 to 17.00 ft.				8,11	microstructure, some to trace of coarse sand, fine gravel, & clay.
Elev.: +2.28 to +0.28 ft.					Threads easily. Moist.
					S.P.T. "N" value =15
Soil Sample No. 4	20	140	72	12,31,	Dark reddish-brown fine to coarse sand, w/ some clay and silt,
Depth: 20.00 to 22.00 ft.				22,21	trace of fine to medium gravel. Barely threads. Moist.
Elev.: -2.72 to -4.72 ft.					S.P.T. "N" value =43
Soil Sample No. 5	25	140	27	10,28,	Dark reddish-brown fine to coarse sand, some gravel, trace of silt &
Depth: 25.00 to 27.00 ft.				34,33	clay, Barely threads. Moist.
Elev.: -7.72 to -9.72 ft.					S.P.T. "N" value =54
Soil Sample No. 6	30	140	67	24,11,	Dark reddish-brown fine to coarse sand, some gravel, trace of clay,
Depth: 30.00 to 32.00 ft.				24,26	and trace to some silt. Moist.
Elev.: -12.72 to -14.72 ft.					S.P.T. "N" value =42
Soil Sample No. 7	35	140	100	10,13,	Dark reddish-brown fine to medium sand and some silt. Moist.
Depth: 35.00 to 37.00 ft.				21,18	S.P.T. "N" value =33
Elev.: -17.72 to -19.72 ft.					
Soil Sample No. 8	40	140	85	15,22,	Dark reddish-brown very fine to fine sand, some silt, and trace of
Depth: 40.00 to 42.00 ft.				22,22	clay. Barely threads. Wet.
Elev.: -22.72 to -24.72 ft.					S.P.T. "N" value = 44
Soil Sample No. 9	45	140	90	8,11	Dark reddish-brown fine to coarse sand, some silt, and trace of

Surface Elevation:	+17.28 ft.
Rock Elevation:	-79.72 ft
Bottom Elevation:	-523.46 ft
Depth in Earth:	97.00 ft.
Depth in Rock:	443.74 ft
TOTAL DEPTH:	540.74 ft.

By: Warren George, Inc.
Under: Contract 554

Date Started: 04/03/03
Date Completed: 04/03/03

BORING NUMBER: 29B-1279-01

LOCATION: On "Parcel A" traffic island adjacent to Holland Tunnel, South from the South curb of Laight St. and East from the East curb of Hudson St., Manhattan.

Coordinates:
North: 263,808.061
East: 590,033.375

Miscellaneous	Depth (feet)	Wt #	Rec %	Blows	Descriptions of Materials Encountered
					ALL DESCRIPTIONS IN THIS LOG ARE BASED ON
					FIELD INSPECTOR'S OBSERVATIONS AND NOTES.
					Surface Elevation: +17.83 ft.
					Rock Elevation: N/A
					Bottom Elevation: +0.83 ft.
					Depth in Earth: 17.00 ft.
					Depth in Rock: N/A
					TOTAL DEPTH: 17.00 ft.
	0				
					Environmental Sampling Data
Soil Sample No. 1		140	N/A	N/A	Two soil samples were collected by Peter Diglio
Depth: 2.00 to 4.00 ft.					of PDM Environmental Services Inc. for soil contaminant testing.
Elev.: +15.83 to +13.83 ft.	5				
					Boring was started using a 3 7/8" tri-cone roller bit, drilling to 2.00 ft. depth.
					Sample No.1 was collected using the split spoon sampler from 2.00 to
					4.00 ft. depth. Borehole was again advanced using 3 7/8" roller bit roller bit
					to 15.00 ft. depth, (approximate depth to water table).
	10				Sample No. 2 was collected from 15.00 to 17.00 ft. depth.
					Borehole was backfilled and grouted upon completion of drilling and
					sampling activities.
					To view the results please refer to the Environmental Site Summary
					Report by PDM dated April 2003, PDM Project No.1279-00,
	15				Enviro Boring #1 (SB-01).
Soil Sample No. 2		140	N/A	N/A	
Depth: 15.00 to 17.00 ft.					END OF BOREHOLE AT 17.00 ft. (Elev.: +0.83 ft.).
Elev.: +2.83 to +0.83 ft.					
					Environmental Boring
					Drilling Rig: Acker Mayhew 500
					Drillers: R.J. Gregory, N. Burgess
					Inspector: B. Bowman
					Environmental Inspector: P. Diglio
					Reviewed By: C. Morris, C. Dozier

By: Warren George, Inc.
Under: Contract 554

Date Started: 04/04/03
Date Completed: 04/04/03

BORING NUMBER: 29B-1279-02

LOCATION: On "Parcel B" traffic island adjacent to Holland Tunnel, East from the East curb of Hudson St. and North from the North curb of Ericsson Pl., Manhattan.

Coordinates:
North: 202,685.423
East: 590,118.121

Miscellaneous	Depth (Feet)	Wt #	Rec %	Flow	Description of Materials Encountered
					ALL DESCRIPTIONS IN THIS LOG ARE BASED ON
					FIELD INSPECTOR'S OBSERVATIONS AND NOTES.
	0				
					Environmental Sampling Data
Soil Sample No. 1		140	N/A	N/A	Two soil samples were collected by Peter Diglio
Depth: 2.00 to 4.00 ft.					of PDM Environmental Services Inc. for soil contaminant testing.
Elev.: +16.76 to +14.76 ft.	5				Boring was started using 3 7/8" tri-cone roller bit, Drilling to 2.00 ft. depth
					Sample No.1 was collected using the split spoon method from 2.00 to
					4.00 ft. depth. Borehole was again advanced using 3 7/8" tri-cone roller bit
					to 15.00 ft. depth, (approximate depth to water table).
					Sample No. 2 was collected from 15.00 to 17.00 ft. depth.
	10				Borehole was backfilled and grouted upon completion of drilling and
					sampling activities.
					To view the results please refer to the Environmental Site Summary
					Report by PDM dated April 2003, PDM Project No.1279-00,
					Enviro Boring #2 (3B-02).
	15				
Soil Sample No. 2		140	N/A	N/A	
Depth: 15.00 to 17.00 ft.					END OF BOREHOLE AT 17.00 ft. (Elev.: +1.76 ft.).
Elev.: +3.76 to +1.76 ft					
					Environmental Boring
					Drilling Rig: Mayhew 500
					Drillers: R.J. Gregory, N. Burgess
					Inspector: B. Bowman
					Environmental Inspector: P. Diglio
					Reviewed By: C. Morris, C. Dozier

Surface Elevation:	+18.76 ft.
Rock Elevation:	N/A
Bottom Elevation:	+1.76 ft.
Depth in Earth:	17.00 ft.
Depth in Rock:	N/A
TOTAL DEPTH:	17.00 ft.

By: Warren George, Inc.
Under: Contract 594

Date Started: 03/14/03
Date Completed: 03/14/03

BORING NUMBER: 29B-ENV-01

LOCATION: On East sidewalk of Hudson St., 12.44 ft. East from the East curb of Hudson St. and 20.61 ft. South from the South curb of Leight St., Manhattan

Coordinates:
North: 263,066.708
East: 590,023.988

Miscellaneous	Depth (feet)	Wt #	Rec %	Blows	Description of Materials Encountered
					ALL DESCRIPTIONS IN THIS LOG ARE BASED
					ON FIELD INSPECTOR'S OBSERVATIONS AND NOTES.
	5				Environmental Sampling Data
Soil Sample No. 1		140	N/A	N/A	Two soil samples were collected by Peter Diglio
Depth: 5.00 to 7.00 ft.					of PDM Environmental Services Inc. for soil contaminant testing.
Elev.: +11.58 to +9.58 ft.					Boring was started using 3 7/8" tri-cone roller bit. Drilling to 5.00 ft. depth
					Sample No.1 was collected using the split spoon sampler from 5.00 to
	10				7.00 ft. depth. Borehole was again advanced using 3 7/8" tri-cone roller bit
					to 15.00 ft. depth, (approximate depth to water table). Sample No. 2
					was collected from 15.00 to 17.00 ft. depth. Borehole was grouted upon
					completion of drilling and sampling activities.
					To view the results please refer to the Environmental Site Summary Report
	15				by PDM dated March 2003, PDM Project No. 1271-00.
Soil Sample No. 2		140	N/A	N/A	Enviro Boring #1 (SB-01).
Depth: 15.00 to 17.00 ft.		* *			END OF BOREHOLE AT 17.00 ft. (Elev.: -0.42 ft.).
Elev.: +1.58 to -0.42 ft.					
					Environmental Boring
					Drilling Rig: Acker Wireline
					Drillers: R. Bridgepal, A. Feliciano
					Inspector: M. Burton, M. Caranica
					Environmental Inspector: P. Diglio
					Reviewed By: C. Morris, C. Dozier

Surface Elevation:	+16.58 ft.
Rock Elevation:	N/A
Bottom Elevation:	-0.42 ft.
Depth in Earth:	17.00 ft.
Depth in Rock:	N/A
TOTAL DEPTH:	17.00 ft.

By: Warren George, Inc.
Under: Contract 554

Date Started: 03/14/03
Date Completed: 03/14/03

BORING NUMBER: 29B-ENV-02

LOCATION: On the East sidewalk of Hudson St., 12.80 ft. East from the East curb of Hudson St. and 146.90 ft. South from South curb of Laight St., Manhattan.

Coordinates:
North: 262,931.472
East: 590,006.492

Miscellaneous	Depth (feet)	Wt #	Rec %	Blows	Description of Materials Encountered
	ALL DESCRIPTIONS IN THIS LOG ARE BASED				Surface Elevation: +17.07 ft.
	ON FIELD INSPECTOR'S OBSERVATIONS AND NOTES.				Rock Elevation: N/A
					Bottom Elevation: +0.07 ft.
					Depth in Earth: 17.00 ft.
					Depth in Rock: N/A
					TOTAL DEPTH: 17.00 ft.
	5				Environmental Sampling Data
Soil Sample No. 1		140	N/A	N/A	Two soil samples were collected by Peter Diglio
Depth: 5.80 to 7.80 ft.					of PDM Environmental Services Inc. for soil contaminant testing.
Elev.: +11.27 to +9.27 ft.					Boring was started using 3 7/8" tri-cone roller bit. Drilling to 5.00 ft. depth.
					Sample No.1 was collected using the split spoon sampler from 5.00 to
	10				7.00 ft. depth. Borehole was again advanced using 3 7/8" tri-cone roller bit
					to 15.00 ft. depth, (approximate depth to water table).
					Sample No. 2 was collected from 15.00 to 17.00 ft. depth.
					Borehole was grouted upon completion of drilling and sampling activities.
					To view the results please refer to the Environmental Site Summary Report
	15				by PDM dated March 2003, PDM Project No. 1271-00.
Soil Sample No. 2		140	N/A	N/A	Enviro Boring #2 (SB -02).
Depth: 15.00 to 17.00 ft.					END OF BOREHOLE AT 17.00 ft. (Elev.: +0.07 ft.).
Elev.: +2.07 to +0.07 ft.					
					Environmental Boring
					Drilling Rig: Acker Wireline
					Drillers: R. Bridgepal, A. Feliciano
					Inspector: M. Burton, M. Caranica
					Environmental Inspector: P. Diglio
					Reviewed By: C. Morris, C. Dozier

By: Aquifer Drilling and Testing, Inc.
Under: Contract Bore-1

Date Started: 01/23/04
Date Completed: 1/23/04

BORING NUMBER: 29B-ENV-03

LOCATION: On traffic island adjacent to Holland Tunnel, 32.30 ft. East from the East curb of Hudson St. and 115.00 ft. South from the South curb of Laight St., Manhattan

Coordinates:
North: 262,983.289
East: 590,033.407

Miscellaneous	Depth (Feet)	Wt #	Rec %	Blows	Description of Materials Encountered	
		ALL CLASSIFICATIONS AND DESCRIPTIONS IN				Surface Elevation: +17.76 ft.
		THIS LOG ARE BASED ON FIELD INSPECTOR'S				Rock Elevation: N/A
		OBSERVATIONS AND NOTES.				Bottom Elevation: -3.24 ft.
				Note: S.P.T. "N" not determined due to blow counts		Depth in Earth: 21.00 ft.
	0			obtained with a 3" split spoon sampler.		Depth in Rock: N/A
Soil Sample No. 1		140	88	52/6"	Fill materials mostly composed of	TOTAL DEPTH: 21.00 ft.
Depth: 0.00 to 2.00 ft.				35/6"	concrete cement and brick. Cont. Below	
Soil Sample No. 2		140	54	25/6"	Medium to coarse grain reddish brown micaceous Sand with some	
Depth: 2.00 to 4.00 ft.				37/6"	fill material consisting of concrete fragments.	
Elev.: +15.76 to +13.76 ft.	5			20/6"	Moist. S.P.T. "N" - N/A	
				17/6"		
Soil Sample No. 3	10	140	83	3/6"	Medium to coarse grain reddish brown micaceous Sand with trace	
Depth: 9.00 to 11.00 ft.				3/6"	sand, silt and fine gravel.	
Elev.: +8.76 to +6.76 ft.				2/6"	Moist. S.P.T. "N" - N/A	
				4/6"		
Soil Sample No. 4	15	140	79	2/6"	Yellowish brown silty Clay with some fine to coarse grain dark	
Depth: 14.00 to 16.00 ft.				5/6"	reddish brown sand.	
Elev.: +3.76 to +1.76 ft.				6/6"	Moist. S.P.T. "N" - N/A	
				3/6"		
Soil Sample No. 5	20	140	75	4/6"	Fine to coarse grain reddish brown micaceous Sand. Moist.	
Depth: 19.00 to 21.00 ft.		* *		13/6"	S.P.T. "N" - N/A END OF BOREHOLE AT 21.00 ft. (Elev.: -3.24 ft.)	
Elev.: -1.24 to -3.24 ft.				12/6"		
				10/6"		
Soil Sample No. 1 (cont.)				18/6"	Dry. S.P.T. "N" - N/A	
Elev.: +17.76 to +15.76 ft.				21/6"		
					Environmental Sampling Data	
					Five soil samples were collected by Karen Schwartz of Langan	
					Engineering and Environmental Services Inc. for soil contaminant testing.	
					Borehole was backfilled and grouted upon completion of drilling and	
					sampling activities. To view the results please refer to	
					Langan Engineering Environmental Report dated May 7, 2004,	
					Sample B-2.	
					Environmental Boring	
					Drilling Rig: CME 45	
					Drillers: R. Dollar, C. Tolly, R. Molyukov	
					Inspector: M. Yang	
					Environmental Inspector: K. Schwartz	
					Reviewed By: C. Morris, C. Dozier	

By: Aquifer Drilling and Testing, Inc.
Under: Contract Bore-1

Date Started: 01/23/04
Date Completed: 1/23/04

BORING NUMBER: 29B-ENV-04

LOCATION: On traffic island adjacent to Holland Tunnel 27.30 ft. East from the East curb of Hudson St. and 49.00 ft. South from the South curb of Laight St. Manhattan

Coordinates:
North: 203,046,521
East: 590,035,303

Miscellaneous	Depth (feet)	Wt #	Rec %	Blows	Description of Materials Encountered
		ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS			Surface Elevation: +17.49 ft.
		LOG ARE BASED ON FIELD INSPECTOR'S			Rock Elevation: N/A
		OBSERVATIONS AND NOTES.			Bottom Elevation: -0.51 ft.
		Note: S.P.T. "N" was not determined due to the blow counts			Depth in Earth: 18.00 ft.
	0	obtained with 3" split spoon sampler.			Depth in Rock: N/A
Soil Sample No. 1		140	96	22/6"	Fill materials mostly composed of TOTAL DEPTH: 18.00 ft.
Depth: 0.00 to 2.00 ft.				25/6"	concrete, cement and brick. Cont. Below
Soil Sample No. 2		140	75	15/6"	Fill materials mostly composed of concrete fragments, red brick and
Depth: 2.00 to 4.00 ft.				23/6"	medium to coarse grain reddish brown micaceous sand.
Elev.: +15.49 to +13.49 ft.	5			19/6"	Moist. S.P.T. "N" - N/A
				8/6"	
Soil Sample No. 3	10	140	83	2/6"	Fine to coarse grain reddish brown micaceous Sand with trace gravel.
Depth: 9.00 to 11.00 ft.				3/6"	Moist. S.P.T. "N" - N/A
Elev.: +8.49 to +6.49 ft.				2/6"	
				5/6"	
Soil Sample No. 4	15	140	83	4/6"	Fine to medium grain reddish brown micaceous Sand with trace clay, silt
Depth: 14.00 to 16.00 ft.				8/6"	and gravel. Cont. Below
Soil Sample No. 5		140	96	9/6"	Fine grain reddish brown micaceous Sand with some brown silty clay
Depth: 16.00 to 18.00 ft.				15/6"	and gravel. Moist. S.P.T. "N" - N/A
Elev.: +1.49 to -0.51 ft.				11/6"	END OF BOREHOLE AT 18.00 ft. (Elev.: -0.51 ft.)
				15/6"	
Soil Sample No. 1 (cont.)				18/6"	Dry. S.P.T. "N" - N/A
Elev.: +17.49 to +15.49 ft.				14/6"	
Soil Sample No. 4				2/6"	Moist S.P.T. "N" - N/A
Elev.: +3.49 to +1.49 ft.				8/6"	
					Environmental Sampling Data
					Five soil samples were collected by Karen Schwartz of Langan
					Engineering and Environmental Services Inc. for soil contaminant testing.
					Borehole was backfilled and grouted upon completion of drilling and
					sampling activities. To view the results please refer to Langan
					Engineering Environmental Report dated May 7, 2004, Sample B-1.
					Environmental Boring
					Drilling Rig: CME 45
					Drillers: R. Dollar, C. Tolly, R. Malyukov
					Inspector: M. Yang
					Environmental Inspector: K. Schwartz
					Reviewed By: C. Morris, C. Dozier

By: Warren George, Inc.
Under: Contract 554

Date Started: 03/11/03
Date Completed: 03/12/03

BORING NUMBER: 29B-GEO-01

LOCATION: 30.77 ft. South from the North end of P.A. fence and 12.90 ft. East from the curb on East sidewalk of Hudson St., Manhattan

Coordinates:
North: 203,846.051
East: 990,021.897

Miscellaneous	Depth (Feet)	Wt. #	Rec %	Blows	Description of Material Encountered
	ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS				Surface Elevation: +16.55 ft.
	LOG ARE BASED ON VISUAL EXAMINATION ONLY.				Rock Elevation: -76.45 ft.
	ALL SOIL COLORS ARE DETERMINED BY				Bottom Elevation: -76.95 ft.
	COMPARISON WITH THE MUNSELL SOIL CHARTS				Depth in Earth: 93.00 ft.
	(YEAR 2000 REVISED EDITION).				Depth in Rock: 0.50 ft.
					TOTAL DEPTH: 93.50 ft.
					Note: Wash cutting samples may not be representative of the
					particular depth.
	5				
Soil Sample No. 1		140	38	6/6"	Coarse grain, dark reddish brown (5YR 3/4), poorly graded,
Depth: 5.00 to 7.00 ft.				4/6"	ferruginous, gravelly Sand with some fill materials; mostly composed
Elev.: +11.55 to +9.55 ft.				3/6"	of concrete, sandstone, and quartzite; trace silt.
				4/6"	Moist. Non-plastic. S.P.T. "N" - 7
	10				
Soil Sample No. 2		140	65	5/6"	Fine to coarse grain, dark reddish brown (5YR 3/4), well graded,
Depth: 10.00 to 12.00 ft.				3/6"	ferruginous Sand with a subordinate amount of dark yellowish brown,
Elev.: +6.55 to +4.55 ft.				2/6"	(10YR 4/4) silty Clay; trace fine to medium gravel sized quartzite,
				3/6"	granite, and sandstone.
	15				Moist. Plastic. S.P.T. "N" - 5
Soil Sample No. 3		140	80	6/6"	Light yellowish brown (2.5Y 6/4) to yellowish brown (10YR 5/8) Clay
Depth: 15.00 to 17.00 ft.				7/6"	with some fine grain, reddish brown (2.5YR 4/4), ferruginous,
Elev.: +1.55 to -0.45 ft.				9/6"	micaceous, silty sand; trace fine gravel sized arkose and granite.
				17/6"	Moist. Plastic. S.P.T. "N" - 16
	20				
Soil Sample No. 4		140	75	11/6"	Fine to medium grain, dark reddish brown (2.5YR 3/4), poorly graded,
Depth: 20.00 to 22.00 ft.				11/6"	ferruginous, micaceous Sand; trace brown (10YR 4/3) silt and
Elev.: -3.45 to -5.45 ft.				13/6"	clay. Moist. Low plastic. S.P.T. "N" - 24
				12/6"	
	25				
Soil Sample No. 5		140	68	12/6"	Fine to medium grain, dark reddish brown (2.5YR 3/4), well graded,
Depth: 25.00 to 27.00 ft.				10/6"	ferruginous, micaceous Sand with some silt; trace clay and fine gravel
Elev.: -8.45 to -10.45 ft.				15/6"	sized quartzite and claystone.
				13/6"	Moist. Low plastic. S.P.T. "N" - 25
	30				
Soil Sample No. 6		140	73	13/6"	Fine to medium grain, dark reddish brown (5YR 3/3), poorly graded,
Depth: 30.00 to 32.00 ft.				15/6"	ferruginous, micaceous Sand with some silt and trace clay.
Elev.: -13.45 to -15.45 ft.				19/6"	Moist. Non-plastic. S.P.T. "N" - 34
				24/6"	
	35				
Soil Sample No. 7		140	65	9/6"	Fine to medium grain, dusky red (10R 3/4), poorly graded, ferruginous,
Depth: 35.00 to 37.00 ft.				20/6"	highly micaceous Sand with some silt; sporadic presence of reddish
Elev.: -18.45 to -20.45 ft.				26/6"	brown (2.5YR 4/3) to black (5YR 2.5/1) clay.
				31/6"	Moist. Medium plastic. S.P.T. "N" - 46
	40				

By: Warren George, Inc.
Under: Contract 554

Date Started: 03/13/03
Date Completed: 03/14/03

BORING NUMBER: 29B-GEO-02

LOCATION: 67.39 ft. South from the North end of P.A. fence and 12.10 ft. East from the curb on East sidewalk of Hudson St., Manhattan

Coordinates:
North: 203,010.423
East: 990,016.464

Miscellaneous	Depth (feet)	Wt #	Rec %	Blows	Description of Materials Encountered
	ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS				Surface Elevation: +16.62 ft.
	LOG ARE BASED ON VISUAL EXAMINATION ONLY.				Rock Elevation: -77.38 ft.
	ALL SOIL COLORS ARE DETERMINED BY				Bottom Elevation: -78.88 ft.
	COMPARISON WITH THE MUNSELL SOIL CHARTS				Depth to Earth: 94.00 ft.
	(YEAR 2000 REVISED EDITION).				Depth in Rock: 1.50 ft.
					TOTAL DEPTH: 95.50 ft.
					Note: Wash cutting samples may not be representative of the
					particular depth.
	5				
Soil Sample No. 1		140	41	4/6"	Fine to coarse grain, reddish brown (5YR 5/4), well graded,
Depth: 5.00 to 7.00 ft.				5/6"	ferruginous Sand with some fill materials: mostly composed of
Elev.: +11.62 to +9.62 ft.				5/6"	concrete, fine to medium gravel sized sandstone, chert, quartz, and
				5/6"	schist; trace silt.
	10				Dry. Non-plastic. S.P.T. "N" - 10
Soil Sample No. 2		140	40	6/6"	Medium to coarse grain, reddish brown (5YR 5/4), well graded,
Depth: 10.00 to 12.00 ft.				6/6"	ferruginous, micaceous Sand mixed with fine to medium gravel sized,
Elev.: +6.62 to +4.62 ft.				4/6"	variably shaped quartzite, sandstone, chert, siltstone, schist, and fill
				3/6"	materials composed of concrete and red brick; trace silt.
	15				Dry. Non-plastic. S.P.T. "N" - 10
Soil Sample No. 3		140	N/A	10/6"	Mixed assemblages of fine to medium gravel sized, highly fragmented,
Depth: 15.00 to 17.00 ft.				11/6"	variably shaped quartzite, arkose, and granodiorite.
Elev.: +1.62 to -0.38 ft.				13/6"	Dry. Non-plastic. S.P.T. "N" - 24
				20/6"	
	20				
Soil Sample No. 4		140	0	20/6"	No recovery.
Depth: 20.00 to 22.00 ft.				20/6"	S.P.T. "N" - 42
Elev.: -3.38 to -5.38 ft.				22/6"	
				25/6"	
	25				
Soil Sample No. 5		140	60	11/6"	Fine to medium grain, light reddish brown (5YR 6/3), well graded,
Depth: 25.00 to 27.00 ft.				8/6"	ferruginous, micaceous Sand with some silt; trace clay, and fine to
Elev.: -8.38 to -10.38 ft.				8/6"	medium gravel sized quartzite and granite. Moderate magnetic
				14/6"	susceptibility has been noted in the sample. Possible glacial origin.
	30				Dry. Non-plastic. S.P.T. "N" - 16
Soil Sample No. 6		140	85	16/6"	Fine to medium grain, yellowish red (5YR 4/6), well graded,
Depth: 30.00 to 32.00 ft.				13/6"	ferruginous, micaceous Sand with some silt; trace clay, and fine to
Elev.: -13.38 to -15.38 ft.				12/6"	medium gravel sized quartzite, sandstone, and hornblende schist.
				18/6"	Moderate magnetic susceptibility has been noted in the sample.
	35				Possible glacial origin. Moist. Non-plastic. S.P.T. "N" - 25
Soil Sample No. 7		140	100	11/6"	Fine grain, light reddish brown (2.5YR 6/4), poorly graded,
Depth: 35.00 to 37.00 ft.				12/6"	ferruginous, micaceous, silty Sand with some clay; trace fine gravel
Elev.: -18.38 to -20.38 ft.				15/6"	sized siltstone. Weak magnetic susceptibility has been noted in the
				26/6"	sample. Dry. Medium plastic. S.P.T. "N" - 27
	40				

By: Warren George, Inc.
Under: Contract 554

Date Started: 03/17/03
Date Completed: 03/18/03

BORING NUMBER: 29B-GEO-03/W

LOCATION: 103.40 ft. South from the North end of P.A. fence and 12.30 ft. East from the curb on East sidewalk of Hudson St., Manhattan

Coordinates:
North: 262,974.702
East: 590,011.951

Miscellaneous	Depth (Feet)	Wt #	Rec %	Blows	Description of Materials Encountered
					ALL CLASSIFICATIONS AND DESCRIPTIONS IN THIS LOG ARE BASED ON VISUAL EXAMINATION ONLY. ALL SOIL COLORS ARE DETERMINED BY COMPARISON WITH THE MUNSELL SOIL COLOR CHARTS (YEAR 2000 REVISED EDITION).
					Surface Elevation: +16.85 ft.
					Rock Elevation: -78.65 ft.
					Bottom Elevation: -78.65 ft.
					Depth in Earth: 95.50 ft.
					Depth in Rock: N/A
					TOTAL DEPTH: 95.50 ft.
					Note: Wash cutting samples may not be representative of the particular depth.
	5				
Soil Sample No. 1		140	25	11/6"	Fine to medium grain, brown (7.5YR 5/4), well graded, ferruginous,
Depth: 5.00 to 7.00 ft.				4/6"	micaceous Sand with some clayey silt, and fine to medium gravel sized
Elev.: +11.85 to +9.85 ft.				5/6"	quartz, schist, and sandstone.
				6/6"	Dry. Medium-plastic. S.P.T. "N" - 9
	10				
Soil Sample No. 2		140	25	18/6"	Fill materials; mostly composed of concrete and red brick, and fine to
Depth: 10.00 to 12.00 ft.				13/6"	medium gravel sized quartzite, feldspar, chert, and schist fragments,
Elev.: +6.85 to +4.85 ft.				14/6"	with trace silt. Note: S.P.T. "N" was not determined due to the blow
				10/6"	counts obtained with a 3" split spoon sampler.
	15				Moist. Non-plastic. S.P.T. "N" - N/A
Soil Sample No. 3		140	50	13/6"	Fine grain, yellowish brown (10YR 5/6), poorly graded, ferruginous,
Depth: 15.00 to 17.00 ft.				16/6"	slightly calcareous and slightly micaceous silty Sand with some clayey
Elev.: +1.85 to -0.15 ft.				14/6"	silt. Trace fine to medium gravel sized sandstone, gneiss, and granite.
				36/6"	Weak magnetic susceptibility has been noted in the sample. Note:
	20				S.P.T. "N" was not determined due to the blow counts obtained Cont. on page 3
Soil Sample No. 4		140	65	11/6"	Fine to medium grain, reddish brown (5YR 4/4), poorly graded,
Depth: 20.00 to 22.00 ft.				10/6"	ferruginous, highly micaceous Sand with trace silt. Moderate magnetic
Elev.: -3.15 to -5.15 ft.				10/6"	susceptibility has been noted in the sample.
				10/6"	Moist. Non-plastic. S.P.T. "N" - 20
	25				
Soil Sample No. 5		140	60	4/6"	Fine grain, reddish brown (5YR 4/4), poorly graded, ferruginous,
Depth: 25.00 to 27.00 ft.				4/6"	highly micaceous silty Sand with a subordinate amount of clayey silt.
Elev.: -8.15 to -10.15 ft.				16/6"	Weak magnetic susceptibility has been noted in the sample.
				19/6"	Moist. Low plastic. S.P.T. "N" - 20
	30				
Soil Sample No. 6		140	56	25/6"	Fine grain, reddish brown (5YR 4/3), poorly graded, ferruginous,
Depth: 30.00 to 32.00 ft.				19/6"	micaceous Sand with some clayey silt. Trace fine to medium gravel
Elev.: -13.15 to -15.15 ft.				20/6"	sized, garnetiferous hornblende gneiss. Weak magnetic susceptibility
				30/6"	has been noted in the sample.
	35				Moist. Low plastic. S.P.T. "N" - 39
Soil Sample No. 7		140	100	11/6"	Fine grain, reddish brown (5YR 4/4), poorly graded, ferruginous,
Depth: 35.00 to 37.00 ft.				13/6"	highly micaceous silty Sand with clayey silt; trace fine gravel sized
Elev.: -18.15 to -20.15 ft.				14/6"	gneiss and quartzite. Weak magnetic susceptibility has been noted in
				22/6"	the sample. Moist. Low plastic. S.P.T. "N" - 27
	40				

By: Warren George, Inc.
Under Contract 553

Date Started: 07/31/96
Date Completed: 07/31/96

BORING NUMBER: Holland-W

LOCATION: Holland Tunnel Exit Ramp, South of Laight St. and East of Hudson St., Manhattan.

Coordinates:
North: 203,021.509
East: 590,034.096

Blow/Inches	Depth (ft.)	Run	Rec %	RQD %	Description of Materials Encountered
		ALL DESCRIPTIONS IN THIS LOG ARE BASED ON			Surface Elevation: +17.58 ft.
		FIELD INSPECTOR'S OBSERVATIONS AND NOTES.			Rock Elevation: N/A
					Bottom Elevation: -3.42 ft.
					Depth in Earth: 21.00 ft.
					Depth in Rock: N/A
					TOTAL DEPTH: 21.00 ft.
					Note: No manual well readings or testing conducted.
	5				Observation/Monitoring Well Construction Data
					Observation/Monitoring well constructed to 21.00 ft. depth
					(Elev.: -3.42 ft.). Bored with 5 7/8" tri-cone roller bit through overburden
					from 0.00 ft. to 21.00 ft. depth (Elev.: +17.58 to -3.42 ft.).
					2.0" inside diameter, schedule 40 PVC riser pipe
	10				installed from 0.00 to 11.00 ft. depth (Elev.: +17.58 to +6.58 ft.).
					2.0" inside diameter schedule 40 PVC well screen, 20 slots per inch,
					installed from 11.00 to 21.00 ft. depth (Elev.: +6.58 to -3.42 ft.).
					Hole backfilled with #2 silica sand from 9.00 to 21.00 ft. depth
					(Elev.: +8.58 to -3.42 ft.). Bentonite plug from 0.00 to 9.00 ft. depth
	15				(Elev.: +17.58 to +8.58 ft.).
					Flush mount monitoring well cap installed over well.
	20				
					BOTTOM OF WELL AT 21.00 ft. (Elev.: -3.42 ft.)
					Observation/Monitoring Well Installation
					Drilling Rig: Acker Wireline
					Driller: R. Gregory
					Inspector: P. Marks
					Reviewed By: C. Morris, C. Dozier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