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**STAGE 1A  
ARCHAEOLOGICAL  
ASSESSMENT**

**AVENUE V PUMPING STATION  
WET WEATHER FORCE MAIN**

**BAY 16<sup>TH</sup> STREET AND BATH AVENUE  
BOROUGH OF BROOKLYN, NEW YORK**

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May 2006

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STAGE 1A ARCHAEOLOGICAL ASSESSMENT

AVENUE V PUMPING STATION  
WET WEATHER FORCE MAIN  
BAY 16<sup>TH</sup> STREET AND BATH AVENUE  
BENSONHURST, BROOKLYN, NEW YORK

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## I. INTRODUCTION

The New York City Department of Environmental Protection (NYCDEP) has proposed the upgrade and rehabilitation of the Avenue V Pumping Station in order to meet combined sewer overflow conveyance requirements established by the New York State Department of Environmental Conservation (NYSDEC). Part of this plan will be a wet weather flow force main along Bay 16th Street from the Shore Parkway to Bath Avenue. At that point, the proposed wet weather force main would turn northwest under Bath Avenue and terminate at Regulator 9A under the intersection of Bath Avenue and 17th Avenue. (Figures 1, 2)

In this section of the proposed force main route, construction would be below grade within the existing street beds. The force mains would be installed by microtunneling. The depth would be about 10 to 25 feet below existing grade. Microtunneling involves digging 10-foot by 20-foot pits for one pipe and 20-foot by 20-foot pits for two pipes about every 750 feet and at bends in the pipeline route. A tunnel just large enough to fit the force main(s), which have a diameter of 48 inches, would be bored and the pipes inserted. About 1,800 linear feet of single force main would be installed, and about 5,400 linear feet of dual force main would be installed via microtunneling. Microtunneling-minimizes disruptions to traffic, the community and exposure to soils.

### Methodology

The purpose of this assessment is to determine the presence, type, extent and significance of any cultural resources which may be present along the proposed Avenue V Pumping Station wet weather flow force main. It is based on archival research to document whether the site may have hosted any precontact or historical resources, and if so, whether these resources could have survived any subsequent development.

In order to address the above concerns, various sources of data were researched. Primary source material on the project sites was collected to determine the site's original topography and to compile a building history and disturbance record. Historical maps and descriptions of the study area were collected in the *Local History and Map Divisions* of the New York Public Library. Much of the historical background had already been researched for the Phase 1A Archaeological Assessment of the Avenue V pumping station and force main (dry weather flow) completed by Historical Perspectives, Inc. in December, 1998, and the information that is relevant to the new project site has been incorporated into this report (Historical Perspectives 1998).

To place the Avenue V Pumping Station and Force Main sites within their precontact context, archaeological literature, available site reports and journal publications were researched for data specific to the project sites and their vicinity. These include the works of archaeologists Arthur C. Parker, Reginald P. Bolton and Ralph Solecki, as well as historians such as Grumet, Van Wyck and Thompson. William Ritchie's *The Archaeology of New York State* provided a valuable overview of Native American culture and lifeways during the precontact period. Inquiries on inventoried precontact and historical sites in the project area were sent to the New York State Museum and the Office of Parks, Recreation and Historic Preservation. Their responses are discussed within the report.

Soil borings for the proposed force main route were performed by Mueser Rutledge Consulting Engineers (Oct. 2000) and by the City of New York Department of Design and Construction (Oct. 2000) and the logs can be found in the Appendix. They provide a basis for determining the amount of fill deposited over the project site. Additional logs and subsurface studies were examined for information relevant to the project site, but did not provide any new information concerning the potentially sensitive locations. These data sources are cited in the bibliography (Mueser Rutledge 1998a; 1998b; 2001; 2003).

A site visit was made on December 9, 2000 and a photographic record was made of current conditions.

### **Current Conditions**

Bay 16th Street is a 60-foot wide, one-way residential street with parking on either side. There is a large playground between Shore Road and 17th Court, facing an apartment complex. (Photo A) The rest of the street is lined with row houses and apartment buildings. (Photos B, C, D) All utilities are buried, and there are multiple manholes in the street for access to the storm drains, sewer, water pipes and electrical and telephone wires. There are two double fire hydrants on each block. There are also numerous square and rectangular repair patches in the street pavement, sometimes in the middle of the street where a pipe or cable appears to have been laid. The street slopes very gradually downward toward the water.

Bath Avenue is a two-way, two-lane, commercial street with parking meters, traffic lights, and shops with apartments above. There are fire hydrants and several manholes here as well, and there is a large grate in the southwest portion of the street that appears to open. (Photos E, F)

## II. ENVIRONMENTAL SETTING

Long Island is the top of a Coastal Plain ridge formation that is covered with glacial drift, in reality an elevated sea bottom demonstrating low topographic relief and extensive marshy tracts. In the last million years, as glaciers advanced and receded three times, the surficial geology of the island, including the vicinity of the force main site, was profoundly altered.

*The glacier was an effective agent of erosion, altering the landscape wherever it passed. Tons of soil and stone were carried forward, carving and planing the land surface. At the margins of the ice sheet, massive accumulations of glacial debris were deposited, forming a series of low hills, or terminal moraines. (Eisenberg 1978:19)*

Circa 18,000 years ago, the last ice sheet reached its southern limit, creating the Harbor Hill moraine that traverses the length of Long Island. Before extensive alteration of the landscape during the 19th and 20th centuries, a gently-sloping plain extended south of the moraine to the sandy shore at the shallow edges of Gravesend Bay, adjacent to the project site.

Sections of the continental shelf, now buried beneath layers of modern fill deposited during construction of the Belt Parkway System, were exposed during the last ice age and served as Long Island's Atlantic shoreline from c.12,000 to 10,000 years before present (B.P.). The continental shelf was submerged as sea levels rose fairly rapidly until c.4,000 to 2,000 B.P., and continued to rise more slowly to the present.

In the one hundred years from 1895 to 1995, the shoreline has been extended seaward approximately 640 feet (Sanborn 1895, 1995). (Compare Figures 7 and 2) The section of the project site between the Shore Parkway and approximately 17<sup>th</sup> Place was once part of Gravesend Bay. The fill and grading activity for the Shore Parkway during the 1930s brought it to its current elevations varying between approximately 15 feet and 27 feet above mean high water, the higher elevation being at Bath Avenue. It is probable that when sea levels were below the current mean, between c.12,000 and 7,000 years ago, the sections of the Force Main route which were formerly part of the Gravesend Bay floor were once exposed and available for Native American exploitation.

There is some doubt about how much the original topography has been altered by grading and/or the deposition of fill. Two sets of soil borings performed along the path of the proposed wet weather force main on Bay 16<sup>th</sup> Street and on Bath Avenue do not agree on the depth of fill (City of New York 2000 and Mueser Rutledge 2000). (Appendix) The variation can be explained by the fact that natural sand was piped in from the Bay when the Shore Parkway was built (HPI 1998) and, where it did not contain cinders or bits of building material, it was not categorized as fill.

Mike Greenman, of the Subsurface Exploration Bureau of the City of New York Department of Design and Construction, confirmed this scenario (personal communication, 12/19/2000) Since the mean high water mark was in the approximate location of 17<sup>th</sup> Court in 1895, and the current ground

water level at that location is at a depth of 15 feet, it can be assumed that an average of about 15 feet of fill has been added along the present 17<sup>th</sup> Court. Borings identify only 5 feet of fill at this location.

Since the soil borings were performed in the existing streetbeds, elevations for the two sets of recent borings are based on the legal grade set for streets in 1936, which correspond to real estate atlas intersection elevations. These are given on a WPA Rockline Map dated January 1936, following the filling done just prior to the construction of the Belt Parkway in 1930.<sup>1</sup>

The 1936 elevations are given below, followed by those from the 1895 Sanborn map:

<u>Location</u>	<u>1936</u>	<u>1895</u>
Bath Avenue and 17 <sup>th</sup> Avenue	27.3'	27'
Bath Avenue and Bay 16 <sup>th</sup> Street	26.2'	27'
Cropsey Avenue and Bay 16 <sup>th</sup> Street	21.5'	22'
Warehouse Avenue (17 <sup>th</sup> Ct.) and 17 <sup>th</sup> Avenue	19.3'	mean high water
Warehouse Avenue (17 <sup>th</sup> Ct.) and Bay 17 <sup>th</sup> Street	8.8'	mean high water

No elevation was given for Bay 16<sup>th</sup> Street and Warehouse Avenue, but the last two elevations above are for the blocks on either side. It is not clear where the 10.5-foot drop between them occurred, but since the slope for a public street would have been gradual, an elevation of approximately 15 feet can be postulated for Bay 16<sup>th</sup> Street and Warehouse Avenue (17<sup>th</sup> Court). Based on this assumption, the depth of fill of 15 feet from 17<sup>th</sup> court to the current bulkhead is corroborated.

The evidence for fill beyond the former shoreline is much clear. The elevation at Cropsey Avenue and Bay 16<sup>th</sup> Street was 22 feet in 1895 and 21.5 feet in 1906, which should indicate some grading rather than filling at this location, although borings indicate a possible 5 feet of fill four feet south of that intersection and 9.5 feet at the intersection itself. The Bath Avenue elevation has been very slightly raised at 17<sup>th</sup> Avenue, but borings indicate between 1.5 feet and 5 feet feet of fill. The Bath Avenue and Bay 16<sup>th</sup> Street intersection should have been somewhat graded, but borings indicate 3 feet to 9.5 feet of fill.

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<sup>1</sup>Based on the Brooklyn Highway datum, which is 2.56' above the USGS datum of mean sea level at Sandy Hook.

### III. PRECONTACT ERA

The precontact era on western Long Island can be divided into three time periods, based on precontact man's adaptations to changing environmental conditions. These are generally known as the Paleo-Indian (c.12,000 to c.10,000 years ago), the Archaic (c.10,000 to c.2,700 years ago) and the Woodland (c.2,700 to c.500 years ago). These precontact periods are followed by the proto-historic and historical European Contact period, (beginning c.500 years ago), which is distinguished from the precontact by the first Native American contacts with European trade goods, traders, trappers, fishermen, explorers and settlers. From these early contacts we derive much of our firsthand knowledge of Native American culture. In order to be able to assess the project site's potential for precontact exploitation, it is first necessary to review briefly these time periods and their associated settlement patterns.

#### **Paleo-Indian Period (c.12,000 B.P. - 9,500 B.P.)**

Archaeologists generally believe that humans migrated from Siberia to Alaska across the Bering Land Bridge during the Late Pleistocene, more than 12,000 years ago. The **Paleo-Indian** period, c.12,000-10,000 B.P. (Before Present), encompasses the interval from the end of the Pleistocene glacial conditions in eastern North America to the appearance of more modern Holocene environments. Small groups of hunters probably followed roaming herds of megafauna which were their chief prey. The most distinctive weapon in their chipped-stone tool kit was the fluted point, which has been found in association with mammoth, mastodon, bison and horse remains at various sites in the southwestern United States. Although none of these "kill sites" are located east of the Mississippi, the discovery of campsites such as that at Port Mobil, Staten Island, suggest a scattered, highly mobile population in bands of approximately 20 individuals, who ranged across a vast area necessary to support lifeways organized around the hunting of migratory game (Ritchie 1980:1-3, 13).

In the Northeast, the glacially-lowered sea level exposed the broad coastal plain of which Long Island was a part, indicating that the project area would have been dry land during this period. "This large area apparently contained abundant big game resources and provided access along the entire length of the south shore to the area that is present day Long Island" (Saxon 1978:251).

The lanceolate points, two to five inches in length with a concave base and channelled or fluted faces, presumably to facilitate hafting, considerable range in shape and size. They were usually made from a high-grade silicious stone, often exotic to the region in which they are recovered, a function of their makers' seasonal migrations. Other artifacts in the Paleo-Indian tool kit include scrapers, knives, borers and graters, tools which indicate extensive handiwork in wood, bone and leather (Ritchie 1980:3,6).

Judging by the locations of recorded sites in the Northeast, Paleo-Indians exhibited a marked preference for well-elevated situations. However, 30% of sites were found on or near the margins of swampy ground. Environmental characteristics which appear to have been attractive to Paleo-

Indians include the proximity of major waterways, large fertile valleys and the coastal plain, where the densest population of desired food animals was supported (Ritchie 1980:7). However since 10,000 years ago, the rise in sea level estimated to be from 75 to 80 feet, has submerged large numbers of these sites.

The retreat of ice from Long Island approximately 18,000 B.P. and a global warming trend c.14,000 B.P., encouraged Paleo-Indian settlement in the Northeast. The post-glacial environment of spruce and pine underwent a gradual modification in favor of deciduous hardwoods such as oak and hickory, which have greater importance in terms of nutritional value to both animals and humans than do conifers. By 10,000 years ago, these deciduous species dominated forests along the eastern seaboard. In addition, the megafauna on which Paleo-Indian diet was based "were rapidly becoming extinct, and were being replaced by the temperate-climate fauna that are indigenous today" (Gwynne 1982:190-191).

### **Archaic Period (c.9,500 B.P. - 3,000 B.P.)**

The warming trend at the end of the last glaciation completely transformed the northeastern coastal environment from tundra and conifer-dominated forests, to the present deciduous woodlands with generally modern distributions of fauna. Due to the dwindling contribution of meltwater from disappearing glaciers, the reduced flow of streams and rivers promoted the formation of swamps and mudflats. These wetlands created a favorable environment for migratory waterfowl, and a host of edible plant species and shellfish. The new mixed hardwood forests of oak, hickory, chestnut, beech and elm attracted such mast-eating fauna as white-tailed deer, wild turkey, moose and beaver.

Although the Archaic diet was still based on hunting and gathering, due to the greater variety of plants available and exploited, excavated Archaic sites yield a wide array of plant processing tools, including grinding stones, mortars and pestles. The diagnostic tool was the grooved ax. In the coastal areas of New York, numerous, small "nearly always multi-component sites variously situated on tidal inlets, coves and bays, particularly at the heads of the latter, and on fresh-water ponds on Long Island" have been found. By the Late Archaic, these areas provided shellfish, small game, fish, salt hay and tuberous grasses making larger more permanent settlements possible. Semi-nomadic life is still indicated, but wandering occurred within well-defined territorial limits, with seasonal movements between camps near exploitable resources. A dietary shift to shellfish in coastal New York near the end of the Archaic suggests a scarcity of large game, and a change from the early Archaic inland adaptation of forest hunting. Coastal sites show a principal reliance upon shellfish, especially oysters, hard and soft shell clams and bay scallops, which were easily gathered all around Long Island (Ritchie 1980:142-143).

In contrast to conditions during the Paleo-Indian, Early and Middle Archaic, "by Late Archaic times sea level was so close to present levels that its subsequent small rise has failed to obliterate much of what remains on Long Island from that period" (Gwynne 1982:192). Hence the Late Archaic Wading River complex, four sites on the north shore of Suffolk County, was found at the edge of a salt marsh, on dry ground ranging only two to seven feet above mean high water (Wyatt 1982:71).

The Transitional or Terminal Archaic (4,000 to 3,000 B.P.) is a pre-ceramic stage, highlighted by the production of ground and polished soapstone vessels. Characteristic of the Transitional Archaic were "fish-tailed" projectile points (Ritchie 1980:150, 166, 167, 171).

### **Woodland Period (c.3,000 B.P. - 500 B.P.)**

Pottery use became widespread following the introduction of soapstone vessels in the Transitional Archaic, and although copper tools were utilized during that period, the earliest copper ornaments, tubular beads, made their appearance during the Woodland Period. Stone or clay smoking pipes were also an Early Woodland innovation (Ritchie 1980:179-180).

Settlement patterns were altered with the introduction of agriculture, the systematic cultivation of maize, beans and squash possibly beginning as early as A.D. 1000. During this time large villages within palisaded enclosures were developed and occupied by semi-sedentary inhabitants. Groups moved seasonally, depending on exploitable food resources, between villages and camps of varying population concentrations. Preferred village/camp sites were in protected, elevated locations at the confluence of two water systems. "Nearly all the permanent sites are situated on tidal streams and bays on the second rise of ground above water" (Smith 1950:101). Despite the advent of agriculture, shellfish and small game remained an important component of the Woodland diet. Shellfish refuse heaps, termed "middens," reached immense proportions, covering from one to over three acres. Deer, turkey, raccoon, muskrat, ducks and other game were stalked with bow and arrows, replacing the spear and javelin, while dug-out boats, bone hooks, harpoons and nets with pebble sinkers were employed in fishing (Ritchie 1980:180,267).

### **Contact Period (c.500 B.P. to 300 B.P.)**

Native American settlement patterns at the time of contact incorporated seasonal hunting and gathering. Semi-permanent villages or hamlets, containing oval and round mat-covered structures, were established near planting fields. Large subsurface pits were dug nearby to store dried meat, fish and corn, and were eventually filled with trash. Although fields were commonly burned at the end of the planting season to encourage floral and faunal repopulation, settlements centered on agricultural land were generally moved every ten to twenty years as soil fertility, firewood supplies and game resources were depleted (Salwen 1975:57).

Two Indian groups were recorded in the vicinity of the project area, the *Nayack* and the *Canarsee*. Both were Munsee-speaking members of the Delawaran or Lenape culture group. Prior to the sales of their lands, the Nayack had their planting fields and principal village, also called Nayack, possibly meaning "land at the point on the eastern side of the Narrows," at the present Fort Hamilton Reservation, probably near the water supply in what is now Dyker Beach Park (Grumet 1981:37; Bolton 1922:68). (Figure 3) The Canarsee, on the other hand, were centered approximately seven miles east of the project site

What may have been a second settlement is represented on the 1639 Manatus Map, which depicts a longhouse labeled "*Wichquawanck*" near the Gravesend Bay shore, located approximately at present 86th Street and 16th Avenue – adjacent to the New Utrecht village center, and about 2,800 feet northwest of the project site. The toponym, or place name is believed to mean, "as far as, ending at, the end or extreme point." Grumet's map erroneously combines Nayack and Wichquawanck, whereas the earlier map shows Wichquawanck to be much farther east – where Grumet and Bolton both record a native settlement (Grumet 1981:37,59; Manatus 1639).

Historical narratives written by European travelers and settlers provide eyewitness descriptions of Indian customs and lifeways during the 17th century. Jasper Danckaerts' journal of 1679 includes observations of the Nayack, who lived in the vicinity of Fort Hamilton, approximately 4,000 feet northwest of the project site.

*[W]e found the whole troop together, consisting of seven or eight families, and twenty or twenty-two persons, I should think. Their house was low and long, about sixty feet long and fourteen or fifteen feet wide. The bottom was earth, the sides and roof were made of reed and the bark of chestnut trees; the posts, or columns, were limbs of trees stuck in the ground, and all fastened together. The top, or ridge of the roof was open about half a foot wide, from one end to the other, in order to let the smoke escape . . . They build their fire in the middle of the floor, according to the number of families which live in it, so that from one end to the other each of them boils his own pot, and eats when he likes . . . By each fire are the cooking utensils, consisting of a pot, a bowl, or a calabash, and a spoon also made of calabash . . . Their other household articles consists of a calabash of water, out of which they drink, a small basket in which to carry and keep their maize and small beans, and a knife. The implements are, for tillage, a small sharp stone, and nothing more; for hunting, a gun and pouch for powder and lead; for fishing, a canoe without mast or sail, and without a nail in any part of it, though it is sometimes full forty feet in length, fish hooks and lines, and scoops to paddle with in place of oars. . . Their bread is maize, pounded in a block by a stone, but not fine. This is mixed with water, and made into a cake, which they bake under the hot ashes. (James and Jameson 1913:55-56)*

Contact with Europeans had far-reaching effects on Native American cultures. European products such as metal and glass began to replace traditional materials, while warfare and European-introduced diseases (against which the Native Americans had no protection), decimated the population in the present New York City area. This caused many groups to merge and remerge in complex ways in order to maintain viable communities. This activity is poorly represented in the documentary record. In 1670, Daniel Denton observed that the six towns on western Long Island had been reduced to two small villages (Thompson 1918:103). Danckaerts' 1679 journal notes the Nayack remnant, having sold off their lands, living on a small corner of its former holdings. They were "a poor, miserable people," using guns, keeping peach trees, having "dogs, fowls and hogs, which they learn by degrees from Europeans how to manage better" and some able to speak "good Dutch," like their European neighbors (James and Jameson 1913:55-57).

At the termination of the Governor Kieft War in 1645, the Nayack and Canarsee were joined by the *Marechkawieck*, refugees from northern Kings County. In 1652, the Nayack sold their land on Long Island and most of the group moved to Staten Island (Grumet 1981:38; Bolton 1920:273).

The Canarsee are last mentioned in 1684, when they sold the beach known as *Mocuny* or *Mocung*, (east of 27th Avenue, approximately a mile and a half southeast of the project site), to the Town of Gravesend. *Mocuny/Mocung* and a possible synonym, *Morpeesah*, mean black, muddy or miry land, and probably indicated the swampy area around Coney Island and Hubbard Creeks nearby (Grumet 1981:35-36; Bolton 1920: 359). Following the sale, many of the Canarsee, who had merged with the Rockaway and Massapequa groups, are believed to have moved to Patchogue, in Suffolk County, along with the Massapequa. Like the Nayack mentioned in the Danckaerts journal, a number of Canarsee lingered on at the fringes of European settlements until well into the 19th century (Grumet 1981:6-7).

Nineteenth and twentieth century research, survey and excavation have revealed a strong Native American presence in the Borough of Brooklyn. Archaeologist Arthur C. Parker noted that “without a doubt . . . it was occupied in nearly every part, and was once an important place of Indian travel and traffic” (Parker 1920:582). Parker identified two Indian sites in the vicinity of the project area, one at Fort Hamilton, which he listed as “shell heaps or kitchen middens.” The New York State Museum identifies this as its inventoried site #3611. Parker’s other site, in the same vicinity (at the “Narrows”) was a former lithic “workshop” discovered in the early 19th century:

*Some years ago, on digging a few feet below the surface at the Narrows, more than a wagon load of Indian stone arrow heads were discovered lying together, under circumstances calculated to induce the belief that a large manufactory of those indispensable articles of Indian warfare once existed at this place; they were of all sizes, from one to six inches in length, some perfect, others only partly finished. There was also a number of blocks of the same kind of stone found in the same rough state as when brought from the quarry; they had the appearance of ordinary flint, and were nearly as hard; not only arrowheads, but axes, and other articles of domestic utility, were made from these stones. (Bailey 1840:42; Parker 1920:582)*

Archaeologist Reginald Pelham Bolton noted a major Indian trail traversing southwestern Brooklyn, ending at New York Bay above the Narrows. The trail was approximated by the later Kings Highway (a section of which still exists) and Indian stations were established at various points along this important route, including the planting grounds at Indian Pond, a now-filled-in freshwater pond at Avenue P and West 11th Street (about a 1.3 miles northeast of the project site), and the previously discussed Wichquawanck, a settlement consisting of a single longhouse near later New Utrecht village (present 86th Street and 16th Avenue, and about 0.5 miles northwest of the project site) (Manatus 1639; Bolton 1922:237). In addition, a number of Indian trails branched from the main trail, and led to Gravesend Bay. One of these approximates present Fort Hamilton Parkway, and led to the abovementioned Nayack village on the site of the present military reservation, while the other

corresponds to later Bennett Lane, roughly along the path of 16th Avenue about 1,700 feet west of the project site, linking the bay with the Wichquawanck settlement.

Bolton suggests that the toponym *Massabarkem* (misspelled, but meaning land by the great water), which appeared in an early Gravesend deed, also probably referred to a settlement in the vicinity of Gravesend village (Bolton 1922:237).

### **Precontact Archaeological Potential**

As outlined in the general Precontact Era discussion, our knowledge of precontact and contact period settlement patterns indicates that early Native Americans showed marked preference for sheltered, elevated sites close to wetland features and sources of fresh water. Such locations are likely to have been exploited by precontact Americans for their processing sites, camps and more permanent settlements, as is evident from the siting of Nayack village, on the hills overlooking the Narrows at Fort Hamilton. Evidence of Indian exploitation of natural resources in, and occupation of the vicinity of the project area is well-documented through archaeological and historical research.

Although well-drained, elevated sites were preferred by the Native Americans for their activity and habitation sites, precontact archaeological potential is not confined to such areas. Often, low-lying and marshy areas adjacent to these dry, elevated habitation sites were utilized as shell middens, or garbage dumps. Such behavior has been documented archaeologically, as at Aqueduct in southwestern Queens, where soil borings have identified shell middens buried beneath layers of fill, but also atop layers of peat and organic silt (Pickman 1987:4). Only one of the borings from the project site notes the presence of shell. This was on Bay 16<sup>th</sup> Street, 145 feet south of 17<sup>th</sup> Court, approximately where the high water mark was located in the late nineteenth and early twentieth centuries. However, none of the peat deposits usually associated with middens were present, and the percentage of shell was under 10% at a depth of between 15 and 35 feet, indicating that it was probably naturally occurring shell and not a midden. Mike Greenman of the city's Subsurface Exploration Bureau agreed with this assessment (Personal communication, 12/19/2000).

As described in the Environmental Setting discussion (Section II), historical and cartographic research indicates that the southern section of the project site was formerly along the shore of Gravesend Bay, both in the water and in locations regularly inundated by daily tides. However, widespread areas of marsh are not recorded in this area, except in the vicinity of Dyker Beach Park, west of current 8th Avenue. In light of the preceding discussion, due to changing sea level, and the documented presence in the project area vicinity of precontact and early historical period Native Americans, it is theoretically possible that the location was occupied at some time during the precontact era. However, there were areas both east and west of the project site that were more attractive to the Native Americans and therefore held their major settlements, giving the project site a low potential for important archaeological resources.

Given the subsequent rise in sea level, any potential buried precontact cultural remains could have been subject to impact from post-depositional tidal action. On the other hand, because any precontact cultural remains would be below the current water table, as well as deeply-buried beneath

fill, the sites could be well-protected from historical construction disturbance, but the most problematic to identify and recover archaeologically. Disturbance impact on this precontact potential, and the surviving potential archaeological sensitivity will be discussed in the conclusions section of this report.

## IV. HISTORICAL PERIOD

### The Settlement of New Utrecht

Before its incorporation into Brooklyn at the end of the 19th century, the project site and its vicinity was originally part of the town of New Utrecht. The area that became the town of New Utrecht was first sighted by Europeans in 1524, when Giovanni da Verrazano sailed through the “Narrows,” the channel which runs between the southwestern edge of Long Island and the eastern tip of Staten Island, connecting the Atlantic Ocean to New York Bay. It is presently spanned by the bridge that bears his name. Although landfalls may have been made by Dutch fur traders in the intervening period, the next recorded visit was not until 1609, when the *Halve Maen*, with Henry Hudson in command, entered New York Bay (Bergen 1884: 255).

European settlement came only after decades of false starts. A New Amsterdam denizen, Antonie Jansen van Salee, applied to the Governor and Council of New Netherland for lands west of present Gravesend, and received a patent from Governor Kieft in 1642 – apparently dated retroactively to 1639. This 200 acres at the eastern edge of New Utrecht and extreme western Gravesend, in what was later called Unionville, was part of a purchase Kieft had made from the Canarsee Chief Penhawits. Salee leased his property to Edmund Adley from 1646 to 1650, and a house was included in the agreement. In 1645, after the close of a series of Indian wars, Kieft again purchased all the lands around the Narrows, as far as Coney Island, including the project site (Bergen 1884:256; Bangs 1912:12).

The next potential settler was Cornelis van Werckhoven, a *schepen* of the town of Utrecht, and a wealthy and influential stockholder in the Dutch West India Company. Werckhoven planned to establish two *patroonships* or manors in New Netherland, one of which was to be in the vicinity of the project area, near the Narrows. Accordingly, Werckhoven came to New Netherland in 1652, and purchased “the Nyack tract” from the Native Americans for six shirts, two pairs of shoes, six pairs of stockings, six adzes, six knives, two scissors and six combs. He built a house and a mill on the tract and surrounded them with a palisade. This location is unclear. It seems to be approximately 3,000 feet northwest of the project site, in present Dyker Beach Park, where an “old mill pond” is shown on an early 19th-century coastal survey (U.S. Engineering Department n.d.). Werckhoven returned to the Netherlands to organize colonists and supplies, and left the grant in charge of his children’s tutor/guardian, Jacques Cortelyou. Unfortunately, Werckhoven died in 1655/56 before he could return (Bergen 1884:256-257).

Werckhoven’s death, and the fact that his children and/or other heirs never left the Netherlands, made Cortelyou the de facto owner of the land grant (Bangs 1912:17-22). Cortelyou, best known to posterity as the surveyor of the “Castello Plan” of New Amsterdam, a unique birds-eye view from c.1660, decided to go on with the proposed settlement, and in 1657 Director-General Stuyvesant and the Council granted 21 patents of 50 acres each – 19 people received patents and two were retained for the benefit of the poor. In addition to Cortelyou, among the landowners was Nicasius de Sille, council member and Stuyvesant’s *fiscaal*, or attorney general. The settlement was named New

Utrecht, probably in honor of the late Werckhoven's native town and province. By 1660, eleven houses and a blockhouse had been erected, surrounded by a palisades, and the first town charter was issued in 1661 (Bergen 1884:257-258). Cortelyou appears to have occupied Werckhoven's property, which included much of current Fort Hamilton and present Dyker Beach Park (northwest of the project site). His house was on the eastern slope of the Fort Hamilton bluff, with a nearby wharf (U.S. Engineering Department n.d.; Taylor and Skinner 1781).

New Utrecht's position near the narrows made it a front row spectator for each invasion of the colony – in 1664 when the English fleet anchored in Gravesend Bay to take New Netherland from the Dutch, and when the Dutch fleet recaptured the colony in 1673, and, again, when the English repossessed it in 1674. In that year the English squadron seized a New Utrecht sloop transporting cattle to New Jersey, and proceeded to take the remaining cattle in the town, celebrating the return of the colony by feasting on the New Utrecht's beef. The English reconfirmed the town charter, and permitted the town to continue under its old name (Bergen 1884:260-261).

After these events, the town returned to its quiet agricultural existence, its farmers producing grain and tobacco, as well as raising cattle. The village was linked to neighboring settlements and markets with the construction of Kings Highway (which passed through the village in the path of current 84th Street) by the first decade of the 1700s. A ferry to Staten Island was established at the Narrows with a royal grant to Denyse Denyse in 1742. Prior to this, Denyse and his wife Teuntje had acquired the land around the foot of current Fort Hamilton Parkway, and maps show their house and stone wharf outside the project site, west of Fort Hamilton Parkway, adjacent to the Cortelyou lands (Bergen 1884:261-262). The stone wharf still stands there today (Taylor and Skinner 1781).

Settlement along the shoreline (generally from 100 to 400 feet north of the Shore Parkway) was sparse. Two roads leading from Kings Highway to Gravesend Bay appear on the 1781 map: Bennett Lane, which led directly from New Utrecht village to the bay, roughly along the path of 16th Avenue, four blocks west of the project site; and Denyse's Lane, which, approximating Fort Hamilton Parkway, led from Kings Highway to the bay at Denyse's Ferry Landing, on the bluff of present Fort Hamilton. (Cohen and Augustyn 1997:107,108). A third path, DeBruyn or DeBruin's Lane, is partially drawn in as a dashed line, only extending halfway to the shore, generally parallel to 20th Avenue but slightly to the west, eight blocks east of the project site, (Taylor and Skinner 1781).

As with the previous invasions, in August 1776 the British fleet approached New York City by the Narrows. It disgorged about 15,000 troops on the gently-sloping beaches of Gravesend Bay, probably including the project site. They quickly marched up the roads from the shore and invaded New Utrecht village and neighboring Gravesend. The American resistance to the fleet was led by a party under the command of General Henry Knox, Washington's Chief of Artillery, which established a battery of two 12-pounders on the eastern slope of the Fort Hamilton bluff. The party managed to hit the frigate HMS *Asia*, killing five men, and fired on the advancing enemy troops before being forced to abandon the position. Col. Edward Hand and some riflemen were posted in the Simon Cortelyou house, holding off the landing before retreating northwards to the wooded hills (Runyon 1928:4-5; Hazelton 1925:1,087; Bergen 1884:262).

## The Nineteenth and Twentieth Centuries

### *Fort Hamilton*

With the departure of the occupying English and Hessian troops in 1783, the town of New Utrecht once again returned to a quiet rural existence. However, the topography and geographic location of the town ensured that the areas along Gravesend Bay to the Narrows would be the scene of future developments. The first was the recognition of the strategic importance of the bluff at Denyse's Ferry Landing, which commanded the Narrows, and with it the entrance to Upper New York Bay. Recommendations for its fortification date to at least 1703, but no action was taken until that of the American defenders in 1776. After its capture by the British in the same year, two small lunettes were constructed there for a Hessian garrison, including "the first battery capable of keeping ships out of the harbor," although only a small redoubt appears on the 1781 map (U.S. Army 1992:n.p.; Taylor and Skinner 1781).

Colonel Jonathan Williams, Chief Engineer, recommended the construction of a battery on Hendricks Reef, just offshore from the Fort Hamilton site, in 1807. The Federal Government acquired the reef from the State of New York in 1812, and proceeded to build Fort Diamond, so named because of its shape. On the Fort Hamilton site, between 1807 and 1812 the State of New York built an earthwork which was named Fort Lewis. Construction was accelerated with the coming of the War of 1812 and fear of an attack on New York City. Civilians from New York City, armed with pick and shovel, greatly strengthened the works at the Narrows. With New York harbor blockaded, and occasional raids along the coast of Long Island, two new blockhouses were built along Gravesend Bay beach, one at the foot of DeBruyn's Lane, (now approximately the 20th Avenue roadbed), and the other at the foot of Bennetts Lane, four blocks west of the project site (Huffman 1976:51; U.S. Engineering Department n.d.).

In 1814, the city presented the Federal Government with the deed to the Fort Hamilton site for a fort for harbor defense (Runyon 1928:6-7; U.S. Army 1992:n.p.). Permanent harbor defenses were planned, and a new circular, masonry Fort Diamond was built with 96 guns, at a cost of \$275,000. It was renamed Fort Lafayette in 1823 in honor of General Lafayette's visit in 1824. Construction of Fort Hamilton itself did not begin until plans were approved in 1824, and ground was broken the following year. The fort was finished and ready for occupation by 1831, having 70 guns, and facilities for a garrison of 100 men in peacetime and 1,400 in war (U.S. Army 1992:n.p.; Runyon 1928:7-9).

The defenses were strengthened several times during the 19th century, and the Federal reservation also grew, adding 16.5 acres by purchase in 1826, another c.11 acres in 1852, 21 acres in 1862, and an additional 56.5 acres ceded by the state legislature in 1893. At its largest extent, it covered approximately 166 acres.

## *Recreational Development*

The beneficial atmosphere of the Gravesend Bay shore had been recognized as early as the 18th century, when a group of New York City physicians, Drs. Bailey, Bard, Rogers, Tillary "et al.," erected Bath House in 1794 as a place of retreat for their invalid patients to enjoy "the invigorating influence of pure air and sea bathing." Bath House stood adjacent to the beach on the west side of De Bruyn (or DeBruin's) Lane, which was slightly west of present 20th Avenue, approximately 3,000 feet east of the project site, and ran directly to New Utrecht village. The oldest bathing establishment on Long Island, it burned down in 1802. The "Messrs. Brown" rebuilt Bath House as a hotel, having the "power to accommodate with every regard to comfort more than 150 visitors" (Thompson 1918:161). (Figure 4) In the latter decades of the 19th century, it was known as the Avon Beach Hotel (Hazleton 1925:1087). As Brooklyn historian J. T. Bailey wrote in 1840:

*"Bath House" and village . . . has been a favorite place of resort for sea bathing for many years. There is a good hotel here, which is well conducted; it has a lawn in front, beautifully shaded by trees, where the luxury of the ocean breezes may be enjoyed to the fullest extent during the heat of summer. It is the nearest watering place to New York, and new accommodations have been recently erected within a short distance of the beach, which commands a charming prospect of the ocean.*  
(Bailey 1840:41)

Bath Beach grew slowly because it was somewhat isolated, but it benefitted from its proximity to Coney Island, which became a fashionable and increasingly-popular recreational destination in the 1840s. Transportation links were continually improved, and they often passed through or near Bath Beach. The Brooklyn, Greenwood and Bath Plank Company was formed in 1852, and constructed a direct road from the City of Brooklyn to Bath House. Also by 1852, the Bath and Coney Island Plank Road was completed, extending Bath Beach's main street, Franklin Avenue (now Cropsey Avenue) east of DeBruyn Lane toward Coney Island through the swamps east of the project site (Conner 1852). Among the railroads that were constructed, the Brooklyn, Bath and Coney Island Railway was the first to be completed, to Bath in 1864, and extended to Coney Island in 1867. It ran southward along present 19th Avenue, and turned eastward near the Gravesend Bay shore, just south of the line of present 86th Street, two blocks north of Bath Avenue. (Dripps 1868; Beers 1873; Figure 5)

During this period, Bath Beach developed as an affluent resort community, and its boundaries were considered to be west of Bath House (approximately 20th Avenue) as far as Dyker Beach Park, and north to 86th Street. Cropsey Avenue was the main street, lined with fine homes and clubhouses (Hazleton 1925:1087-1088).

Inevitably, real estate developers recognized the potential profits to be had from the development of residential communities along Gravesend Bay, to the east of Bath Beach. That area was made up of large properties owned by a handful of farming families, disinclined to part with the acreage which had sustained many of them for upwards of two centuries. However, after New York City real estate dealers James D. Lynch and his brother persuaded Robert Benson to sell his farm in c1886, the

remaining holdouts sold quickly. The last seller, Judge Robert Benson, reserved the family home and a large plot between 21st and Bay Parkway, extending from Cropsey Avenue down to the bay. After the death of Benson's widow, this land, east of the project site, became Bensonhurst Park (Hazleton 1925:1088-1089).

The layout was the "Result of Broad and comprehensive design," and there was to be "nothing crude or undigested about the place." Lynch hired well-known surveyor Samuel H. McElroy, B. S. and G. S. Olmstead (Olmstead & Olmstead of Boston), landscape architects; Col. George E. Waring Jr., sanitary engineer and the Parfitt Brothers, architects. He contracted 200 men with 90 wagons and carts, who "skinned the land and levelled it out like a lawn." The streets were built first, and by 1889, two miles had been completed, along with 20 miles of fences and sidewalks lined with young trees. The shore from 21st Street to 29th Avenue was leased as a public park and bathing beach "for a term of years." Arrangements for water were made with the Kings County Water Supply Company, and an "elaborate system of sewerage" was installed, which discharged the sewage of Bensonhurst and Bath Beach into Gravesend Bay through two outlets at 15th and 22nd Avenues. Lawns were planted and rolled. By the time this work was completed, 30 villas had already been built, and empty 20 by 100 foot parcels were being sold for \$150 and upward (Bensonhurst 1889:6, 8, 24,28; Hazleton 1925:1089; McElroy 1889).

Building standards restricted stores to certain streets, while the residential streets were graded by the character of the dwelling – on some buyers agreed to build houses that cost no less than \$10,000, while other streets had lower limits of \$7,000 and \$3,000. In parts of the village, no more than one house was permitted for every three lots (60 by 100 feet) for 16 years. "Everyone could have what he could afford, and the symmetry of the neighborhood was preserved" (Hazleton 1925:1089; Bensonhurst 1889:8).

Transportation facilities improved dramatically after 1889, as numerous ferry lines were established from Brooklyn and Manhattan, and the Bensonhurst railroad station, on the north side of Bath Avenue at Bay 28th Street, became a point of convergence for the many lines to Coney Island. Travel time from the Brooklyn Bridge to Bath Beach and Bensonhurst was as little as 30 minutes (Hazleton 1925:1089-90; Bensonhurst 1889:28).

Maps from 1890 and 1895 show a long line of villas, houses, hotels, boating piers and yacht clubs along the bay shore from 15th Avenue to beyond 27th Avenue. (Figures 6 and 7) However, on the same map the seeds of decline are also evident: the ample lots near the shore had been subdivided into small 20 or 25 by 100 foot building lots, and a broken line showing a new projected street to be built on filled land in the bay, with the ominous name (at least for a vacation resort) of Warehouse Avenue. By the time of the 1906 map, the more affluent patrons of the resorts had begun to move on to more exclusive areas, and numerous large hotels were operating along the bay, such as the Lowry, just west of the project block, and the Avon Beach Hotel at Bay 22nd Street (Sanborn 1906). (Figure 8)

Hazleton, a Brooklyn historian writing in 1925, described Cropsey Avenue as the principal street of Bath Beach. "It contained fine homes and clubs. Field and Marine Club fronts Gravesend Bay,

while adjoining Kathleen Villa (wife of Barney Williams, great actor) . . . Laurel House next, opposite Archie Young's large house and grounds. Albert Van Brunt Voorhees lived next door, Lott Nostrand had one of the finest waterfronts, near the Avon Beach Inn. Then was the Benson home" (Hazelton 1925:1,088). As detailed below, two of these "fine homes" were within what is now the proposed wet weather flow force main corridor.

As the twentieth century progressed, more popular amenities appeared, such as multiple public bathing pavilions and a camping ground between Bay 43rd and 38th Streets, and institutions such as the New York Children's Aid Society summer home adjacent to the project site between Bay 17th and 19th Streets. The fuel requirements of all these establishments brought businesses like F. Semken Coal and Wood, which constructed a massive pier with coal pockets, jutting into the bay at the end of Bay 32nd Street, cheek by jowl with the Hotel Idle Rest.

The declining popularity of Gravesend Bay as a resort destination may be attributed to a number of factors: pollution from the growing population; the advent of the automobile and the development of the modern highway system, allowing vacationers to travel to less-crowded destinations; and perhaps competition from a revived Coney Island, after World War I. (Figure 9)

By 1939, the Bensonhurst area was described as an "undistinguished neighborhood," with Bath Beach a cluster of small houses and ramshackle mansions and hotels leading down to a deserted beach (WPA 1939:470). The final blow was the construction of the Shore Parkway in the late 1930s, by which the waterfront communities were literally cut off from the water. Parkway construction required massive amounts of fill to bring the area up to the required grade. This was especially so within the project site, where the Shore Parkway was constructed offshore. The hydraulic fill was "sand," "taken out from the bay by sandsucker pipes," and deposited on and along the shore. A further public works project, the building of the Verrazano-Narrows Bridge a mile and a half northwest of the project site, was proposed as early as 1926, but ground was only broken in 1959. The bridge was completed in 1964 (Wright 1983:537).

### **Construction on the Project Site**

The shore of Gravesend Bay was at the location of the present 17<sup>th</sup> Court when settlement by Europeans began, and Bay 16<sup>th</sup> Street did not exist. The section between Cropsey and Bath Avenues was mapped but not opened in 1895 and was opened under the name of New Utrecht Avenue by 1906. There was no street in the block between Cropsey Avenue and Gravesend Bay at least through 1906.

Early maps show that there were structures in the path of what later became Bay 16<sup>th</sup> Street, but it is difficult to pinpoint their exact location (Conner 1852, Walling 1859). Beginning in 1873, they are more precisely located and will be discussed going from the shore inland. (Figures 2, 4-9)

The original shoreline was a sloping beach, but a boardwalk was constructed in the late nineteenth century along the shore, at the present location of 17<sup>th</sup> Court.

### *A. V. B. Voorhees/Willomere Hotel Property*

The property overlooking Gravesend Bay was owned by the Voorhies/Voorhees family by 1852, with the spelling, initials, and even the location of the structures changing over time<sup>2</sup>.

The Voorhees' pre-1852 structure lies in or adjacent to the project corridor. It is simply too difficult to establish a precise location on today's landscape for a specific structure but there is no question that the proposed corridor traverses the Voorhees' homelot. However, by 1873 (Figure 5) there are two moderate-sized structures on the lot traversed by the corridor - both associated with a J. I. (or J. J.) Voorhees. The more northerly structure was slightly east of the more southerly structure. Regardless of whether both are in or out of the footprint of the proposed installation, their yard areas are definitely within the installation corridor.

By 1890 the property was labelled A. V. B. Voorhees and although the more northerly house, or "cottage," had not been altered, the more southerly, or waterfront, structure had been replaced by a large frame building and two outbuildings. This complex was named *Willomere House* (Figure 6) later identified as a resort hotel. In addition to other outbuildings, two large bathing houses had been built near the beachfront. As can be noted on Figure 6, from the 1890 Robinson atlas, there is a second A. V. B. Voorhees property (1 dwelling and 3 outbuildings at Cropsey and Bay 14th).

By 1895, Willomere is depicted with porches on three sides and four bathing houses. (Figure 7) It was enlarged again by 1906, with the added amenities of gas and lights, and there was a N.Y. & N.J. Telephone Exchange on the property. Part of the west wing of the hotel structure, containing the kitchen, was in the eastern portion of the future Bay 16<sup>th</sup> Street.

Also partially in the path of Bay 16<sup>th</sup> Street, on its western side, were the "helps quarters" associated with the hotel. Adjacent to the helps' quarters was the hotel laundry, part of which was also in the western part of Bay 16<sup>th</sup> Street. (Figure 8) By 1929 the property had more than likely changed hands since the complex was now depicted as the Belvedere Hotel (Figure 9).

### *A. Young Property*

Almost the entire two blocks north of what is now Cropsey Avenue, between 17<sup>th</sup> Avenue and Bay 19<sup>th</sup> Street, including the project site except for the Voorhees parcel, is shown on maps as belonging to A[rchibald]. Young (Beers 1873; Dripps 1877; McElroy 1889; Robinson 1890). Young's residence was depicted as approximately 60 feet square in 1873, and by 1890, the home was depicted as much enlarged and supported by several outbuildings. (Figures 6 and 7)

Directly north of the Young house was a well (Sanborn 1895). Farther north of the house, by about 30 feet, were two small buildings side by side, also in the path of Bay 16<sup>th</sup> Street. One was an ice house and the other an unidentified 1-story structure, possibly a privy (Ibid.).

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<sup>2</sup>The 1873 map shows a cottage directly in the path of Bay 16<sup>th</sup> Street, but a building with the same footprint appears on later maps to the east of the future street. Either the building was moved, or more likely, it was an anomaly on the 1873 Beers map.

Young died in 1895 (Brooklyn Eagle 10/24/1895: 7). His widow continued to reside there until New Utrecht Avenue (later Bay 16<sup>th</sup> Street) was constructed between 1898 and 1906. Rather than tear down the building, she had it moved out of the path of the street in 1898 (Brooklyn Eagle 6/25/1899: 15; Sanborn 1895; 1906).

A sewer system was in place by 1889, with pipes running along Cropsey Avenue, 17<sup>th</sup> Avenue, and the project site block on Bath Avenue between 17<sup>th</sup> Avenue and Bay 16<sup>th</sup> Street. It emptied into Gravesend Bay via a long pipe at 15<sup>th</sup> Avenue (McElroy 1889). There were no water pipes in the project area in 1895, except for a 4" main on Bath Avenue and a 6" one on Cropsey Avenue, which was enlarged to 8 feet by 1906. The corner elevation at Bay 16<sup>th</sup> Street and Cropsey had decreased from 22 feet in 1895 to 21 feet in 1906, probably as a result of grading connected with the opening of Bay 16<sup>th</sup>.

Eight dwellings had been constructed on the west side of New Utrecht Avenue (later Bay 16<sup>th</sup> Street) and five on the east side by 1906. The three corner lots on Bath and New Utrecht were vacant, but seven 3-story cement and cinderblock flats, with stores on the ground floor, stood along Bath Avenue on the west side of the block. These are still standing but are not impacted by the proposed force main construction. The demolition of some buildings and construction of others on either side of the street over time probably had little effect on the Bay 16<sup>th</sup> Street project site roadbed itself.

### **Historical Archaeological Potential**

There were structures within or directly adjacent to the path of Bay 16<sup>th</sup> Street, between 17<sup>th</sup> Court (the original shoreline) and Cropsey Avenue by 1852. On the property of the Voorhees family, a dwelling had been erected before 1852, and the Willomere House hotel was established by the end of the 19th century, standing through 1929. (Figures 7, 8, 9)

Soil borings indicate fill to the depth of 4.5 to 9.5 feet in this block. However this may be an underestimate, because much of the fill was sand pumped from the bay in the 1930s, and may have been misinterpreted as naturally-occurring strata. It is possible that as much as 15 feet of fill was deposited. If there is 9 to 15 feet of fill covering the original surface associated with the Voorhees dwelling and hotel-associated outbuildings in that block, cultural remains would have been protected from disturbance caused by the later installation of water and sewer pipes and other now-buried utilities. The only structural materials in the core samples (wood, glass and brick) came from a boring on the east side of Bay 16<sup>th</sup> Street, just south of Bath Avenue. Its source could be from demolition in either block.

The project site north of Cropsey Avenue is also potentially sensitive, since it contained structures associated with the Archibald Young family, dating to before 1873. At the center of the block directly north of the house was a well, and there was an ice house and possibly a privy to the north of that; both would be valuable time capsules for archaeological study. Privy and well shafts, which are often filled with contemporary refuse related to associated dwellings and their occupants, or businesses and their workers and managers, provide important stratified cultural deposits for the archaeologist. Such shafts, five or more feet deep, usually survive all but the deepest post-

depositional disturbance and frequently provide the best remains recovered on sites, including animal bone, seeds, glass, metal, stone, ceramics, and sometimes leather, cloth, wood and even paper. By analyzing such artifacts, archaeologists can learn much about the diet, activities, customs and technology of the former occupants, and attempt to combine this data with what the documentary record tells us about their ethnicity, socioeconomic status, environment, etc. Since the first recorded sewer lines were installed throughout the area in 1889, with the development of "Bensonhurst-by-the-Sea," 1890 was considered the year after which such shaft features were not a necessity for inhabitants and workers in the project area (Robinson 1890; Bensonhurst 1889).

According to soil borings, the fill layer ranges between 3 to 9.5 feet thick at the southern end of the block to 9.5 feet thick at the northern end, with only 6 feet of fill indicated in the center. It is possible the Young house was situated on a rise, so less fill was needed to level the ground at this point. If this depth of fill is correct, the house location may have been more-thinly covered, or a certain amount of regrading may have been done at the time the house was moved out of the project site in 1898. The well location, and that of the two outbuildings, an ice house and a possible privy, were north of the house, protected from subsequent disturbance beneath a of fill overmantle of between 6 and 9 feet thick.

Bath Avenue was in existence by 1852, although the main road was Cropsey (then called Franklin) Avenue, when it was an extension of the Bath and Coney Island Plank Road. There were no structures fronting directly on Bath within the project site until circa 1906, and some of these buildings are still standing. This section of the project site is not considered archaeologically sensitive.

## V. CONCLUSIONS AND RECOMMENDATIONS

### **Precontact Archaeological Potential**

Although Native Americans certainly ranged over the project site on their way between their documented preferred sites under a mile on either side of it, there is no evidence that they either camped or settled there. The shell found in one of the soil borings is too sparse to indicate a midden, and there are no peat layers that are usually associated with drowned embayments or marshland. In addition, the shell was found at the point where Gravesend Bay lapped against the shore, and wave action over the years would have dissipated the remains of a potential midden. Therefore, the potential presence of buried precontact cultural remains within the project site is **VERY LOW**, and no further testing is recommended.

### **Historical Archaeological Potential**

The Bath Avenue segment of the project site has an extremely low potential sensitivity for cultural remains from the historic period. Building first appeared along the street on a 1909 map, postdating the installation of sewer lines beneath the street in 1889. Since water mains are normally installed at the same time, or prior to the laying of sewer lines, there would have been no need for the construction of shaft features, such as privies and wells. Furthermore, since Bath Avenue was already a public thoroughfare and not a private yard, such use would not have been possible. No additional archaeological research or testing for this section of the project site is recommended.

On the Bay 16<sup>th</sup> Street section of the project site, however, the presence of two homelots with dwellings and associated outbuildings, one of which (A. V. B. Voorhees/Willomere Hotel property) dates to before 1852, and the other to before 1873 (A. Young property), has been documented. In addition, the route of the force main also passes between the structures of a late 19th century hotel, Willomere House. These occupations make this part of the force main route potentially sensitive for archaeological remains related to these structures and their occupants. As discussed in the previous section, the high probability of surviving shaft features, i.e., privies (both domestic occupations pre-date the installation of the first sewer lines in 1889), and a documented well and another structure which may have been a privy, heightens the potential sensitivity. With an estimated 6 to 9 feet of fill overburden added during road construction, the historical resources in these abandoned "shaft features" would have been protected from the subsurface disturbance caused by the later laying of sewer and water pipes and other underground utilities. See Figure 10 for the areas of potential historical archaeological sensitivity.

The proposed installation method for the project site wet weather force main is microtunneling. The depth would be about 10 to 25 feet below existing grade. Microtunneling involves digging 10-foot by 20-foot pits for one pipe and 20-foot by 20-foot pits for two pipes about every 750 feet and at bends in the pipeline route. A tunnel just large enough to fit the force main(s) would be bored and the pipes inserted. Using this method, excavation and tunneling could be deep enough to destroy any potential historical archaeological remains on the site.

## **Recommendations**

For the areas of potential sensitivity on Bay 16th Street, additional documentary research, and if appropriate, testing is recommended. To further evaluate the potential significance of the A. Young and A. V. B. Voorhees properties, these homelots will be included in the Topic Intensive Study requested by the New York City Landmarks Preservation Commission (LPC), and being prepared for the Dry Weather Flow Force Main (Historical Perspectives 1998). The additional documentary research will focus on the occupation of the homelots, from before 1852 to the advent of water and sewer service in c. 1889. Similar research is needed for the section of the A. V. B. Voorhees property used as the site of the Willomere House hotel. The study of directories, census, real estate and tax records, as well as other historical data, could provide an important basis for the interpretation and understanding of these lots, and also enable archaeologists to formulate questions associated with work- and life-ways, diet and consumer behavior.

Based on the conclusions of the additional documentary study, additional study in the form of archaeological testing could be warranted.

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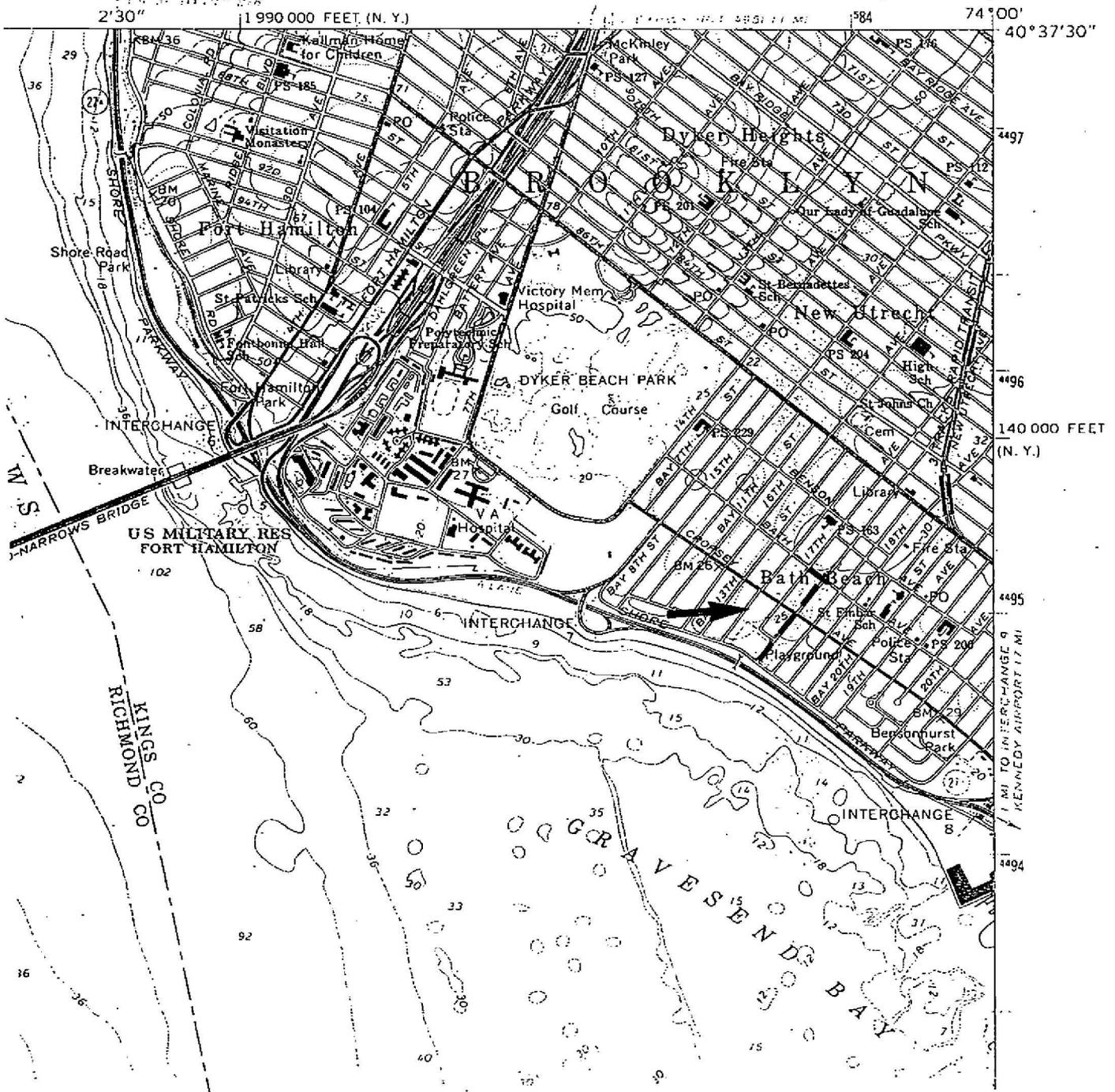
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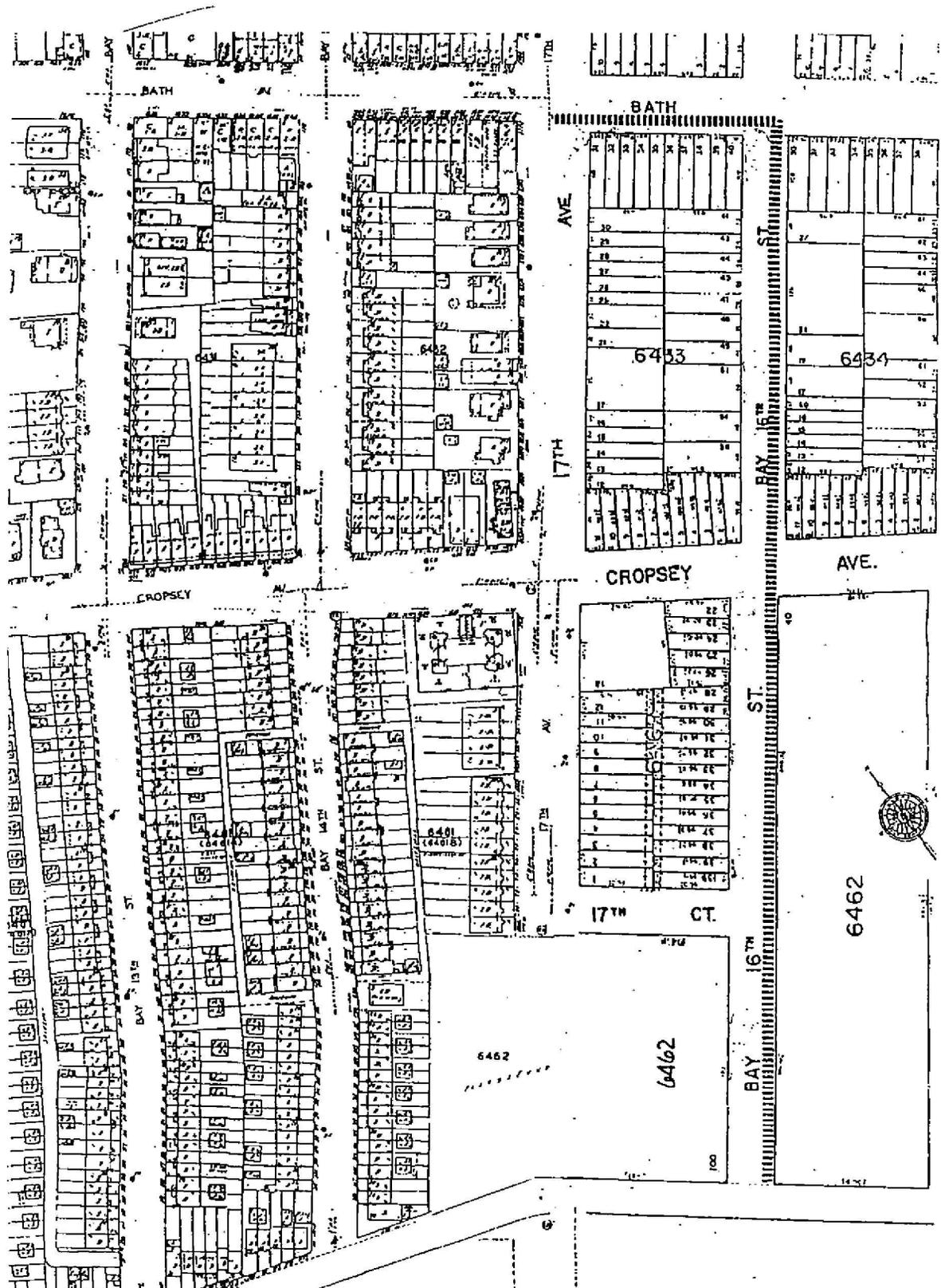
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Scale 1:24,000.

Figure 1. Site Location on U.S.G.S. Topographic Map, photorevised 1979.  
The Narrows Quadrangle, New York. 7.5 Minute Series (Topographic).

HPI/Avenue V Pumping Station, Bay 16<sup>th</sup> Street and Bath Avenue/Phase IA Archaeological Assessment



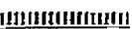
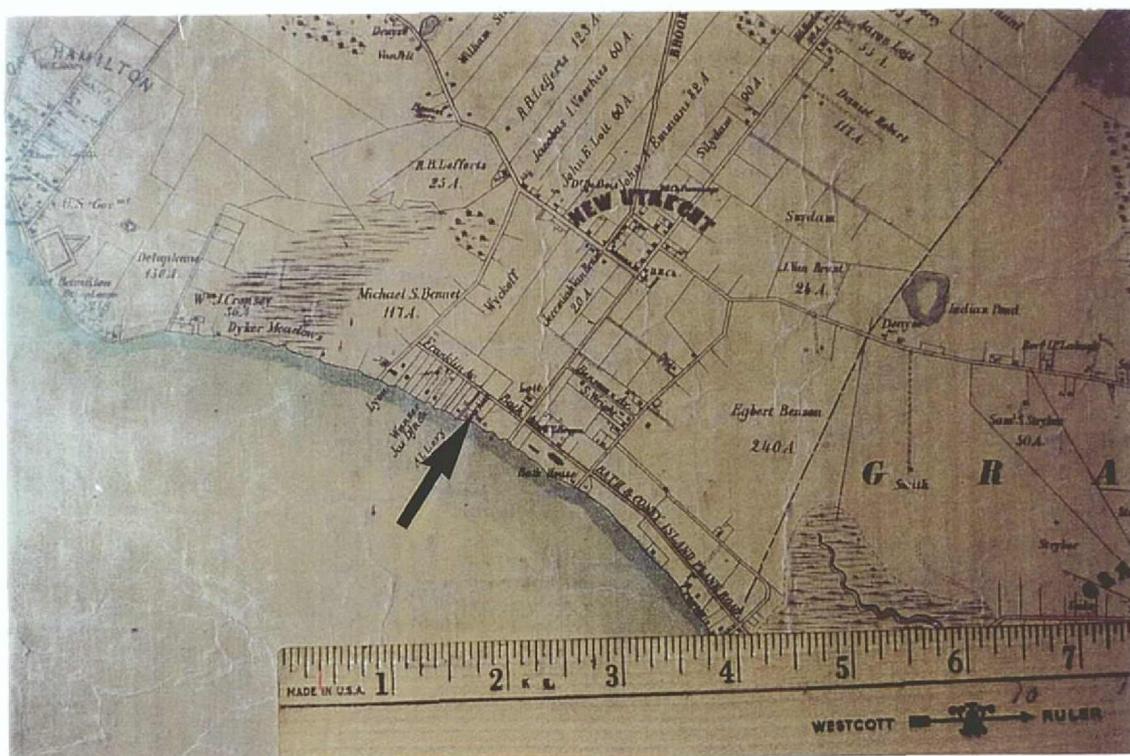
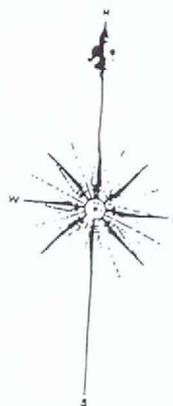
Project Site 

Figure 2. Site Location Map.

(Supplied by Allee King Rosen & Fleming, Inc.)

HPI/Avenue V Pumping Station, Bay 16<sup>th</sup> Street and Bath Avenue/Phase 1A Archaeological Assessment





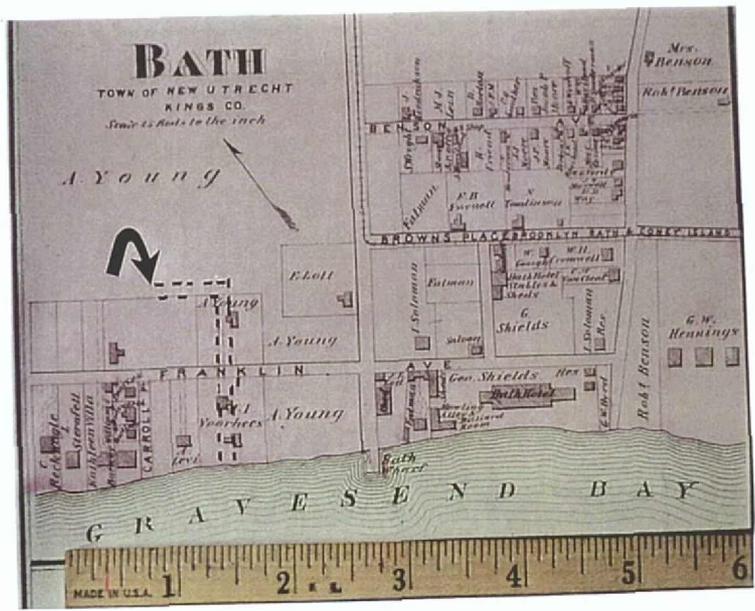
Scale: 6 inches = approximately 2 miles

#### Figure 4. 1852 Conner Map.

The two major roads on either side of the project site are Bennett's Lane on left, and DeBruyn's Lane on the right. Bennett's Lane followed the course of an old Indian trail. Note marshlands northwest and southeast of project site, and structure on Voorhies property, south of Franklin [now Cropsey] Avenue.

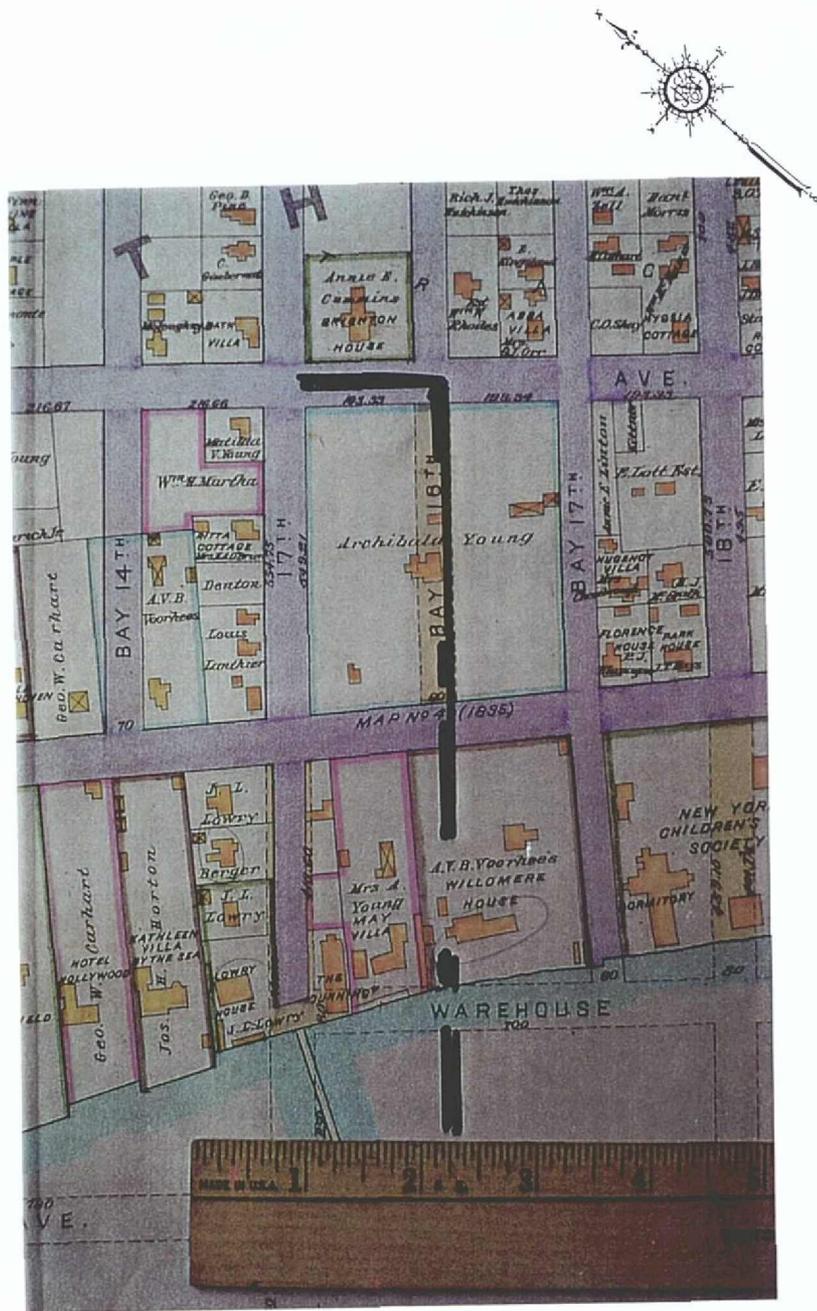


Map scale: 1 inch = 120 rods



Inset scale: 1 inch = 25 rods

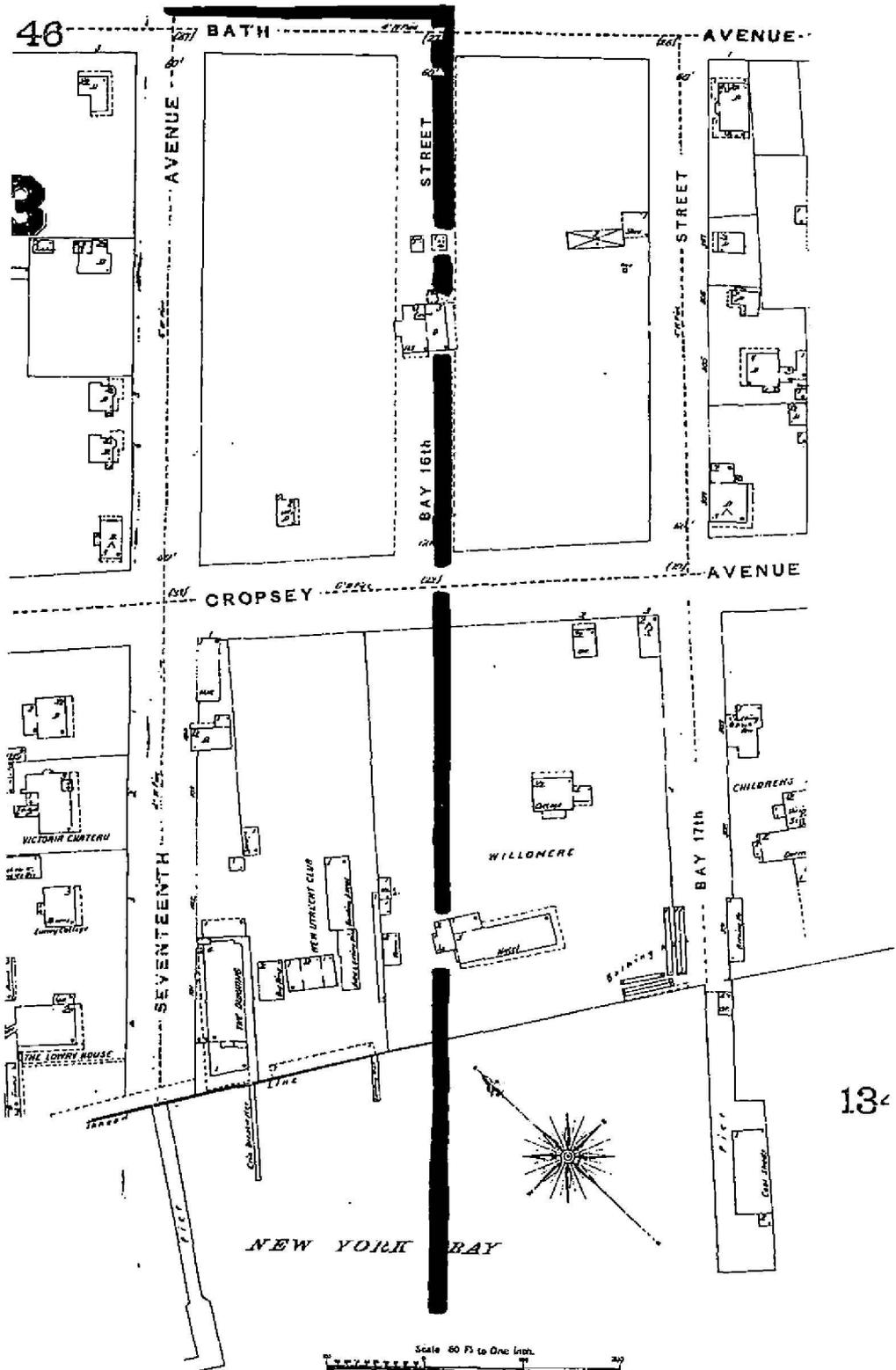
Figure 5. 1873 Beers Map and Inset.



Scale: 1 inch = 200 feet

**Figure 6. 1890 Robinson Map**

Note that planned changes include the breaking up of the Archibald Young estate, the construction of Warehouse Avenue, and the extension of the waterfront.

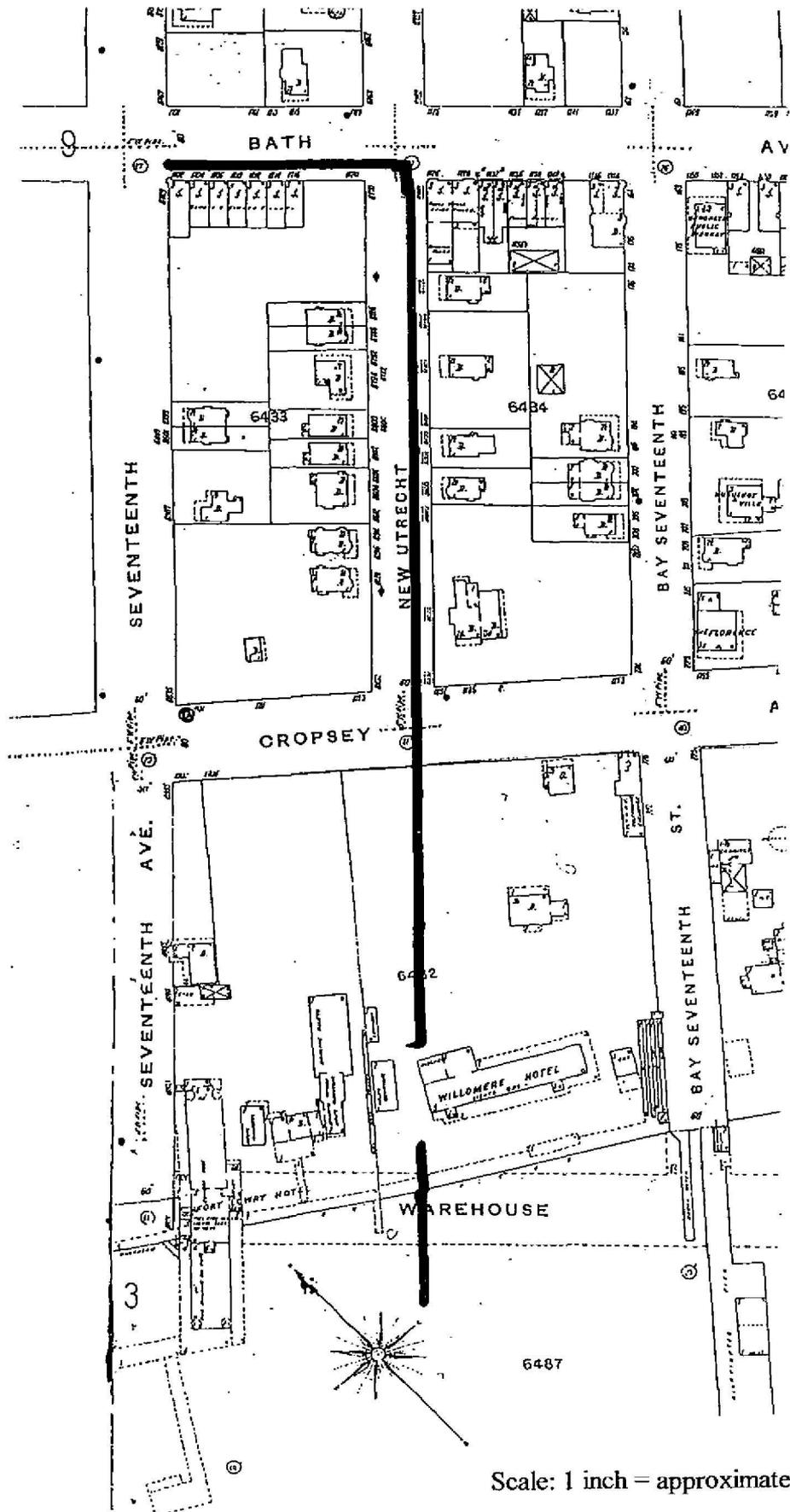


Scale:  
1 inch = approximately 170 feet

**Figure 7. 1895 Sanborn Map.**

Note that well directly behind house on Bay 16<sup>th</sup> Street is in path of the force main, as is ice house, small structure on right behind house. Bold line shows project site.

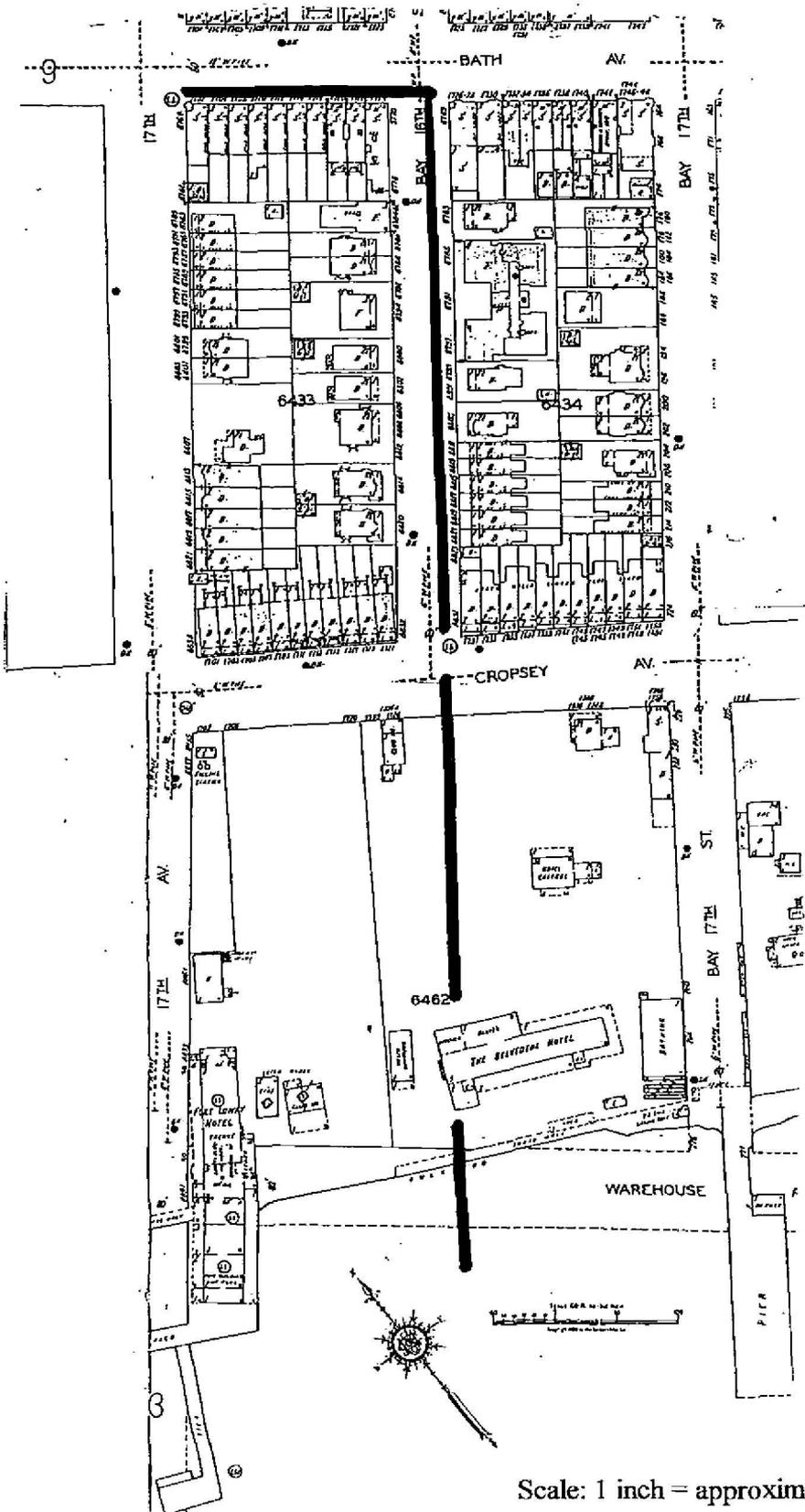
HPI/Avenue V Pumping Station, Bay 16<sup>th</sup> Street and Bath Avenue/Phase 1A Archaeological Assessment



Scale: 1 inch = approximately 120 feet

Figure 8. 1906 Sanborn Insurance Map.

HPI/Avenue V Pumping Station, Bay 16<sup>th</sup> Street and Bath Avenue/Phase IA Archaeological Assessment



Scale: 1 inch = approximately 170 feet

Figure 9. 1929 Sanborn Insurance Map.

HPI/Avenue V Pumping Station, Bay 16<sup>th</sup> Street and Bath Avenue/Phase IA Archaeological Assessment

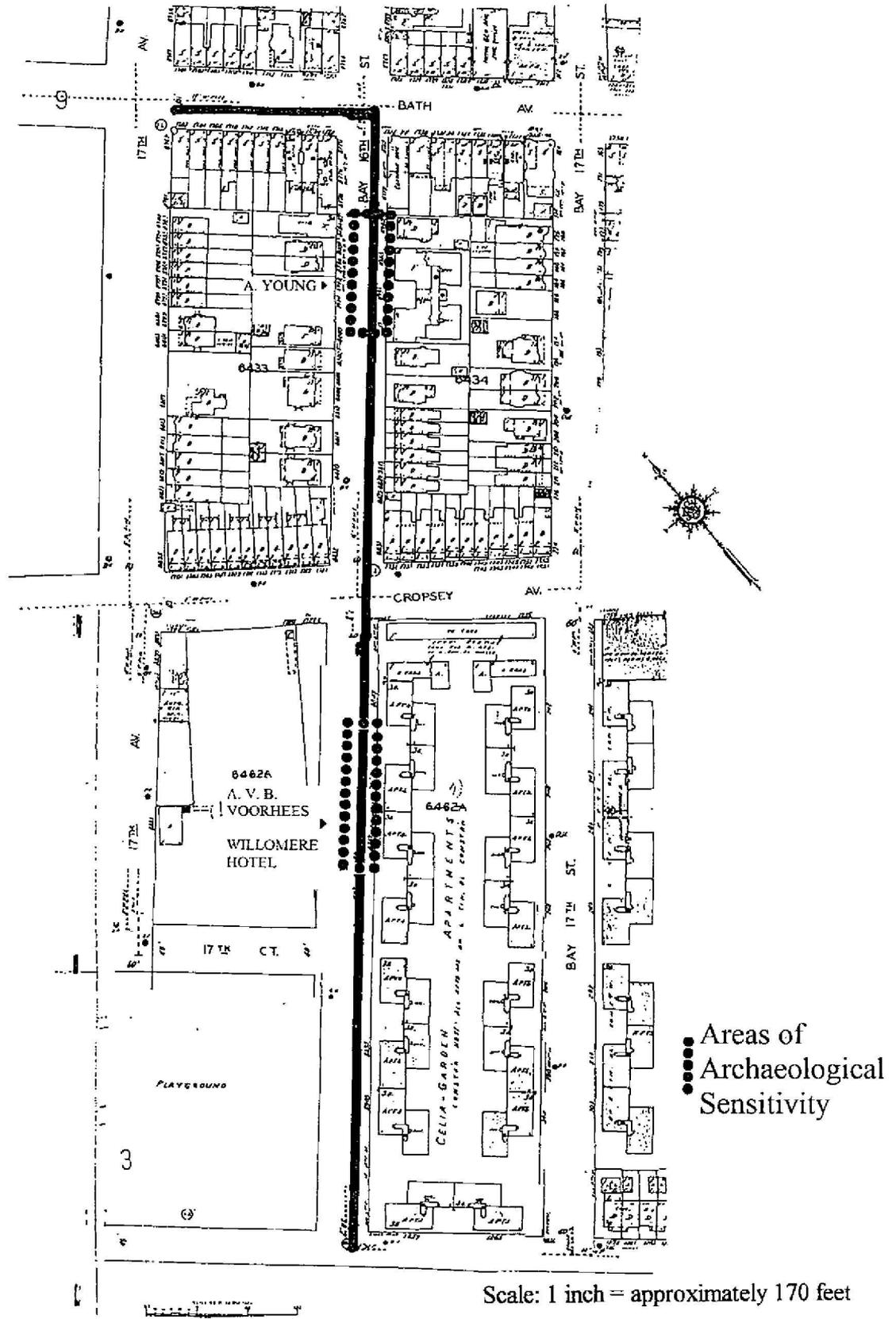
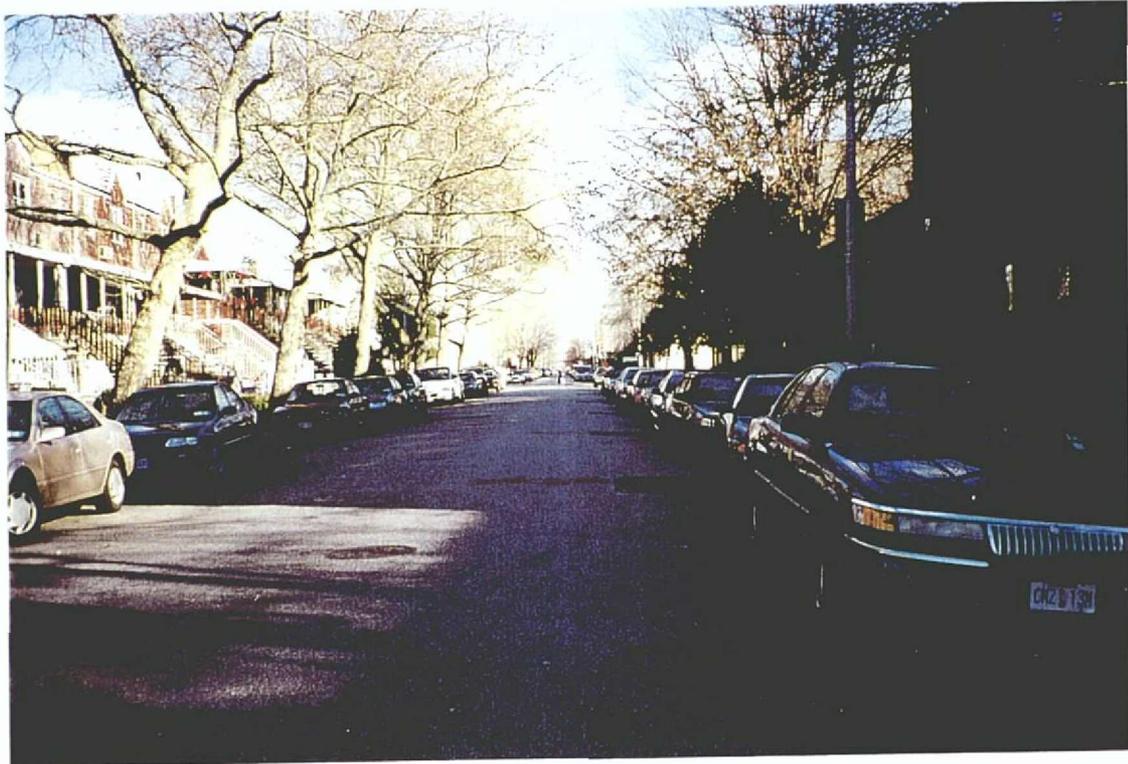


Figure 10. 1950 Sanborn Insurance Map.

HPI/Avenue V Pumping Station, Bay 16<sup>th</sup> Street and Bath Avenue/Phase 1A Archaeological Assessment



**Photograph A.** Bay 16<sup>th</sup> Street, looking northeast from Shore Parkway, with playground on left and apartment complex on right.



**Photograph B.** Bay 16<sup>th</sup> Street from 17<sup>th</sup> Court, looking northeast.



**Photograph C .** Bay 16<sup>th</sup> Street at Cropsey Avenue intersection, looking northeast.  
(Note manholes and patched pavement.)



**Photograph D.** Bay 16<sup>th</sup> Street at Bath Avenue intersection, looking northeast.



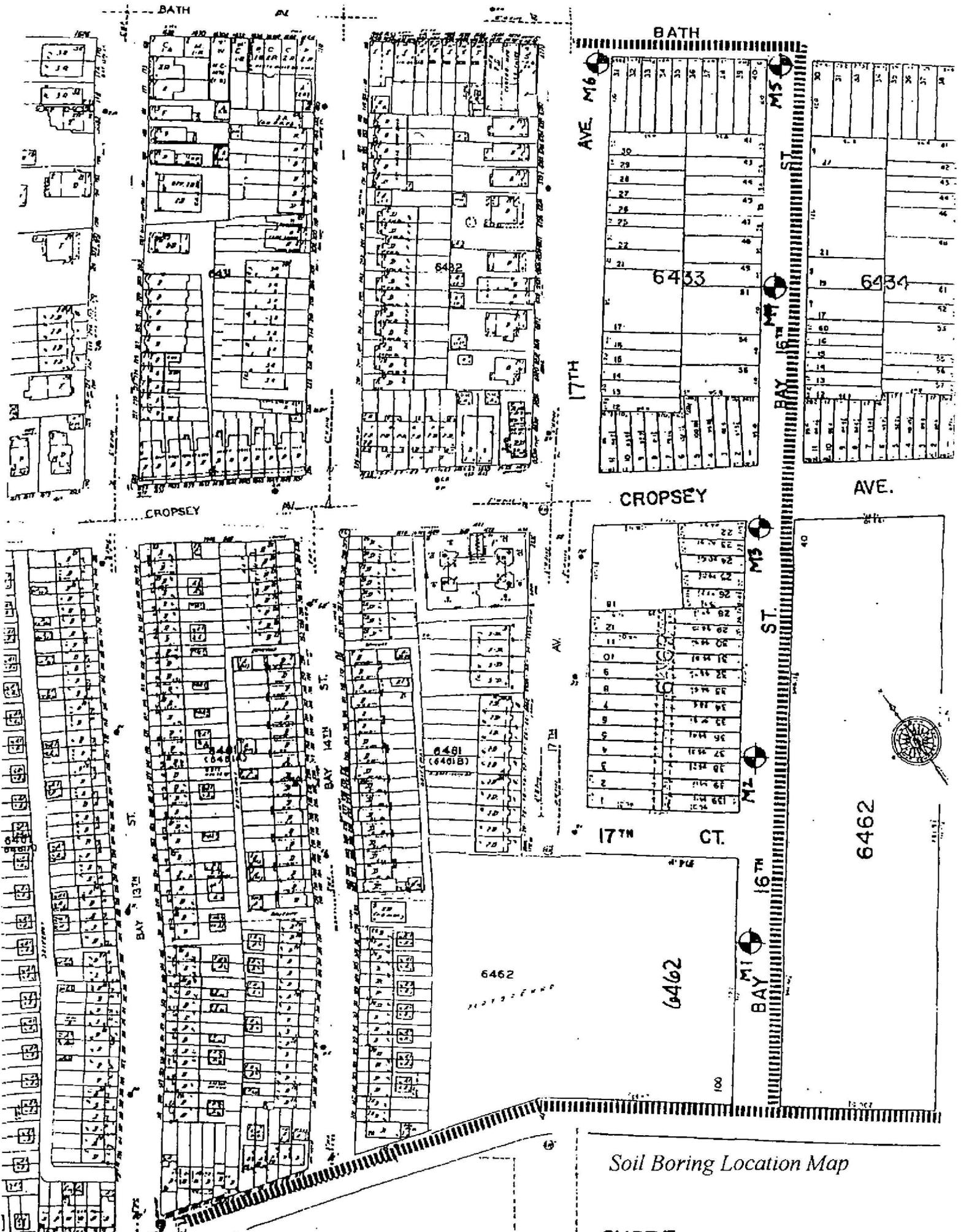
**Photograph E.** Bath Avenue, looking northwest toward 17<sup>th</sup> Avenue.



**Photograph F.** Bath Avenue, looking southeast toward Bay 16<sup>th</sup> Street.  
(Note grate in street.)

# APPENDIX

## *Soil Boring Logs*



Soil Boring Location Map

SCALE

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 3

FILE NO. 8769

BORING NO. M-1

SURFACE ELEV. \_\_\_\_\_

PROJECT Avenue V Pump Station

PROJECT LOCATION Brooklyn, NY

RES. ENGR. Keith Ferguson

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
	NO.	DEPTH	BLOWS/6"					
0/23/00 START 1330					Fill	4"		4" (cont.) SILT CLAY
	1D	2 - 4.0	8 - 12	BRN F-M SAND, SM SILT, TR BLK LINDERS (AM) (SM)		7.5		
	2D	4.0 - 6.0	2 - 9	WHITE-BRN F SAND, TR SILT (SP) (S)	S	5.0		
	3D	6.0 - 8.0	7 - 5	BRN F SAND, TR SILT (SP)				
SUNNY 60's	4D	8.0 - 10.0	5 - 5	Do 3D (SP)		10.0		
	5D	10.0 - 12.0	3 - 5	Do 3D (SP)				
END 1500	6D	15.0 - 17.0	WOM - 2 1 - 3	BRN F SAND, TR SHELLS, SILT (SP)		15.0		Water observed @ 15.0 on 10/24/00 morning
12/24/00 PART 0700						20.0		
	7D	20.0 - 22.0	5 - 2 2 - 2	GRY F SAND, SM SILT, TR MICA, SHELLS (SP-SM)				
						25.0		
	8D	25.0 - 27.0	WOR - 8 10 - 11	BRN-GRY F-C SAND TR SILT SHELLS, GRAUL, MICA (SP-SM)				
MOSTLY SUNNY						30.0		
50's-AM	9D	30.0 - 32.0	1 - 4 9 - 12	BRN-GRY F-C SAND, TR SILT, SHELLS GRAUL, MICA (SP-SM)				
						35.0		
60's-PM	10D	35.0 - 37.0	2 - 4 9 - 12	BRN F-M SAND, TR SILT, MICA (SP-SM)				
						40.0		
	11D	40.0 - 42.0	2 - 7 14 - 20	BRN-RED F-M SAND, SM SILT (SM)				
						45.0		
	12D	45.0 - 47.0	1 - 6 13 - 15	BRN-RED F-C SAND, TR SILT (SP-SM)				No m. ... 3.25" ID Auger advanced to 5.
END	13D	50.0 -	6 - 6	BRN-RED F-M SAND, TR SILT (SP-SM)				

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 2  
FILE NO. 8769  
BORING NO. M-2  
SURFACE ELEV. \_\_\_\_\_  
RES. ENGR. Keith Ferguson

PROJECT Avenue V Pump Station

PROJECT LOCATION Brooklyn, NY

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
	NO.	DEPTH	BLOWS/6"					
3/25/00 START 12:45	1D	1.0 - 3.0	2-2	REN SILTY F-C SAND, TR GVL, ASPHALT (2H) (Sm)	Fill	0.5		Drilled thru 6" conc diaphragm
	2D	3.0 - 5.0	5-3	Do 1D (Sm)		5.0		
SUNNY 70°	3D	5.0 - 7.0	2-1	LT BRN SANDY SILT, TR WOOD FIBER (Gvl) (Sm)	S	7.0		
	4D	7.0 - 9.0	3-6	BRN F-M SAND, TR SILT, GVL (S) (SP-Sm)		10.0		
	5D	9.0 - 12.0	8-9	BRN F-C SAND, TR SILT, GVL (S) (SP-Sm)		15.0		
END 15:10 15:25:00 START 0700	6D	15.0 - 17.0	4-7	BRN-RED F-M SAND, TR SILT (SP-Sm)		20.0		Water level observed on next 6' shaft 19.2 @ 0715
	7D	20.0 - 22.0	1-4	BRN RED F-C SAND, TR SILT, GVL (SP-Sm)		25.0		
CLOUDY 30'S	8D	25.0 - 27.0	3-5	BRN RED F-C SAND, TR SILT, GVL (SP-Sm)		30.0		
	9D	30.0 - 32.0	2-12	Do 8D (SP-Sm)		35.0		
END 10:45	10D	35.0 - 37.0	8-10	BRN RED F-C SAND, SM SILT, TR GVL (Sm)		40.0		37.5' ANOMALY - ADVANCED TO 40'
	11D	40.0 - 42.0	2-8	REN RED F-C SAND, TR SILT (SP-Sm)		42.0		END OF BORING @ 42.0'
						45.0		

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 2

FILE NO. 8769

PROJECT Avenue V Pump Station

BORING NO. M-3

PROJECT LOCATION Brooklyn, NY

SURFACE ELEV.

RES. ENGR. Keith Ferguson

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS		
	NO.	DEPTH	BLOWS/6"							
2/25/00 START: 0730	1D	1.0 - 3.0	5-21 16-14	BRN SILTY F-C SAND, TR WOOD, GLASS (Fill) (SM)	Fill			Drilled ahead to LARGE PIECES & BRICK - UNDER BLOCKS IN FIL		
	2D	3.0 - 5.0	9-10 21-30	BRN SILTY F-C SAND, TR GRAVEL (Fill) (SM)			5.0			
	3D	5.0 - 7.0	5-13 15-15	BRN F SAND, TR SILT (Fill) (SP-SM)						
	4D	7.0 - 9.0	12-11 15-15	BRN F-C SAND, SM SILT, TR BRICK, GRAVEL (Fill) (SM)			9.5 10.0			
	5D	10.0 - 12.0	4-7 7-6	BRN F-C SAND, SM SILT (SM) (S)		S				
	6D	15.0 - 17.0	5-6 7-10	BRN F-M SAND, SM SILT (SM)					15.0	
	7D	20.0 - 22.0	5-4 6-2	BRN F-C SAND, TR SILT, GRAVEL, MICA (SP-SM)					20.0	WATER OBSERVED @ 20.0 @ 0.5' ON RODS
	8D	25.0 - 27.0	7-7 9-12	Do 7D (SP-SM)					25.0	
	9D	30.0 - 32.0	2-8 11-11	BRN F-C SAND, TR SILT, GRAVEL (SP-SM)					30.0	
	10D	35.0 - 37.0	2-7 8-9	BRN F-C SAND, TR SILT, GVL (SP-SM)					35.0	
	11D	40.0 - 42.0	6-11 12-13	BRN F-C SAND, TR SILT (SP-SM)					40.0	
	12D	45.0 - 47.0	5-7 12-15	Do 11D (SP-SM)					45.0 47.0	3.25' AUGER ADVANCED TO 45' B.O.B. @ 47.0

UNNY  
60's

END  
12:00



MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 2

FILE NO. 8769

PROJECT AVENUE V PUMP STATION

BORING NO. M-5

PROJECT LOCATION BROOKLYN, NY

SURFACE ELEV. \_\_\_\_\_

RES. ENGR. KEITH FERGUSON

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS	
	NO.	DEPTH	BLOWS/6"						
2/26/00 1000	1D	1.0 - 3.0	4.2 3.5	BRN SILTY F-C SAND, TR BRK, GRYL (Fill) (Sm)	Fill	0.5		DRILLED 71/2" & 2" CONC. STRENGTH	
	2D	3.0 - 5.0	7.7 8.9	BRN F-C SAND TR SILT, GVL (Flu) (SP-Sm)			5.0		
	3D	5.0 - 7.0	6.6 8.9	Do 2D (Fill) (SP-Sm)					
	4D	7.0 - 9.0	11.10 8.9	BRN F-C SAND, TR BRICK SILT, GVL (Fill) (SP-Sm)			9.5 10.0		
	5D	10.0 - 12.0	3.4 5.7	BRN F-C SAND, TR SILT, GVL (S) (SP-Sm)		S			
	6D	15.0 - 17.0	7.7 11.11	Do 5D (SP-Sm)			15.0		
	7D	20.0 - 22.0	3.5 8.8	BRN F-C SAND, TR SILT, MICA, GVL (SP-Sm)			20.0		
	8D	25.0 - 27.0	4.6 8.11	BRN F-C SAND, SM SILT, TR GVL (Sm)			25.0		
	9D	30.0 - 32.0	5.10 13.13	BRN F-C SAND, SM SILT, TR MICA (Sm)			30.0		
	10D	35.0 - 37.0	5.8 9.11	BRN F-C SAND, SM SILT (Sm)		35.0			
	11D	40.0 - 42.0	10.11 12.11	Do 10D (Sm)		40.0		3.25" ANGLE CASING ADVANCED TO 40.0	
						42.0		E.O.B. @ 42.0	
						45.0			
						50.0			

ARTLY  
SUNNY  
10'S

END  
200

MUESER RUTLEDGE CONSULTING ENGINEERS

SHEET 1 OF 3  
 FILE NO. 8761  
 BORING NO. M-6  
 SURFACE ELEV. \_\_\_\_\_

PROJECT Avenue V Pump Station

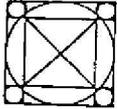
PROJECT LOCATION Brooklyn, NY

RES. ENGR. Kevin Ferguson

DAILY PROGRESS	SAMPLE			SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
	NO.	DEPTH	BLOWS/6"					
10/27/00 START: 0800	1D	0.5 - 2.5	9-7 2-3	BRN SANDY SILT, SM BLK ASPHALT CLINDERS (Fill) (Sm)	(Fill)			BROK UP 4" CONC SL
	2D	2.5 - 4.5	6-7 7-9	BRN F C SAND, SM SILT, TR ASPHALT GVL (Fill) (Sm)				
	3D	5.0 - 7.0	5-5 5-6	BRN F C SAND, TR SILT, GVL (S) (SP-SM)	(S)	5.0		
	4D	7.0 - 9.0	9-5 5-6	Do 3D (SP-SM)				
	5D	10.0 - 12.0	2-3 3-3	Do 3D (SP-SM)		10.0		
	6D	15.0 - 17.0	6-7 7-9	BRN F C SAND, SM GVL, TR SILT (SP-SM)		15.0		
	7D	20.0 - 22.0	5-3 4-4	BRN F C SAND, TR GVL, SILT (SP-SM)		20.0		
	8D	25.0 - 27.0	5-6 7-8	Do 7D (SP-SM)		25.0		
	9D	30.0 - 32.0	5-6 7-1	BRN F C SAND, SM SILT, TR GVL (Sm)		30.0		
	10D	35.0 - 37.0	2-6 10-13	Do 1D (Sm)		35.0		
	11D	40.0 - 42.0	5-8 10-9	Do 9D (Sm)		40.0		
	12D	45.0 - 47.0	4-6 7-9	BRN F C SAND, SM SILT (Sm)		45.0		
						46.0		CONC. 17.0

CONC  
5.0'S

ET



# DDC

3903A

City of New York Department of Design and Construction

Kenneth Holden Division of Technical Support  
Commissioner

Bureau of Site Engineering

Mark A. Canu  
Assistant Commissioner  
Technical Support

## Transmittal

30-30 Thomson Avenue  
Long Island City, NY 11101

Tel. 718 / 391-1391  
Fax 718 / 391-1651

www.ci.nyc.ny.us/buildnyc  
CANUM@ddclan.ci.nyc.ny.us

Date: November 15, 2000

To: Mr. Saad Mallik, P.E.  
Dep't of Environmental Protection  
96-05 Horace Harding Expressway

Project: WP-169  
Avenue V Pump Station and Force Main  
Brooklyn

We are sending you the following:

1 set of inspector's logs and wellpoint readings for the above project.

Elevations will be taken shortly.

Please forward copies to the Consultant on the project.

Remarks:

The above are:

<input checked="" type="checkbox"/> as per your request	<input type="checkbox"/> disapproved	<input type="checkbox"/> for approval
<input type="checkbox"/> for your information	<input type="checkbox"/> approved	<input type="checkbox"/> for distribution
<input type="checkbox"/> for compliance	<input type="checkbox"/> approved as noted	<input type="checkbox"/>

c: Barcenilla  
Greenman Project File

From: Michael Greenman  
Title: Deputy Director  
Unit: Site Engineering  
Telephone No: 718-391-1327

# COVER SHEET

## THE CITY OF NEW YORK

DEPARTMENT OF DESIGN AND CONSTRUCTION  
BUREAU OF SITE ENGINEERING, SUBSURFACE EXPLORATION SECTION  
30-30 THOMSON AVE, 5th FLOOR, LONG ISLAND CITY, N.Y., 11101

JOB # 2903A PROJECT: AVENUE V PUMP STATION & FORCE MAIN  
BOROUGH: BROOKLYN LOCATION: B. 16TH STREET & BATH AVENUE

### IMPORTANT NOTE

The Boring Logs shown on this sheet are the result of inferences drawn by the Subsurface Exploration Section engineers or scientific personnel during boring operations at the site, and from certain evidence, viz. (1) samples of subsurface materials recovered during boring operations; (2) the logs kept by the drill operator and the inspector, which contain, among other things, expression of their opinions as to the nature of subsurface materials encountered during boring operations; and (3) other records concerning the site deemed pertinent by the engineers. The driller's log, the inspector's log, the samples and the records, together with the engineer's reports, are made available for inspection and study by the bidders so that they may draw their own inferences from all of the available evidence.

Bidders are warned that in the subsurface, other than that actually penetrated by the borings, obstructions, both natural and man-made, and which are not indicated on the Boring Logs, may be encountered, and that the Boring Logs make no representations or warranties either as to the presence or absence of such obstructions, or as to their nature and extent. Where possible, borings are located to avoid all obstructions and previous construction which can be found by inspection of the surface, and the bidder is required to estimate the influence of such features from his own inspection of the site.

In addition, bidders are warned that in the subsurface other than that actually penetrated by the borings, soil or rock may vary widely, with regard to elevation, composition, texture, structure, perviousness, soundness, and other characteristics, from the descriptions given on the Boring Logs and all reports.

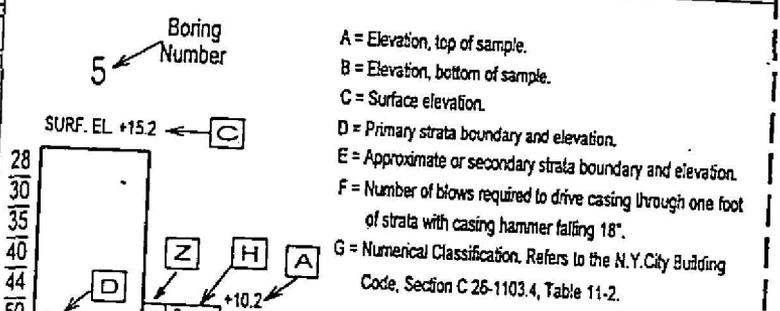
The "water reading", shows the elevation of water in the boring holes at the times indicated. They may or may not indicate the elevations of perched water or true ground water table during boring operations or subsequently.

### EXPLANATION OF TERMS

SOIL SIZES			
Description Term	Pass Sieve No.	Retained Sieve No.	Size Range
Clay	200	Atterberg Limits, Hydrometer Analysis	< .005 mm.
Silt	200		.005 to .074 mm.
Fine Sand	40 (60)	200	.074 to .420 mm.
Medium Sand	10	40	.420 to 2.00 mm.
Coarse Sand	4	10	2.00 to 4.76 mm.
Gravel (fine)	—	—	4.76 mm. to 3/4"
Gravel (coarse)	—	—	3/4" to 3"
Cobble	—	—	3" to 6"
Boulder	—	—	> 6"

Note: Special F-Sand (60) designated in the N. Y. City Building Code.

### BORING LEGEND



- A = Elevation, top of sample.
- B = Elevation, bottom of sample.
- C = Surface elevation.
- D = Primary strata boundary and elevation.
- E = Approximate or secondary strata boundary and elevation.
- F = Number of blows required to drive casing through one foot of strata with casing hammer falling 18".
- G = Numerical Classification. Refers to the N.Y. City Building Code, Section C 26-1103.4, Table 11-2.

GROUP SYMBOLS	UNIFIED SYSTEMS	QUANTITATIVE ESTIMATE
	Typical Names	Secondary Components
H	Well-graded gravels, gravel-sand mixtures, less than 5% fines.	AND
P	Poorly-graded gravels, gravels-sand mixtures, less than 5% fines.	SOME
J	Silty gravels, gravel-sand-silt mixtures, more than 12% fines.	LITTLE
I	Clayey gravels, gravel-sand-clay mixtures, more than 12% fines.	TRACE
	Well-graded sands, gravelly sands, less than 5% fines.	
	Poorly-graded sands, gravelly sands, less than 5% fines.	
	Silty sands, sand-silt mixtures, more than 12% fines.	
	Clayey sands, sand-clay mixtures, more than 12% fines.	
	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	
	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	
	Organic silts and organic silty clays of low plasticity.	
	Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	
	Inorganic clays of high plasticity. Fat clays.	
	Organic clays of medium to high plasticity, organic silts.	
	Peat and other highly organic soils.	

**GRAIN SIZE ABBREVIATIONS**

F = FINE, M = MEDIUM, C = COARSE  
\* = PREDOMINANT FRACTION (e.g. F-M\*)

The descriptive size terms in the Boring Logs were arrived at by estimate only, using standard samples for visual comparison.

These tables have been used as an approximate guide, with latitude for interpretation and selective judgement.

⊙ = Spoon Blows and or Rock Recovery for this material are below Minimum Load Rating. C 26-1103.0.

### SPOON SAMPLES

- Unless otherwise specified, sample spoon was driven 1.5 feet.
- H = Number of Blows required to drive sample spoon for each 6" increment of penetration, with spoon hammer falling 30".
- Z = Sample Number, or: M = Missed sample.
- U = Undisturbed sample.
- W = Wash sample.
- P = Pushed by weight of hammer.
- I = Insufficient recovery of undisturbed sample, sample put in jar.

### CORE DRILLING

- R = Run number.
- K = Elevation, at start of core drilling.
- Y = Elevation, at completion of Run.
- N = Percentage of rock core recovered.
- S = Core bit used if other than that shown.



**THE CITY OF NEW YORK**

**DEPARTMENT OF DESIGN AND CONSTRUCTION**

BUREAU OF SITE ENGINEERING, SUBSURFACE EXPLORATION SECTION  
30-30 THOMSON AVE., 5th FLOOR, LONG ISLAND CITY, N.Y., 11101

BOROUGH: BROOKLYN      JOB # 2903A      BORING # M1  
PROJECT: AVENUE V FORCE MAIN AND PUMP STATION  
LOCATION: BATH BEACH

INSPECTOR: BARRY A. SCHWARTZ, CPG  
CONTRACTOR: AQUIFER DRILLING & TESTING  
DRILLER: DAVID CARTER  
HELPER: PAUL KHAN  
CONSULTANT: MUSER RUTLEDGE

**BORING LOG**

SHEET 1 OF 1

Date Started: 10-23-00  
Date Finished: 10-24-00

Depth Of Hole: 52'      Spoon Type: 2" od      Weight Of Hammer: For Casing: 300 lb;  
Rig Type: B-57      Drilling Bit Type: AUGER      Weight Of Hammer: For Spoon: 140 lb;  
Casing Size: XXX      Depth Of Casing: XXX

PAVEMENT CORE DATA  
PC # XXX  
Asphalt: XXX  
Concrete: XXX

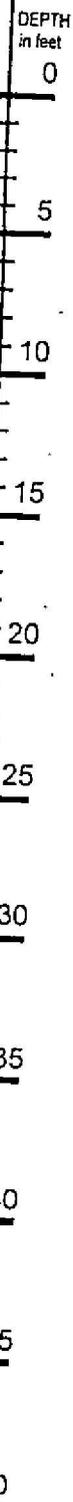
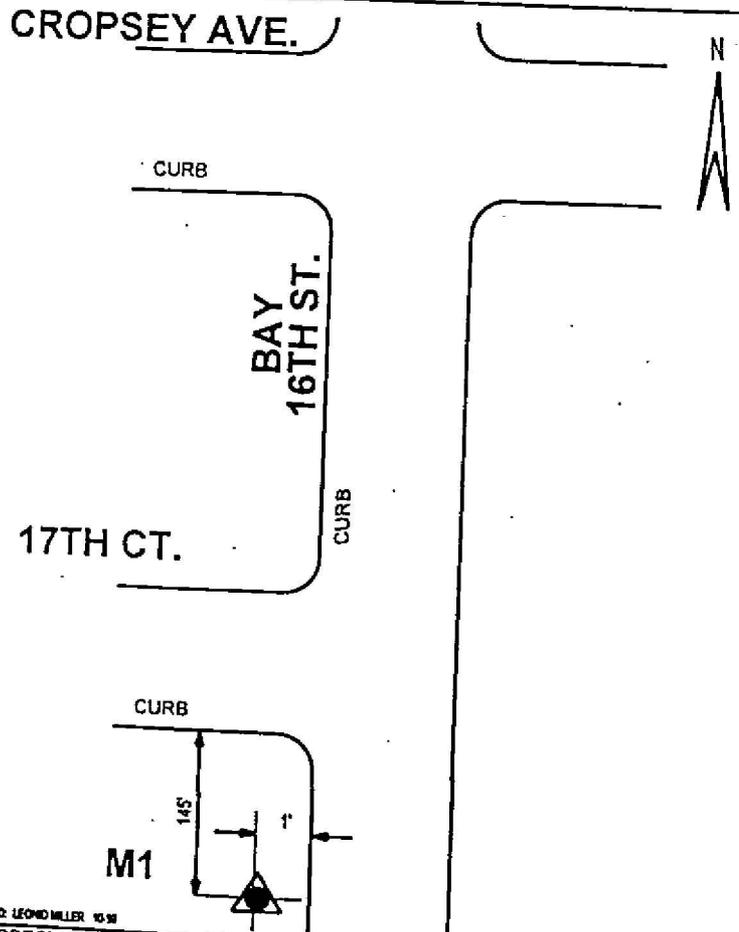
Wellpoint Installed: 25'  
PVC Riser: 20'  
Screen: 5'

**GROUND WATER RECORD**

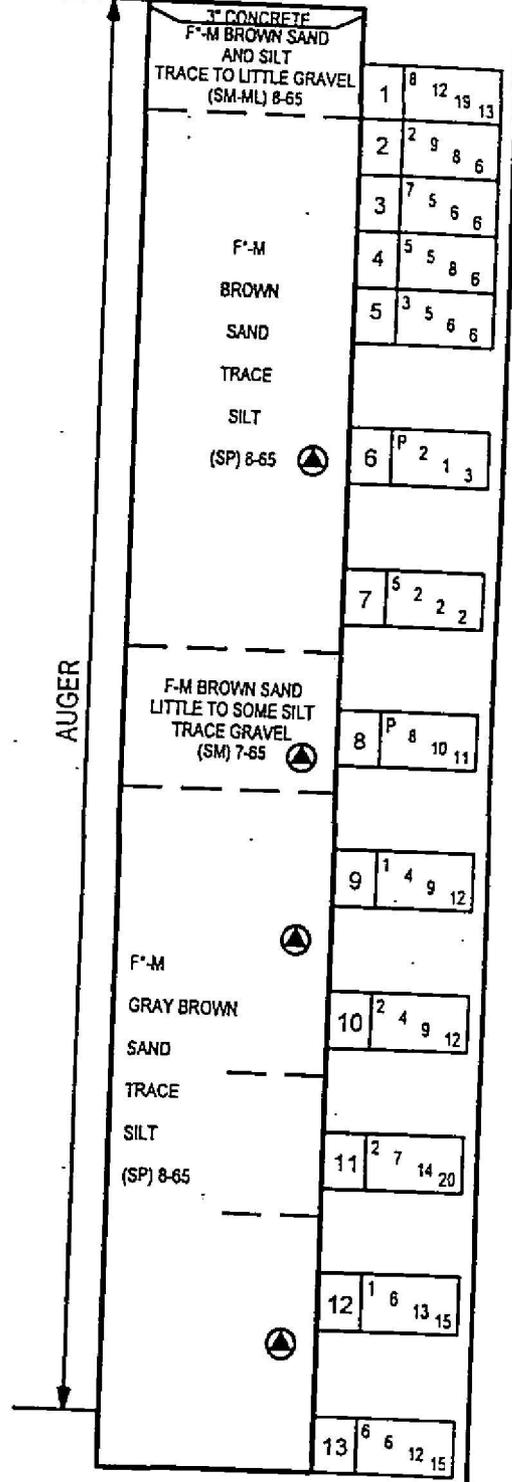
DATE	TIME	DEPTH
10-24-00	1:00PM	15.8'
10-27-00	11:00AM	16.8'

- LEGEND**
- ⊕ Test Boring
  - Test Boring (Failed Attempt)
  - ⊕ Previously Done Test Boring (see job as noted)
  - ⊕ Environmental Test Boring
  - Pavement Core
  - ▲ Test Boring With Observation Well
  - ⊕ Swamp (Current or Former)

**LOCATION PLAN (NOT TO SCALE)**



**M1**  
SURF. EL. X



REVISED: LEON MILLER 10/31

INSPECTOR'S REMARKS:  
XXX  
XXX

**THE CITY OF NEW YORK**  
**DEPARTMENT OF DESIGN AND CONSTRUCTION**  
 BUREAU OF SITE ENGINEERING. SUBSURFACE EXPLORATION SECTION  
 30-30 THOMSON AVE, 5th FLOOR, LONG ISLAND CITY, N.Y., 11101

BOROUGH: BROOKLYN      JOB # 2903A      BORING # M2  
 PROJECT: AVENUE V FORCE MAIN AND PUMP STATION  
 LOCATION: BATH BEACH

INSPECTOR: BARRY A. SCHWARTZ, CPG  
 CONTRACTOR: AQUIFER DRILLING & TESTING  
 DRILLER: DAVID CARTER  
 HELPER: PAUL KHAN  
 CONSULTANT: MUSER RUTLEDGE

**BORING LOG**  
 SHEET 1 OF 1  
 Date Started: 10-25-00  
 Date Finished: 10-26-00

Depth Of Hole: 42'      Spoon Type: 2" od      Weight Of Hammer: For Casing: 300 lb;  
 Rig Type: B-57      Drilling Bit Type: AUGER      Weight Of Hammer: For Spoon: 140 lb;  
 Casing Size: XXX      Depth Of Casing: XXX

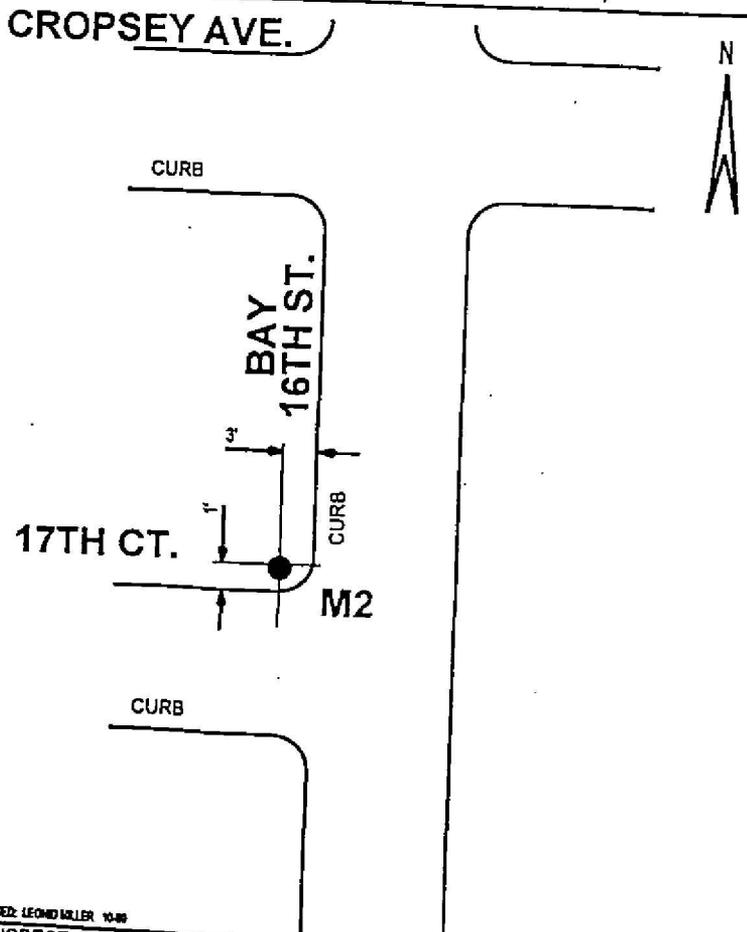
PAVEMENT CORE DATA  
 PC # XXX      Wellpoint Installed: XXX  
 Asphalt: XXX      PVC Riser: XXX  
 Concrete: XXX      Screen: XXX

**GROUND WATER RECORD**

DATE	TIME	DEPTH
10-26-00	2:00PM	15'
XXX	XXX	XXX

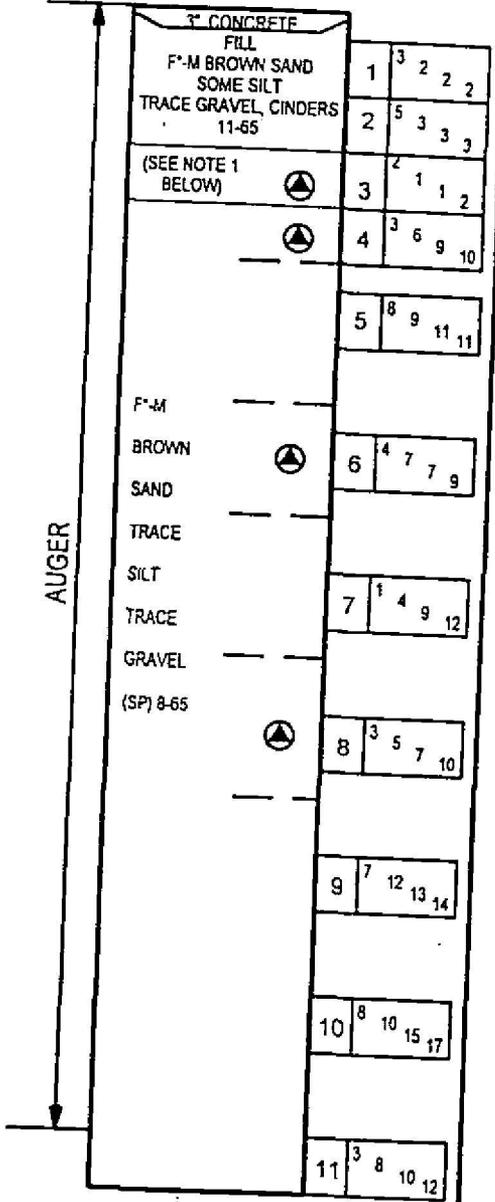
- LEGEND**
- Test Boring
  - Test Boring (Failed Attempt)
  - ⊕ Previously Done Test Boring (see job as noted)
  - ⊗ Environmental Test Boring
  - Pavement Core
  - ▲ Test Boring With Observation Well
  - ⬮ Swamp (Current or Former)

**LOCATION PLAN (NOT TO SCALE)**



DEPTH in feet  
 0  
 5  
 10  
 15  
 20  
 25  
 30  
 35  
 40

**M2**  
 SURF. EL. X



NOTE 1:  
 F-M BROWN SAND  
 SOME TO AND SILT  
 (SM) 8-65  
 TILL

REVISION: LEONID MILLER 10-26  
 INSPECTOR'S REMARKS:  
 XXX  
 XXX

**THE CITY OF NEW YORK**

**DEPARTMENT OF DESIGN AND CONSTRUCTION**

BUREAU OF SITE ENGINEERING, SUBSURFACE EXPLORATION SECTION  
30-30 THOMSON AVE, 5th FLOOR, LONG ISLAND CITY, N.Y., 11101

BOROUGH: BROOKLYN      JOB # 2903A      BORING # M3  
PROJECT: AVENUE V FORCE MAIN AND PUMP STATION  
LOCATION: BATH BEACH

INSPECTOR: BARRY A. SCHWARTZ, CPG  
CONTRACTOR: AQUIFER DRILLING & TESTING  
DRILLER: DAVID CARTER  
HELPER: PAUL KHAN  
CONSULTANT: MUSER RUTLEDGE

**BORING LOG**

SHEET 1 OF 1

Date Started: 10-25-00  
Date Finished: 10-25-00

Depth Of Hole: 47'  
Rig Type: B-57  
Casing Size: XXX

Spoon Type: 2" od  
Drilling Bit Type: AUGER  
Depth Of Casing: XXX

Weight Of Hammer: For Casing: 300 lb;  
Weight Of Hammer: For Spoon: 140 lb;

**PAVEMENT CORE DATA**

PC # XXX  
Asphalt: XXX  
Concrete: XXX

Wellpoint Installed: XXX

PVC Riser: XXX  
Screen: XXX

**GROUND WATER RECORD**

DATE	TIME	DEPTH
10-25-00	11:00AM	20'
XXX	XXX	XXX

**LEGEND**

- ⊕ Test Boring
- Test Boring (Failed Attempt)
- ⊙ Previously Done Test Boring (see job as noted)
- ⊗ Environmental Test Boring
- Pavement Core
- ▲ Test Boring With Observation Well
- Swamp (Current or Former)

**LOCATION PLAN (NOT TO SCALE)**

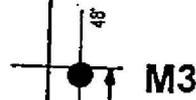
CROPSY AVE.

CURB

BAY 16TH ST.

CURB

17TH CT.



DEPTH in feet

0

5

10

15

20

25

30

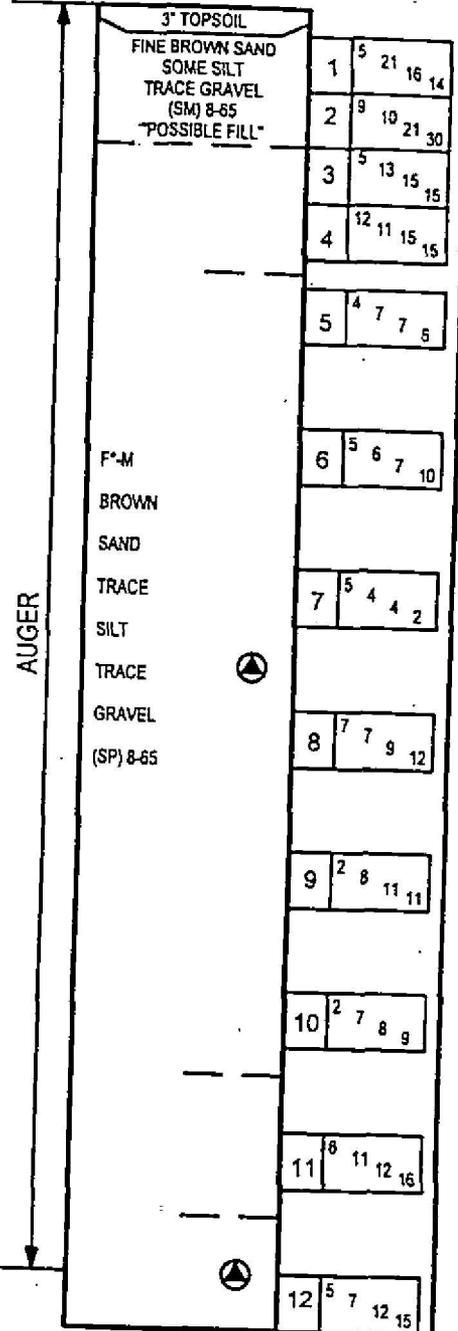
35

40

45

**M3**

SURF. EL. X



REVISED: LEONID MILLER 10/00

INSPECTORS REMARKS:

XXX  
XXX

THE CITY OF NEW YORK

DEPARTMENT OF DESIGN AND CONSTRUCTION  
 BUREAU OF SITE ENGINEERING, SUBSURFACE EXPLORATION SECTION  
 30-30 THOMSON AVE., 5th FLOOR, LONG ISLAND CITY, N.Y., 11101

BOROUGH: BROOKLYN JOB # 2903A BORING # M4  
 PROJECT: AVENUE V FORCE MAIN AND PUMP STATION  
 LOCATION: BATH BEACH

INSPECTOR: BARRY A. SCHWARTZ, CPG  
 CONTRACTOR: AQUIFER DRILLING & TESTING  
 DRILLER: DAVID CARTER  
 HELPER: PAUL KHAN  
 CONSULTANT: MUSER RUTLEDGE

**BORING LOG**  
 SHEET 1 OF 1  
 Date Started: 10-27-00  
 Date Finished: 10-27-00

Depth Of Hole: 42' Spoon Type: 2" od  
 Rig Type: B-57 Drilling Bit Type: AUGER  
 Casing Size: XXX Depth Of Casing: XXX

Weight Of Hammer: For Casing: 300 lb;  
 Weight Of Hammer: For Spoon: 140 lb;

**PAVEMENT CORE DATA**  
 PC # XXX  
 Asphalt: XXX  
 Concrete: XXX

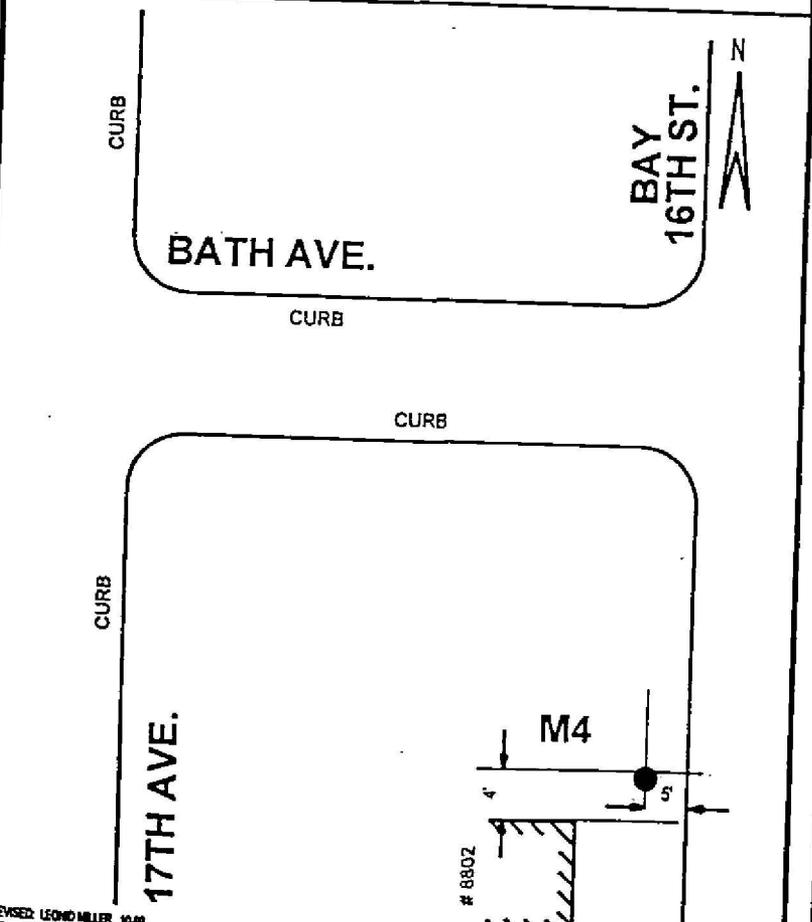
Wellpoint Installed: XXX  
 PVC Riser: XXX  
 Screen: XXX

**GROUND WATER RECORD**  

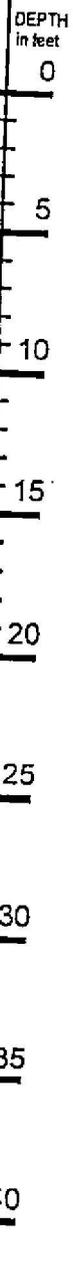
DATE	TIME	DEPTH
10-27-00	2:00PM	26'
XXX	XXX	XXX

- LEGEND**
- Test Boring
  - Test Boring (Failed Attempt)
  - ⊕ Previously Done Test Boring (see job as noted)
  - ⊙ Environmental Test Boring
  - ◻ Pavement Core
  - ⊠ Test Boring With Observation Well
  - ⊙ Swamp (Current or Former)

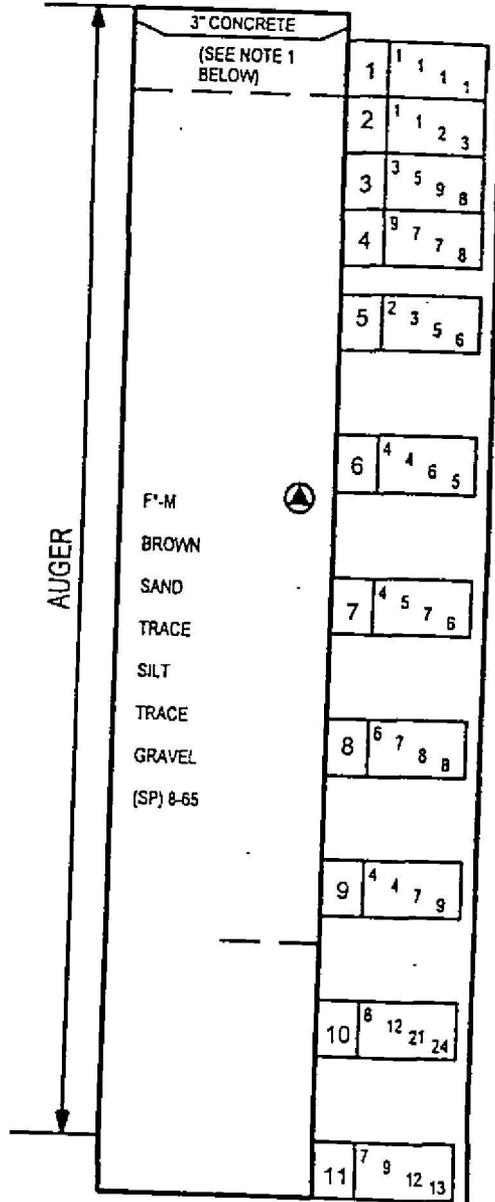
**LOCATION PLAN (NOT TO SCALE)**



REVISED LEONID MILLER 10-00  
 INSPECTOR'S REMARKS:  
 XXX  
 XXX



**M4**  
 SURF. EL. X



NOTE 1:  
 FILL  
 FINE BROWN SAND  
 SOME SILT  
 11-55

**THE CITY OF NEW YORK**

**DEPARTMENT OF DESIGN AND CONSTRUCTION**

BUREAU OF SITE ENGINEERING. SUBSURFACE EXPLORATION SECTION  
30-30 THOMSON AVE, 5th FLOOR, LONG ISLAND CITY, N.Y., 11101

BOROUGH: BROOKLYN JOB # 2903A BORING # M5  
PROJECT: AVENUE V FORCE MAIN AND PUMP STATION  
LOCATION: BATH BEACH

INSPECTOR: BARRY A. SCHWARTZ, CPG  
CONTRACTOR: AQUIFER DRILLING & TESTING  
DRILLER: DAVID CARTER  
HELPER: PAUL KHAN  
CONSULTANT: MUSER RUTLEDGE

**BORING LOG**

SHEET 1 OF 1

Date Started: 10-26-00

Date Finished: 10-26-00

Depth Of Hole: 42'  
Rig Type: B-57  
Casing Size: XXX

Spoon Type: 2" od  
Drilling Bit Type: AUGER  
Depth Of Casing: XXX

Weight Of Hammer: For Casing: 300 lb;  
Weight Of Hammer: For Spoon: 140 lb;

PAVEMENT CORE DATA  
PC # XXX  
Asphalt: XXX  
Concrete: XXX

Wellpoint Installed: XXX  
PVC Riser: XXX  
Screen: XXX

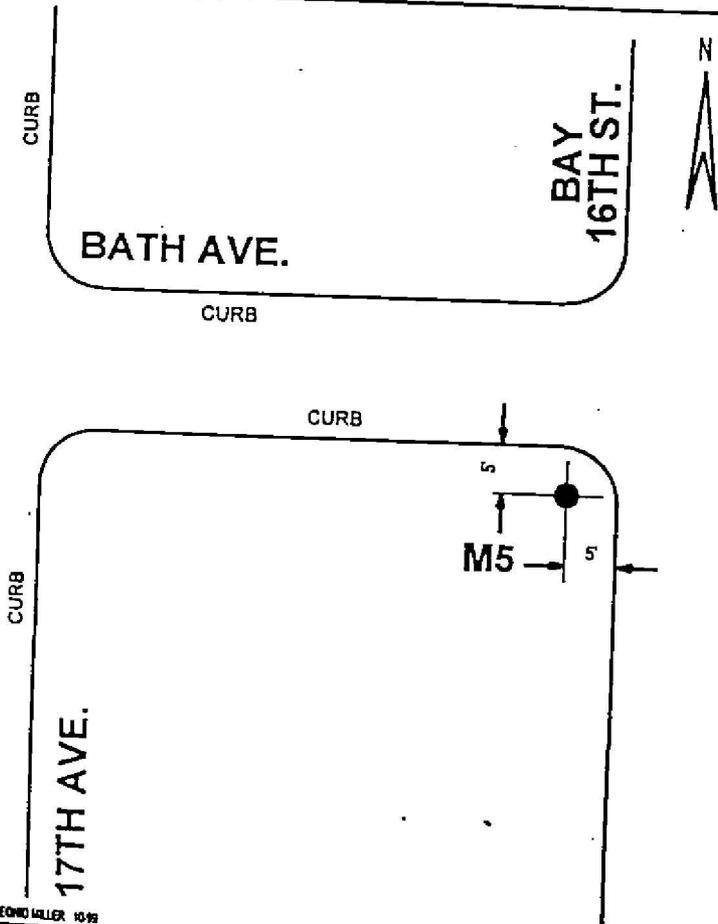
**GROUND WATER RECORD**

DATE	TIME	DEPTH
10-26-00	3:00PM	25'
XXX	XXX	XXX

**LEGEND**

- ⊕ Test Boring
- Test Boring (Failed Attempt)
- ⊙ Previously Done Test Boring (see job as noted)
- ⊗ Environmental Test Boring
- Pavement Core
- ▲ Test Boring With Observation Well
- ⬮ Swamp (Current or Former)

**LOCATION PLAN (NOT TO SCALE)**



REVISED: LEONARD MILLER 10/00

INSPECTOR'S REMARKS:  
XXX  
XXX

DEPTH  
in feet  
0

5

10

15

20

25

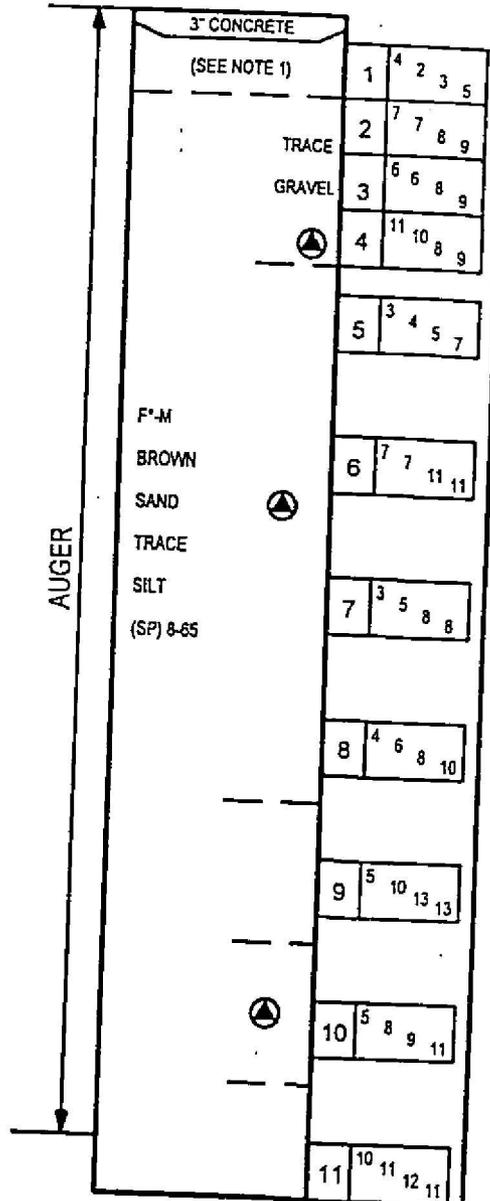
30

35

40

**M5**

SURF. EL. X



**NOTE 1:**

FILL  
F-M BROWN SAND  
LITTLE TO SOME SILT  
TRACE GRAVEL  
11-85

**THE CITY OF NEW YORK**

DEPARTMENT OF DESIGN AND CONSTRUCTION  
 BUREAU OF SITE ENGINEERING, SUBSURFACE EXPLORATION SECTION  
 30-30 THOMSON AVE, 5th FLOOR, LONG ISLAND CITY, N.Y., 11101

BOROUGH: BROOKLYN      JOB # 2903A      BORING # M6  
 PROJECT: AVENUE V FORCE MAIN AND PUMP STATION  
 LOCATION: BATH BEACH

INSPECTOR: BARRY A. SCHWARTZ, CPG  
 CONTRACTOR: AQUIFER DRILLING & TESTING  
 DRILLER: DAVID CARTER  
 HELPER: PAUL KHAN  
 CONSULTANT: MUSER RUTLEDGE

**BORING LOG**

SHEET 1 OF 1

Date Started: 10-27-00  
 Date Finished: 10-27-00

Depth Of Hole: 47'      Spoon Type: 2" od  
 Rig Type: B-57      Drilling Bit Type: AUGER  
 Casing Size: XXX      Depth Of Casing: XXX

Weight Of Hammer: For Casing: 300 lb;  
 Weight Of Hammer: For Spoon: 140 lb;

PAVEMENT CORE DATA  
 PC # XXX  
 Asphalt: XXX  
 Concrete: XXX

Wellpoint Installed: 45'  
 PVC Riser: 40'  
 Screen: 5'

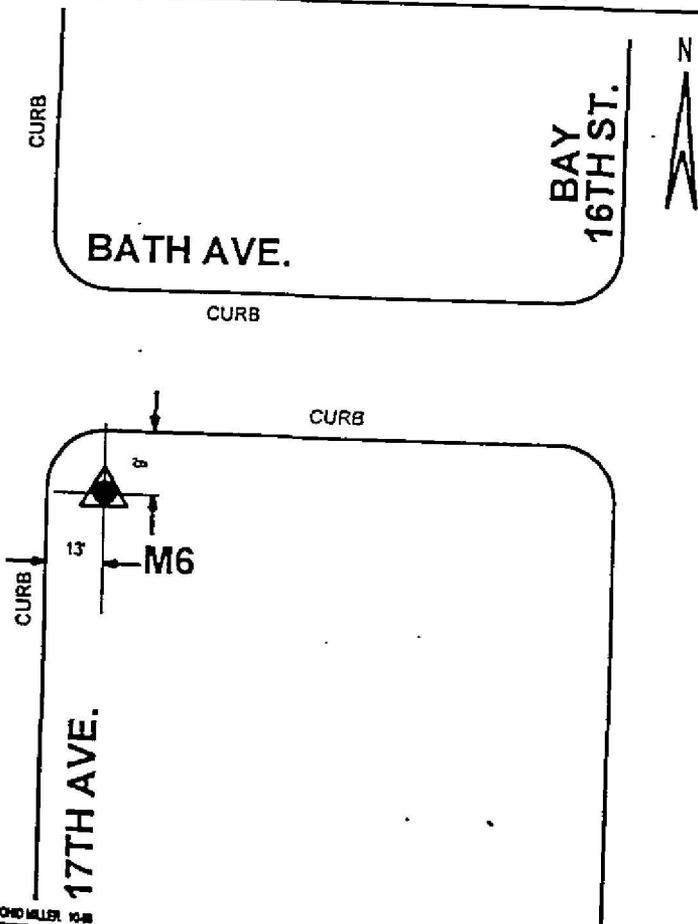
**GROUND WATER RECORD**

DATE	TIME	DEPTH
10-27-00	11:00AM	25.8'
XXX	XXX	XXX

**LEGEND**

- ⊙ Test Boring
- Test Boring (Failed Attempt)
- ⊕ Previously Done Test Boring (see job as noted)
- ⊗ Environmental Test Boring
- Pavement Core
- ▲ Test Boring With Observation Well
- ⊙ Swamp (Current or Former)

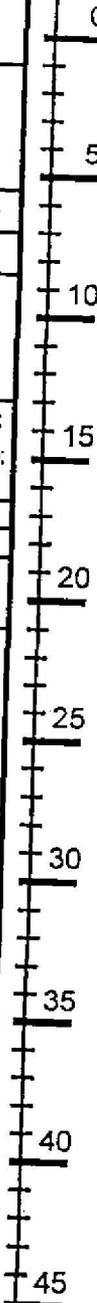
**LOCATION PLAN (NOT TO SCALE)**



REVISED: LEONID MILLER, 10/28

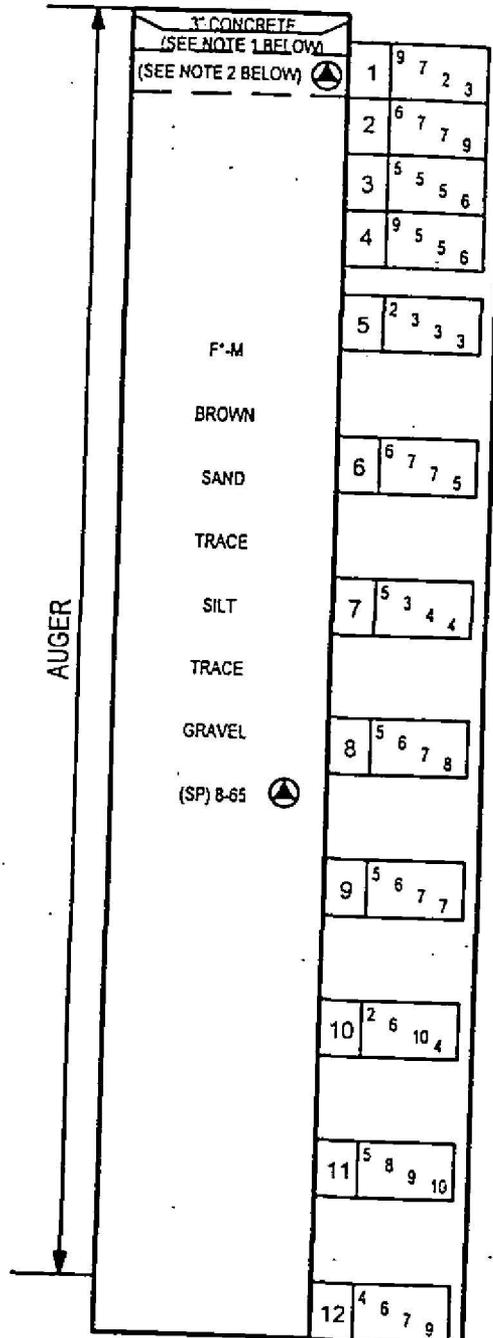
INSPECTOR'S REMARKS:  
 XXX  
 XXX

DEPTH  
 in feet



**M6**

SURF. EL. X



NOTE 1:  
 FILL  
 BLACK CINDERS  
 11-65

NOTE 2:  
 FINE BROWN SAND  
 AND SILT  
 (SM-ML) 8-65