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ARCHAEOLOGICAL DOCUMENTARY STUDY

BRONX RIVER PEDESTRIAN GREENWAY DOT PIN X027

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**ARCHAEOLOGICAL DOCUMENTARY STUDY
BRONX RIVER PEDESTRIAN GREENWAY
DOT PIN X027**

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EXECUTIVE SUMMARY

The proposed creation of a Pedestrian Greenway (DOT PIN X027) along both sides of the Bronx River has necessitated an Archaeological Documentary Study of the project site. The proposed Greenway site lies between Westchester and East Tremont Avenues in the West Farms and Tremont neighborhoods of the Bronx (Figures 1, 2). An initial review by the New York City Landmarks Preservation Commission (LPC) concluded that the site may be potentially sensitive for Native American and 19th century archaeological sensitivity (LPC Environmental Review April 30, 2004). This Archaeological Documentary Study addresses the potential archaeological sensitivity of the Bronx River Greenway site for these resource types.

The Archaeological Documentary Study of the Bronx River Greenway project site identified areas of extensive prior disturbance which now lack archaeological potential, and areas that have not been disturbed that may have both precontact and/or historical archaeological sensitivity. For the ease of discussion and presentation, the site was artificially subdivided into seven distinct study Areas, and it was determined that four of those areas are potentially sensitive for buried resources, while three have experienced extensive disturbance that negated archaeological potential (Figure 13). Areas 1, 2, 3, and 4 may possess buried precontact and/or historical deposits.

Prior to any archaeological field investigations, a series of soil borings should be undertaken for those sensitive Areas (1, 2, 3, and 4) that will experience subsurface impacts with the proposed development of the Greenway. It is recommended that large diameter core, continuous-tube soil samples (affording a minimum of compaction or distortion) be taken on all four of the sensitive Areas described above. When these soil borings are conducted, depth and thickness of fill layers must be recorded. After boring logs are completed, archaeologists should review them to establish a more comprehensive knowledge of subsurface conditions.

Following the completion of soil borings and a review of boring logs, archaeological subsurface testing may be recommended. A comprehensive testing plan would be developed based on the results of the boring analysis and the finalized plans for the proposed action.

For those portions of the proposed Greenway that are found to be potentially sensitive, but would not undergo any subsurface disturbance, no archaeological testing would be warranted. However, if future plans are revised to entail subsurface disturbance, then testing would be recommended.

INTRODUCTION

The proposed creation of a Pedestrian Greenway (NYS DOT PIN X027) along both sides of the Bronx River has necessitated an Archaeological Documentary Study of the project site. The proposed Greenway site lies between Westchester and East Tremont Avenues in the West Farms and Tremont neighborhoods of the Bronx (Figures 1, 2). An initial review by the New York City Landmarks Preservation Commission (LPC) concluded that the site may be potentially sensitive for Native American and 19th century archaeological sensitivity (LPC Environmental Review April 30, 2004).

This Archaeological Documentary Study addresses the potential archaeological sensitivity of the Bronx River Greenway site for the resource types noted by LPC: Native American and 19th century occupations. According to Section 311/Archaeological Resources in the City Environmental Quality Review *Technical Manual* (2001), “the area of subsurface work of the proposed action is considered the impact area” and is referred to as the Area of Potential Effect (APE). Archaeological studies for LPC review must consider the context of a larger, cultural region but the impact analysis focuses only on the APE.

RESEARCH GOALS AND METHODS

As noted above, the Archaeological Documentary Study, as clarified by the LPC guidelines (2002), will only address those land areas within the proposed Greenway that will be subject to direct development activities, the APE.

Sufficient information was gathered on the proposed linear parkland to assess the subsurface disturbance record, both horizontally and vertically, and to establish the potential for precontact period and 19th century archaeological resources. Prior archaeological studies and surveys that were undertaken for areas either within or directly adjacent to the current project site provided an invaluable data base from which to complete the current assessment, and included the Penn Station Access/Hunt’s Point Station Project for Metro-North (2002) and the East River CSO Facility (1996).

This documentary study, which also entails a cartographic analysis of the project site through time, is designed to determine areas of possible precontact and 19th century archaeological sensitivity as well as areas unlikely to produce archaeological materials due to prior disturbance from river realignment, underground piping, extreme landscape manipulation, previous construction and demolition cycles, etc. For ease of discussion in this report, the project site is artificially divided into seven distinct areas with cross streets and avenues serving as artificial boundaries (Figure 2; see Area descriptions below).

HPI’s protocol adheres to a conservative and phased approach. It relies on a series of tasks to identify which – if any – of the riverfront parcels would require invasive testing to satisfy the applicable environmental review regulations.

Task 1:

Primary source material, which helps to establish a site-specific framework in which to assess the project site were reviewed to identify historic land use through time. Census tracts were reviewed. Atlases, maps and other pertinent records, such as aerial photographs, were also reviewed.

Task 2:

In order to place the project parcel in a broader historical context, local and regional histories were reviewed.

Task 3:

Paralleling the research to determine the archaeological and historical sensitivity was research to determine the likelihood that resources are extant, having survived the normal destructive forces of urban development. Episodes of late 19th and 20th century construction included dredging and bulk-heading of the River, extensive grading and/or filling, street and expressway construction, the introduction of drainage systems, etc. Original documentation on the construction of the Cross Bronx Expressway and the concurrent realignment of the Bronx River were sought in order to document prior disturbance. The archives of the Army Corps of Engineers were also researched for data on disturbance to and from the realigning of the Bronx River. Verifiably disturbed areas were eliminated from further archaeological consideration.

Late 19th century atlases and Sanborn Fire Insurance Maps were reviewed to establish construction episodes, building heights, and the presence of basements, which are indicators of subsurface disturbance. Cartographic comparisons were critical in demonstrating elevation changes over the last 150 years.

Task 4:

To augment the records research described above, interviews were conducted with both amateur and professional archaeologists and/or historians knowledgeable in neighborhood history.

Task 5:

A walkover of the proposed Greenway and a photographic record of the current conditions were completed in October, 2004. Anomalies and areas of obvious ground disturbance were noted on the site sensitivity map.

SITE LOCATION AND CURRENT CONDITIONS

The borough of the Bronx lies within the Hudson Valley Region and is considered to be part of the New England Upland Physiographic Province, which is a northern extension of the Great Appalachian Valley (Schuberth 1968:10, 74). Situated on the northern end of the Crotona Park Ridge, a wide area of moderately high land which extends northward from the South Bronx, the project site is underlaid by volcanic rock called the Manhattan Formation, composed mostly of quartz, mica, feldspar, and hornblend (Glenn 1978:2). The exposed bedrock on the site is composed of this coarse-grained schist. During the most recent period of glacial activity, the Wisconsin episode, the Bronx was covered by ice. Following deglaciation, postglacial Lake Hudson covered much of the Hudson Valley below the Highlands including the project site. When it receded, smaller water courses were left scouring the landscape into what it is today. The Bronx River, which bisects the project site, was one of these.

The Bronx River is the major river conduit draining this section of the Bronx, running north-south through the project site. The river originates to the north in Westchester County and empties at the East River to the south. "Before the arrival of the Wisconsin Ice Sheet the Bronx River emptied into the Hudson, but, on the retreat of the ice, glacial till blocked up the old channel and the Bronx River, whose ordinary flow was much increased by water pouring from the melting face of the retreating ice sheet, had to dig itself a new channel in its rush toward salt water. It now empties into Long Island Sound..." (Kieran 1982:27).

The project site is located along the Bronx River between East Tremont Avenue on the north, and Westchester Avenue on the south. From north to south, the project site extends along the east side of the river from East Tremont Avenue south to a point where the Amtrak Bridge crosses the river, exclusive of the actual crossing of Cross Bronx Expressway over the river (Figure 2). The project site extends along the west side of the river for a much shorter span, only between 172nd Street and 174th Street. Between East Tremont Avenue and the Cross Bronx Expressway, the project site ranges between two and four hundred feet in width, bordered in part by Devoe Avenue on the east. South of the Cross Bronx Expressway the project site is bordered by railroad tracks, and at one point is narrowly sandwiched between the railroad tracks and the Bronx River. Bronx River Avenue, a noted thoroughfare, is directly east of the tracks.

On the west side of the river there are two distinct segments of the project site. The northernmost segment is bounded by 174th Street on the north, 172nd Street on the south, the Sheridan Expressway on the west, and the Bronx River on the east. The southernmost segment is considerably smaller and is bounded by railroad tracks on the west, Westchester Avenue on the south, and the Bronx River on the north and east (Figures 1, 2).

The current conditions of the project site vary considerably. Sections of the corridor have been subjected to varying degrees of cutting and filling in conjunction with building the Cross Bronx Expressway and the Sheridan Expressway, creating the railroad line, and realigning the Bronx River. Some areas are paved while others areas have reforested. Large portions of the project site bear evidence of historical and modern manipulations and the

general process of urbanization. Site photographs portray current conditions (Photographs 1-14).

Subsurface Data

A series of soil borings have been conducted on a portion of the APE, providing evidence of subsurface conditions in the project site that is between 177th Street and the Cross Bronx Expressway. A compilation of borings data from prior tests, including the pre-Expressway period, indicate a fill overmantle of construction and demolition debris that ranges from 5 to 20 feet in depth and a relatively shallow bedrock in the northeastern portion of the APE (Lawler, Matusky & Skelly Engineers 2001a:1-2). Testing in 1991 and 1992 had recorded groundwater present at 3 to 9 feet below grade in the same portion of the project site (Ibid.: 2-2). See Appendix.

Additional borings conducted in the same area in the same year (2001), recorded fill from 4.5 to 9 feet in depth for the land areas furthest removed from the disturbances created by the Expressway ramp construction (URS 2001b). Specifically, borings BR-GEO #s 7, 9, 11, 15, and 23 were placed further south of the ramp system than any other tests. None of these four locations revealed any buried A or B horizon soils or any organic matter or peat lens.

A Surface Soils Investigation for the Environmental Assessment Statement in the Northern Portion of the Bronx River Greenway was prepared by Lawler, Matusky & Skelly Engineers (2001b). Basically, this engineering report takes the most pertinent borings data from the CSO report, discussed above, and applies relevant data to the proposed project. The report states, "The subsurface of the project area consists of a top layer of man-made fill which consists of gravel, boulders, reinforced concrete, and other construction and demolition (C&D) materials. Material below the fill at the project site is comprised solely of silty sand of varying grain size and color which in turn overlays bedrock" (page 2-3). Regretfully, there are no additional, new borings for the APE south of the Cross Bronx Expressway.

The silt, sands, and gravel that were noted in all the subsurface reports may be indicative of the natural Bronx River stream channel. Alternatively, the absence of buried layers of organic/natural levels argues strongly that during the Expressway construction process sections of the project site were severely graded. See Appendix.

Area Boundaries

For the purpose of facilitating the discussion of the land use history, the project site has been artificially divided into seven distinct subareas, or "Areas." From north to south, these seven Areas are (Figure 2):

- Area 1 is the northernmost portion of the project site on the east side of the river that lies between East Tremont Avenue on the north and the Cross Bronx Expressway on the south (on or adjacent to City Block 3904).
- Area 2 is on the east side of the river between the Cross Bronx Expressway and the north side of 174th Street (on or adjacent to City Block 3904).

- Area 3 is on the east side of the river, between the north side of 174th Street and the north side of 172nd Street (City Block 3861).
- Area 4 is on the east side of the river between the north side of 172nd Street and the Amtrak Bridge, west of the railroad tracks (City Block 3769).
- Area 5 is on the east side of the river and the railroad tracks between the south side of 172nd Street and the Amtrak Bridge (City Block 3769).
- Area 6 is on the west side of the river between the south side of 174th Street and the north side of 172nd Street (City Block 3019).
- Area 7 is on the west side of the river from the Amtrak Bridge on the north, south to Westchester Avenue on the east of the railroad tracks (City Block 3017).

A Contextual Background for the project site in its entirety is provided, while the archaeological potential of each of the distinct Areas is addressed individually in the Site Specific Land Use subsection. A more detailed discussion of current site conditions is also provided below within the Site Specific Land Use subsection.

CONTEXTUAL BACKGROUND

Precontact Land Use

The presence of Native Americans in the Bronx for the Early Archaic through Late Woodland Periods has been documented, although some periods are more abundantly represented than others (Boesch 1994). At the time of European contact, Native American groups known as the Siwanoy occupied the northern coastline of Long Island Sound from Norwalk, Connecticut to what is now known as the south Bronx. However, the Bronx River is theorized to be the dividing line between the Siwanoy and another Upper Delaware Munsee speaking cultural group, the Wiechquaesqueak (Grumet 1981:1, 59-60). The Contact Period aboriginal name for the Bronx River including the adjoining Hunts Point shoreline at its mouth was reportedly "Aquahong" which roughly translates as "high bank" in reference to the area's topography (McNamara 1984:362).

An examination of records relating to precontact habitation in the immediate area indicates that a diverse number of precontact sites were located throughout the Bronx at various time periods, including areas close to the project site and specifically along nearby watercourses. Grumet's map of Indian Trails indicates that a portion of a lengthy Native American path ran near the project site along the Bronx River, with a section of it following what is now East Tremont Avenue (Grumet 1981:69). The trail essentially connected what is now Kingsbridge Heights to "Snakapins," a village site on the East River near Clasons Point in the Bronx south of the project site (Ibid.:54). A second trail reportedly split from this near the "Bear Swamp" and veered to the west onto what is now Tremont Avenue. This trail ultimately terminated on the Long Island Sound near Weir Creek (Grumet 1981:69).

An inventory of archaeological resources for the nearby New York Botanical Garden and the Bronx Zoological Garden, prepared by the LPC in 1991, reported that "numerous prehistoric sites, dating from the Early Archaic through Woodland Periods (ca.8000 B.C. - 1600 A.D.), were once located to the northwest, east, and south" (Baugher et al. 1991:33). Their inventory indicates that the West Farms area was frequented by precontact peoples.

One source referred to an "Indian Settlement" once located near the junction of Fordham Road and the Bronx River, placing it to the north of the project site within the Bronx Zoological Garden (Hermalyn 1982:3). The Westchester County Historical Society's "Map of Westchester County Showing Indian Occupation" (Westchester County Historical Society 1978) has a camp site, 113X, pinpointed in an area that appears to be directly north of the project site on the banks of the Bronx River. The legend and notes to explain Site #113X were not available. The Westchester Heritage map also depicts shell heaps south of what was once the site of DeLancey's mills, on the east bank of the Bronx River, possibly within the project site (Westchester County Historical Society 1978). It is not uncommon to find precontact period shell heaps along river banks, and several have been documented in the Bronx.

Possibly within the project site, the Bronx River Avenue Prehistoric sites (NYSM 2830, 2831 and ACP-BRNX-9) were reported by former state archaeologist Arthur C. Parker in 1922.

These sites are attributed to the Archaic through Late Woodland Periods. A shell midden and small camp site containing pit features were reportedly located in West Farms immediately east of the Bronx River in the vicinity of Westchester Avenue and Bronx River Avenue (Parker 1922: Plate 147). Another stream, which Native Americans referred to as "Sacrahong" was reportedly formerly located near the site (McNamara 1984:487).

Archaeologist Eugene Boesch undertook the task of creating a model of precontact land use in the Bronx based upon the knowledge of existing precontact sites and their topographic locations coupled with an understanding of the precontact environmental conditions (Boesch 1994). Boesch identified fresh water courses, such as small streams, larger rivers, and saltwater estuaries as magnets for prehistoric settlement and resource exploitation. He noted that there were reportedly scattered small habitation sites, camps, and shellfish processing stations along the East River and Long Island Sound shores. His generalized sensitivity map for the borough indicated that the current project site adjacent to the Bronx River has a high sensitivity for precontact period resources (Ibid.). However, it should be noted that Boesch's assessment was generalized, and was not intended to account for prior disturbance, which is essential to establish in order to determine if any potential archaeological resources may have retained their integrity.

A Native American presence is well documented for the immediate area. This further suggests that the project site may have at one time hosted Native American remains. The fact that a known Native American trail ran almost directly through the site and that there are inventoried sites in the immediate vicinity, and possibly within the project site, are clear indicators of extended site use nearby. This is indicative of the high potential for Native American resources within the current project site.

Typically, precontact resources are encountered within several feet of the historic land surface, but adjacent to a river with alluvial floodplain, resources can be buried much deeper. In an urban environment, potentially sensitive strata are either typically impacted by historic development, or buried beneath fill prior to a site being developed. However, the accretion of alluvial deposits may have served to protect potential resources from subsequent historic disturbance. While the project site has a high potential for precontact resources, sections of it have experienced extensive prior disturbance, and in some places this disturbance may have been deep enough to negate the potential for resources to have remained undisturbed. The specific precontact potential of each Area within the project site is discussed below.

Two prior archaeological studies have been undertaken for sections of the project site; the Phase 1A survey of the East River CSO Facility and the Cultural Resources Management Survey of the Hunt's Point Access (URS 2001a and PAF 1987). The East River COS Storage Conduit site overlapped a small portion of Area 1 within the current project site at the intersection of East 177th Street and Devoe Avenue. An analysis of boring logs collected for the CSO project between the Cross Bronx Expressway and East 177th Street found that bedrock was buried between three and 17 feet below grade. Above bedrock was fill of varying thickness above sand and gravel sediments (URS 2001a: 4-1, 4-2). The study concluded that potential precontact deposits may be found in this vicinity between six and nine feet below grade.

In contrast, the archaeological field tests undertaken for the Hunt's Point Access project, the boundaries of which are located directly south of the current project site, found no archaeological potential (PAF 1987:16). A series of shovel test pits (STPs) undertaken between Garrison Avenue and Bruckner Boulevard found extensive disturbance (Ibid.:30).

Historical Land Use

In 1663 Edward Jessup, an English Quaker, and John Richardson purchased a tract of land along the west side of the Bronx River from nine Native Americans (Jenkins 1912:42). Richardson eventually acquired most of the land encompassing the project site. After Richardson's death, the tract was later divided into twelve farms and became known as West Farms, referring to its location in relation to the larger town of Westchester to the east.

In 1683 the County of Westchester was formed, extending from Putnam County to the north, south to the Harlem and East Rivers. What is now the Borough of the Bronx, including the project site, was included in this tract (Jenkins 1912:1). In 1788 Westchester County was further divided into townships. West Farms was formed west of the Bronx River, while Westchester lay east of the Bronx River. Although West Farms was a separate community (Burr 1839), it technically fell within the larger township of Westchester until 1846, when it split off and became the township of West Farms. The township of Westchester was formed from the lands east of the Bronx River. West Farms was annexed by New York City in 1874 and became part of the 24th Ward. In 1890 the Town of Westchester was annexed by the City and in 1898 the Borough of the Bronx was formed (McNamara 1989:511; Jenkins 1912:7).

The water power of the Bronx River was harvested quite early when Jonas Bronck, who purchased the land from the Native Americans in 1639, established mills near what is now West Farms (Jenkins 1912:389). Bronck's mills came into the hands of the DeLancey family and the mill complex had become known as DeLancey's mills by the 1870s. David Lydig eventually purchased the mills and the DeLancey house, which stood east of the Bronx River. The site of these former mills now lies within Bronx Park, north of the project site (Ibid.).

Early roads in what is now the Bronx, such as West Farms Road to the east of the project site and sections of the Boston Post Road to the north and west of the project site, were established along existing Indian trails. In 1790 Lewis Morris built a 66-foot-wide road from Manhattan, across the Harlem River, and through Morrisania and West Farms. This followed present day Third Avenue to 163rd Street, and up Spring Hill to Union Avenue and 170th Street. Morris owned all the land up until 170th Street, and had to purchase land north to East 174th Street for his road (Sack 1974:46). From there the road ran northeast to Bryant Avenue, Tremont Avenue, and finally joined West Farms Road. This became the Boston Post Road, now Boston Road, and was opened from East 174th Street to West Farms Road in 1825 (Ibid.). East Tremont Avenue, which demarcates the northern boundary of the project site, was originally an extension of West Farms Road, which borders the project site to the west. It was locally nicknamed the "Plant Road" (McNamara 1991:91). Westchester Avenue, which forms the southern boundary of the project site, was also reportedly created,

in part, over an old Indian trail. It was utilized in the 18th century to connect the Manor of Morrisania to the town of Westchester (Ibid.:267). Numerous farmsteads and homes were established along these new and improved roads, and a series of mills were built along the Bronx River within and adjacent to the project site.

The first major transportation improvement that served to alter surrounding neighborhoods was the construction of the New York, New Haven, and Hartford Railroad (NYNH&HRR) in the 1870s. Although the line traced its founding to 1826, when one of its predecessor companies originated, the NYNH&HRR was not chartered until 1872 (New York, New Haven & Hartford Railroad Archives: 2001).

In 1908-1910 the railroad line was rebuilt and increased to six tracks with complete grade separation, electrification, and all new stations. Throughout its entire length, the line had been built to conform to the main line standard of the New Haven portion of the line. A new rail consisted of 100-lb. sections with creosoted ties. The heavier tracks required the installation of 22 inches of ballast for support and more substantial bridges (Browne 1912:1). Extensive modifications to the existing landscape east of the project site were required to create the consistent grade elevations needed for the new line.

In 1912, an additional railroad line was constructed east of the project site.

The New York, Westchester & Boston Railway, part of which was put in operation last week, is a four-track electric line owned by the New York, New Haven & Hartford. It runs from White Plains, N. Y., to 174th Street, New York City, where it joins the Harlem branch of the New York, New Haven & Hartford, and when completed will be operated as a part of that system. Beside connecting with the Harlem branch at 174th Street, interchange of traffic will be made with the West Farms branch of the Interborough Rapid Transit subway at 180th Street and Morris Park Avenue. There is also a branch connecting with the New Haven main line at New Rochelle.
(Browne 1912:1)

Adjacent to the project site, the line was built with four-tracks from 174th Street north to Mount Vernon. When it was built, the maximum grade was 1.0 percent, except for one stretch of 2.5 percent from 174th Street, the junction with the Harlem branch tracks, to the south end of the West Farms Viaduct at 177th Street. This stretch is tangential to the eastern boundary of the project site.

The adjustment of alignment and grade at this point was one of the most difficult problems which the engineers encountered and the present location was adopted only after trying and discarding many others. Certain fixed street grades over which the tracks must have sufficient clearance, certain other points, like the junction point, at which the elevation was fixed, added to difficulties in obtaining right-of-way. All served to confine the possible solutions within narrow limits, and made the task one not so much of choosing the best, but of avoiding the worst. It was finally decided to carry

the tracks over 177th Street, and this extraordinary grade was necessary to give the tracks sufficient clearance. The curvature is limited to 4 degs., except for one 6-deg. curve through Mount Vernon. (Browne 1912:1)

As transportation networks grew, so did the resident population and manufacturing endeavors. In the late 19th century, immigrant Frenchmen established inns and restaurants along the river that attracted artists and summer excursions from Manhattan. At the turn of the century, the Bronx River was described as...

a short and narrow stream that empties into a shallow bay or estuary on the East river at Hunts Point, about 11 miles northeast of the Battery. The navigable portion of the river consists of a channel extending from its mouth to a dam at East 177th Street. This channel is about 2-1/2 miles long and from about 50 to 300 feet wide extending from the East river up to Watson Avenue, about 1,000 feet below Westchester Avenue Bridge. Above this to the gas works at East 173rd Street [within the project site] the channel is 50 feet wide and 4 feet deep at mean low water. The mean range of tide in the Bronx River is about 7 feet in the estuary and 6 feet at the dam. (Sullivan 1927)

Prior to extensive development, the Bronx River was a small meandering waterway with bucolic vistas despite the establishment of several large manufacturing plants along its banks (Figure 3). By World War I, an International Exposition was erected on the river's east bank south of West Farms Square, which evolved into Starlight Amusement Park (see Area 1 below). Fishing boats and row boats were also available for hire along the shores. In 1925, in an effort to preserve the river's natural beauty, the Bronx River Parkway, extending northward from the Botanical Garden, was completed. However, through the 20th century, the Bronx River became polluted and was essentially utilized as a sewer.

Improvements were planned for the Bronx River as early as 1913 but were not implemented for several decades. In 1940 funds were allocated by the War Department to what remained of the project. Improvements were designed to enlarge and deepen a navigable channel from the falls on the Bronx River in Bronx River Park, north of the project site, south to Hunts Point. Specifically, the project provided for...

a channel 10 feet deep at mean low water and generally 100 feet wide except for the section between the Westchester Avenue Bridge and the New York, New Haven and Hartford Railroad Bridge, where the authorized width is 140 feet...The section of the channel from East River to Westchester Avenue was completed in 1926...a new bridge (was) completed in February, 1939. The work remaining to be done will continue the improvement from Westchester Avenue to East 174th Street. (New York Times June 16, 1940)

Prior to this time, the east side of the river had a bulkhead built along its edges and cuts were made through upland property. There was some concern that dredging in these areas would

result in the river bank sliding into the river. To mitigate this problem, additional bulkheads were built along the river's edges.

Further alterations to the river within the project site occurred with the construction of the Cross Bronx Expressway in the 1950s through 1960s and the Sheridan Expressway in the late 1950s. Although most of the Cross Bronx Expressway was depressed, Section 3 of the highway – built in the 1950s – included a viaduct over the Bronx River within the project site. A component of this project included realigning a section of the Bronx River to allow for the creation of interchange 4A which connects the Cross Bronx Expressway with the Sheridan Expressway.

Construction of the Sheridan Expressway, which forms the western boundary of Area 6, began in 1958 as part of the elevated Bruckner Expressway project. The 1.2-mile-long Sheridan Expressway was constructed with two 12-foot-wide lanes in each direction, and forced the relocation of West Farms Road westward in the vicinity of Area 6. When the highway was constructed, a sharp bend in the river was straightened and the entire river in the south half of the APE was shifted eastward. Figure 2 depicts the former alignment of the river, which once veered in a sharp curve west of its current location from just north of the Cross Bronx Expressway south to 174th Street. This action, coupled with the creation of extensive ramp systems, disturbed sections of the project site.

Site Specific Land Use

The following discussion provides a detailed description of the current conditions and the historical land use of each of the seven subsections of the project site.

Area 1 is the northernmost portion of the project site. It lies on the east side of the river between East Tremont Avenue on the north and the Cross Bronx Expressway on the south (Figure 2). Area 1 is currently part of City Block 3904. It is currently predominantly wooded (Photographs 1, 2). The area bordering the river south of East Tremont Avenue has some bulkheading along the shore, with a steep rise up to the east.

Area 1 was vacant from 1851 through at least 1872, but dwellings associated with the Philip Lydig estate had been established to the east of the project site, with the project site itself remaining undeveloped (Sidney and Neff 1851; Merry 1858; Beers 1868, 1872). Although Lydig did not develop the APE, an offshoot of the Bronx River had been diverted through his property within Area 1 and a dam was built across it. Lydig's mills – formerly Delancey's mills of local importance – were north of what is now East Tremont Street and the APE, and no mills were depicted in Area 1. However, it is possible that one may have operated along the river or its offshoot at some point in the vicinity of the APE.

An 1891 topographic map of Westchester County indicates that Area 1 was located along the river in an area which rose to the 20 foot contour interval above sea level (ASL) (Bien 1891). By the 1890s, a system of streets and city blocks were being developed east of the Bronx River and the project site. However, the project site was not subject to subdividing, and instead was occupied, in part, by a dancing pavilion associated with "Little Coney Island"

(Sanborn 1898). In addition, a one-story building of unknown use spanned across the diverted portion of the Bronx River downstream of the dam. By 1900 more comprehensive plans were being made for the establishment of streets and avenues east of the Bronx River. A topographic map with proposed roads prepared for this area shows the dance pavilion and the structure over the side channel of the Bronx River within the APE (Figure 4; Topographic Map 1900). By 1910 the dance pavilion had been removed (Bromley 1910).

In 1917 Exposition Park was created within that part of Area 1 south of East 177th Street to approximately East 174th Street, also encompassing Area 2 (McNamara 1991:356). In 1921 most of Area 1 was vacant north of East 177th Street, but south of this the Area 1 APE contained a portion of the exposition grounds which had become Starlight Amusement Park. Here, the APE contained "witching waves," a motor raceway, and several other buildings west of the approximate line of Devoe Avenue. East of this, the property remained part of the N.Y. International Exposition. Within the Area 1 APE were a carousel, a theater, and pony track (Sanborn 1921). The exposition proudly boasted their acquisition of the *U.S.S. Holland*, a WWI submarine, which they promptly put on display as part of the Palace of American Achievements (McCue 2002). Other attractions included an embalmed whale in whose open mouth couples would stand to be wed (McNamara 1991:494).

Although the banks of the Bronx River were unchanged, atlases show dashed lines drawn along their edges as plans were being made for building bulkheads along the shoreline and straightening some of the lesser curves. This action eventually resulted in the realignment of the Bronx River slightly east of its former location adjacent to Area 1 (Sanborn 1921; New York Times June 16, 1940).

By 1927 the Starlight Amusement Park had taken over the Exposition land, and the park had been expanded, but buildings within the APE were unchanged (Bromley 1927). Also by this time, a structure had been built directly south of East 177th Street, labeled as a Transit Station. A year later, the structure had been enlarged significantly to the south (Sanborn 1928). Starlight Park closed in 1930, but the *U.S.S. Holland* remained on the grounds until at least 1932 (McCue 2002), and several structures associated with the park stood through the early 1940s as did the transit structure.

According to a prior archaeological study undertaken for this area, the park was purchased by the United States Army and utilized as a vehicle maintenance facility from 1942 to 1946 (URS 2001a:3-8). By 1948 the amusement park had been removed as plans for the construction of the Cross Bronx Expressway were underway (Sanborn 1948). However, four small structures stood within the APE north of East 177th Street. One of the four structures was unlabeled but the other three included an auto repair shop, a gas station, and an office building (Ibid.; Figure 5). To the south of East 177th Street was a small transformer along the Bronx River, and the river had clearly been widened with the completion of the U.S. Pier and Bulkhead line. Furthermore, the massive repair shop of the Third Avenue Transit System still stood south of East 177th Street and east of the route of Devoe Avenue (Ibid; Figure 5).

When the Cross Bronx Expressway was constructed in the 1950s, extensive changes were made to the course of the Bronx River. Photographs document the work undertaken in order

to straighten the river and create a viaduct over it (Figures 6 and 7). As a result, the Bronx River was straightened and realigned approximately 500' to the east of its former location to form the western border of what is now Area 1 (Figure 2).

A prior archaeological survey of this tract reviewed a series of soil borings undertaken prior to the construction of the Cross Bronx Expressway and for the proposed construction of the Bronx River CSO Conduit (URS 2001b). Their study concluded that...

buried archaeological deposit may be found within the project area at depths up to ca. 6-9 feet below surface, although it is possible that, if such deposits exist, they may have been disturbed by previous construction such as that for the amusement park and the army facility. It cannot be clearly determined whether documented disturbances related to prior construction on the site have exceeded the depths at which archaeological sites may be identified. These sites would include both prehistoric sites as well as historic mills.

(URS 2001a:4-1)

A comparison of the route of the river when mills may have been on it with its current location, which was altered by the creation of a bulkhead line and the 1950's realignment, suggests that any mills in the vicinity of the APE would have been located west of the current project site boundaries. However, there is always the possibility that a mill or mills were once present on David Lydig's property on or adjacent to the small dam once present on the offshoot of the river within the APE. Clearly, Lydig's larger mill complex was located north of the project site.

Area 2 is the portion of the project site located on the east side of the river between the Cross Bronx Expressway and the north side of East 174th Street (Figure 2). Area 2 is currently adjacent to City Block 3904. This portion of the project site is currently wooded (Photographs 3, 4). A tributary to the Bronx River formerly ran east of this Area and veered west to empty into the river within the southern portion of Area 2.

Area 2 was originally part of William W. Astor's landholdings. In 1851 and 1858 a carpet factory was located somewhere on or adjacent to this tract, as one was depicted directly north of the tributary of the Bronx River, west of Watson's Lane – now the approximate route of the railroad right-of-way (Sidney and Neff 1851; Merry 1858). In 1867 the factory is listed as Smith's Carpet Factory, and is situated on an island in or adjacent to Area 2, created by channeling a portion of the Bronx River eastward around the building for his growing carpet business (Beers 1867). This was the original carpet factory of Alexander Smith - who established his manufacturing business in West Farms in 1845 (Ibid). Smith, listed on the 1850 census as a carpet maker residing in West Farms with his family (U.S. Census 1850:269), moved his factory to Yonkers in the mid-1860s. There, he expanded his business into an enormous manufacturing facility with 45 buildings, 800 looms, and over 4,000 workers. In 1929 Alexander Smith & Sons was the largest manufacturer of carpets and rugs in the world, eventually merging with Mohawk Carpets (<http://www.carpet-rug.com>).

By 1868 Area 2 was depicted as under the ownership of G. Wilson, although the 1860 and 1870 Federal Census records failed to record a G. Wilson in either West Farms or Westchester County. According to the 1868 atlas, the main Wilson dwelling stood on or adjacent to Area 2, although the scale of the figure does not permit an accurate measurement of its location (Beers 1868). Furthermore, at this time the factory was no longer depicted within or adjacent to the APE (Ibid.).

By 1872 Area 2 was under the ownership of Lewis Wilson, lying within West Farms District four (Beers 1872). The U.S. Census for 1870 lists no Lewis Wilson in Westchester County, but does list a Lewis Wilkins as residing in West Farms (U.S. Census 1870: 424). Wilkins was only aged one at the time of the census, so it is unlikely that this is the owner of the tract in 1872. There is also a Lewis Wilson listed as living in Ward 5, District 4 of New York City, but none of the names before and after the Wilson entry on the census record correlates to the named residents in the vicinity of the project site (U.S. Census 1870:56). Lewis is listed as a 60 year old maker of sauce, with an at-home wife, but no street address is provided.

At later map of the former property of John J. Astor, prepared in 1889, failed to depict any structures on the property, but did indicate that Astor held a total of roughly 203 acres, including Area 2 (Robinson 1897; Map 978).

An 1891 topographic map of the project site indicates that Area 2 was located about 500 feet east of the Bronx River in an area which rose up to the 20 foot contour interval ASL (Bien 1891). There is no indication that this area was wetland along the river, probably because of the rise in elevation. A small tributary stream was again depicted east of Area 2, forming a wide rill and joining the Bronx River within the southern portion of Area 2.

In 1900, when a system of roads was being proposed for this area, Devoe Avenue was slated to run south into Area 2, but this never came to fruition. At that time, a brick structure was shown in the proposed route of Devoe Avenue at East 176th Street, partially within the APE (Figure 4: Topographic Map 1900). A second wooden structure stood directly north of the brick building, and a third stood to the east. The location of these structures was eventually disturbed by the construction of the Cross Bronx Expressway and the New York, Westchester and Boston Railway.

From the early 20th century forward, Area 2 was developed in the same manner as Area 1. In 1908 two structures were still present in the proposed route of Devoe Avenue, but neither was labeled with regard to their function despite the fact that surrounding structures were (Sanborn 1908). In 1916 major development of the property transpired when the exposition and amusement center was constructed (see above). By 1927 Area 2 hosted race car tracks, a roller coaster, numerous gaming stands and rides, a restaurant and dance hall, and a large swimming pool – complete with an artificial beach and reservoir - just north of 174th Street. The former locations of the ca. 1900 structures were developed with the Court of Honor, a band stand, and the Forest Inn (Bromley 1927). Starlight Park closed in 1930, and several structures associated with the park stood through the early 1940s. In 1948, all that remained within the Area 2 APE were the remnants of the concrete lined swimming pool, the

bandstand, and the reservoir (Figure 8; Sanborn 1948). By 1977 the entire project site Area 2 was vacant (Sanborn 1977).

Area 3 is the portion of the project site located on the east side of the river between the north side of East 174th Street and the north side of East 172nd Street (Figure 2). It is currently a narrow wooded tract of land situated between railroad tracks to the east and the Bronx River to the west (Photographs 5, 6). Area 3 is currently part of City Block 3861.

Area 3 was shown as vacant in 1851 and 1858 (Sidney and Neff 1851; Merry 1858). In 1868 a factory was situated adjacent to the Bronx River possibly within the northern portion of Area 3 (Beers 1868). However, by 1872 the project site was again shown as vacant, and was part of the W. Watson estate – a 225-acres parcel with dwellings located west of the railroad tracks and Area 3 (Beers 1872). Watson's Lane ran east of the project site. This was once a carriage lane which led from William Watson's mansion – which stood near the current site of James Monroe High School about two blocks east of the project site – to Morris Park Avenue at East Tremont Avenue (McNamara 1991:523).

Four males named William Watson, three adults and one child, were listed as living in the township of Westchester in 1870 (U.S. Census 1870; 105, 311, 309), and two men and two children were listed as residing in the township of Westchester in 1880 (U.S. Census 1880:345A, 317A, 371B). Street addresses were not provided on either census, but atlases indicate that none of the Watson dwellings stood on or adjacent to the APE (Beers 1867, 1868, 1872). However, a portion of Watson's Woods, a wooded tract that once lay on both sides of Westchester Avenue from the Bronx River east to Morrison Avenue, may have encompassed Area 2 (McNamara 1991:523).

In 1891 the project site was depicted as being below the 20 foot ASL contour interval, sandwiched between the Hartford Railroad and the Bronx River (Bien 1891), and in 1898 a two-story building stood within the APE in the approximate location of the factory visible on the 1868 atlas (Beers 1868; Sanborn 1898). The site was shown as entirely vacant in 1900 (Figure 9), but in 1908 the earlier building was depicted as a two-story dwelling/ice house with a basement (Sanborn 1908). However, two years later the site was again portrayed as entirely vacant (Sanborn 1910). Even as late as 1910, adjacent roadways such as Bronx River Avenue had not been laid out, nor had water and sewer lines been made available to residents in this immediate area (Ibid.). These improvements were not realized until sometime between 1921 and 1927 (Sanborn 1921; Bromley 1927). Of note, a large sewer pipe supply building was constructed east of the project site between these two dates, probably in response to the growing need for this commodity as the city expanded along new transportation links.

While the Bronx River appeared to be unimproved in 1910 (Sanborn 1910), plans to erect bulkheads along the river were enacted shortly thereafter. By 1927 the bulkhead line had been established, effectively enlarging the river's width adjacent to Area 3 (Bromley 1927). As previously noted, improvements were planned for the Bronx River as early as 1913, but they were not wholly realized until years later. When completed, the river was widened to 100 feet adjacent to Area 3, and 140 feet south of 172nd Street (New York Times June 16,

1940; Bromley 1927; Sanborn 1948). During the early- to mid-20th century, the railroad was apparently utilizing a narrow portion of the eastern edge of Area 3, as a two-story signal tower was built adjacent to the tracks by 1927 (Bromley 1927). The signal tower was eventually accompanied by an oil house and a small shed (Sanborn 1948). All three are still present (Sanborn 1977, 1989). In the 1960s when the Sheridan Expressway was constructed on the west side of the Bronx River, the river was reconfigured adjacent to Area 3 to form its current alignment (Ibid.).

Area 4 is on the east side of the river between the north side of 172nd Street south to the Amtrak Bridge, west of the existing railroad tracks (Figure 2). It is currently designated as a portion of City Block 3769. Area 4 is a relatively narrow wooded parcel situated between the railroad right-of-way on the east and the Bronx River on the west (Photographs 7, 8). At its maximum width on the north it is about 200 feet wide, while at its southern end it is about 20 feet wide.

Early historical maps and atlases portray Area 4 as undeveloped through the late 19th century (Sidney and Neff 1851; Merry 1858; Beers 1867, 1868, 1872; Sanborn 1898). Like Area 3 directly to the north, this tract was probably part of Watson's Woods owned by William Watson who resided in a mansion several blocks east of the project site (McNamara 1991:523). A topographic map of the project site in 1891 showed that there were wetlands along the river within this portion of the APE and that the entire project site fell below the 20 foot ASL contour interval (Bien 1891).

When the railroad line was constructed east of the project site, the original bridge across the river was an at-grade bridge (Beers 1872; Jenkins 1912:405). A topographic map of the project site in 1900 and earlier photographic views show this at-grade crossing (Figures 9, 10; Topographic Map 1900). Eventually, in ca. 1907, a bascule bridge was erected over the river and the tracks of the New York, New Haven, and Hartford Railroad were elevated slightly above grade (Jenkins 1912:405).

The only real modification of Area 4 occurred in the early 20th century when the Bronx River was widened to 140 feet and a bulkhead line was established on the western border of the project site. About the same time, the railroad tracks were widened and improved on the eastern border of the project site. Apart from these events, Area 4 has remained unchanged and undeveloped throughout the 20th century (Bromley 1927; Sanborn 1948, 1977, 1989).

Area 5 is on the east side of the river between the south side of 172nd Street south to the Amtrak Bridge, east of the railroad tracks (Figure 2). Area 5 is also relatively narrow, ranging in width from about 40 feet wide on the north to 150 feet wide on the south. Area 5 is partially developed with one-story brick commercial buildings, and the site is bordered by rowhouses which front onto Bronx River Avenue. Much of the site is paved, and it is currently designated as a portion of City Block 3769. Access to the lot is from East 172nd Street.

Area 5 was undeveloped through the late 19th century (Sidney and Neff 1851; Merry 1858; Beers 1867, 1868, 1872). Like Areas 3 and 4 to the north, the parcel was historically within

Watson's Woods (McNamara 1991:523). By 1898 a two-story house had been built on or adjacent to Area 5, with access along a drive heading north from Westchester Avenue, as Bronx Avenue had not yet been created (Sanborn 1898). To the south of the dwelling, closer to the railroad tracks, were three second-class one and two story buildings, presumably sheds and/or barns. A 1900 topographic map showing proposed streets east of the Bronx River depicts the dwelling and three structures as wood (Figure 9). The dwelling is actually shown fronting the future route of Bronx River Avenue east of Area 5, whereas the three wooden outbuildings are closer - two within and one adjacent - to the APE. Their size, configuration, class, and location in relation to the main dwelling strongly suggest that they are outbuildings. Furthermore, the same map depicted the parcel as sloping downward from its highest point where the dwelling stood, west toward the river (Figure 9). The site appeared unchanged in 1908 (Sanborn 1908).

Between 1908 and 1927 the wooden structures within the Area 5 APE had all been removed, and two one-story brick buildings associated with the Bronx Iron Metals Corporation were built on the eastern side of the APE (Bromley 1927). By this time the bridge system over the Bronx River had been improved, and the tracks had been widened. Two small one-story wooden buildings related to the railroad stood in the APE near what is now the Amtrak Bridge (Ibid.). Furthermore, by this time Bronx River Avenue had been established, and brick rowhouses had been constructed along it. These buildings form the eastern boundary of the current project site.

In 1943 additional one-story buildings were constructed within the APE along its eastern boundary (New York City Department of Finance). By 1948 these buildings were part of the Bronx Iron and Metal Corporation complex, which included an elongated building with a metal shop, dressing room, machine shop, and garage. About half of Area 5 was also used as a scrap iron yard (Sanborn 1948). Access to the site was gained through a passage from East 172nd Street. The rest of the APE was vacant, although by this time the Bronx River had been bulkheaded along the shoreline to the south (Figure 11). The structures associated with the Bronx Iron and Metal Corporation are still standing within the APE, and most of the site has been graded and leveled, and paved for parking (Sanborn 1977, 1989).

Area 6 is on the west side of the river between the south side of 174th Street and the north side of 172nd Street (Figure 2). This portion of the APE is currently within City Block 3019. Currently, there is silt fencing along the eastern side of the APE (Photograph 9) and a silt barrier in the river at the southeastern end of the APE (Photograph 10). The area is generally flat, with portions that are paved and one area in the approximate center which is surrounded by a high chain link fence (Photograph 11). The area bordering the river contains trees and other vegetation. There is also a very large spoil pile (now covered with vegetation) in the mid-eastern section of the APE. At the southern end of the APE, the remnants of the former route of West Farms Road within the APE are visible (Photograph 12).

As discussed above, the land use history of Area 6 is complicated by the fact that the Bronx River was realigned through the southern half of this section of the project site when the Sheridan Expressway was constructed in the 1960s. As a result, a portion of land that was

originally on the east side of the river is now on the west side of the river within Area 6 (Figure 2).

West Farms Road, formerly known as the Back Road, the Queens Road, the Lower Road, and the West Farms and Hunt's Point Road, was laid out prior to 1700 directly west of Area 6 (New York Times October 8, 1918:12). By 1851 there was development along West Farms Road on or adjacent to the APE (Sydney and Neff 1851). Structures are shown along the road in 1858 and again in 1868, but are not mapped on the 1867 atlas (Merry 1858; Beers 1867, 1868). In 1872 it is evident that a gas works has been established in Area 6 at a bend in the Bronx River, and several buildings stood between the river and West Farms Road to the south of this (Beers 1872). Manufacturing gas plants were used between the 1800s and mid 1900s before the development of natural gas systems, in order to convert coal and oil into gas for heating, lighting and cooking. The fact that the Bronx River was navigable from Long Island Sound north to this point made it a good location for such a facility.

In 1877 the southern part of the APE was part of the Thomas Hedger farm. The center part at the bend in the river was owned by the Suburban Gas Company, and the northern part was owned by Filch and L. Pierce (Beers 1877). Filch and L. Pierce's tract had been subdivided with small lots created along West Farms Road, west of the project site. Neither Filch nor Hedger are listed on the 1860, 1870 or 1880 U.S. Census as living in West Farms. However, Lemuel Pierce, a retired farmer aged 80, was residing in West Farms in 1870 with his wife, two grown sons, and one grown daughter (U.S. Census 1870:383). It is unclear as to whether Pierce was residing on or near the project site since the census records fail to provide street addresses, and only one or two surrounding names shown on the 1872 atlas corresponded to names on the census. Since no dwellings are depicted as in the APE, he most likely resided elsewhere.

Water lines were laid in West Farms Road sometime between 1879 and 1893 (Bromley 1879, 1893). In 1893 the Northern Gas Works had expanded to include two holding tanks and five brick and wooden buildings in the APE. Because of their proximity to the river, it is highly unlikely that any of the buildings had basements, and none were indicated on the atlas (Bromley 1893; Figure 12). An inlet or channel was created from the northernmost tank south into the river, presumably so that boats could moor here. Adjacent to the western side of the gas works was a flour, grain, and coal yard which contained three wooden buildings, also in the APE. Two of these fronted onto West Farms Road. To the south was another wood building, also fronting West Farms Road. Given the industrial and commercial nature of all the buildings to the south and north of this structure, it probably had a similar use. Later maps confirm this.

Also visible on the 1893 atlas are the former boundary lines of West Farms Road, which had previously run through a portion of the project site, south of the bend in the river (Figure 12). The action of narrowing and regulating West Farms Road had the effect of leaving structures formerly in its path out of its route and in the APE (Ibid.). A later 1896 map fails to make this correction and shows the buildings, which are part of a lumber yard, in the footprint of West Farms Road (Sanborn 1896). Another map dating to the same period showing site

topography places a small inlet of the Bronx River traversing the northern portion of the APE (New York Street Commissioner 1897).

By 1901 the Northern Union Gaslight Company was no longer in operation, although three gas holder tanks, a naphtha tank, purifying house, electric light plant, retort house, and engine house were left standing in the APE (Sanborn 1901). The coal yard still fronted West Farms Road partially within the APE, and the lumber yard still bordered East 172nd Street. By 1907 the coal yard was owned by D. Mapes Jr., and there were four buildings in the lumber yard to the south at East 172nd Street (Hyde 1907). A wooden cement storage shed had also been constructed in the northern portion of Area 6. This was part of a building materials facility in 1915 (Sanborn 1915). Also by 1915, the coal yard been reconfigured, so that a spur in the Bronx River was no longer diverted north to the gas plant, but was now diverted northwest into the coal yard, now a coal and wood yard. Two coal houses and a small office building stood in the yard (Ibid.). The realigning of the spur in the river coincided with the installation of bulkheads along the river's western shoreline. To the south near East 172nd Street, the Builder's Brick and Supply Company maintained a storage yard for brick, cement, etc. Two buildings fronted onto East 172nd Street, and coal pockets were located south of Area 6 in the footprint of East 172nd Street.

The Area 6 portion of the project site was virtually unchanged through the 1940s when all the buildings in the APE were razed and Starlight Park was created (Bromley 1927, Sanborn 1948). Landscaping and construction at the park created several grassed ball fields, paved ball fields, basketball courts, and other park features. The APE was further modified when the Sheridan Expressway was constructed in the 1960s. At that time West Farms Road was shifted west, the Bronx River was realigned to its current configuration, and the former route of the river was filled (Sanborn 1989). The Starlight Park is currently undergoing environmental remediation and plans have been made for its redevelopment.

Area 7 is on the west side of the river from the Amtrak Bridge on the north, south to Westchester Avenue, east of the railroad tracks (Figure 2). Area 7 is currently within City Block 3017. This area is paved and used as a surface parking lot (Photograph 13). There is a high, solid fence along the Westchester Avenue end with a driveway opening that turns into a down ramp to the lot (Photograph 14). Westchester Avenue is supported by a bridge spanning the railroad and river, and as such is much higher than the project site. There is a cement-block bulkhead along the river at the east side of Area 7, which gets higher as it approaches Westchester Avenue. The project site appears to be about 5-10 feet above the river channel.

Area 7 is bounded on the south by Westchester Avenue, which originally passed over the river here at the site of Matthew Pugsley's causeway (New York Times October 8, 1918: 2). Area 7 remained undeveloped in the mid to late-19th century, and the railroad was first depicted bordering its western side in 1868 (Sidney and Neff 1851; Merry 1858; Beers 1867, 1868, 1872, 1876, 1882). Viele portrays Area 7 as undeveloped, unimproved marsh along the Bronx River, which may account for why the site was not developed (Viele 1874). However in 1876 and 1882 the plot was part of a larger tract owned by Mrs. Bates, who resided in a dwelling west of the project site fronting the Boston Road (now West Farms

Road; Beers 1876, 1882). Main Street was eventually created west of the railroad line, in the approximate route of the present day Sheridan Expressway, so development in the area was focused west of the project site (Bromley 1893, 1897; Sanborn 1896). The site remained undeveloped through 1910 (Sanborn 1901; Bromley 1910).

Between 1910 and 1914 the railroad tracks bordering the western side of Area 7 were significantly upgraded and the bridge over the Bronx River was replaced with bascule bridge. Concurrently, the Bronx River on the east side of the project site was widened and bulkheads were installed along its new boundaries. A spur from the railroad was created extending into the project site to access a new commercial building along the waterfront (Bromley 1914). A second structure was built fronting Westchester Avenue. Both were part of the P. J. Heaney Company Building Materials complex. The northernmost building was a loading shed and store house, while the southernmost building was for cement storage. Both were accessed by a ramp extending down from Westchester Avenue (Sanborn 1915). The complex stood through 1921, but the site was once again vacant by 1927 (Sanborn 1921; Bromley 1927). No additional buildings were constructed on the site through the mid-20th century (Bromley 1955; Sanborn 1948). Subsequently, three additional storage buildings were erected on the parcel mid-way between the river and the railroad tracks (Sanborn 1977). These have since been dismantled (Sanborn 1989; Photographs 13, 14).

ARCHAEOLOGICAL POTENTIAL

Area 1:

A prior archaeological survey of this Area reviewed a series of soil borings undertaken prior to the construction of the Cross Bronx Expressway and for the proposed construction of the Bronx River CSO Conduit (URS 2001b). Their study concluded that...

buried archaeological deposit may be found within the project area at depths up to ca. 6-9 feet below surface, although it is possible that, if such deposits exist, they may have been disturbed by previous construction such as that for the amusement park and the army facility. It cannot be clearly determined whether documented disturbances related to prior construction on the site have exceeded the depths at which archaeological sites may be identified. These sites would include both prehistoric sites as well as historic mills.

(URS 2001a:4-1)

The data suggests that Area 1 of the Bronx River Greenway APE is potentially sensitive for both precontact period and historical period archaeological deposits outside of the locations of modern structures such as the gas station and automobile repair facility near East Tremont Avenue. However, the potential for a mill site to exist in Area 1 is only based on the supposition that Lydig utilized a channel of the river that ran through the APE for this purpose in the 19th century. Documentary evidence confirms that the main complex of mills owned by Lydig were located further upstream, north of the project site. Regardless, potential precontact and historical resources may be buried beneath fill levels.

Area 2:

Area 2 was historically about 500' east of the Bronx River. Therefore, any undocumented mills which were once located along the river's shores would not have fallen within the APE. Furthermore, prior to the 20th century, the only documented development was a carpet factory that may or may not have been located within the APE, as it was depicted adjacent to the river. However, this particular factory was the early site of a nationally-significant carpet enterprise and although foundations of the factory may not provide much of an archaeological footprint, the associated, buried features on the grounds may be revealing of the workers at the complex. Nearby, three late-19th century buildings once stood adjacent to the northeast corner of Area 2, but this area was subsequently disturbed by the extensive engineering efforts required to meet the necessary grade of the New York, Westchester, and Boston Railway. Furthermore, the Cross Bronx Expressway and support structures were built in this vicinity.

Although Area 2 was once an elevated terrace rising to 20 foot ASL along the river, it experienced extensive 20th century development which may have disturbed any potential earlier precontact and historical resources. However, since it is possible that fill was added to the site, as was evident in soil borings collected for the construction of the Cross Bronx Expressway (Lawler, Matusky & Skelly Engineers 2001a), carpet factory shaft features (e.g.,

privies) may exist beneath the fill. Isolated areas of precontact potential may also exist. It is not anticipated that potential resources would have remained undisturbed where the pool, beach, and reservoir were formerly located, since they presumably involved deep excavations which would have destroyed any existing resources' integrity (Figure 4).

Area 3:

The lack of 20th century development in Area 3 suggests that portions of this section of the APE are potentially sensitive for remnants of a mid-to-late 19th century factory which was later utilized as a dwelling and ice house. The structure stood prior to the availability of sewer and water lines – which were laid in Westchester Avenue in the late 19th century and on Bronx River Avenue between 1921 and 1927 – so there is the potential for shaft features associated with the structure to exist in the APE. No other historical period deposits are anticipated. Furthermore, because Area 3 lacked extensive historical land manipulation, it is possible that precontact resources lie buried within undisturbed portions of the APE. Therefore, Area 3 is potentially sensitive for both the footprint of the factory and associated shaft features, as well as potential precontact resources.

Area 4:

Area 4 was not developed historically, and, therefore, has no potential for historical period resources. This parcel was lower-lying than the Areas to the north and was probably never utilized for extended precontact habitation. However, it is possible that the site was utilized for resource procurement and/or processing, and potential remains from these uses may exist within the APE. This low-lying area undoubtedly experienced repeated flooding, which means that deep levels of alluvial strata may have accrued over potential precontact resources. Because this area was never subjected to historical development, and because of the probable accretion of alluvial deposits, Area 4 is considered potentially sensitive for precontact resources. Anticipated resources may include shell middens and resource procurement stations.

Area 5:

Area 5 experienced virtually no historical development, other than the creation of the railway to the west, throughout the 19th century. A house stood outside the APE by 1898, and three small wooden outbuildings associated with it stood in the APE. These were all razed by 1927. The location of the three outbuildings was later developed with brick commercial buildings and a parking lot, which has been graded and leveled. Pre-development topographic maps show the lot as sloping downward from Bronx River Avenue to the river, while the parking lot is currently level. The transitory nature of the buildings, the fact that they were wood outbuildings and the subsequent development of the lot suggests that this portion of the APE is not sensitive for historical resources. Furthermore, 20th century development would have disturbed any potential precontact resources. Therefore, Area 5 is not considered potentially sensitive for historical or precontact archaeological deposits.

Area 6:

Area 6 was partially developed with a gas works that stood from the mid-19th century through the mid-20th century, although it was inactive by the 1890s. Archaeologists investigating industrial sites study the history of technology by examining buried resources, if any exist, and by also examining company records, and extant machinery and buildings. Remnants of the gas works in Area 6 would likely only entail building foundations, piping supports, and footings, as all above grade facilities and equipment have been removed. Since the coal-to-gas process in the 19th century is well studied, little would be gained by archaeologically investigating building footprints. However, it is more than likely that privies for company workers were located on-site since the complex predates the availability of sewer and water lines (late 19th century on West Farms Road). Potential shaft features from these privies may have existed in the APE. However, in the 1940s the entire APE was landscaped and turned into a City Park. In 2002, it was designated as a hazardous waste site that Con Ed is in the process of remediating (<http://www.dec.state.ny.us>). These efforts would have undoubtedly destroyed any remaining archaeological potential at the gas works.

Similarly, several wooden buildings that were associated with building material yards once stood in the APE. Three of these were directly west of the gas works, while others were located further south near East 172nd Street. The only archaeological deposits associated with these buildings would be their footings, and possibly remnants of the materials stored in and around them in the yards. Data from these site types in an urban setting that is perpetually being redeveloped is of little research value. Furthermore, their locations were later disturbed by the development of Starlight Park. Therefore, Area 6 is not considered potentially sensitive for this resource type.

Although Area 6 may have once been sensitive for precontact resources, given its proximity to the Bronx River, the majority of the site has experienced subsurface disturbance with the construction and demolition of the gas works and other commercial structures, the realignment of the river, the realignment of West Farms Avenue and the creation of Starlight Park. Therefore, Area 6 is not considered potentially sensitive for this resource type.

Area 7:

Area 7 lacks the potential for precontact and historical archaeological resources. The site never appeared to contain historical dwellings or structures that would yield archaeological deposits, having only been developed with a series of warehouses and storage buildings in the 20th century. Furthermore, the parcel was graded and leveled to create a parking area, and the western border was extensively manipulated with the construction and reconstruction of the railroad bed and the upgrading of the bridge. Filling and leveling was undertaken adjacent to the river when the new bulkhead line was created, and the bridge over the river at Westchester Avenue was replaced several times. All of these actions further disturbed the original site stratigraphy. It is highly unlikely that any potential precontact deposits, which may have once been located along the river, would have remained undisturbed by these actions. Therefore, because of the lack of historical deposits and the subsequent disturbances to the site, Area 7 has no archaeological potential.

CONCLUSIONS AND RECOMMENDATIONS

The Archaeological Documentary Study of the Bronx River Greenway project site identified areas of extensive prior disturbance which now lack archaeological potential, and areas that have not been disturbed that may have both precontact and/or historical archaeological sensitivity. For ease of discussion and presentation, the site was artificially subdivided into seven distinct study Areas, and it was determined that four of those areas are potentially sensitive for buried resources, while three have experienced extensive disturbance that negated archaeological potential (Figure 13). Areas 5, 6, and 7 do not warrant further archaeological consideration. Areas 1, 2, 3, and 4 may possess buried precontact and/or historical deposits. As can be noted on Figure 13, only a portion of Areas 1, 2, and 3 is considered sensitive for archaeological resources, while the entirety of Area 4 is considered archaeologically sensitive.

Prior to any archaeological field investigations in Areas 1, 2, 3, and/or 4, a series of soil borings should be undertaken in the sensitive land of each Area that will experience subsurface impacts due to the proposed development of the Greenway. It is recommended that professional archaeologists and geo-technicians establish a borings protocol that will specify appropriate testing parameters, e.g., large diameter core and continuous-tube sampling. Such parameters for the four sensitive Areas (1 – 4) will afford maximum data for review. When these soil borings are conducted, depth and thickness of fill layers must be recorded. After boring logs are completed, archaeologists should review them to establish a more comprehensive knowledge of subsurface conditions.

Following the completion of soil borings and a review of boring logs, archaeological subsurface testing and/or additional research may be recommended. If indicated, a comprehensive testing plan would be developed, in consultation with LPC, based on the results of the boring analysis and the finalized plans for the proposed action.

For those portions of the proposed Greenway that are found to be potentially sensitive, but would not undergo any subsurface disturbance, no archaeological testing would be warranted. However, if future plans are revised to entail subsurface disturbance, then testing would be reconsidered.

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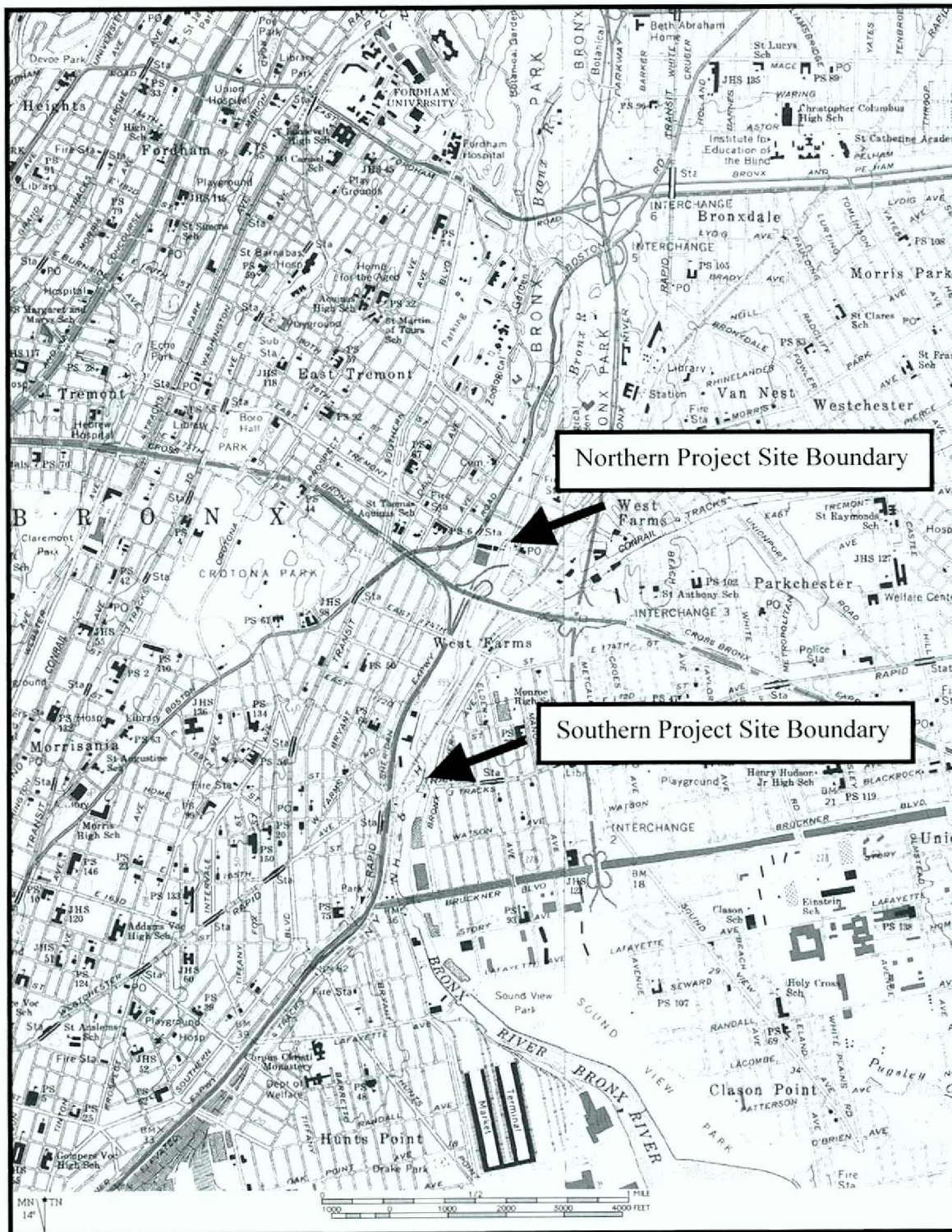


FIGURE 1

U.S.G.S. Topographic Map: Central Park and Flushing, NY Quadrangles.

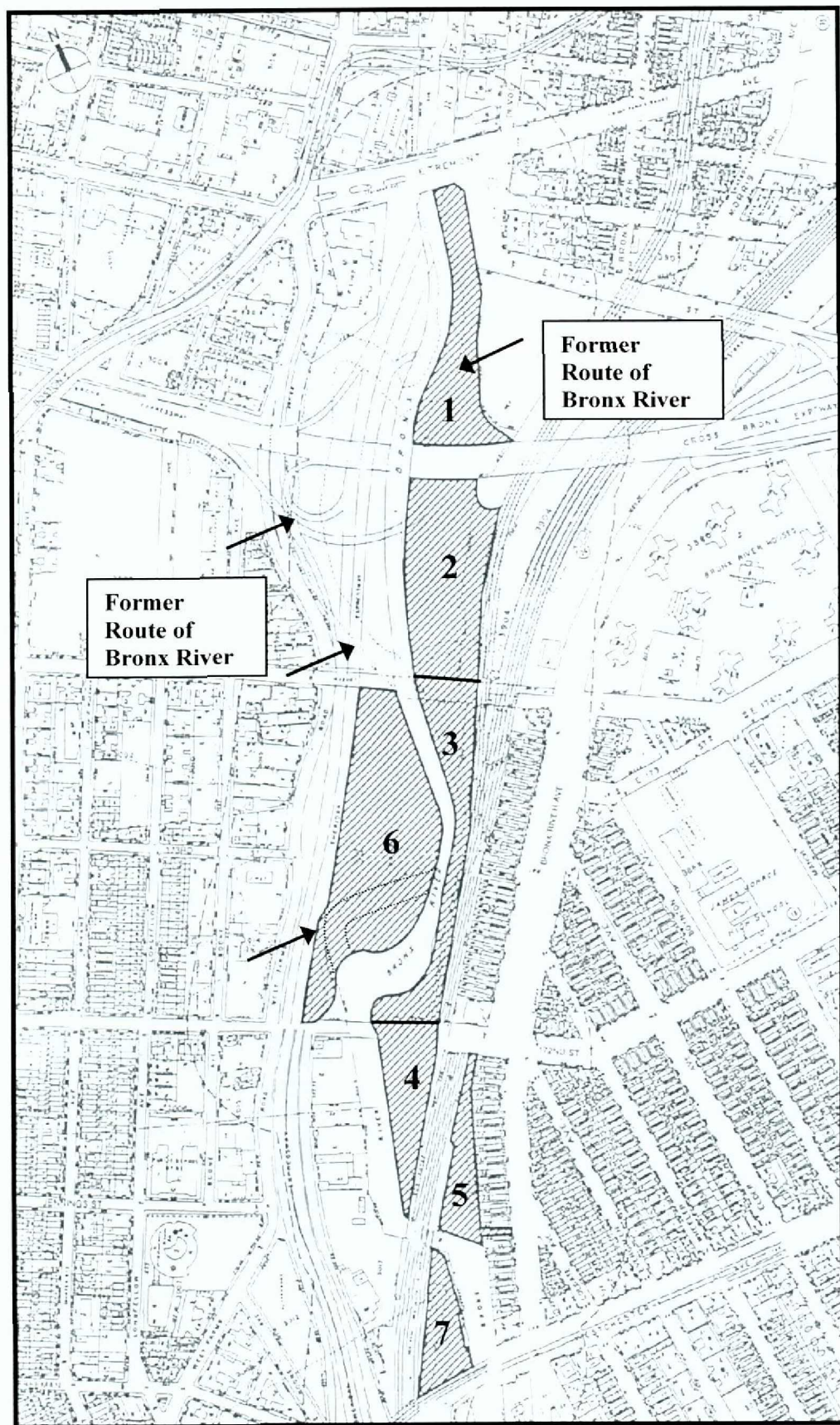


FIGURE 2

Project Site Boundaries and Area Designations.
Note: Dashed lines indicate former route of Bronx River.



FIGURE 3

The Bronx River, just south of the East Tremont Avenue bridge ca. 1890. Note that the bend in the river has since been straightened out.

Source: Bronx County Historical Society

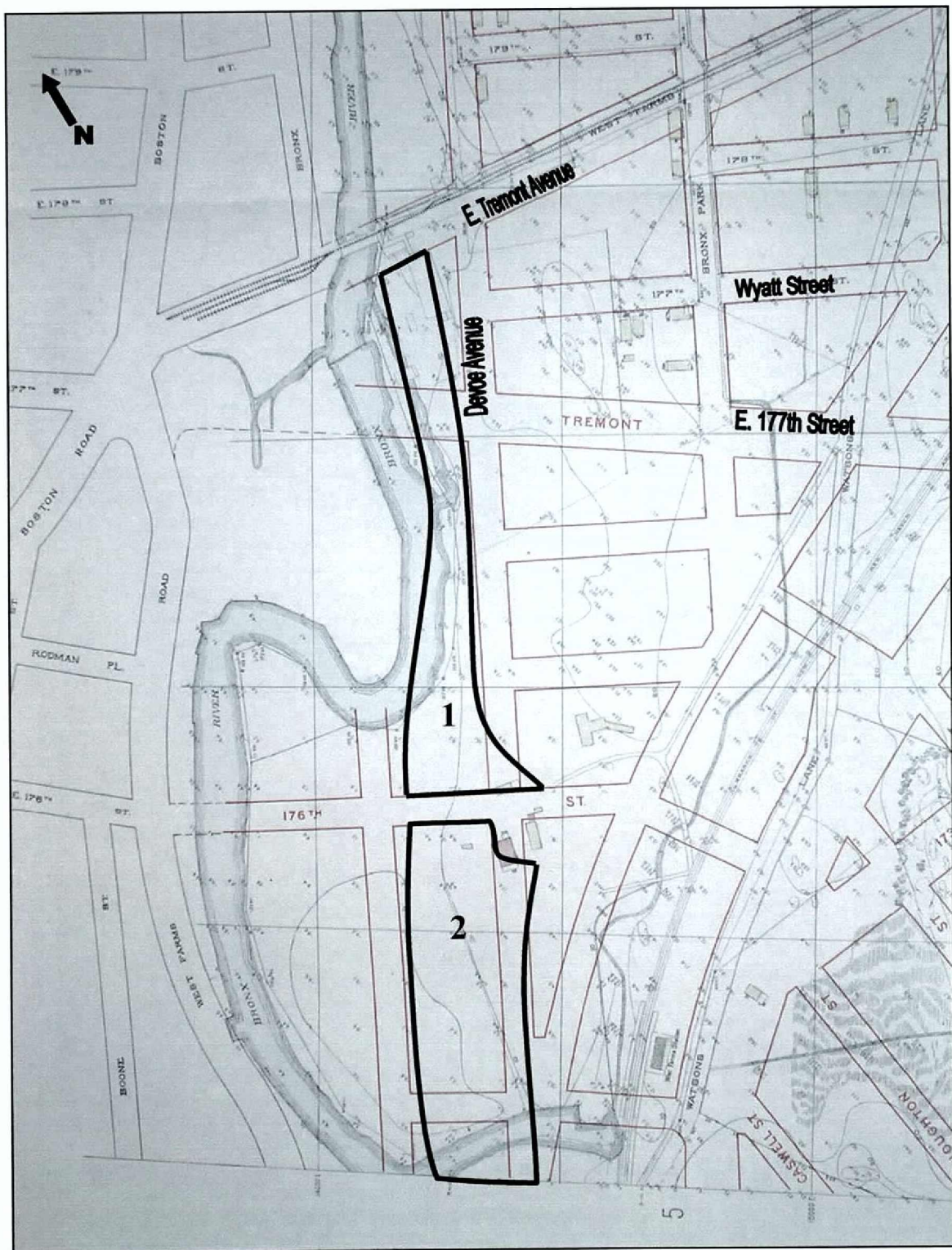


FIGURE 4

Topographic Map with Proposed Roads, 1900.
No scale.

Repository: New York Public Library Map Room

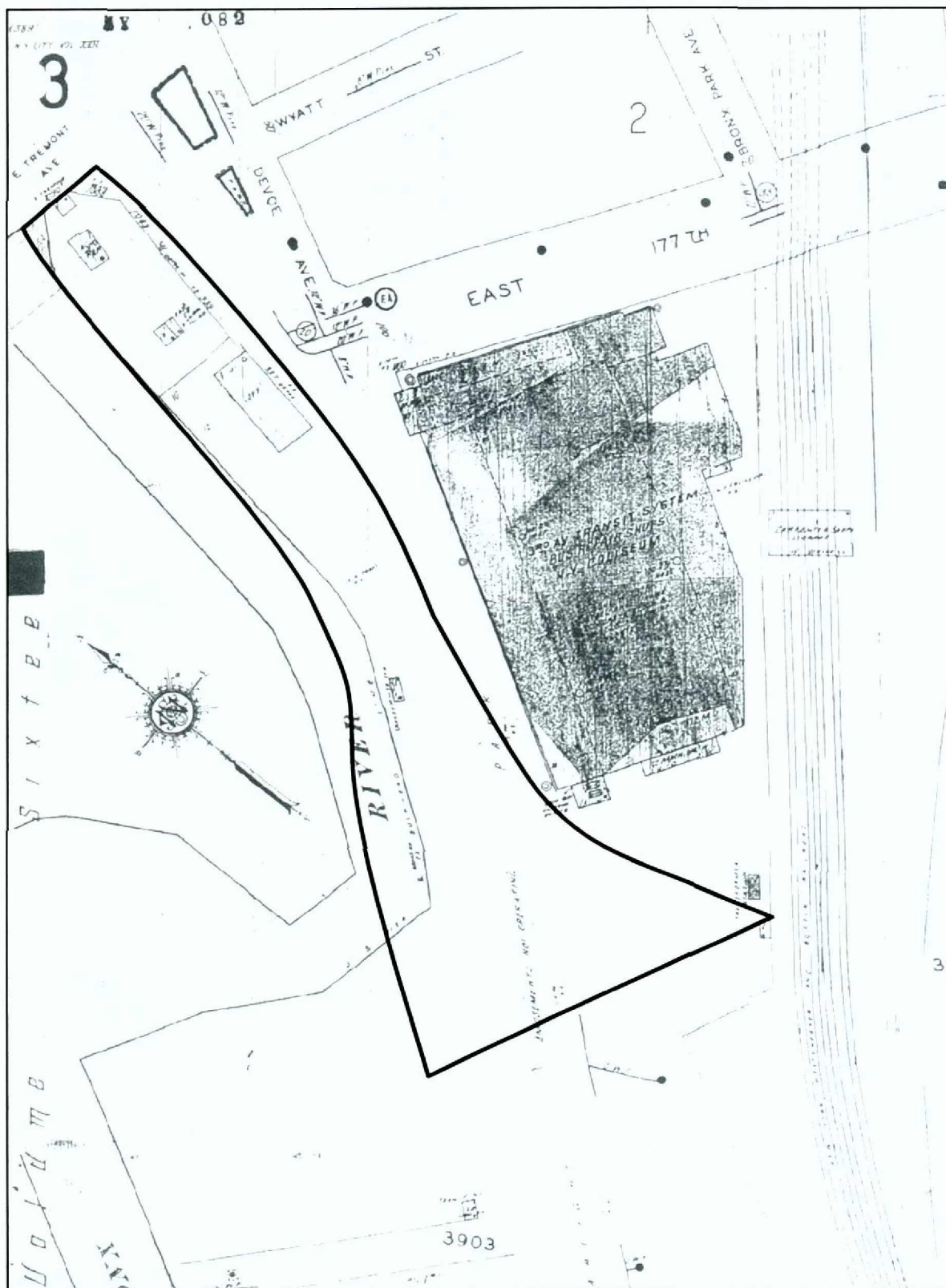


FIGURE 5

Area 1, Sanborn 1948.
No scale.



FIGURE 6

Cross Bronx Expressway Construction over the Bronx River, facing south. Area 1 is to the left. Note new channel of river and extensive disturbance due to shifting the river 500' east.



FIGURE 7

Cross Bronx Expressway construction over Bronx River, facing north. Area 1 is at right.

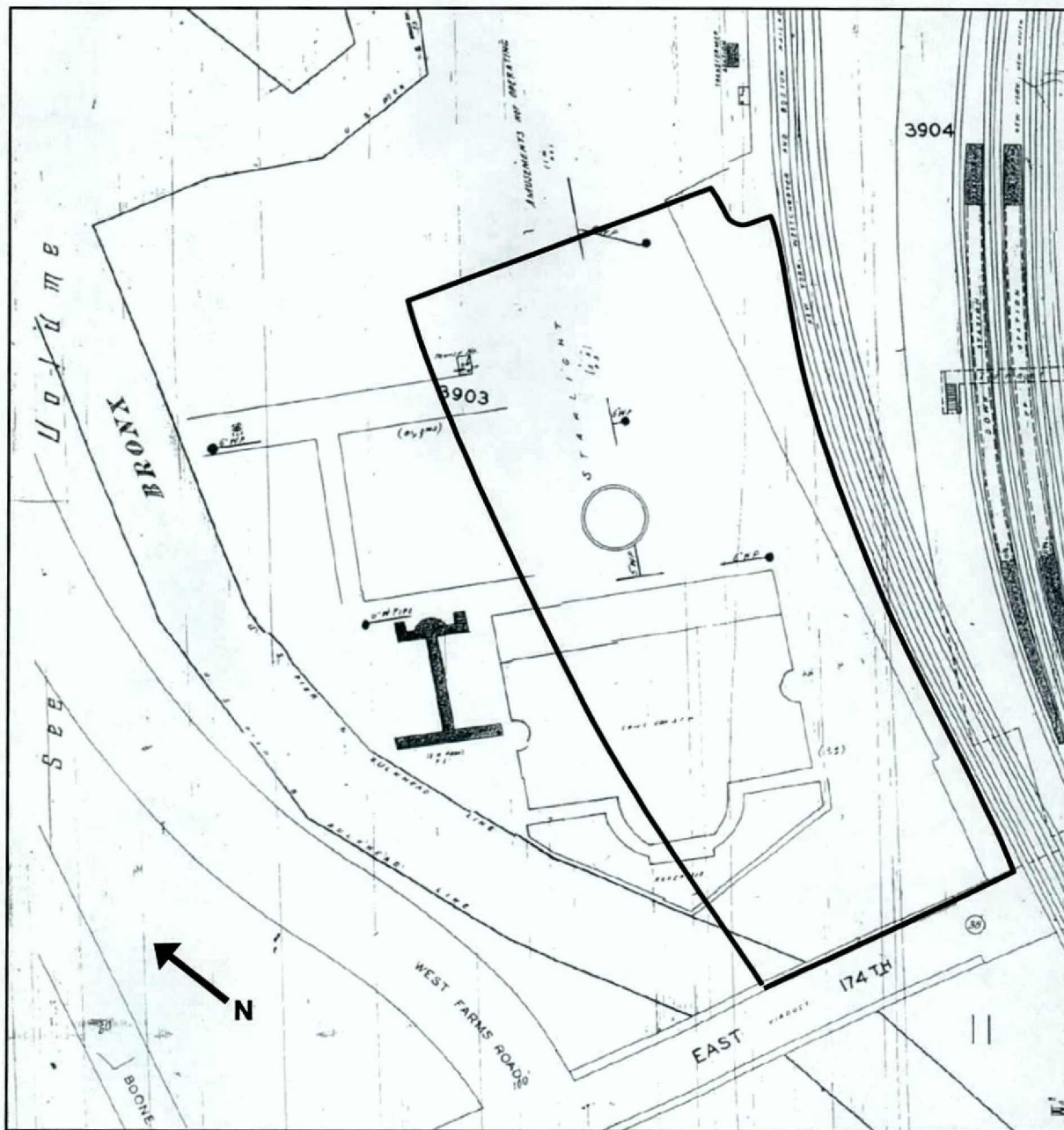


FIGURE 8

Area 2, Sanborn 1948.
No scale.

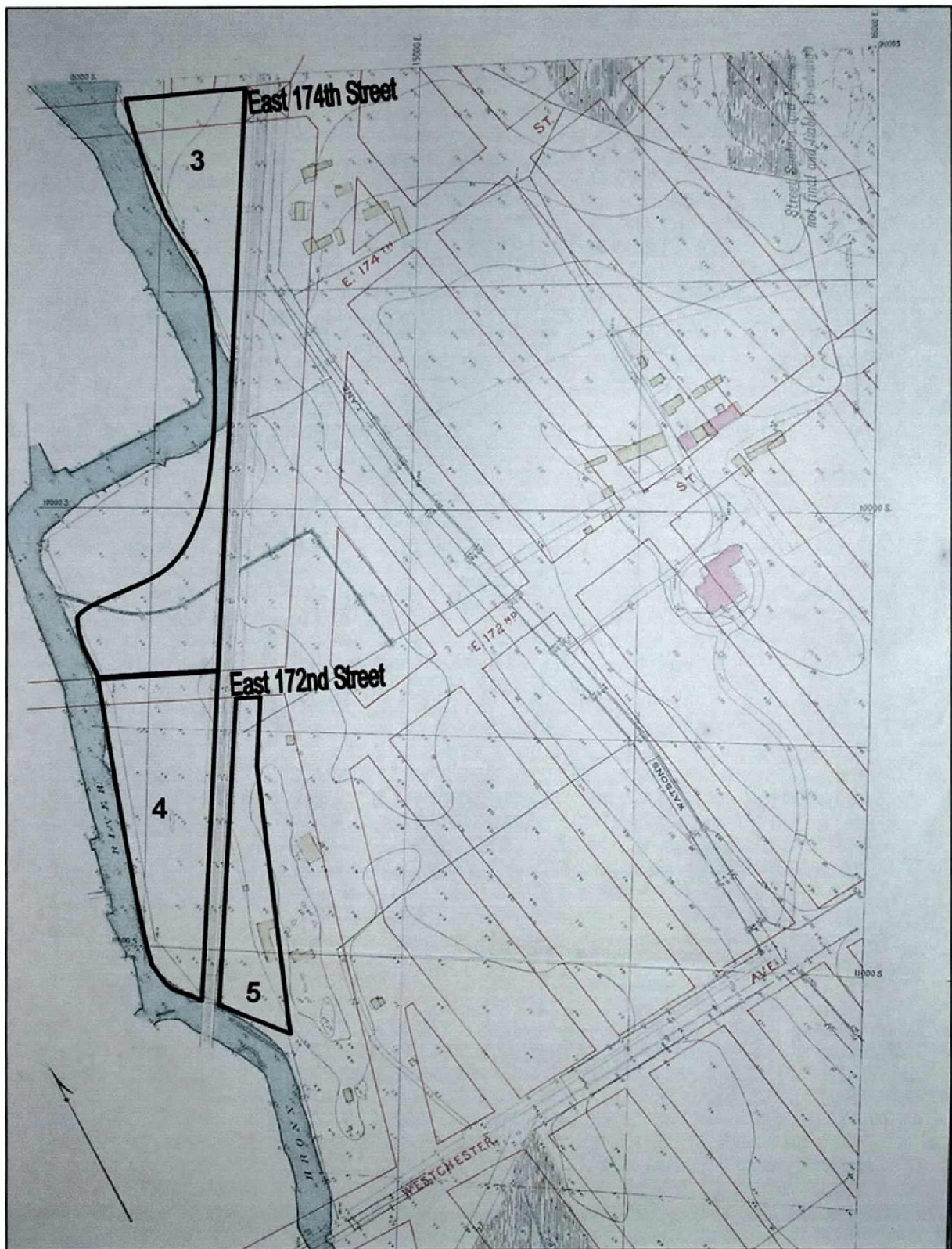


FIGURE 9

Areas 3, 4 and 5: Topographic Map with Proposed Roads, 1900.

No scale.

Repository: New York Public Library Map Room

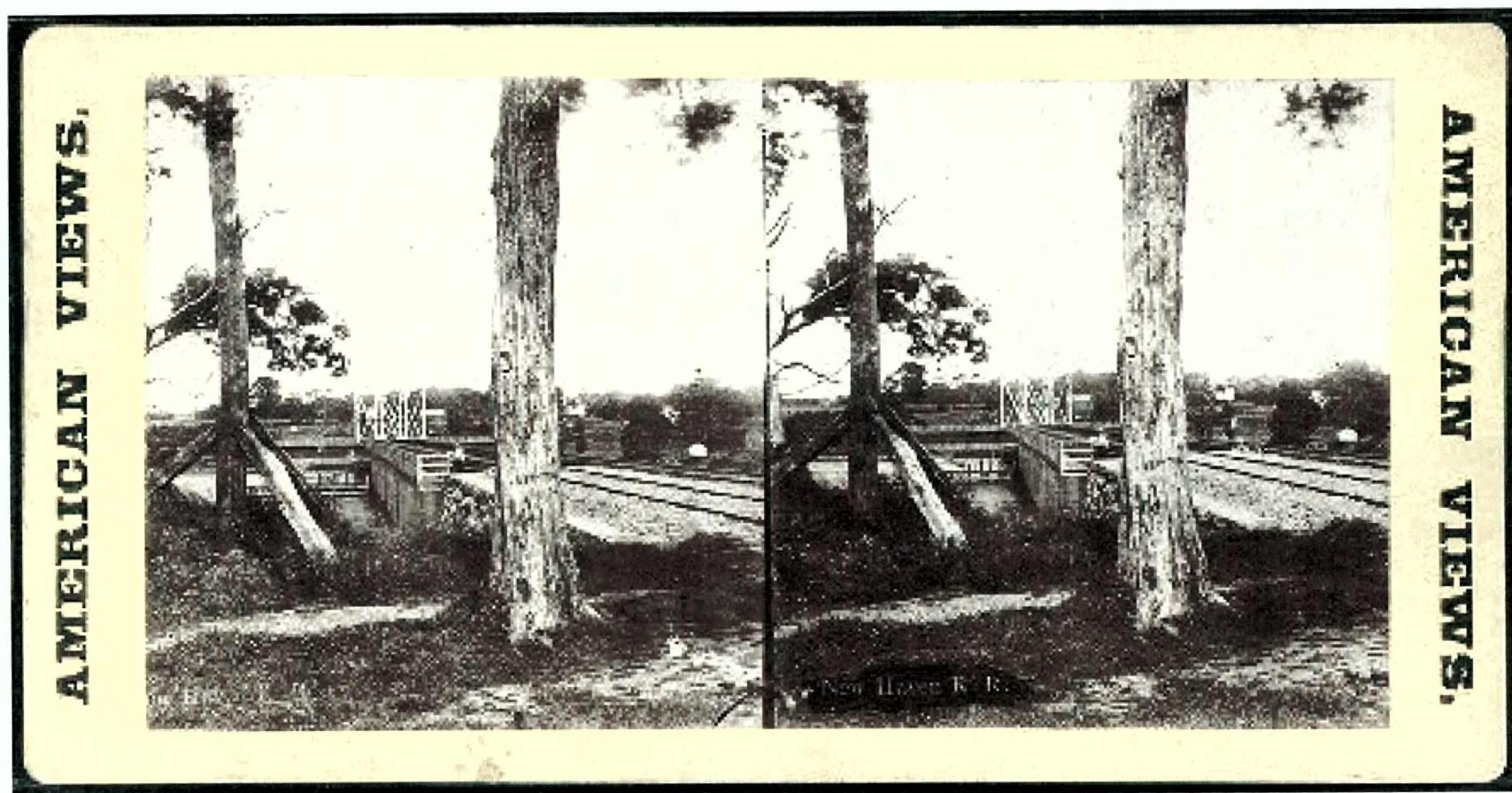


FIGURE 10

Stereoscopic View of the Railroad Bridge over the Bronx River.
Facing east from the west side of the Bronx River.

The Robert N. Dennis Collection of Stereoscopic Views, [image number, e.g., NYPG91-F112],
Courtesy of The New York Public Library.

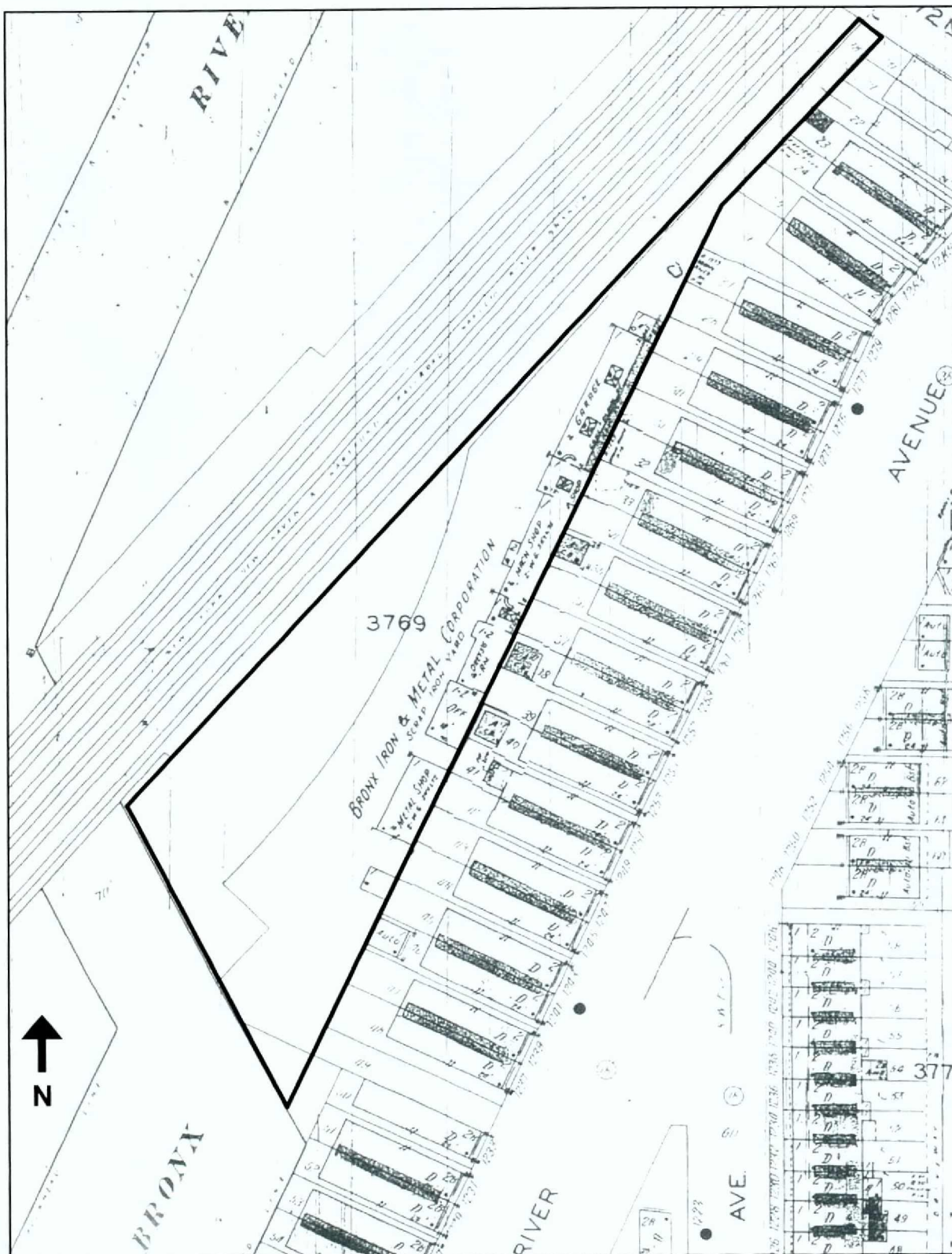


FIGURE 11

Area 5, Sanborn 1948.
No scale.

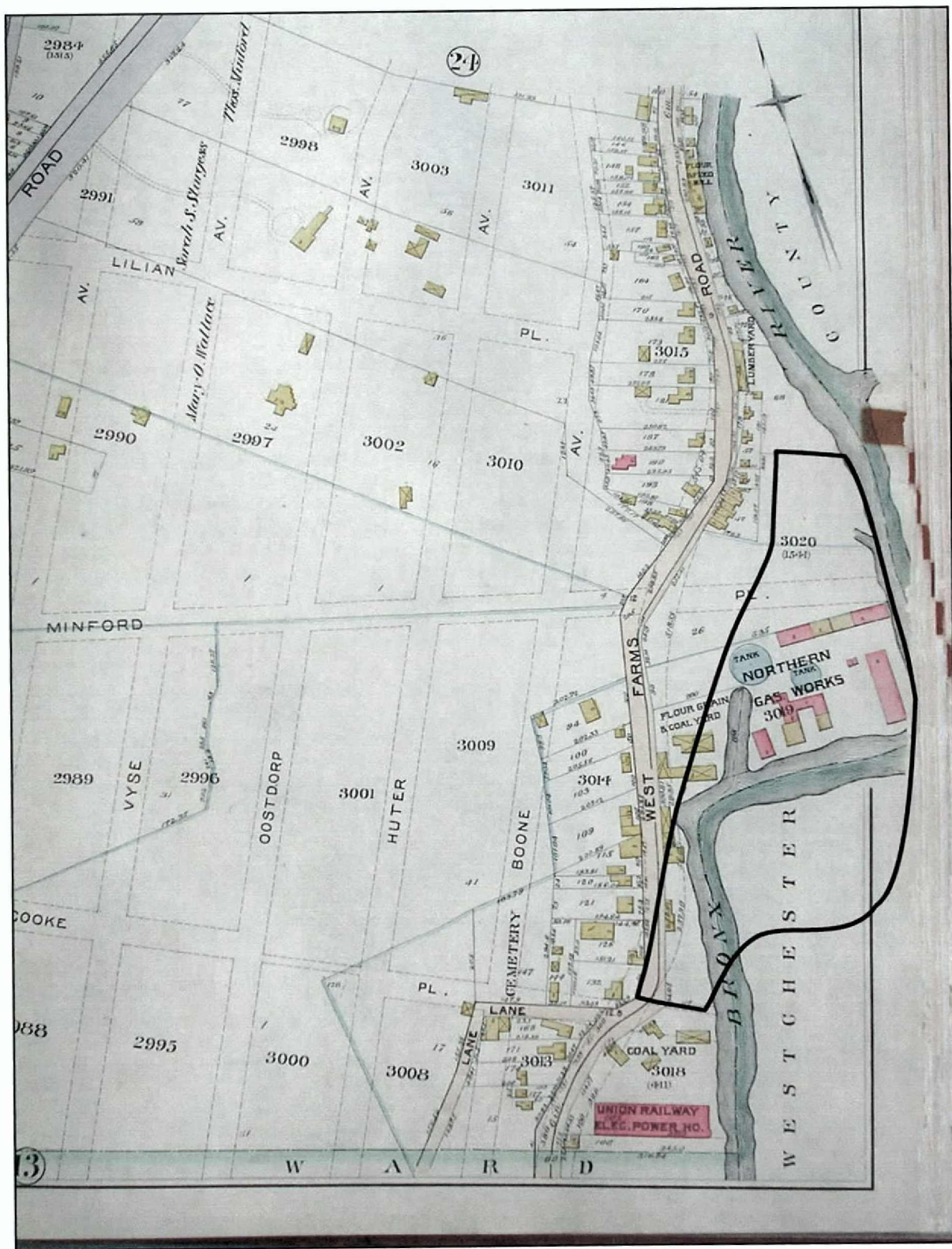
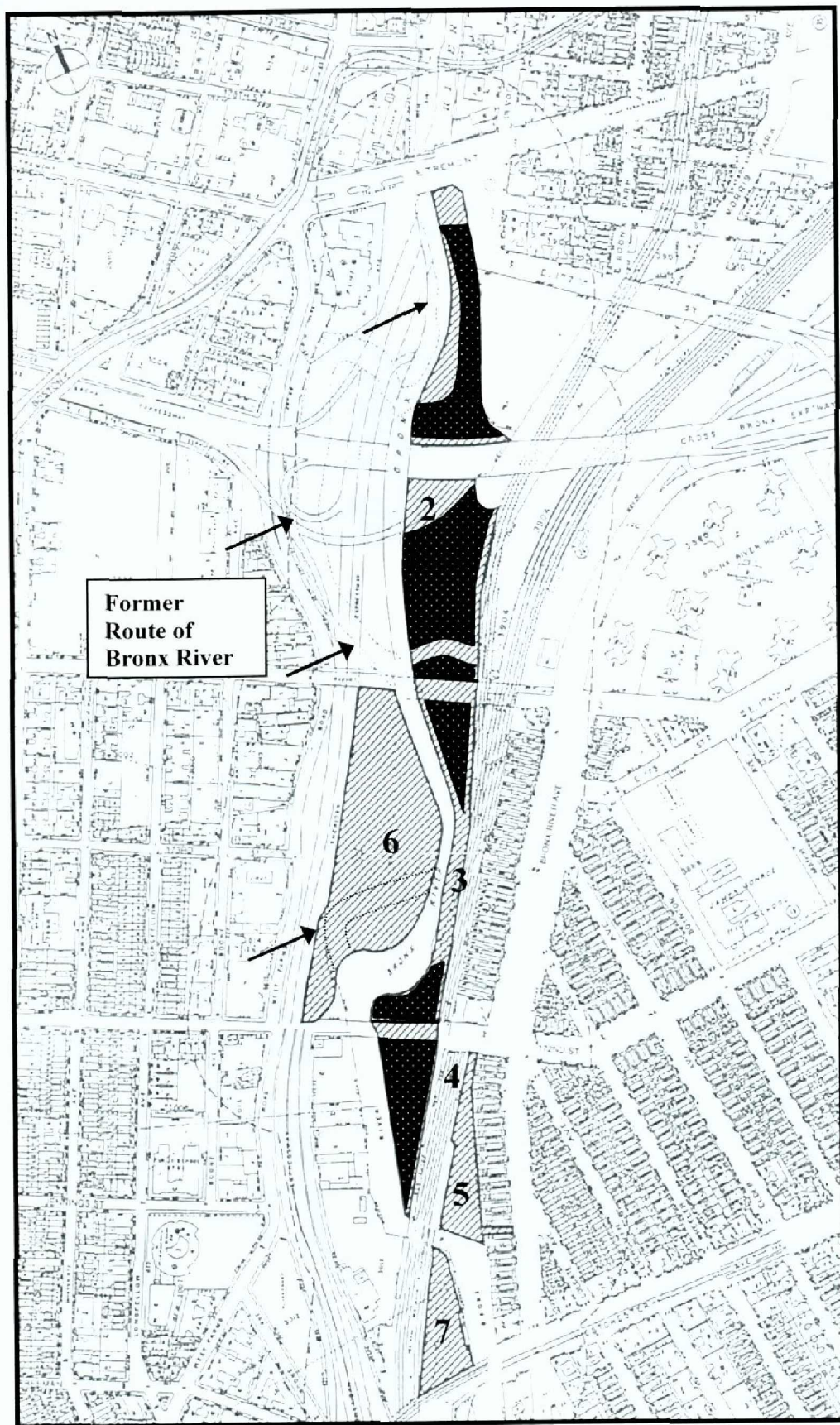


FIGURE 12

Area 6, west of the Bronx River, 1893. *Atlas of the City of New York, 23rd and 24th Wards.*
G.W. Bromley and Company.



 POTENTIAL ARCHAEOLOGICAL SENSITIVITY

FIGURE 13
Bronx River Greenway, Potential Archaeological Sensitivity.

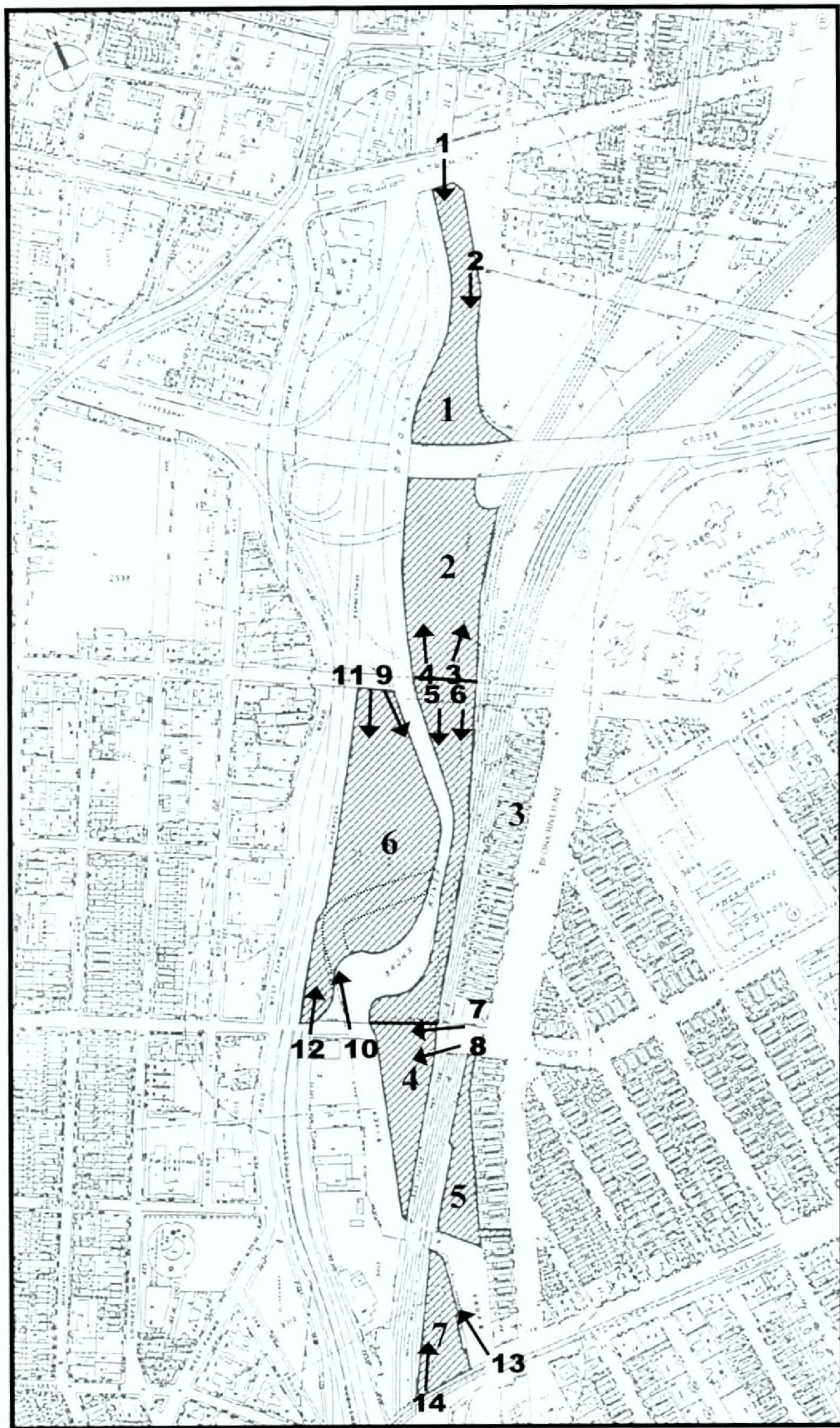


PHOTO KEY



Photograph 1: Northern section of APE facing south from East Tremont Avenue. Area 1 is at left on the east side of the river.



Photograph 2: Area 1, facing south from the approximate intersection of East 177th Street and Devoe Avenue.



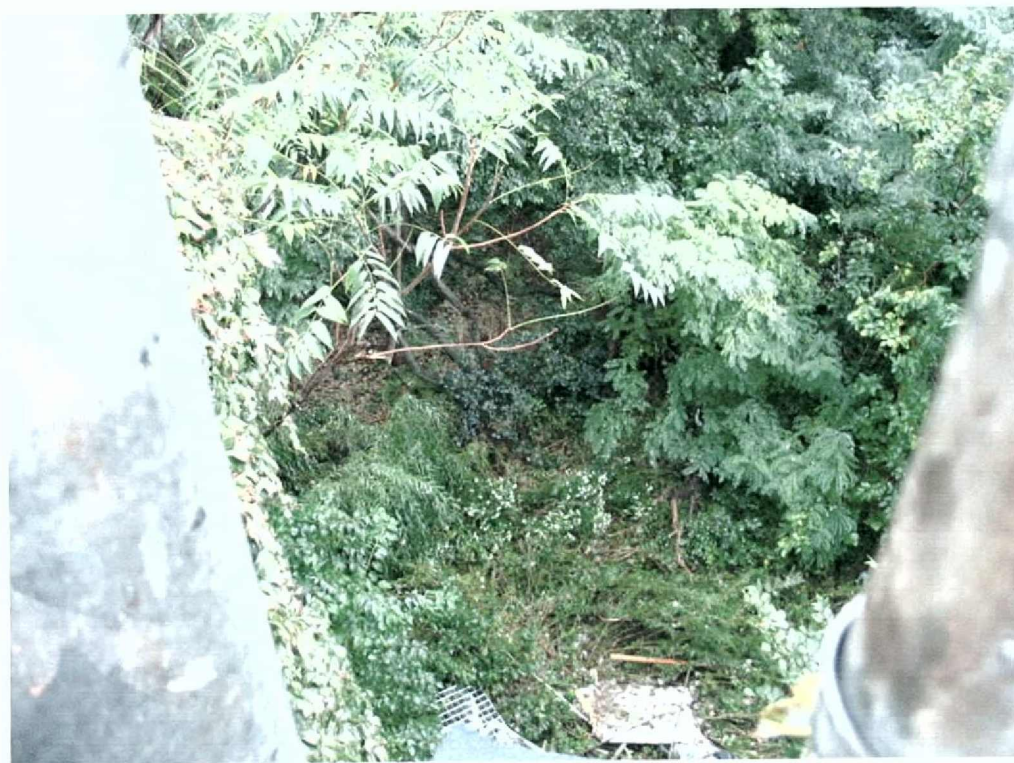
Photograph 3: Area 2 facing northeast from the East 174th Street overpass.



Photograph 4: Area 2 facing north from the East 174th Street overpass.



Photograph 5: Northern section of Area 3 APE, facing south from the East 174th Street overpass.



Photograph 6: Area 3, facing south from the East 174th Street overpass.



Photograph 7: Area 4 facing west from East 172nd Street (now abandoned).



Photograph 8: Area 4 facing southwest from East 172nd Street (now abandoned).



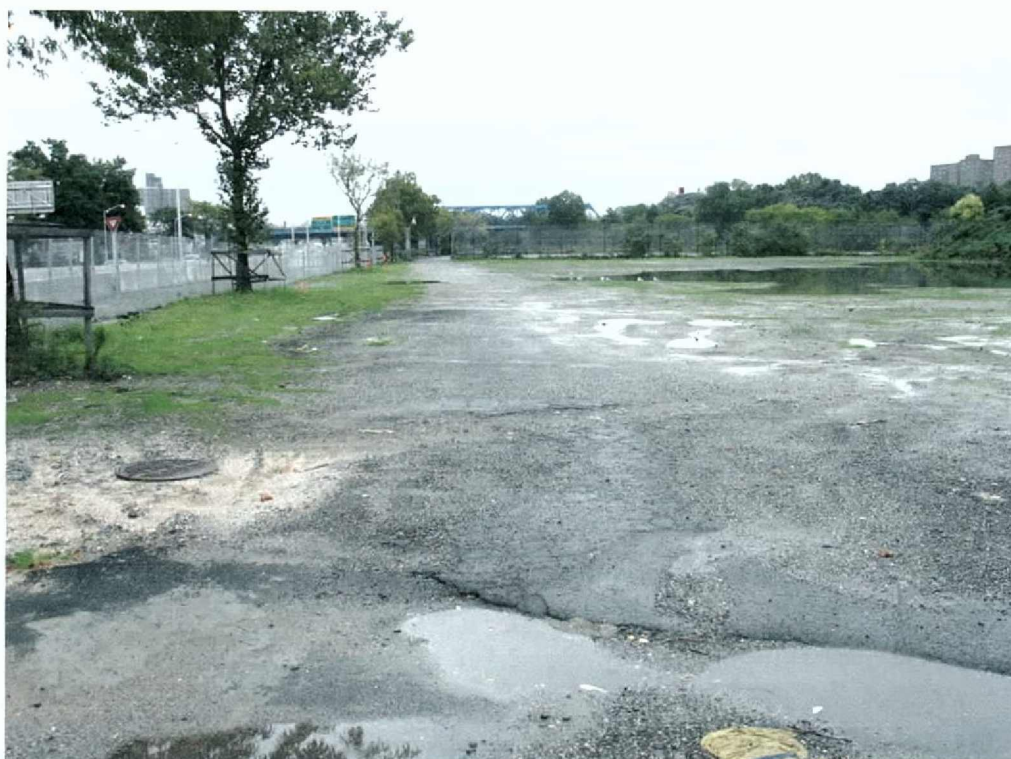
Photograph 9: Area 6 facing south from East 174th Street overpass. Note the silt fencing along the eastern boundary of the project site along the Bronx River.



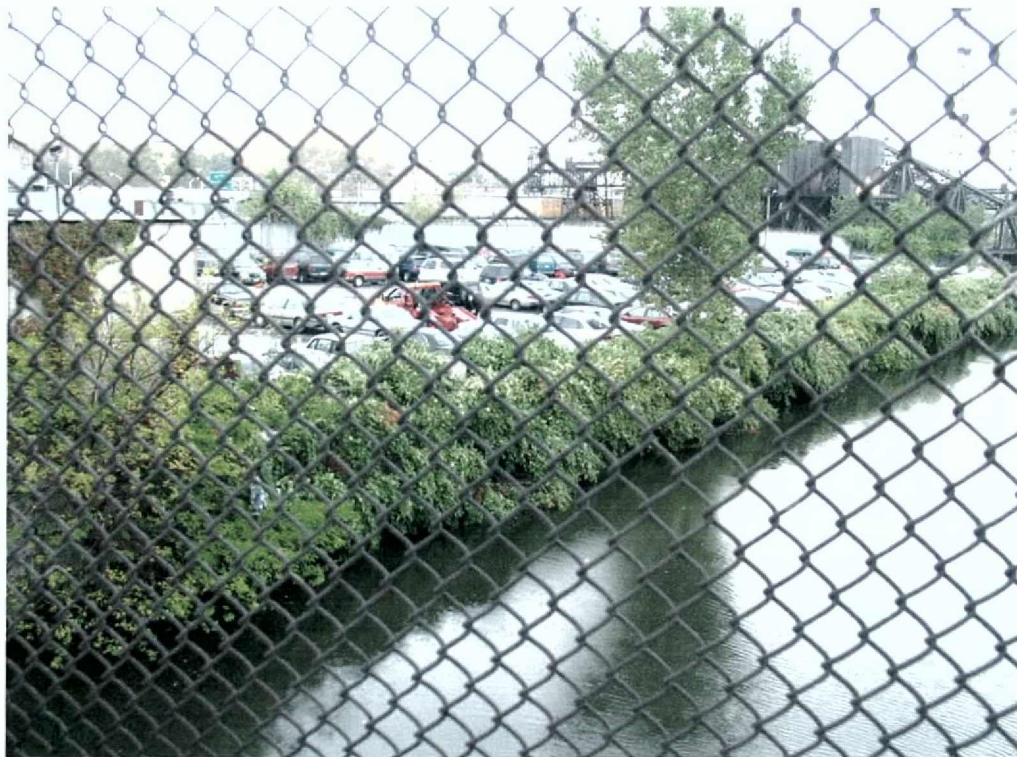
Photograph 10: Silt barrier in the Bronx River along the southeastern border of Area 6. Facing northwest from East 172nd Street. Note this portion of the project site is wooded.



Photograph 11: Area 6 facing south from East 174th Street.



Photograph 12: Area 6 facing north from East 172nd Street. Note the remnants of the former route of West Farms Road in foreground.



Photograph 13: Area 7 facing north from Westchester Avenue over Bronx River.



Photograph 14: Ramp from Westchester Avenue down into parking lot in Area 7. Note the railroad bridge at the upper left.

APPENDIX

Pertinent Excerpts Copied from the following Soil Reports:

URS, Inc.

2001 NYC DEP, Bronx River CSO Storage Facility, Geotechnical Borings.

Lawler, Matusky & Skelly Engineers, LLP

2001a NYC DEP, East River Combined Sewer Overflow Facility Planning Project,
Subsurface Soils Investigation for the Proposed CSO Storage Conduit-Bronx
River.

2001b NYC DEP, Bronx River Greenway: Surface Soils Investigation for the
Environmental Assessment Statement in the Northern Portion of the Bronx River
Greenway.

November 10, 2004

Mr. Roger K. Weld
Non-Motorized Transportation Coordinator
New York State Department of Transportation
47-40 21st Street, Room 420
Long Island City, New York 11101

Re: **Bronx River CSO Storage Facility
Geotechnical Borings**

Dear Mr. Weld;

As per your request, attached is the geotechnical boring information you requested.

The information consists of a boring location plan, two subsurface profiles, boring logs (Appendix A), and the laboratory testing data conducted on soil samples (Appendix C).

If there is any additional information needed, do not hesitate to contact me.

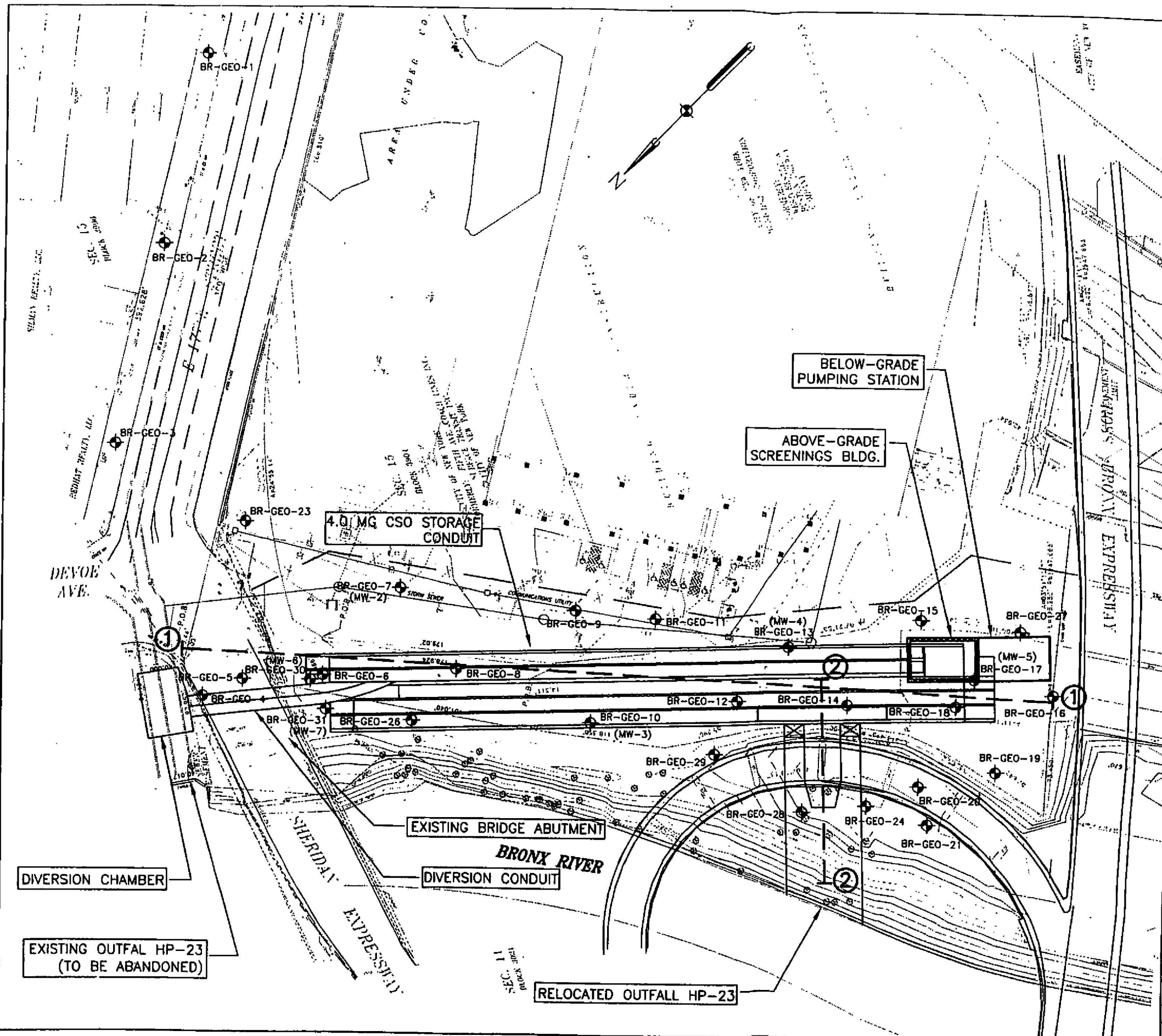
Very truly yours,

URS Corporation



Robert Curti, P.E.
Project Manager

K:\Cadd\323653704\dwg.dwg, 01/28/2002 05:13:14 PM



LEGEND:

BR-GEO-18 + LOCATION AND NUMBER OF GEOTECHNICAL TEST BORING

① — ① SECTION FOR SUBSURFACE PROFILE

(MW-2) MONITORING WELL LOCATION AND NUMBER

NOTES:

1. BASE MAP OBTAINED FROM MASSAND ENGINEERING, LS P.C.
2. BORINGS PERFORMED FROM NOVEMBER 28 TO DECEMBER 7, 2001 WERE NOT SURVEYED, THEREFORE LOCATIONS ARE CONSIDERED APPROXIMATE.
3. ELEVATIONS REFER TO BRONX VERTICAL DATUM.
4. BORINGS BR-GEO-22 AND BR-GEO-25 WERE NOT PERFORMED.

BORING LOCATION PLAN
NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION
FINAL DESIGN OF EAST RIVER
PROPOSED CSO RETENTION FACILITIES-CONTRACT III
BRONX RIVER CSO STORAGE CONDUIT

URS

WAYNE, NEW JERSEY

DR. BY	JL	SCALE	AS SHOWN	DWG. NO. 3236537041	PROJ. NO. 3236537
CK'D. BY	JM	DATE	DEC. 26, 2001	FIG. NO.	1-2

Project: Bronx River CSO

Project Location: Bronx, New York

Project Number: 09.00032159

Log of Boring BR-GEO-7 (MW-2)

Sheet 1 of 2

Date(s) Drilled	6/12/00 - 6/13/00	Logged By	J. Shannon	Approximate Surface Elevation (feet)	19.65 BVD
Drilling Method	Hollow Stem Auger	Drilling Contractor	Aquifer Drilling and Testing	Coordinates North:	
Casing Size/Type	Auger 4 1/4"	Drill Rig Operator	Jim Bitic	East:	
Drill Rig Type	Mobil B59	Drill Bit Size/Type	NA	Total Depth Drilled (feet)	40.0
Groundwater Level and Date Measured	12.50 ft (MW-2) 6-13-00	Hammer Wt/Drop	Safety 300lb/24in	Sampler Type(s)	2" Split Spoon
Boring Location and Comments	532 N, 94 E	Casing Hammer Wt/Drop		Core Barrel Size/Type	NX, 2 1/8", double tube
				No. of Samples Dist.: 7	Undist.: 0
				Core (ft): 5	

Depth, feet	Soil Samples			Rock Coring			Graphic Log	MATERIAL DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont. (%)	% Fines	REMARKS/ OTHER TESTS
	Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Run Number	Recov. (%)	RQD (%)							
0								Asphalt Pavement with gravel subbase					
	S-1	0.5	6 4 3 2					(SM)- brown, dry, silty c-f SAND, with red brick and asphalt fragments. [fill] [11-65]					
5	S-2	1.5	2 1 1					(SM)- reddish brown, moist, silty c-f SAND. [11-65]					center bit installed at 5ft
10	S-3	1.1	8 13 20 18					(SM)- reddish brown, moist, c-f SAND, some silt with weathered gneiss. [11-65]					mild rig chatter
15	S-4	1.0	10 12 16 18					same as above, wet.					
20	S-5	0.7	8 10 13 12					(SM)- reddish brown, wet, c-f SAND, some silt with weathered rock. [7-65]					
25	S-6	1.1	16 12 12 13					(SW)- gray to brown, wet, c-f SAND with mica chips. [7-65]			14	4	
30													

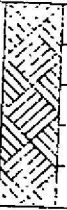
Project: Bronx River CSO

Project Location: Bronx, New York

Project Number: 09.00032159

Log of Boring BR-GEO-7 (MW-2)

Sheet 2 of 2

Depth, feet	Soil Samples			Rock Coring			Graphic Log	MATERIAL DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont. (%)	% Fines	REMARKS/ OTHER TESTS
	Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Run Number	Recov. (%)	RQD (%)							
30	S-7	0.8	22 50/5'					(SW)- brown, wet, c-f SAND parting to gray weathered gneiss [7-65]					
35				R-1	95	55		GNEISS with seams of quartz from 38'-39' [1-65 to 2-65]					Auger to 35'.
40													well installed upon completion.
45													
50													
55													
60													
65													

Project: Bronx River CSO

Project Location: Bronx, New York

Project Number: 09.00032159

Log of Boring BR-GEO-9

Sheet 1 of 1

Date(s) Drilled	6/7/00 - 6/7/00	Logged By	J. Shannon	Approximate Surface Elevation (feet)	19.17
Drilling Method	Hollow Stem Auger	Drilling Contractor	Aquifer Drilling and Testing	Coordinates	North: East:
Casing Size/Type	Auger 4 1/4"	Drill Rig Operator	Jim Bitic	Total Depth Drilled (feet)	17.0
Drill Rig Type	Mobil B59	Drill Bit Size/Type	NA	Rock Depth (feet)	NA
Groundwater Level and Date Measured		Hammer W/Drop	Safety 140lb/30in	Casing Hammer W/Drop	
Boring Location and Comments	430 N. 97 E			Sampler Type(s)	2" Split Spoon
				Core Barrel Size/Type	NX, 2 1/8", double tube
				No. of Samples	
				Dist.: 2	Undist.: 0 Core (ft): 10

Depth, feet	Soil Samples			Rock Coring			Graphic Log	MATERIAL DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont. (%)	% Fines	REMARKS/ OTHER TESTS
	Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Run Number	Recov. (%)	RQD (%)							
0								Asphalt Pavement with gravel subbase					
	S-1	1.0	8 9 11					(SM)- reddish brown, moist, silty m-f SAND, [fill] [11-65]					Boring moved slightly east due to sewer line.
5	S-2	0.8	24 42 100/5"					(SM)- same as above with mica chips and weathered gneiss [fill] [11-65]					
10				R-1	43	0		highly weathered GNEISS, 4" seam of quartz, [11-65]					
15				R-2	28	7		BOULDER, COBBLES, SAND, [11-65]					Core barrel breaks
20								See BR-GEO-9A for continuation of boring.					After core barrel is removed, borehole collapses to 9ft cannot core any further. See BR-GEO-9A.
25													
30													

Project: Bronx River CSO

Project Location: Bronx, New York

Project Number: 09.00032159

Log of Boring BR-GEO-9A

Sheet 1 of 1

Date(s) Drilled	6/7/00 - 6/8/00	Logged By	J. Shannon	Approximate Surface Elevation (feet)	19.17 BVD
Drilling Method	Hollow Stem Auger	Drilling Contractor	Aquifer Drilling and Testing	Coordinates	North: East:
Casing Size/Type	Auger 4 1/4"	Drill Rig Operator	Jim Bitic	Total Depth Drilled (feet)	25.0
Drill Rig Type	Mobil B59	Drill Bit Size/Type	NA	Rock Depth (feet)	20.0
Groundwater Level and Date Measured		Hammer WVDrop	Safety 140lb/30in	Sampler Type(s)	2" Split Spoon
Boring Location and Comments	426 N, 97E, 4' south of B-9	Casing Hammer WVDrop		Core Barrel Size/Type	NX, 2 1/8", double tube
				No. of Samples	Dist.: 1 Undist.: 0 Core (ft): 5

Depth, feet	Soil Samples			Rock Coring			Graphic Log	MATERIAL DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont. (%)	% Fines	REMARKS/ OTHER TESTS
	Type, Number	Recov. (ft)	Pen. Resist (blows/6 in)	Run Number	Recov. (%)	RQD (%)							
0													
5													see BR-GEO-9
10													
15	S-1	1.0	5 14 30 100/2"					(SW)- brown to green, wet, c-f SAND, some gravel. [fill] [11-65]					
20													
25				R-1	98	23		GNEISS with a 6" seam of quartz at 24.3 ft. [1-65 to 2-65]					hollow stem auger and center bit to 20'. Rod snaps at 8:30 , 4 hr delay coring resumes at 12:30 am.
30													

Date(s) Drilled	6/5/00 - 6/5/00	Logged By	J. Shannon	Approximate Surface Elevation (feet)	19.69 BVD
Drilling Method	Hollow Stem Auger	Drilling Contractor	Aquifer Drilling and Testing	Coordinates	North: East:
Casing Size/Type	Auger 4 1/4"	Drill Rig Operator	J-m Bitic	Total Depth Drilled (feet)	20.0
Drill Rig Type	Mobil B59	Drill Bit Size/Type	NA	Rock Depth (feet)	15.0
Groundwater Level and Date Measured		Hammer Wt/Drop	Safety 140lb/30in	Sampler Type(s)	2" Split Spoon
Boring Location and Comments	333N, 96E	Casing Hammer Wt/Drop		Core Barrel Size/Type	NX, 2 1/8", double tube
				No. of Samples	Dist.: 4 Undist.: 0 Core (ft): 5

Depth, feet	Soil Samples			Rock Coring			Graphic Log	MATERIAL DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont. (%)	% Fines	REMARKS/ OTHER TESTS
	Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Run Number	Recov. (%)	RQD (%)							
0													
	S-1	1.1	12 24 30 26					(SM)- gray to brown, dry, gravelly c-f SAND, some silt. [fill] [11-65]					
5	S-2	0.1	5 7 10 10					(SM)- dark gray to brown, moist, silty m-f SAND. [fill] [11-65]					
10	S-3	0.6	5 9 7 7					(SM)- brown, moist, silty m-f SAND, with traces of mica and weathered rock. [7-65]					
15	S-4	0.2	100/2"					highly weathered GNEISS. [1-65 to 2-65]					
				R-1	97	82		GNEISS [1-65 to 2-65]					
20													
25													
30													

Project: Bronx River CSO

Project Location: Bronx, New York

Project Number: 09.00032159

Log of Boring BR-GEO-15

Sheet 1 of 1

Date(s) Drilled	6/2/00 - 6/2/00	Logged By	J. Shannon	Approximate Surface Elevation (feet)	18.90 BVD
Drilling Method	Hollow Stem Auger	Drilling Contractor	Aquifer Drilling and Testing	Coordinates	North: East:
Casing Size/Type	Auger 4 1/4"	Drill Rig Operator	Jim Bitic	Total Depth Drilled (feet)	14.0 / Rock Depth (feet) 9.0
Drill Rig Type	Mobil B59	Drill Bit Size/Type	NA	Sampler Type(s)	2" Split Spoon
Groundwater Level and Date Measured		Hammer WVDrop	Safety 140lb/30in	Casing Hammer WVDrop	
Boring Location and Comments	134' N, 78' E			Core Barrel Size/Type	NX, 2 1/8", double tube
				No. of Samples	Dist.: 4 Undist.: 0 Core (ft): 5

Depth, feet	Soil Samples			Rock Coring			Graphic Log	MATERIAL DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont. (%)	% Fines	REMARKS/ OTHER TESTS
	Type, Number	Recov. (ft)	Pen. Resist. (blows/6 in)	Run Number	Recov. (%)	RQD (%)							
0								Asphalt Pavement with gravel subbase					
	S-1	0.2	100/5"					(GP)- black to gray, dry, c-f sandy GRAVEL. [fill] [11-65]					
5	S-2	0.2	100/5"					(SW)- black to dark gray, dry, gravelly c-f SAND. [fill] [11-65]					rig chatter, center bit added at 4ft
10													rig chatter, cuttings became brown m-f SAND. S-3 taken from cuttings spoon bounces at 9ft.
				R-1	97	38		highly weathered GNEISS. [1-65 to 2-65]					
15													
20													
25													
30													

Project: Bronx River CSO

Project Location: Bronx, New York

Project Number: 09.00032159

Log of Boring BR-GEO-23

Sheet 1 of 1

Date(s) Drilled	6/19/00 - 6/19/00	Logged By	J. Shannon	Approximate Surface Elevation (feet)	20.58 BVD
Drilling Method	HSA and Rotary	Drilling Contractor	Aquifer Drilling and Testing	Coordinates	North: East:
Casing Size/Type	Auger 4 1/4"	Drill Rig Operator	Jim Bitic	Total Depth Drilled (feet)	24.0
Drill Rig Type	Mobil B59	Drill Bit Size/Type	NA	Rock Depth (feet)	19.0
Groundwater Level and Date Measured		Hammer W/Drop	Safety 300lb/24in	Casing Hammer W/Drop	
Boring Location and Comments	53.2' to traffic light, 48.1' to street lamp. (see map)			Sampler Type(s)	2" Split Spoon
				Core Barrel Size/Type	NX, 2 1/8", double tube
				No. of Samples	
				Dist.: 4	Undist.: 0 Core (ft): 5

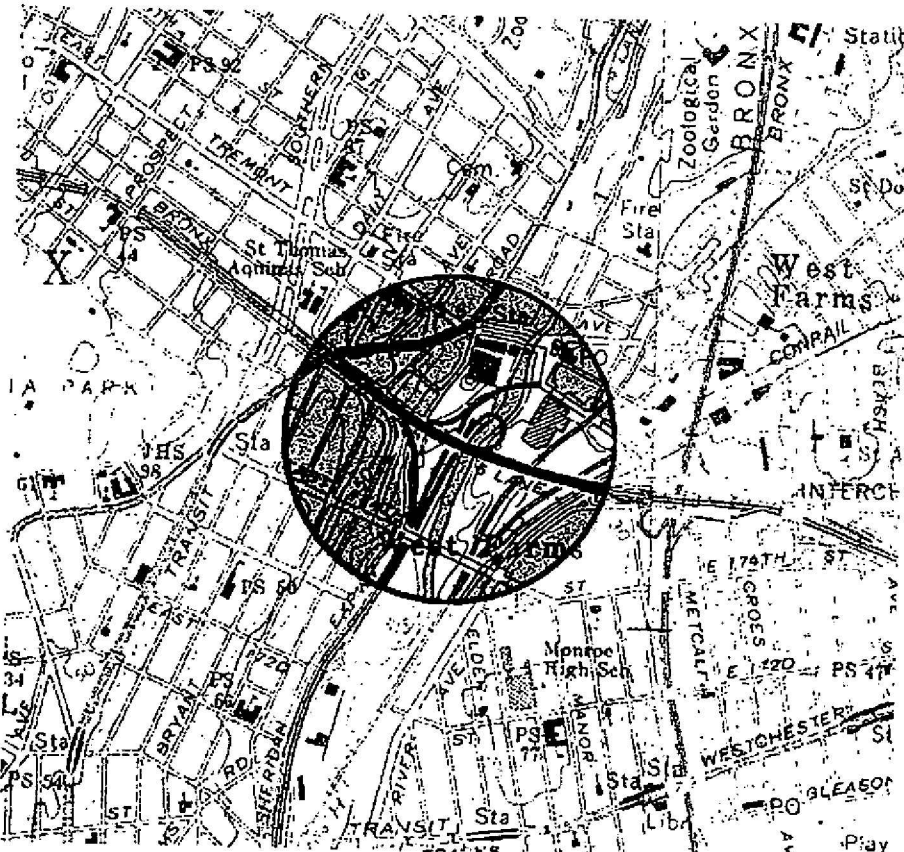
Depth, feet	Soil Samples			Rock Coring			Graphic Log	MATERIAL DESCRIPTION	Liquid Limit	Plastic Limit	Water Cont. (%)	% Fines	REMARKS/ OTHER TESTS
	Type Number	Recov. (ft)	Pen. Resist (blows/6 in)	Run Number	Recov. (%)	RQD (%)							
0	S-1	0.9	11 10 9					(SM)- brown, moist, silty m-f SAND, with asphalt and concrete cuttings. [fill] [11-65]					
5	S-2	1.1	9 9 10 11					(SM)- reddish brown, moist, silty m-f SAND, trace gravel. [fill] [11-65]					auger to 5ft, auger removed.
10	S-3	0.9	23 16 17 19					(SW)- brown, wet, c-f SAND, some gravel, silt. [6-65]					
15	S-4	10 50/4"						(SW)- gray to brown, gravelly c-f SAND to weathered rock [6-65]					
20				R-1	76	23		GNEISS [1-65 to 2-65]					heavy rig chatter roller bit refusal
25													
30													

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION



EAST RIVER COMBINED SEWER OVERFLOW FACILITY PLANNING PROJECT

Subsurface Soils Investigation for the Proposed CSO Storage Conduit - Bronx River



September 2001

Performed by
LAWLER, MATUSKY & SKELLY ENGINEERS LLP
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Under Subcontract to
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CHAPTER 1

EXECUTIVE SUMMARY

This report presents the findings of the subsurface investigation conducted by Lawler Matusky & Skelly Engineers LLP (LMS) in April, May, and June 2001 of the proposed Bronx River Combined Sewer Overflow (CSO) Storage Conduit. LMS conducted the investigation as a subcontractor to URS Corporation (URS) for the New York City Department of Environmental Protection (NYCDEP). The proposed conduit is located along the east bank of the Bronx River in Bronx County, New York (Figure 1-1). The site is bordered by East 177th Street to the north, the Bronx River to the west, the old New York, New Haven and Hartford railroad line and the old Coliseum Bus Depot to the east, and the Cross Bronx Expressway to the south. The site is the location of the NYCDEP proposed 4-million-gallon (MG) storage conduit for CSOs that currently discharge into the Bronx River through Outfall HP-23 (Figure 1-2). A portion of the site will be occupied by the new MTA facility that is currently being constructed. The MTA facility is being constructed west of and adjacent to the proposed storage conduit and will be used to store, fuel, and maintain buses. Based on the information provided to LMS, approximately 90,500 yd³ of material will be excavated and removed from the site to complete this portion of the overall project.

A site assessment and 50 year site history of the project area was conducted by LMS and the results were presented in a separate report (LMS June 2000). The site history included a database files search in accordance with the American Standard for Testing and Materials (ASTM) due diligence standard for conducting environmental site assessments (E.1527). The database search was conducted to determine if the site or adjacent properties were ever registered as hazardous waste sites, or if any releases of petroleum products or other wastes were documented. A database search of New York State Department of Environmental Conservation (NYSDEC) reports was also included; these documents list inactive hazardous waste sites, spills, leaking underground storage tanks, and other potential environmental hazards.

Other documents reviewed as part of the site history included: U.S. Geological Survey (USGS) topographic maps and other geologic sources, aerial photographs, city engineering plans, Sanborn fire insurance maps, and miscellaneous files available for the site.

A review of available site documents indicated that near the turn of the century, the site was privately owned. In the early 1900's up to 1940 it was occupied by an amusement park. During WWII, the U. S. Army used the site and afterwards it became an MTA facility. During the 1950's, the Cross Bronx Expressway was built. The MTA Coliseum bus depot was demolished in the summer of 1997 to make way for a new bus depot, which will also be operated by the MTA. Construction of the new depot was begun in 1999 and was still in progress at the time of this investigation.

During the 1950s, the Cross Bronx Expressway was built. Several borings logged during construction showed fill thickness ranging from 10 to 20 ft in the construction area. The fill is described as a combination of construction and demolition debris (C&D), railroad construction material, and fill created during the relocation of the Bronx River, which was performed as part of the construction of the Sheridan Expressway. Borings installed as part of MTA's construction of the bus depot show fill material in the area of their construction to range between zero and ten feet in thickness. Bedrock is exposed in some parts of the site and is believed to be within 25 ft of the surface throughout the site. This information is based on borings installed by URS as part of their investigation of the bus depot in 1993 and MTA in 1995, 1996 and 1997 in advance of construction of the new MTA facility.

In June 2000 URS installed a number of geotechnical borings and monitoring wells at the site as part of the subsurface investigation (URS, January 2001). A review of those studies indicates that the subsurface of the project area consists of a top layer of fill which consists of gravel, boulders, reinforced concrete, and other C&D materials. Boring logs indicate the fill varies in thickness across the site and is generally 5 to 20 feet thick. This C&D material may be associated with local highway and bridge construction or may have been from other areas; no documentation as to its source was located.

The environmental investigation completed on the proposed CSO Storage Conduit included installation and sampling of fifteen (15) test borings and sampling of two (2)-monitoring wells. The subsurface soil investigation was conducted in order to assess the presence of subsurface impacted media and to verify, in places, the depth to bedrock. As noted above, construction of the proposed Bronx River CSO Storage Conduit will require the excavation and removal of substantial amounts of upland soil and fill materials. Fill material that is excavated for off-site disposal is regulated by the NYSDEC under the 6 NYCRR Part 360 regulations. In addition, the off-site disposal of natural soils that have been affected by contaminants present in overlying solid waste are also regulated under Part 360; soils that have not been affected are not. The soil sampling program performed by LMS was developed to determine the quantity of native soils, if any, that have been impacted by overlying fill material and are therefore regulated as a solid waste for disposal purposes.

Construction of the conduit will involve long, wide and deep excavations, which may require dewatering. The groundwater investigation was also conducted in order to provide aquifer characteristics for dewatering and disposal options. Monitoring wells were installed by URS in June 2000 at select locations along the pathway of the proposed conduit. Two of the wells previously installed by URS were sampled by LMS in June 2001. An off-site well was also located on the sidewalk along East 177th Street; however, the well was found to be dry and was not sampled. The remainder of the original monitoring wells on site were apparently destroyed due to the ongoing excavation and construction activities associated with the MTA facility. The

locations of the two wells sampled were appropriate for providing a general assessment of groundwater quality in the area of the proposed CSO.

The investigative workscope prepared for the storage conduit route and described in this report was devised to provide chemical data and subsurface information on the conditions and types of materials, which may be encountered during construction in this area. The fill materials are heterogeneous, and therefore, analytical data vary from location to location. Conditions described in this report represent fill type at a given point in time and may change as a result of above or underground releases or migration of existing contamination.

The scope was based on approved NYCDEP protocols that were submitted to the agency for review and approval prior to beginning fieldwork.

The approved workscope included the following tasks:

- Installation of 18 test borings
- Sampling of soil from two horizons (fill and native material) within the borings
- Assessment of data and material description

Fifteen of the proposed eighteen borings were installed with a mobile hollow stem auger drill rig operated by Craig Test Boring (Craig) of Mays Landing, NJ between 30 April and 1-3 May 2001. The remaining three borings (ENV-5, -7, and -11) were excluded upon recommendation by an on-site MTA engineer due to the known presence of underground utilities in the general area of these proposed borings. No as-built plans were available and MTA employees could not provide specific utility locations. In addition, four borings (ENV-3, -8, -10, and -12) were discontinued at varying depths at the direction of Craig due to concern for the possible presence of utilities in those areas. All remaining borings were advanced to the maximum depth required for construction as determined by URS. The field investigation confirmed the results of previous borings drilled in the project area in regard to subsurface material type. However, average depths to refusal were found to be much shallower based on the environmental boring investigation. Since rock core samples were not taken to verify bedrock at refusal as part of this investigation, refusal depths are ascribed to the possible presence of subsurface boulders.

The subsurface consists generally of a fill layer comprised primarily of fine to medium sands, silt, gravel, and limited amounts of construction and demolition debris (C & D). The fill material overlays native sediment consisting of brown sandy silt, which in turn overlays bedrock. Native material was only noted in borings (ENV-3, -4, and -6). Groundwater was noted in only one boring (ENV-2) at a depth of 8 ft below grade.

During the environmental boring installation, soil samples from each boring were collected with acetate liners and individually screened in the field for volatile organic compounds (VOC's) with

an HNU photoionization detector (PID) and a combustible gas indicator (CGI). Grab samples exhibiting the greatest concentrations and/or possibility of VOC's in the field were submitted and analyzed for Target Compound List (TCL) VOC's at the contract analytical laboratory, Toxikon Corporation (Toxikon) of Bedford, Massachusetts. Only one sample from the fill material and one sample from the native soil were submitted for analysis per boring. In addition, composite samples of the fill material and the underlying native soils were collected and submitted for TCL base neutral and acid extractable semivolatile organic compounds (SVOC's), pesticides and polychlorinated biphenyls (pesticides/PCB's), Target Analyte List (TAL) metals, and cyanide analyses in addition to the hazardous characteristic testing: reactive cyanide/sulfide, ignitability, and corrosivity. In the event that one of the Resource Conservation and Recover Act (RCRA) metals results exceeded their respective hazardous waste levels (based on the 20:1 factors), the composite soil sample from the individual location displaying this elevated characteristic was extracted using the toxicity characteristic leaching procedure (TCLP) and the extract analyzed for the specific RCRA metals of concern.

Groundwater samples were collected on 4 June 2001 and analyzed at Toxikon for TCL organics, petroleum hydrocarbons, oil and grease, total dissolved solids (TDS), total suspended solids (TSS), settleable solids, TAL metals (filtered and unfiltered), cyanide, chloride, chlorine demand, chemical oxygen demand (COD), nitrate/nitrite-nitrogen, 5-day biochemical oxygen demand (BOD₅), and fecal coliform.

Analytical results of the subsurface soil samples collected indicated no VOC's were detected above the recommended soil cleanup objectives presented in the January 1994 NYSDEC Division of Technical and Administrative Guidance Memorandum (TAGM) 4046. Of the SVOC's collected, polynuclear aromatic hydrocarbons (PAH's), including benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)pyrene, were found in select samples above the cleanup objectives. All exceedances were found in the fill material. The highest concentration was found in boring ENV-10. The area of the site however is surrounded by major high-traffic thoroughfares (East 177th Street and the Cross Bronx Expressway) and railways. The site has also been used recently and will be used in the future as an MTA facility for the storage and maintenance of buses, all of which may have contributed to the PAH contamination found in this area. The only pesticide detected was well below the cleanup objective and only found in one sample. PCB's were not detected in any of the samples collected.

Metals were found in every sample collected. Barium, beryllium, chromium, copper, iron, mercury, nickel, and zinc were all found above the soil cleanup objective in one or more samples. Antimony, calcium, lead, magnesium, manganese, and thallium do not have specific numerical cleanup objectives, rather, the cleanup objective is based on site background. Where no site background data are available, as is the case here, a range of concentrations are provided for eastern USA background soil concentrations. All of these metals exceeded the low end range in one or more samples, however only calcium and magnesium exceeded the high end range in

or more samples. Cadmium, silver, and cyanide were not detected in any of the samples collected. TCLP was done on seven samples for lead based on results of the total analyses. Only one of the samples at boring ENV-18 slightly exceeded the hazardous level of 5 mg/L. Because lead did not pass the TCLP analysis, it is considered a toxic substance and therefore the soil in this area is considered hazardous and will have to be disposed of accordingly. This boring is located directly under the on-ramp to the Cross Bronx Expressway, a major traffic area. A hazardous level of lead in the soil of this particular location is most likely due to flaking or weathering of lead-based paint from the ramp above or the use of leaded gasoline in the motor vehicles that travel on this roadway.

The groundwater samples from the two monitoring wells were compared to the NYSDEC Class I Standards (the surface water classification for the Bronx River) and the NYCDEP discharge limits indicating that if dewatering is necessary during excavation, the water should be able to be discharged to the sewer under a NYCDEP permit. None of the samples exceeded any of the current NYSDEC or NYCDEP standards used for comparison. The only organics detected may be attributed to a possible laboratory contamination problem. Copper, lead, and nickel exceeded their respective Class I standards in all three unfiltered samples and only copper and nickel exceeded the standard in one filtered sample. Generally it was found that the metals are associated with soil particles and not dissolved in the groundwater. Fecal coliform was reported as too numerous to count in one of the well samples. High levels of fecal coliform are not typical of groundwater conditions. Such a high level may be due to the presence of storm/sewer drains and portable toilets on the MTA construction site, which are in close proximity to the monitoring wells. Fecal coliform should be retested to confirm whether the initial results are representative of groundwater conditions in the area of the site. The remaining conventional analytical data appeared to be at low-level concentrations where detected although no applicable standards were available for comparison. If a construction dewatering permit to the Bronx River is envisioned, solids removal will most likely be required prior to discharge.

CHAPTER 2

SITE BACKGROUND AND GEOLOGY

2.1 SITE BACKGROUND

A site assessment and 50 year site history of the project area was conducted by LMS and the results were presented in a separate report (LMS June 2000). The site history included a database files search in accordance with the American Standard for Testing and Materials (ASTM) due diligence standard for conducting environmental site assessments (E.50.02.2). The database search was conducted to determine if the site or adjacent properties were ever registered as hazardous waste sites, or if any releases of petroleum products or other wastes were documented. A database search of New York State Department of Environmental Conservation (NYSDEC) reports was also included; these documents list inactive hazardous waste sites, spills, leaking underground storage tanks, and other potential environmental hazards.

Other documents reviewed as part of the site history included: U.S. Geological Survey (USGS) topographic maps and other geologic sources, aerial photographs, city engineering plans, Sanborn fire insurance maps, and miscellaneous files available for the site.

In the early 1800s, the site area was a somewhat rural countryside with some industry. The industry consisted of several mills and logging facilities that utilized the Bronx River as a power source. The economic value of the river became evident and there were many additional industries along its length by the late 1800s. The increased industry usage of the river resulted in the construction of a railroad to supply and ship the goods made in the area. As more and more development took place along the river, distribution routes were increased and the area became increasingly urbanized.

Prior to 1900, the site was part of the William Watson, D. Lydel, and Neill estates. Starlight Amusements was established on the site in 1916. The Bronx International Exposition was held at the facility in 1918. The New York International Exhibition was located at the site in 1919. At the beginning of the exhibition, a stucco-clad exhibition building existed on the site parallel to East 177th Street. In 1928, the Coliseum building was constructed adjacent to East 177th Street. Following construction of the Coliseum building, the facility was used for political rallies, exhibitions, and social events. Starlight Amusements operated at the site until 1940, at which time it fell into receivership. Between 1942 and 1946, the facility was taken over by the U.S. Army and was used as a vehicle maintenance facility. After the Army left the facility, it was taken over by MTA and has been used as a bus maintenance facility since that time.

During the 1950s, the Cross Bronx Expressway was built. An aerial photograph from 1954 shows the construction of the Cross Bronx Expressway. According to the 1969 Sanborn Map, all permanent structures to the south of the MTA bus facility had been removed leaving the area

vacant. The Cross Bronx Expressway appears on this map, as well as the Sheridan Expressway. The straightening of the Bronx River for the construction of the Sheridan Expressway is notable on this map as well. Several borings logged during construction showed fill thickness ranging from 10 to 20 ft in the construction area. The fill is described as a combination of construction and demolition debris, railroad construction material, and fill created during the relocation of the Bronx River, which was performed as part of the construction of the Sheridan Expressway. Borings installed as part of MTA's construction of the bus depot show fill material in the area of their construction to range between zero and ten feet in thickness. Bedrock is exposed in some parts of the site and is believed to be within 25 ft of the surface throughout the site. This information is based on borings installed by URS as part of their investigation of the bus depot in 1993 and MTA in 1995, 1996 and 1997 in advance of construction of the new MTA facility.

The site, until the summer of 1997 when it was demolished, consisted almost entirely of MTA's Coliseum bus depot where buses were maintained and stored. Diesel fuel, engine oils, antifreeze, and other maintenance material were stored on site. Fuel was stored in two aboveground storage tanks east of the building. One 20,000-gal underground No. 4 oil tank supplied heating fuel and was located west of the bus depot adjacent to the footprint of the proposed storage conduit area. No soil sampling data were available regarding this tank. Three on-site 5000-gal underground diesel fuel tanks were also identified on-site. A report prepared by URS in February 1993 indicates that tank tightness testing was performed in early 1991, the results indicated that two 5,000-gal underground diesel fuel tanks failed and were reported as leaking. The third 5,000-gal underground diesel fuel tank was reported abandoned several years before the 1991 tank tightness testing and was found to be filled with sand at that time.

Groundwater monitoring wells were installed by URS in 1991 and 1992. Groundwater was found to be present between 3 to 9 feet below grade. A non-aqueous phase liquid (NAPL) layer was identified along the southwestern end of the building. Investigations performed at the time estimated that the product plume existed over a 16,000-ft² area and contained between 2,000 and 4,000 gal of diesel fuel. The plume at the time was located approximately 350 linear feet to the east of the proposed storage conduit site. The 1993 URS Remedial Investigation Report suggests that the plume is migrating in a north-northwest direction due to a localized groundwater flow created by bedrock conditions and the foundation of the original Coliseum Bus Depot. During a 1993 site inspection conducted by LMS, surface staining was visible on site soils, which was attributable to activities associated with the regular maintenance of buses. It is currently unknown whether any remedial activities have been performed on-site with respect to the product plume. However, a recent groundwater sample collected in May 2000 from a dewatering trench located within the new Coliseum Bus Depot building did not show evidence of petroleum contamination.

The MTA Coliseum bus depot was demolished in the summer of 1997 to make way for a new bus depot, which will also be operated by the MTA. Construction on the new depot was begun in 1999. All aboveground fuel storage tanks were closed and removed in November 1996. The two

underground 5,000-gal diesel storage tanks were closed in place in October 1996. The 20,000-gal heating fuel storage tank was reported closed and removed from the ground in October 1996.

In June 2000 URS Corporation installed a number of geotechnical borings and monitoring wells at the site. Based on results of those studies, the subsurface of the project area consists of a top layer of man-made fill which consists of gravel, boulders, reinforced concrete, and other construction and demolition (C&D) materials. Boring logs indicate the fill varies in thickness across the site and is generally 5 to 20 feet thick. This C&D material may be associated with local highway and bridge construction or may have been from other areas; no documentation as to its source was located.

2.2 SITE GEOLOGY

Published information indicates the site is underlain by bedrock of the Hartland Formation, which extends from Connecticut to Cameron's Line, located just east of Third Avenue in the Bronx. The formation is reported to contain several variations of gneiss and schist described as follows:

- Thinly laminated, gray, muscovite-biotite-quartz schist with minor garnet
- Medium gray, fine-grained biotite-muscovite-quartz schist
- Fine- to medium-grained, white to pinkish white, gneissic quartz-microcline muscovite-biotite-plagioclase granite
- Dark greenish-black quartz-biotite hornblende amphibolite, with some white and/or pink granite pegmatite
- Unevenly foliated, gray sillimaite-plagioclase-muscovite-biotite-microcline quartz gneissic schist

Based on bedrock contour maps of the Bronx, it is believed that bedrock is located within 25 ft below the ground surface across the site. It is estimated that below the Sheridan Expressway the bedrock surface is much deeper than on the east side of the Bronx River. Boring logs installed by MTA adjacent to the area of the proposed conduit in advance of the construction of the bus depot indicate that bedrock is present within 10 feet of the ground surface in the southern section of the project and as deep as 35 ft in the northern.

Generally, the Hartland Formation is characterized as medium-grade metamorphic rock. Schists and gneiss imply a specific foliation direction associated with lamination or layering.

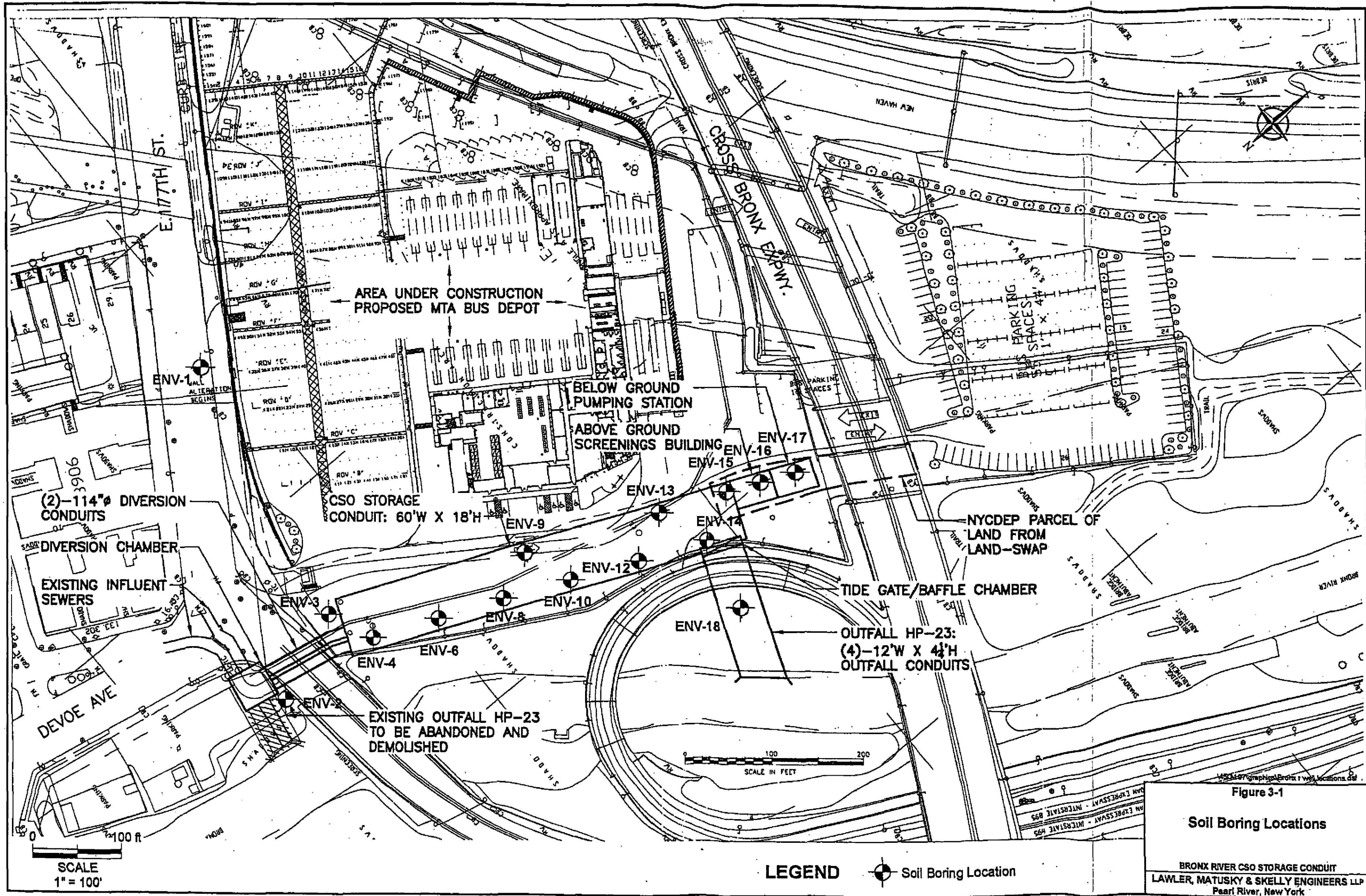
Bedding in this formation may have multiple orientations over short distances caused by compressional folding pressures. Fractures and faults occur following deformation and may have no specific orientation with regard to foliation. Water occurring within these fractures may not flow directly with the gradient but with fracture orientation.

2.3 SITE SURFICIAL GEOLOGY

The project site is located in Central Bronx County, which lies in the Manhattan Prong Subprovince of the New England Uplands Physiographic Province. The topography of the area is largely a product of preglacial stream erosion and deposition, modified by Pleistocene glacial and recent stream erosion and deposition. It is mainly characterized by parallel, linear ridges and valleys having a northeasterly trend. Test borings conducted in association with construction of the Cross Bronx Expressway indicate that locally there are only two types of overburden material. The topmost layer is man-made fill. During the 1993 LMS site inspection, seven holes were dug throughout the site area to a depth of approximately 1 ft. Material from these holes consisted of gravel, boulders, reinforced concrete, and other construction and demolition (C&D) materials. Cross sections obtained from the Cross Bronx Expressway borings indicate that the fill thickness is generally 5 to 20 feet thick. The site may contain 15 to 20 feet of fill, and the property south of the site closer to 5 to 10 feet. This C&D material may be associated with local highway and bridge construction or may have been from other areas; no documentation as to its source was located.

Material below the fill is modified drift, which generally consists of sand, silt, clay, and gravel deposits that are better sorted than glacial till. The modified drift lies between the fill material and bedrock but may be absent in areas where C&D waste is substantial. Aquifer testing of the modified drift and fill near Crotona Park (about $\frac{3}{4}$ mile west of the site) suggest that the overburden has little storage capacity, but can yield an average of 20 gpm after emptying the shaft used during the construction of the Cross Bronx Expressway.

Additional borings were installed by LMS in April and May 2001 to collect samples for chemical analyses. Boring logs from this investigation are contained in Appendix A. As previously described, borings were advanced to refusal, however, rock coring was not performed to verify the presence of bedrock. Based on a review of the Subsurface Investigation Bronx River Combined Sewer and Overflow Storage Conduit Bronx, New York report (URS Corporation, January 2001), approximate depths to bedrock have been superimposed onto the cross-sections; however, these depths are only approximate and may not represent actual depths at the environmental sampling locations. Additional discussion of each environmental boring is provided in Section 4.1. Figure 2-1 shows the locations of the cross-sections and Figures 2-2 to 2-6 show the geological cross-sections, which describe the materials encountered at each boring. Cross-section A-A' (Figure 2-2) is located along East 177th Street northeast of the site. The material existing in this area consists of brown sand and silty sand with mica and gneiss fragments and hydraulic fill. C&D was present as trace amounts of ash, brick, cloth, rubber, and concrete. Cross-section B-B' (Figure 2-3) connects the area across East 177th Street to the MTA site. Fill material ranges from grade to 12 ft. Native material was found on the MTA site at 5 ft. All of the material consisted of brown sand and silty sand with mica and gneiss fragments as well as quartz fragments in the native material. C&D was present as trace amounts of ash, brick, cloth, rubber, and concrete.



Test Boring Log

Sheet 1 of 1

Project Name: Bronx River CSO Storage Conduit

Project No.: 450-197

Client: URS Greiner Woodward Clyde

Date: Start 5/2/01

Driller: Craig Test Boring

Finish 5/2/01

Drilling Method: HSA

Total Depth: 3.7'

Boring Location: 177th St. between Devoe and Bronx River Ave.

Depth To Water: NA

Coordinates:

Surf. Elevation: NA

Logged By: Ed Townsend

Hole Diameter:	
-----------------------	--

Monitoring Instrument(s): PID CGI

[illegible]

LMS Test Boring Log

Boring No.:ENV-9

Sheet 1 of 1

Project Name: Bronx River CSO Storage Conduit

Project No.: 450-197

Client: URS Greiner Woodward Clyde

Date: Start 5/3/01

Driller: Craig Test Boring

Finish 5/3/01

Drilling Method: HSA

Total Depth: 6'

Boring Location: 75' in front of MTA trailer.

Depth To Water: NA

Coordinates:**Surf. Elevation: NA**

Logged By: Ed Townsend

Hole Diameter:

Monitoring Instrument(s): PID CGI

Depth (ft)	Blows On Sampler				Recovery (in.)	Instrument Reading	Sample Retained	Classification Of Material f - fine and - 35-50% m - medium some - 20-35% c - coarse little - 10-20% trace - 0-10%	Remarks
	0"-6"	6"-12"	12"-18"	18"-24"					
0-2	16	12	12	23	18	0		0-12" black coal and coal ash, trace brick. 12-18" brown tight fine to medium sand, trace mica and gneiss fragments. 0-8" crushed gneiss. 8-16" brown tight fine to medium sand, trace mica and gneiss fragments.	Augering to 4'.
2-3.5	23	46	100/5		16	0		Gneiss fragment stuck in tip of spoon.	Augering to 6'.
4-4.1	100/1				1	0		No recovery.	
6-6	100/0				0	0		Bedrock refusal @ 6'.	
								E.O.B. @ 6'.	

Test Boring Log

Boring No.:ENV-15

Sheet 1 of 1

Project Name: Bronx River CSO Storage Conduit

Project No.: 450-197

Client: URS Greiner Woodward Clyde

Date: Start 4/30/01

Driller: Craig Test Boring

Finish 4/30/01

Drilling Method: HSA**Total Depth: 4.6'**

Boring Location: 125' south of Cross Bx. Expressway.

Depth To Water: NA

Coordinates:**Surf. Elevation: NA**

Logged By: Ed Townsend

Hole Diameter:

Monitoring Instrument(s): PID CGI

[illegible]

Test Boring Log

Boring No.:ENV-16

Sheet 1 of 1

Project Name: Bronx River CSO Storage Conduit

Project No.: 450-197

Client: URS Greiner Woodward Clyde

Date: Start 4/30/01

Driller: Craig Test Boring

Finish 4/30/01

Drilling Method: HSA

Total Depth: 3.5'

Boring Location: 75' south of Cross Bx. Expressway.

Depth To Water: NA

Coordinates:

Surf. Elevation: NA

Logged By: Ed Townsend

Hole Diameter:

Monitoring Instrument(s): PID CGI

[illegible]

Test Boring Log

Boring No.:ENV-17

Sheet 1 of 1

Project Name: Bronx River CSO Storage Conduit

Project No.: 450-197

Client: URS Greiner Woodward Clyde

Date: Start 4/30/01

Driller: Craig Test Boring

Finish 4/30/01

Drilling Method: HSA

Total Depth: 2.1'

Boring Location: 50' south of Cross Bx. Expressway.

Depth To Water: NA

Coordinates:

Surf. Elevation: NA

Logged By: Ed Townsend

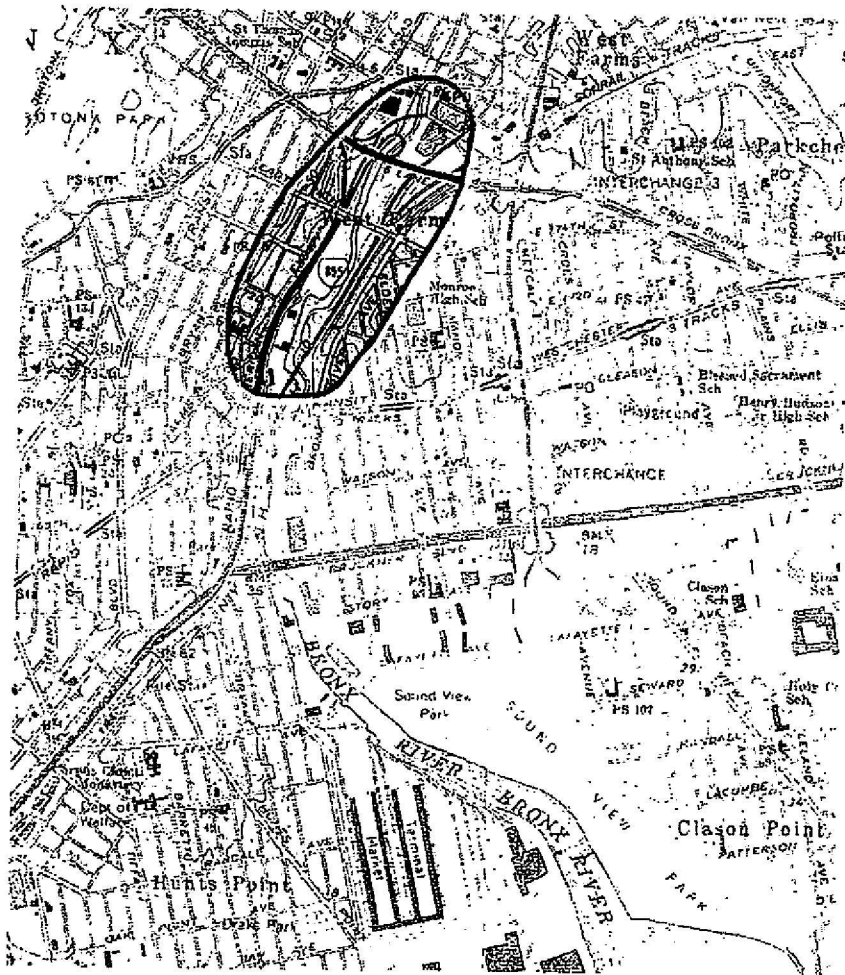
Hole Diameter:

Monitoring Instrument(s): PID CGI

[illegible]

BRONX RIVER GREENWAY

**Surface Soils Investigation for the
Environmental Assessment Statement in the
Northern Portion of the Bronx River Greenway**



September 2001

Performed by
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Under Subcontract to
URS Corporation
Mack Centre Drive
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CHAPTER 2

SITE BACKGROUND AND GEOLOGICAL INFORMATION

2.1 SITE BACKGROUND

A review of historical and background information for the project area was completed by LMS to identify possible areas of environmental concern and to better define the proposed sampling program for this work scope. A corridor study report prepared by Environmental Data Resources, Inc. (EDR) of Southport, Connecticut was reviewed. This report summarizes findings from available environmental records and database searches. In addition, aerial photographs (from years 1954, 1966, 1975, 1984, and 1994) and Sanborn maps (from years 1915, 1928, 1950, 1981, and 1996) were reviewed for possible areas of environmental concern along the northern portion of the Greenway. A copy of the EDR Report, aerial photographs, and Sanborn Maps were provided in the workscope (LMS, March 2001). A summary of the review of these materials is included below.

One listed site in close proximity to the proposed corridor route in the project area was identified in the EDR report. This site is shown on Figure 1-2, and is referenced by the site identification number assigned in the EDR report. Site No. 12 is listed at 1100 East 177th Street (east side of Bronx River) and appears to be part of the MTA Coliseum Bus Depot. Two spills, diesel fuel (1991) and No. 2 fuel oil (1989) were noted in the EDR report. Reportedly, underground storage tanks (USTs) containing these constituents had failed tightness tests. Corrective action has been performed on the USTs at the site, as described in LMS' 50-year site history report, (LMS, June 2000).

A review of aerial photographs showing the project area was conducted. In 1954, neither the Sheridan Expressway (west side of river) nor the Cross Bronx Expressway have yet been constructed; however, the Cross Bronx Expressway is shown to be under construction. The project area in general is shown to be highly developed. Tremont Avenue is present at the northern end of the project area, and 172nd Street is present at the south end of the project area. The MTA Coliseum bus depot appears to be present to the east of the Cross Bronx Expressway construction activities. Railroad tracks are present along the east side of the Bronx River. The present-day location of Starlight Park is shown to exist along the west side of the river, south of the 174th Street bridge; however, a review of the 1954 aerial photo demonstrates that this land is partially developed. Possible small structures and vehicles are present, along with dirt roads and possible earth mounds and surface scarring.

Changes around the project area were noted on the 1966 aerial photograph. The Cross Bronx Expressway is shown to be complete. In addition, the Sheridan Expressway is present along the west side of the Bronx River. Starlight Park is also shown on the 1966 photo, as evidenced by ballfields and unoccupied open space. The land that the park occupies appears to have been filled

and extended south along the Bronx River since 1954, and the route and channel of the river has thus been slightly altered. No major changes in the project area were observed on the 1975, 1984, and 1994 aerial photographs. The surrounding locations are still depicted as being highly developed, and features such as Starlight Park, expressways and streets, river crossings, and railroads are all shown.

Sanborn maps showing the project area were also analyzed. Maps from 1915 depict a brick and cement storage facility on the north side of 172nd Street, west of the Bronx River. Residential development has also begun around the project area at this time. A Northern Union Gas Company plant, with three large gas tanks and several other structures, is also on the west side of the river, in proximity to East 173rd Street and what is today Starlight Park. Some residential buildings are depicted along the west bank of the Bronx River, north of 174th Street, on the maps from 1915.

Sanborn maps from 1928 show that New York - New Haven and Hartford Railroad lines exist along the east side of the Bronx River (in present-day configuration). Residential dwellings are also shown to be present north of 172nd Street on the east side of the river, along Bronx River Avenue. Starlight Amusement Park is also depicted on 1928 maps, between 174th Street and 177th Street, along the eastern bank of the Bronx River. Rides, buildings, and a large swimming pool are shown. By 1950, the project area surrounding the river is shown to be highly urbanized, as evidenced by residential and commercial/industrial structures. The Starlight Amusement Park on the east side of the river is no longer functioning in 1950. The N.Y. Coliseum Bus Repair facility is shown on the east side of the Bronx River, along the south side of East 177th Street. The former Northern Union Gas Company facility depicted on the west side of the river (near 173rd Street) on the 1915 Sanborn map is now shown to be owned by Consolidated Edison of New York. The plant has been significantly downsized since 1915, as no gasoline storage tanks are shown and a few storage/shop buildings are depicted on the 1950 map. In addition, it is noted that all buildings on this property are vacant and open. Further north along the west side of the Bronx River (on what is today Starlight Park), an automobile junk yard and repair shop are shown south of 174th Street.

By 1981, Starlight Park is present on the west side of the Bronx River, north of 172nd Street (apparently in its present location and configuration). The land is shown as open and unoccupied. The Sheridan Expressway also exists along the west side of the river. Further west of the project area (i.e., west of Sheridan Expressway and West Farms Road) and north of 173rd Street, NYC Department of Sanitation facilities are shown. Industrial properties and storage structures are also depicted on the 1981 map in this area (e.g., marble shop, automobile repair shop, and Adhesive Products Corp.). No other significant changes in the project area were noted on the 1996 Sanborn maps.

2.2 GEOLOGY

Published information indicates the site is underlain by bedrock of the Hartland Formation, which

extends from Connecticut to Cameron's Line, located just east of Third Avenue in the Bronx. The formation is reported to contain several variations of gneiss and schist described as follows:

- Thinly laminated, gray, muscovite-biotite-quartz schist with minor garnet
- Medium gray, fine-grained biotite-muscovite-quartz schist
- Fine- to medium-grained, white to pinkish white, gneissic quartz-microcline muscovite-biotite-plagioclase granite
- Dark greenish-black quartz -biotite hornblende amphibolite, with some white and/or pink granite pegmatite
- Unevenly foliated, gray sillimaite-plagioclase-muscovite-biotite-microcline quartz gneissic schist

Based on bedrock contour maps of the Bronx, it is believed that bedrock is located within 25 ft below the ground surface across the site. It is estimated that below the Sheridan Expressway the bedrock surface is much deeper than on the east side of the Bronx River. Boring logs installed by MTA adjacent to the area of the proposed conduit in advance of the construction of the bus depot indicate that bedrock is present within 10 feet of the ground surface in the southern section of the project and as deep as 35 ft in the northern. During surface soil sample collection, bedrock was found to be very shallow along the majority of the corridor route.

Generally, the Hartland Formation is characterized as medium-grade metamorphic rock. Schists and gneiss imply a specific foliation direction associated with lamination or layering.

Bedding in this formation may have multiple orientations over short distances caused by compressional folding pressures. Fractures and faults occur following deformation and may have no specific orientation with regard to foliation. Water occurring within these fractures may not flow directly with the gradient but with fracture orientation.

The subsurface of the project area consists of a top layer of man-made fill which consists of gravel, boulders, reinforced concrete, and other construction and demolition (C&D) materials. Fill varies in thickness and is generally 5 to 20 feet thick. This C&D material may be associated with local highway and bridge construction or may have been from other areas. Based upon analytical data collected from other construction and demolition sites, the potential exists for concentrations of metals and semivolatile organic compounds (SVOCs) exceeding regulatory levels to be present within the fill. Material below the fill at the project area is comprised solely of silty sand of varying grain size and color which in turn overlays bedrock. It should be noted that fill materials are heterogeneous, and therefore, analytical data may vary from location to location.