PHASE 1A ARCHAEOLOGICAL ASSESSMENT

NYC DEPARTMENT OF ENVIRONMENTAL PROTECTION

NEWTOWN CREEK WATER POLLUTION CONTROL PLANT

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TABLE OF CONTENTS

FIGURES

FIGURES (continued)

I. INTRODUCTION AND METHODOLOGY

The New York City Department of Environmental Protection (DEP) has proposed the expansion and upgrading of the Newtown Creek Water Pollution Control Plant (WPCP). At present, this plant, on a 32-acre site along Newtown Creek in the Greenpoint section of the Borough of Brooklyn, treats wastewater from a drainage area that includes sections of Brooklyn, Queens and Manhattan. It was designed for an "average dry weather flow" of 310 million gallons a day (mgd). However, a Consent Judgement by the New York State Supreme Court obliges the city to upgrade the level of treatment at the plant to meet the federal Environmental Protection Agency's definition of secondary treatment, with construction completed by December 31, 2007. The city also proposes to provide adequate treatment capacity for projected increases in raw sewage flows by the year 2045.

In order to accommodate the new proposed facilities (both facility plan options are described in DEP 1995:8-10, Figs.8-11), the Newtown Creek WPCP requires additional land, and under both options the plant site would be expanded to include three adjacent parcels totalling 17.3 acres. These three parcels have been designated Expansion Sites 1, 2 and 3.

Expansion Site 1

Block 2491, Lot 101, currently owned by the Exxon Oil and Refining Co., is a 7.6 acre, basically V-shaped parcel, bounded on the south by the present Newtown Creek WPCP, on the west by Provost Street, on the north by Expansion Site 3 (Block 2491 Lot 201, formerly the center line of Eagle Street, now demapped) and Lot 150 of Block 2491 (formerly the center line of Duck Street, now demapped), and on the east by Whale Creek Canal and Newtown Creek. Under the DEP's proposal, Freeman Street west of Provost will also be demapped and absorbed into the expanded WPCP (See Fig. 1).

Expansion Site 2

Block 2527, Lot 2 is currently owned by the Mobil Oil Corp. This 7.2-acre trapezoidal lot is bounded on the south by Greenpoint Avenue, the west by North Henry Street, the north by Block 2527 Lot 27, and on the east by Kingsland Avenue. North Henry Street north of Greenpoint Avenue will be demapped and added to the expanded WPCP (See Fig. 1).

Expansion Site 3

Block 2491, Lot 201, currently owned by the Williamsburg Steel Products Co., is a 2.5 acre, roughly triangular lot, bounded on the south by Expansion Site 1 (Block 2491 Lot 101, formerly the center line of Eagle Street, now demapped), on the west by Provost Street, on the north and northeast by Paidge Avenue and Block 2491 Lot 150

(See Fig. 1).

A Phase 1A archaeological assessment completed for the Newtown Creek Water Pollution Control Plant Upgrading (CEQR No.89-170K, Kearns, Kirkorian and Schaefer 1989) has been used extensively in the preparation of the following report. The New York City DEP had proposed the upgrading and expansion of the original 32-acre plant, in order to comply with the requirements of the Water Pollution Act of 1972 and the 1988 New York State Supreme Court Judgment. Also proposed was the expansion of plant capacity from 310 mgd to 360 mgd to treat expected increases in sewage flows to the year 2020. In order to satisfy the concerns of the New York City Landmarks Preservation Commission (LPC), Historical Perspectives, Inc. performed an archaeological assessment of Block 2515 and demapped Green Street east of Provost Street, a 4-acre parcel adjacent to the original Newtown Creek WPCP on the north, and abutting present Expansion Site 1 to the south along Freeman Street.

The Department of Environmental Protection is required by the City Environmental Quality Review to submit an archaeological assessment of proposed Newtown Creek WPCP Expansion Sites 1, 2 and 3. The purpose of such a documentary study is to determine the possibility that the site has ever contained prehistoric or historical cultural resources, their significance, and the likelihood that these resources have survived subsequent episodes of ground disturbance. The New York City Landmarks Preservation Commission (LPC) has reviewed the project and has determined that the study area may have a significant potential for containing prehistoric American remains. The following "Phase 1A Archaeological Assessment Report," prepared by Historical Perspectives, Inc. and based on an archival study of the site history and development, addresses the concerns for the preservation of cultural resources by evaluating the likelihood that potentially significant cultural resources ever existed on the Newtown Creek WPCP Expansion Sites, and that such resources might still exist. In order to address these concerns, various sources of data were researched.

Primary source material on the project site was collected to determine the study lot's original topography, and to compile a building history and disturbance record. Historical maps and descriptions of the study area were gathered at the Local History and Map Divisions of the New York Public Library and the Brooklyn Historical Society. The Department of Buildings' Block and Lot files were consulted. Building records were also used to determine the extent and types of subsurface disturbance. Additional information concerning subsurface disturbance, and topography in the form of boring logs was sought at the Subsurface Exploration Section of the New York City Topographical Bureau and from Blasland, Bouck & Lee, Inc. Borings logs from the earlier plant expansion project (Kearns, Kirkorian and Schaefer 1989) were also

utilized.

To place the Expansion sites within an historical context, local and regional histories were examined for pertinent material. The collections of the New York Public Library, the Brooklyn Central Library, and the Brooklyn Historical Society were utilized in the course of research. Particularly useful was William L. Felter's 1919 work, *Historic Greenpoint*, both for its historical narrative and its contemporary observations, Henry Stiles' *History of the City of Brooklyn, New York*, and the Brooklyn Historical Society's Newspaper Clippings File. In addition to this documentary evidence, informants familiar with modern Greenpoint were sought and interviewed.

Information on inventoried historical and prehistoric archaeological sites in the vicinity of the Expansion sites has been provided by the New York State Office of Parks, Recreation and Historic Preservation (OPRHP) and the New York State Museum. These institutions have also given their assessments of potential archaeological significance of the general area based on previously developed models. These data, taken from the 1989 report on the Newtown Creek WPCP upgrading (Kearns, Kirkorian and Schaefer 1989), cover the current expansion sites as well. The correspondence may be found in Appendix A of this report.

William Ritchie's *The Archaeology of New York State* provided a valuable overview of Native American culture and lifeways during the prehistoric period. Other archaeological literature, available site reports and journal publications, were researched for data specific to the project area.

Although no subsurface investigations were conducted, a site visit (5-23-95) and photographic record of current conditions was made. (See Photos 1-14)

III. ENVIRONMENTAL SETTING

The Wisconsin glaciation was the last great episode of the North American Pleistocene. This glacial period commenced tens of thousands of years ago, and the glaciers did not begin to recede from the northeastern United States until c.18,000 years ago. With the final retreat of the ice, Long Island, a section of the coastal plain [i.e., elevated sea bottom demonstrating low topographic relief and extensive marshy tracts (Eisenberg 1978:7)] was covered with a layer of glacial drift brought forward by the retreating ice. The terminal moraine, two great ridges that form the north (Harbor Hill Moraine) and south (Ronkonkoma Moraine) forks of Long Island, combine west of central Nassau County to form a single ridge marking the limit of advance of the ice sheets, the result of their numerous temporary stabilizations. The moraine is almost two hundred feet high in some places in Brooklyn and Queens (Gratacap 1901:106-107; Schuberth 1968:181, 184). In Kings County the moraine lies approximately 4.7 miles south of the project area, along Eastern Parkway.

North of the moraine, the complex rising and subsidence of the coastal plain, relieved of its glacial burden, as well as the rising sea level, caused by the volume of melting ice, created a coastline of embayed rivers or estuaries, with extensive marsh tracts, which stabilized approximately 3,000 years ago (Schuberth 1968:195, 199). From available maps (e.g., the Taylor and Skinner Map of 1781 and the 1849 Sidney Map), we know that until the second half of the nineteenth century, the study area was situated in such an inundated marsh or meadow near the shore of Newtown Creek and its tributary Whale Creek, which drained the study area environs. (See Figs. 6, 7, 8)

> The stream [Newtown Creek] and its tributaries had their rise in wooded swamps, flaggy pools, fed by flowing springs, all of which opened out in a broad expanse of lowlands, consisting of extensive marshes, muddy flats, and bogs. On every tide these marshy tracts and adjacent lowlands were flooded, a condition caused mainly by the backing up of the two tides from the west and east, which met at Hell Gate (Harper 1901:339-40).

The Newtown Creek WPCP Expansion sites and their surroundings have been considerably altered during the nineteenth and twentieth centuries. Before c. 1870, the study sites were part of a large tidal marsh which lay along both sides of Newtown Creek. On the Brooklyn side these meadows stretched almost as far west as present McGuinness Boulevard (then Oakland or Liberty Street, See Figs. 7, 8, 10). Whale Creek drained its section of the marsh and "had many small tributaries and devious courses" (Felter 1919:14). One such unnamed stream ran just west of Provost Street, within 60 feet of Expansion Sites 1 and 3. Depicting a slightly different topography, a WPA Rock Line Map shows the stream actually on

Provost with the western edges of Sites 1 and 3 within the streambed. The northeastern part of Site 1 between Whale and Newtown Creek was also under water (See Figs. 10, 14a - former shoreline runs through Block "2501"; WPA 1935). A tributary of Newtown Creek had its beginning in the northern section of Site 2, while another flowed to Newtown Creek immediately south of Greenpoint Avenue (See Fig. 10).

Beginning in the 1850s, Neziah Bliss encouraged the development of Greenpoint by improving access, laying out streets and houselots. However, there was still "not a single pavement and hardly a well" in Greenpoint as late as 1859 (*Brooklyn Daily Eagle*:2-12-1936), in spite of the fact that the 1855 Dripps Map of the area shows all the (proposed) streets laid out and Whale Creek tamed as Whale Creek Canal (See Fig. 9). Early development was confined to the western section of Greenpoint which was nearer the cities of New York and Brooklyn, and required fewer filling operations prior to construction. As land became scarce in western Greenpoint, the lands along Newtown Creek became more attractive, and the low-lying marshland was filled. These filling episodes, as well as the bulkheading of Whale Creek and its transformation into Whale Creek Canal, greatly altered the Expansion Sites' topography. The enormous amount of fill created the current site elevations of between 0 and 15 feet above sea level, generally sloping downward as Newtown Creek is approached. Ten-foot contour lines run through all three expansion sites (U.S.G.S. Topographic Map, Brooklyn Quadrangle) (See Fig. 2).

Site 1: Boring Log Data

A number of soil borings were performed on Site 1 in 1989 (EA 1990:Appendix C). These borings show a layer of fill overmantle on Site 1 with a thickness of 6.75 feet to more than 18.5 feet. In all cases, the ground water level penetrates the fill layer (See Appendix B). Other borings logs from blocks adjacent to the study parcels show a layer of fill between 14 and 22 feet thick, with the water table generally extending into the fill layer. Such data indicates that the original surface was frequently, or even continuously under water, supporting the conclusion that the pre-fill landscape was a salt marsh, and that sections of Site 1 along Whale Creek Canal and Newtown Creek were completely and continuously under water. Furthermore, the presence of grass in many of the below-fill layers (EAW-5,-7,-8,-9,-10,-11,-13,-14,-15,-18,-19), suggests the potential survival of pre-fill surfaces throughout Site 1 (City of New York Department of Public Works, Sewage Treatment Works, 1942; City of New York Department of Environmental Protection, Record of Borings Newtown Creek PCP, 1962; Kearns, Kirkorian and Schaefer 1989:Addendum) (See Appendix B). Presently, Site 1 slopes gradually downward from Provost Street, which according to the 1993 atlas has an elevation of more than 11 feet, dropping to between five and six feet along Whale

Creek Canal (See Fig. 21a). A rubble berm runs the length of Duck Street, approximately 12 feet higher than the neighboring lot to the west, and about 6 feet above the adjacent sections of Site 1 to the east. It slopes steeply downward, and then gently downward toward an elevation of between about 4 and 5 feet along Whale Creek Canal and Newtown Creek (See Photos 5,6). An earthen heap in this otherwise flat terrain, appears to be mounded fill, perhaps deposited when the buried tanks in this area were removed (See Fig. 21b and Photos 7, 8). Freeman Street slopes down from an elevation of more than 11 feet at Provost, to 5.07 feet at the canal.

Site 2: Boring Log Data

No borings were available for Expansion Site 2, which contains fifteen large above ground storage tanks, connected by a maze of above ground piping (See Photos 11-14). However, borings performed in 1990 on the adjacent section of the Newtown Creek WPCP, immediately west of North Henry Street (B-101 through B-105 - See Appendix B), and those from 1942 on North Henry Street and west along Green Street (beginning about 50 feet west of the northern tip of Site 2), indicate conditions similar to those described in the previous paragraph, namely, an extremely thick fill overmantle (approximately 16 to 18 feet or greater), and a water table with a level which fluctuates wholly within this fill layer. Although the 1990 borings begin at a surface elevation of 8 to 11 feet, the site visit observed that portions of Site 2 were never filled to present street level as on neighboring blocks (See Photo 14). Near the intersection of Greenpoint and Kingsland Avenues, the surface of Site 2 is approximately 5 feet below the adjacent sidewalk, giving it an elevation of only about 1.58 feet. Boring #38 from 1942 begins at a surface elevation of only 6 feet, where, at the intersection of North Henry and Green Streets, the 1905 real estate atlas lists the elevation as 10 feet (See Fig. 15c) The U.S.G.S. topographic map does not confirm this observation, and indicates that a small rise with an elevation of greater than or equal to 10 feet centers on Site 2. Street intersection elevations listed in post-fill atlases show an elevation of 11.37 feet on Kingsland Avenue at the northeast corner of Site 2, sloping gradually to 8.89 feet along North Henry Street, and more steeply along Kingsland to 6.58 feet at Greenpoint Avenue (See Fig. 21c). These elevations appear to predate the complete development of the site (See Fig. 14b; City of New York Department of Public Works 1942:#37,#38).

Furthermore, the 1942 boring location plan shows that the area west of North Henry Street and Site 2 was mostly underwater! Apparently, Whale Creek Canal had not been sufficiently bulkheaded during modern filling and channelling operations, and the low-lying and perhaps original bed of Whale Creek filled or remained filled with water. This shoreline can be seen along the west side of North Henry Street on the 1905 map (See Fig. 15c; City of New York Department of Public Works 1942:#37,#38).

Site 3: Boring Log Data

Although no borings were available for Expansion Site 3, four borings on neighboring Site 1 run near Site 3's southern boundary (EAW-7,-8,-9,-10). These borings show layers of fill between 12 and 15 feet thick, and ground water only between 7 and 10 feet below the surface (See Appendix B). Most of the surface of Site 3 is covered by buildings of Williamsburg Steel (See Photos 2,9,10). Department of Buildings records describe the eastern section of Site 3 (Block 2491 Lot 201) as "fill ground" requiring piles (Alt. 4266-1958). Records for Block 2515 (present WPCP property, directly south of Expansion Site 1) also specify foundations resting on fill (e.g. Lot 1, New Building (NB) 2646-1910; Lot 13, NB 2362-1918; Lot 25, Permit 9802-1920). Street elevations indicate the most elevated part of the site is at its southwestern corner, near the intersection of Eagle Street and Provost (11.45 feet), gently sloping downward toward the north (8.23 feet at Paidge and Provost) and east (6.81 feet near Whale Creek Canal) (See Figs. 20, 21a).

III. PREHISTORIC PERIOD

The archaeological evidence of the Indian habitation of Long Island is generally divided into four periods, based on changing diet, tool kit, and the presence of ceramics and agriculture - in essence, the material remains of adapting Native American cultures. These periods are known as the Paleo-Indian (c. 13,000 to 10,000 years ago), the Archaic (c. 10,000 to 2,700 years ago), the Woodland (c. 2,700 to 500 years ago) and the European Contact Period (c. 500 to 300 years ago). Before it is possible to formulate hypotheses concerning prehistoric archaeological potential, it is necessary to review the characteristics of the different cultural periods in order to determine the attractiveness of the vicinity of Expansion Sites 1, 2 and 3 to Indian settlement patterns.

Paleo-Indian Period (c.13,000 to 10,000 years ago)

Due to a warming trend beginning approximately 18,000 years ago, the end of the Wisconsin glaciation, the Long Island environment was a forbidding arctic landscape, which had few resources to offer humans until about 13,500 BP (Before Present). Paleo-environmental studies indicate a tundra environment of mosses, grasses and low-growing shrubs for the southern regions of New York until about 12,000 BP (Lavin 1988:01). Pollen analysis has shown that as the warming trend continued, tundra conditions retreated with the ice sheet and were replaced by a cold, wet climate (compared to modern conditions), with clumps of spruce and fir trees and scattered herbaceous growth such as grasses, sedges, and willows as the prevailing vegetation. Among the fauna inhabiting this environment were mastodon, mammoth, barren-ground caribou, giant beaver, elk, and deer as well as many smaller mammals, whose bones have been recovered in Pleistocene deposits in New York and New England (Ritchie 1980:13).

During this period, such a great volume of water was still trapped in the glaciers that the sea level was "several hundred feet lower" than at present. The continental shelf, which underlies Long Island, was a broad fertile plain exposed "for a distance of about 100 kilometers," joining the island to the mainland. The number and distribution of the teeth of mammoths and mastodon recovered from the continental shelf suggest that they roamed there in large numbers, making the area attractive as well as accessible to Paleo-Indian hunters (Saxon 1973:251-252,259-260). When the remaining glaciers melted and sea levels rose, the shelf was inundated, and fresh water glacial "Lake Flushing" was flooded by the Atlantic Ocean, forming Long Island Sound. The "mega-fauna" continued to roam Long Island, followed by Paleo-Indian hunters. By the end of the period, approximately 10,000 years BP, deciduous trees such as oak and hickory had begun to dominate all along the eastern seaboard, and the Pleistocene "mega-fauna" were becoming extinct. Whether or not this was caused by prehistoric

overhunting, these animals were replaced by the "temperate climate fauna indigenous today" (Gwynne 1982:190-191).

As would be expected, the tool kit of the Paleo-Indian indicates a reliance on hunting, particularly the hunting of mega-fauna. The diagnostic artifact of the Paleo-Indian period is the fluted point, a lanceolate point usually two to five inches in length, with parallel, slightly excurvate edges, and channeled or fluted faces. Usually made from a high-grade silicious stone often exotic to the region, such as flints and jaspers, the wide-ranging quarry sources indicate a nomadic lifestyle (Ritchie 1980:3-6). At present no fluted points are known to have been recovered from Kings County, and only one in Queens. Although 14 have been recovered on Long Island as a whole, the paucity of finds in Kings and Queens Counties is probably due to the destruction of sites by the intensive development there (Saxon 1973:251, 259). Other tools include scrapers, knives, borers, and gravers, all used for butchering meat and preparing and processing hides, bone, and wood.

Excavated campsites at Port Mobil on Staten Island and the Davis Site in Essex County near Lake Champlain suggest that Paleo-Indians were a highly mobile population which roamed vast uninhabited areas in bands of about twenty members, following the migratory herds of proboscidians. These sites include temporary camps and lithic reduction stations. Although in choosing campsites Paleo-Indians showed a predilection for well-elevated areas, 30 percent of Paleo-Indian campsites in the Northeast are found near the margins of low swampy ground formerly occupied by lakes. Access to main waterways and large fertile valleys were preferred, since these areas support the heaviest populations of food animals. Difficulties in locating these sites are due to their small size as well as the substantial rise in sea level occurring since that period which has submerged many Paleo-Indian sites, particularly those on the continental shelf.

Archaic Period (c.10,000 to 2,700 years ago)

The cultures of the Archaic Period are considered to be human adaptations to the changed environmental conditions of the warm and dry hypersithermal interval, during which temperatures are believed to have been considerably warmer than at present. The spruce and pine forest dwindled further, and mixed hardwoods - oak, hickory, chestnut, beech, and elm - became dominant. This essentially modern, open, oak woodlands pattern provided ample food for mast-eaters such as white-tailed deer, turkey, moose, beaver and even black bear, and thus the hardwood forest provided a greater carrying capacity for Archaic man (Ritchie 1980:32). During the Early and Middle Archaic, saltwater fish and shellfish apparently did not play an important dietary role. Although oysters were abundant on the South Atlantic Shelf by 12,000 years ago, they did not become a dietary staple until the Late Archaic. This is mainly

because during the early and middle stages the coastal areas were relatively barren environments, providing little aside from oysters. Artifacts recovered from Middle Archaic shell heaps indicate that these sites were temporary processing stations. Larger base camps, indicating a semi-sedentary lifestyle, were generally inland, near freshwater bogs and lakes, which were far more hospitable, providing fresh water, fish, waterfowl, and attracting deer and other game animals (Lavin 1988:103-104). Archaic man was still highly mobile, but within well-defined territorial limits, moving between seasonally exploitable lacustrine and riverine food resources. Although there was little storable surplus, meat and fish could be dried or smoked, and plant foods such as acorns, chestnuts, beech nuts, and various seeds could be saved. Bark-lined and roofed storage pits for this purpose have been found in up-state New York.

The Archaic tool kit reflects this greater reliance upon seeds and nuts, with grinding tools such as mortars and pestles represented; bone fishhooks and notched pebble netsinkers for fishing; woodworking tools such as adzes, celts, axes and scrapers, as well as many general purpose tools.

The warmer and drier conditions during the thermal maximum, occurring after 7,500 years BP, and definitely by 5,000 to 2,000 BP, caused the shrinkage of interior lakes and streams, and resulted in the crowding of Archaic peoples at the larger and therefore more reliable water and food sources. The population pressure and resource competition thus caused is reflected in the increased incidence of burial ceremonialism during the Late and Terminal Archaic.

At the end of this warm period, between 4,000 and 3,000 years ago, cooler temperatures slowed the melting of the polar ice cap, substantially reducing the rate of sea level rise. This enabled silt deposits to build up along coasts and at the mouths of rivers and streams like Newtown and Whale Creeks, which in turn developed into salt marshes. Established salt grasses such as *Spartina* sp. trapped more silt, building up the marsh to the high tide level, providing ideal environments for clam beds and scallops (Lavin 1988:106). Such salt marshes are incredibly rich in plant and animal life, providing food and breeding grounds for numerous species of fish, shellfish, birds, amphibians and mammals. As elevations rise toward the uplands, and salinity decreases further inland, different econiches are represented, often presenting a year round selection of exploitable plant and animal resources within close proximity to one another (Lavin 1988:108). During the Late and Terminal Archaic, coastal sites and the exploitation of shellfish resources were more heavily represented. Archaic period shell middens excavated in the Hudson Valley indicate that oysters were processed on site, but that the meat was taken elsewhere for consumption or exchange. Other types of sites represented include rockshelters and open woodland camps (Schaper 1993:32).

The earliest known pottery type made its appearance during the Terminal Archaic (2,750 years BP), which enabled Archaic people to cook longer and more evenly the grains and plants now being gathered from the marshes (Lavin 1988:110). Many Early and Middle Archaic coastal sites have been flooded due to the general stabilization of the sea level since that time. Many Late Archaic coastal sites have also met the same fate. For example, the Late Archaic Wading River Complex, four archaeological sites on the north shore of Suffolk County, was found on the edge of a salt marsh, on dry ground that ranges from only two to seven feet above mean high water (Wyatt 1982:71). At Shelter Island, Suffolk County, a small Late Archaic special purpose camp, probably for tool making and food processing, lies near tidal wetlands, and at its highest elevation is only five feet above mean high water (although its lowest points indicate a rise in water level since its occupation) (Witek 1988:21, 28). Closer to the project area, the Grantville Site in College Point, Queens County, approximately 6.3 miles east of Whale Creek, is located on a narrow promontory bounded on the west by Flushing Bay and on the east by a salt marsh (Smith 1950:173).

Woodland Period (c.2,700 to 500 years ago)

By the beginning of the Woodland period, the climate had stabilized, becoming much as it is today. The trend toward increased exploitation of coastal resources which had begun at the end of the Archaic intensified, with site size and frequency rising until large semi-sedentary settlements appear in the Late Woodland. There are also indications that inland sites declined in number (Lavin 1988:106, 108, 110). The number and size of sites and artifact diversity indicate longer occupations and the increased use of non-local lithic materials. The regionalization of ceramic styles suggests an growing territoriality.

By the late Middle Woodland, the disappearance of mortuary ceremonialism points to an increasingly successful adaptation to the environment. The largest sites of the Late Woodland, generally located on the coast or the intertidal zone near estuary heads, often contain evidence of structures, and are recognized as villages by some archaeologists. People of Woodland times preferred the same sites as those of the Late Archaic in order to exploit both salt and fresh water marsh environments (Lavin 1988:106, 108, 110). The sites are described as well-drained locations on bays and tidal streams close to sources of marine shellfish, with shell heaps or middens covering areas of up to three acres or "situated on tidal streams or coves" (Ritchie 1980:266, 269). Nearly all of the permanent sites are on tidal streams and bays on the second rise of ground above the water (Smith 1950:101). The documented Woodland sites nearest the project area are in Queens; the North Beach site on Flushing Bay

near LaGuardia Airport, six miles east of Whale Creek, the Grantville Site, discussed previously, with a Woodland as well as Archaic component, and the Wilkins Site in Whitestone, at the head of a small tidal cove ten miles east of Greenpoint.

The Woodland tool kit shows some important additions, notably the bow and arrow for hunting, dugout boats and barbed bone/antler harpoons for sea fishing and hunting of sea mammals. Fish runs in rivers provided a stable and reliable resource, and fish weirs were utilized in rivers and major creeks for the capture of large quantities of anadromous[1] fish (Brumbach 1986:35). Cups, bowls and spoons were fashioned of wood and tortoise shell, and the use of pottery for cooking became more widespread. In fact, pottery sherds become the most common artifact found on Woodland large camp and village sites (Ritchie 1980:267-268). Horticulture appeared in certain areas during Middle to Late Woodland times, but very little evidence of its practice has been found in coastal New York. Although coastal Indians were familiar with maize as early as 1150 A.D., it remained a minor source of nutrition, probably since it was unnecessary to supplement their already rich and bountiful diet (Lavin 1988:113).

European Contact Period (c.500 to 300 years ago)

Following the earliest known visit of Europeans to the New York City area, the exploration of New York Bay by Giovanni da Verazzano in 1524, descriptions of Native Americans and their settlements were recorded, providing another source of data to buttress archaeological inferences about Indian lifeways in the Contact Period. Johannes de Laet described the Indians of New Netherland in his *New World, or Description of West India* in 1625:

> The barbarians are divided into many nations and languages, but differ little in manners. They dress in the skins of animals. Their food is maize, crushed fine and baked in cakes, with fish, birds and wild game. Their weapons are bows and arrows, their boats are made from the trunks of trees hollowed out by fire.
>
> Some lead a wandering life, others live in bark houses, their furniture mainly mats and wooden dishes, stone hatchets, and stone pipes for smoking tobacco (Bolton 1972:16).

The cultivation of maize (which previously was an unnecessary supplement to an already rich diet) and an increasingly sedentary lifestyle became more widespread on Long Island during the Contact Period, probably due to trade relations with the Europeans. Shell bead and wampum production was increased, and furs were collected

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[1]I.e., sea fish such as salmon, which swim up rivers to spawn.

by Natives for exchange. Although there are many ethnohistorical accounts of trade, there is little archaeological evidence of this in the region (Kraft 1991:213). Shellfish remained an important food source. Isaac Jogues (1862:29), who visited New Netherland in 1633-1634, observed the "great heaps" of oyster shells made by the "savages, who subsist in part by that fishery."

Apparently, the larger villages developed into permanent settlements whose populations expanded and contracted with the availability of various natural food resources, while agriculture provided a storable surplus to maintain a smaller population throughout the year. Part of the population still migrated between food sources, inhabiting smaller seasonal campsites. However, this period of growth was interrupted by epidemics of European diseases against which the Indians had no natural immunity, resulting in decimation of the population. By 1660, Daniel Denton reported that the number of Indian villages on Long Island had dropped from six to two. Anthropologists generally agree that the Whale Creek area was part of the lands inhabited by Munsee-speaking Upper Delaware Indians, whose territory stretched from central New Jersey to southern Connecticut. The Indians inhabiting the present Borough of Brooklyn are believed to be members of the Canarsee chieftaincy, which had its major village in Canarsie, southwestern Brooklyn (Bolton 1972:9, 11; Denton 1902:40, 45).

As discussed in the previous pages, the marsh that existed around Whale Creek was a food and raw materials source of incredible richness. Historians and researchers have attempted to reconstruct the traces of Native American life on western Long Island, using ethnographic accounts, and archaeological reports and tales of "Indian relics." At the beginning of this century, Reginald Bolton utilized these sources and identified the Indian village of Maspaetches/Maspeth as lying near the head of Newtown Creek on the Queens side, about 1.6 miles east of the project area (Bolton 1972:150). Bolton also suggests there was an old Indian road, corresponding to the Old Wood Point Road leading to southwestern Greenpoint from the Bushwick area to the south. His uncertainty of this is revealed in his next sentence: "If the natives were accustomed to visit Greenpoint, this old track doubtless followed their woodland trail" (Bolton 1922:146).

Pursuing a similar line of inquiry, Grumet disagrees with Bolton, stating that no Canarsee village can be documented as having occupied the present day Maspeth. However, the records do show that there was a "wigwam at Mashpath Kills" in 1669, and incidents were recorded between the Dutch and Indians in the area. In his maps of Brooklyn and Queens, Grumet also locates "Mespaetches" adjacent to the project area on the Brooklyn side of Newtown Creek, but his explanation gives the location as "Newtown Creek," and notes that another researcher places it somewhere in Nassau County. From the speculative etymology Grumet provides, Mespaetches appears to be a place name referring to New Town Creek

itself (Grumet 1981:28-29,71; See Fig. 3). In addition, Dr. Ralph Solecki's intensive archaeological exploration of Queens and Brooklyn during the 1930s and 1940s has revealed many Indian sites, including three along the Queens shore of Newtown Creek, one of which appears to be on the opposite shore from Whale Creek (See Fig. 4). The lack of sites on the Brooklyn side of Newtown Creek is perhaps a result of its early development, occurring before there was any widespread movement to document Indian sites.

There are no ethnographic or antiquarian accounts of shell middens, the refuse deposits of shellfish harvesting, along Whale Creek. There is also no conclusive evidence of middens from the soil borings analyzed during this research. Although the 1942 City of New York Department of Public Works boring logs reported that "plant matter, soft silt, shells" were recovered in three borings (#33, #34, and #35) on Green Street, approximately 300 feet south of Site 1, and 600 feet south of Site 3, and 1962 borings (City of New York Department of Environmental Protection) (on Block 2525) recorded two locations that yielded a "trace of shells," approximately 85 to 95 feet further south of the earlier shell-bearing borings, neither the borings performed on Expansion Site 1, nor those on the block directly south of Site 1, already part of the Newtown Creek WPCP (Kearns Kirkorian and Schaefer 1989:Addendum), recovered any evidence of shells or other materials associated with shell middens (See Appendix B).

There is a moderate case for the presence of shell-bearing deposits on Site 2. No borings were performed on Site 2, but the single log from a boring on North Henry Street (part of the project site), 50 feet west of Site 2, reveals a layer of silt and shells directly below 16 feet of fill (City of New York Department of Public Works 1942:#38). The 1990 WPCP borings to the west and south of Boring #38, found no shell, but were performed in an area that the 1942 locational map, and the 1905 atlas (See Fig. 15c) indicates was under water. Borings (1942) proceeding west from #38 along the path of Green Street all have shells present (#33-35, 37,38), except for the two that were taken in inundated areas (#36,B). Boring #36 also has no fill present, suggesting that the flooded condition existed prior to the historical period. Such an area would not have provided an appealing site for prehistoric processing areas. However, Site 2 and North Henry Street are outside this completely inundated area, and since the boring on North Henry and in adjacent swampy areas of similar physiographic characteristics reveal the presence of shells, it is possible that some sort of shell deposits exist on the rest of North Henry Street as well as Site 2.

Inquiries to the New York State Historic Preservation Office/Field Services Bureau identified traces of Indian occupation at the mouth of Newtown Creek, approximately 0.6 miles northwest of the project area. The New York State Museum also cites this area (NYSM Number 3613), noting that "a recorded site is indicated in or

immediately adjacent to the location," and there is "reason to believe it could be impacted by construction." The State Museum also reports that the physiographic characteristics suggest a high possibility of prehistoric use (See Appendix A). Site number 3613 corresponds to the high ground which stretched as far east as Manhattan Avenue, approximately 1,400 feet west of the project area, indicating an elevated, dry place for Indian use.

However, Albany's sensitivity ranking is predicated on a predictive model based in part on proximity to water and mapped on a current USGS topographic map, which accounts for the high archaeological potential rating. With this in mind, it is important to note that Expansion Sites 1, 2 and 3, from a review of current maps, appear to possess perhaps more prehistoric sensitivity than is realistic considering the historical manipulation of the landscape.

IV. HISTORICAL PERIOD

Near the northern tip of Brooklyn borough, Expansion Sites 1, 2 and 3 lie in the present Greenpoint neighborhood. The following section discusses the study parcels in the context of this larger community, and concludes with a detailed building history of the individual project sites.

The area now known as Greenpoint supposedly received its name from its appearance to travelers viewing it from their ships on the East River:

> Near where the foot of Freeman street now lies, a point of land jutted abruptly beyond the shore for a considerable distance. This point, covered with river ooze and green grass, naturally attracted the gaze of sailors on passing vessels, who gave this verdant projection the name of Green Point (Felter 1919:14-15).

Despite the charm of this story, the original Dutch name for the area was Hout Hoek or Wood Point, suggesting a forested aspect (Stiles 1869:321). Whatever the name, the area of present Greenpoint proved to be attractive to Europeans who settled there under the auspices of the Dutch West India Company. Governor-General Willem Kieft purchased the land between Bushwick and Newtown Creeks from the Canarsee Indians in 1638. Apparently this section of northeastern Kings County was already settled, probably illegally, by a group of immigrants of mainly Scandinavian origin. The project area lay on the farm of Dirck Volkertse, who was called the Norman or Noorman,[2] which means Norwegian in Dutch. The early farmers lived far from the nearest village in "the wild days of smuggling, rum drinking, of hardy sailors free in the use of their dirks, of gambling, of risk and adventure" (Felter 1919:17). Volkertse's land lay between Mispat Kill (Newtown Creek) and Norman's Kill (Bushwick Creek) which was named after him (See Fig. 5). He was officially granted the land in 1645 (Stiles 1869:321). His family lived in a stone house on the north side of Bushwick Creek, at least 0.75 miles southwest of the study area (Armbruster 1912:18,31).

The first village in the area was founded in 1655 on an ait at the head of Newtown Creek, and named New Aernhem, after the old Dutch town. Although the island afforded a good defensive position in case of Indian attack, it was a poor site for a town. More successful was Boswyck, which was founded in 1660, after fourteen Huguenots and their interpreter Peter Jan de Wit went to New Amsterdam, the seat of the colonial government, and requested land for settlement. Director-General Peter Stuyvesant traveled with

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[2]This name has caused confusion among many local historians, who mistakenly assumed that it meant Norman French.

them and chose a site between the two creeks for the new town. The settlers laid out 22 houselots with garden plots behind them, enclosed it with a palisade and surrounded all with large fields. This settlement was centered on Wood Point Road, approximately 1.3 miles south of the study area. Stuyvesant named the town Boswyck (BOSS-vake) - forest district - in 1661, and the New Aernhem lands and settlers were incorporated into Boswyck, whose name was later anglicized to Bushwick (Armbruster 1912:12-15). Boswyck was the last of the "Five Dutch Towns" of Long Island to be founded.[3]

Apparently the pre-Boswyck settlers were not dispossessed, and were able to remain on their lands. Dirck Volkertse sold 62 acres (including 12 meadow acres) to Jacob Hey or Hay in 1653. Hay's part of Greenpoint was passed to his daughter Maria Hayes, the wife of Captain Peter Praa of Newtown, in 1687. Praa is considered one of the most important figures in the history of Greenpoint. Active in the community, he commanded the local militia, served as magistrate and was said to be a superb horseman. Praa owned 40,000 acres in New Jersey and purchased much land on Long Island. His purchases included the rest of the Volkertse lands bought from Dirck's sons in 1719, at which time Praa's farm in Greenpoint encompassed 164 acres. Praa lived in a stone house on the meadow's edge, at the northeast corner of Freeman Street and McGuinness Boulevard. This house, which burned in 1832, was less than 750 feet west of the project site (See Fig. 6, Praa house is near the East River shore, at the end of the road which skirts the western side of the project area marsh). From Praa's four daughters and their husbands were descended all the residents of Greenpoint until about 1840: the Meseroles, van Zandts, Provoosts, and Bennetts, after whom many streets in the area were named. The Praa house went to daughter Christina, who married David Provoost (Schroeder 1852:7; Felter 1919:19-24; Stiles 1869:321-322, 407).

Life in Greenpoint, based as it was on the seasonal round of agriculture, was little affected by the capture of New Netherland by the English (1664) and only temporarily disrupted by the depredations of British forces during the American Revolution. Although nominally a part of Bushwick town, Greenpoint was physically isolated because of its marshes and creeks. There was only one road to the outside world, the Wood Point Road, which lead from a dock on Newtown Creek past the Praa house (750 feet west of the project area - See Fig. 6) and to Bushwick. Going east to Astoria was akin to "taking a journey to the moon" (Stiles 1869:407). Therefore, farmers depended mostly on large boats to carry their surpluses to the New York market (Armbruster 1912:28). Grain, fruits, and vegetables were raised with the assistance of enslaved Africans, of whom Peter Praa owned many. The meadows along Newtown Creek, including the study parcel, were used as

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[3]The others were Breuckelen, Nieuw Utrecht, Midwout (Flatbush) and Nieuw Amersfoort (Flatlands).

common lands, producing salt hay for grazing livestock. The farmers conserved and improved this valuable resource. As one amateur historian noted, the meadows were not wasteland. "The bulk of the meadowland was developed, and artificial grasses grown to make pastures for the cattle of Boswyck residents" (*Brooklyn Daily Eagle*:4-16-1916).

The nineteenth century expansion of the cities of New York and Brooklyn could not but affect the then outlying towns of Kings County. The village of Brooklyn became a city in its own right in 1834, and from 1830 to 1840 its population more than doubled to 36,000, growing faster than that of New York City. Brooklyn expanded into the neighboring farmland, and eventually annexed Greenpoint, Bushwick, and Williamsburg in 1855. This growth was spurred by large scale European immigration, improvements in industry, such as the spread of the factory system which lowered costs and increased production, and improved transportation made possible by the railroads, steamboats, and the building of canals, which opened up the vast American hinterland as both a new market for goods and a source of raw materials. Expanding industries seeking dock space on convenient and cheap land began to move into the waterfront areas of Kings County, such as Williamsburg and Greenpoint; hence these neighboring sections of Bushwick began their expansion and industrialization at the same time (Ment 1979:37-41).

Instrumental in the growth of Greenpoint was Neziah Bliss, who has been called the "Father of Greenpoint" (although it seems that the title biologically belongs to Peter Praa). Bliss, born in Hebron, Connecticut, married the daughter of John Meserole and settled in Greenpoint in 1831. He and Eliphalet Nott purchased 30 acres of the John and Peter Meserole farm in 1833, and later the Griffin farm (of which sections of Sites 1 and 3 were a part - See Fig. 7) at auction. Bliss had these lands surveyed, and houselots laid out the following year.

Realizing that better access to Greenpoint would promote business and residential development by making the community a viable residence for people working in Manhattan and Brooklyn, Bliss launched a series of ventures which improved Greenpoint's connections with New York City and the other towns of Long Island. Streets were surveyed and extended, connecting with those of Williamsburg, Bushwick, and Hunters Point in Queens in 1834 (Stiles 1869:407; Edwards 1937:17). In 1838 he built a foot bridge over Bushwick Creek to Williamsburg, and promoted the Ravenswood, Greenpoint, and Hallett's Cove Turnpike (present Franklin Avenue, about 0.4 miles west of the study parcels) which opened in 1839. In 1850 he leased a ferry operation from New York City which ran regularly from the foot of Greenpoint Avenue (about 0.7 miles west of the project lots) to East 10th Street, and later East 23rd Street in Manhattan.

When the City Railroad was completed in 1855, running horsecars through Williamsburg as far as the Bushwick Creek Bridge, Bliss convinced the company to extend the tracks as far as Green Street and Franklin Avenue (Felter 1919:36-38). Bliss even attempted to get the United States Navy Yard to move to Greenpoint, but his negotiations were frustrated and he became financially overextended, losing all his land except thirteen acres, which, undaunted, he continued to develop.

The first housebuilder was John Hillyer, who erected his house on I Street (later India - the streets were named alphabetically starting with Ash) in 1839. Many houses followed, usually built on stilts which were "rendered necessary by the extreme depth of the mud, as always the great drawback of the place" (Stiles 1869:413).

By 1840 the first shipyards appeared, occupying the "fine white sand" of Greenpoint's East River beaches, and the adjacent land along West Street. This attracted workers, especially English, Irish, German, and Scandinavian immigrants. Between 1840 and 1870, 35 percent of the population was engaged in shipbuilding. The most famous ship to hail from a Greenpoint shipyard was the ironclad warship Monitor, completed by Continental Ironworks in 1862 (Felter 1919:28-34). Encouraged by the shipbuilding industry and the rising demand for housing, lumber and stoneyards became numerous in Greenpoint after 1850. Other industries followed soon after. By 1860 each of the "Five Black Arts," printing, pottery, gas, glass, and iron were established. Most notable were the pottery manufactories, such as Charles Cartlidge's which was established in 1848 on Pottery Hill, just east of the river. It began with "china door furnishings," buttons, and later tablewares, eventually becoming one of the earliest successful American porcelain makers (Felter 1919:47, 50-52). Another prestigious factory was Christian Dorflinger's glassworks, a modern large-capacity works built in 1860 on Commercial Street along Newtown Creek, about 0.4 miles northwest of the study parcel. Dorflinger imported French glassblowers, whose skill was nationally recognized when Mary Todd Lincoln purchased a full table service for the White House (Ment 1979:42).

Foundries made machinery castings, piano plates, architectural iron, boiler and gas tanks and other machine parts. Later, rope making became one of the most important industries in Greenpoint when two cordage plants, the American Manufacturing Company and Chelsea Fibre Mills, located there. They were among the largest in the world, and with the waning of the shipbuilding industry after 1870, came to employ over 15,000 workers, more than any other industry (Felter 1919:56-58).

Perhaps the most important industry was oil refining, which Greenpoint shared with neighboring Williamsburg. The process for producing kerosene from crude petroleum was developed in 1852, and the use of this fuel for lamps and industrial purposes, was

introduced to the American public the following year (gasoline did not become an important product until after 1900). With the drilling of the first artesian oil well in Titusville, Pennsylvania in 1859, there was a new and plentiful supply of the raw material, and as a result, the use and availability of kerosene increased. Because of its concentration of population and industry, New York City became the first major market for kerosene, and the center of oil refining was established along Newtown Creek and the East River in Williamsburg and Greenpoint, because of their proximity to New York, the space for facilities, and the easy access for oil barges. At the industry's peak in 1875, there were more than fifty refineries in operation (Brown and Ment 1980:42,53). On the eastern shore of Whale Creek Canal, only about 100 feet east of the study site, stood the Empire Refining Co., which was established between 1869 and 1886 along Newtown Creek (See Fig. 12a).

The Astral Oil Works of Charles Pratt, the most famous refinery in the area, eventually occupied seven acres near Bushwick Creek. It was actually in Williamsburg, but only about one mile southwest of the study parcel, and many of Pratt's workers lived in Greenpoint. Founded in 1867, Pratt's refinery produced gasoline, benzine and other distillates, and also barrels and cans for packing the products, however, the chief product was kerosene (Ment 1979:58). The company was known for its innovative and exemplary organization, production processes and facilities. Astral Oil was lauded as the safest and best of kerosenes, and was thus in constant demand (Felter 1919:56; Brown and Ment 1980:43). Perhaps indicative of its international renown was a company slogan, "The holy lamps of Tibet are primed with Astral Oil" (Willensky and White 1988:691). However, after John D. Rockefeller's Standard Oil acquired the refinery of Pratt's main competitor in 1873, Pratt secretly merged his company with Standard Oil the following year, and the Astral Works became the New York branch of that company (Ment 1979:58).

Pratt continued to take an interest in the welfare of the Astral Oil workers, even after the Standard Oil merger. In 1886 he built the Astral Apartments, one of the earliest model housing developments for workers. Designed by Lamb and Rich, the patterned brickwork apartment block was modelled on the Peabody Apartments in London, and still stands at 184 Franklin Street, between Java and India (about 0.5 miles west of the study parcels) (Willensky and White 1988:692-693). Pratt even established a model home to demonstrate "wholesome life" (Harding 1944:14). Other factory owners also built quarters for their employees; Christian Dorflinger of the Greenpoint Glass Works erected tenements for his employees near Newtown Creek (Felter 1919:54)

Following the peak year of 1875, the number of refineries declined. The smaller firms could not compete with the giants like Charles Pratt & Co. and Standard Oil, which bought out the smaller firms and consolidated operations into huge refinery complexes.

Also, by the 1880s, both the industrial and residential areas, especially along the East River, were crowded, and new oil transport techniques allowed refineries to be built far away from residential areas, where land was cheaper and there were fewer people to complain of the bad odors and fire hazards. Originally, oil was transported by barge from New Jersey railroad terminals to the refineries. In 1879, Standard Oil completed the Crosstown Pipeline, which passed beneath the Hudson, Manhattan and the East River, connecting Rockefeller's oil fields in western Pennsylvania with the Williamsburg and Greenpoint oil refineries. This pipeline, which operated until 1920, provided oil to all companies in the district (Brown and Ment 1980:42).

One of the deciding factors in Pratt's 1874 merger with Standard Oil must have been the provision that the company continue under Pratt's own prestigious name and management. In fact the merger did not become public knowledge until 1882, when the Standard Oil Trust was organized with Pratt as a member of the advisory and executive boards. Meanwhile, Pratt continued to expand "his" operation, purchasing several refineries in the Greenpoint-Newtown Creek area in 1876, and absorbing others on the Queens side of the creek (Brown and Ment 1980:52-53). One of the Greenpoint refineries was Sone and Fleming's King's County Oil Works Ltd., whose first oil tanks began occupying Expansion Site 2 in 1886 (Compare Figs. 12b and 13c). Sone and Fleming was among the last of Pratt's refineries to shut down, closing in 1950 (Ibid.:54). Following Pratt's death in 1891, his company was officially absorbed into Standard Oil. By 1892, Standard Oil had become the dominant company in the refining district. When Standard Oil was divided (1911) as a result of the Sherman Anti-Trust Act, Standard Oil of New York became an independent entity, and was renamed Socony, and later Mobil. These corporate name changes can be followed in the historical atlases (See e.g. Figs. 15c, 21c).

Greenpoint had been transformed from the "garden spot of the world" and "little more than a wilderness" in 1859, to the "most thickly settled industrial community in the country with the exception of Fall River" forty years later (*Brooklyn Daily Eagle*:2-12-1936; Harding 1944:20). A newspaper article of December 1868 observed:

> Within the last two or three years manufacturing interests of considerable magnitude have sprung up in this suburban locality, and several large and substantial buildings for manufacturing are now in the course of completion. Some of these employ several hundred hands, thus enabling many to avail themselves of their labor, their sole capital, in providing the comforts of home and means of contentment. . .from seventy-five to one hundred houses are now being constructed...it is not to be wondered at that so many seek this section. Its natural

> advantages and attractions account for it, its churches and public schools, commodious and convenient, with cheaper rents, better air, and plenty of Ridgewood water. It has two railroads and two ferries to facilitate travel; a discount and a savings bank, for the accommodation and security of all their money transactions (Felter 1919:48-50).

The Greenpoint Historic District, which includes the area between Java and Calyer Streets and Manhattan and Franklin Avenues, approximately 0.35 miles southwest of the project site, encompasses an area of church buildings (including Ascension Episcopal, Greenpoint Reformed, St. John's Lutheran, St. Anthony of Padua Roman Catholic, and Union Baptist), banks, row houses, and tenement buildings dating from between 1860 and 1900, the period of Greenpoint's first industrial and residential expansion.

After 1880 the ethnic character of Greenpoint began to change, as southern and eastern Europeans, Russians, Poles, Slovaks, and Hungarians supplanted the earlier immigrants, the Germans and Irish. In 1919 northern Greenpoint was "largely foreign," with 40 percent of the residents of foreign birth, and 80 percent having one foreign-born parent. Half the inhabitants were Polish or Russian, and the section had a literacy rate of 89.5 percent, the lowest in the city. 'American' Greenpointers made efforts to turn "these foreigners into liberty-loving intelligent citizens" through organizations such as the Americanization League of the Greenpoint Neighborhood Association and the YMCA, for "compulsory education for adults is as necessary for the safety of the republic as for their children" (Felter 1919:59). However, there was ample work for the new immigrants, as the number of industries expanded to include fat-reducing plants, sugar refining, the manufacture of paint and varnish, sheet steel products, chairs, paper boxes, knit goods, and shoes. By 1940, Greenpoint was termed the "industrial hub of Brooklyn," and Newtown Creek was "mile for mile the busiest waterway in the U.S." (Corby 1940).

It was during this period that the project area received its first structures. In 1853 the lands west of Oakland Street were just beginning to be divided into lots, but Provost Street had not yet been laid out, and Expansion Lots 1, 2 and 3 remained meadow surrounded by creeks and small streams (See Fig. 8). There was "not a single pavement and hardly a well" in Greenpoint as late as 1859 (*Brooklyn Daily Eagle*:2-12-1936). Although Whale Creek appears to be tamed into Whale Creek Canal in 1855 (See Fig. 9), the 1869 map (See Fig. 10) continues to show Whale Creek's meandering course, and the 1873 map superimposes the future shore and canal lines over the courses of the old waterways (See Fig. 11). Shading on the 1869 map also indicates built-up areas, and these begin west of Union Street (now Manhattan Avenue, about 0.25 miles west of the study area). Most of the Whale Creek marshes and smaller watercourses were probably drained and filled in sometime

after 1873, and certainly before 1886. The first buildings, the New York Cedar Ware factory, appear on Expansion Site 1 by 1886 (See Figs. 10, 12a), while only Provost Street (the western boundary of Expansion Lots 1 and 3) was open as far south as Green Street.

While the blocks west of Provost Avenue appear to be mainly residential, those east of Provost, along Newtown Creek and Whale Creek Canal, because of their better connections with Manhattan and the shipping routes, were industrial. Access was to be further improved in 1907 when Whale Creek Canal and Newtown Creek south of the canal were to be bulkheaded with concrete, and two 1,000 foot piers erected for public use (*Brooklyn Daily Eagle*:2-5-1907).

After World War II, Greenpoint did not experience the same demographic and ethnic changes as did many other Brooklyn neighborhoods. This was probably due to the stability of the working class population, still mostly Polish and Irish, living between the factories and plants along the East River and Newtown Creek. A former resident (1936-1953) remembers a mix of "nice" streets, with trees, brownstones or other well-kept houses, mostly divided into apartments, interspersed with treeless streets of small, usually four-story apartment buildings. There were few gardens, and perhaps one unattached house. It was not a luxurious neighborhood, but rents were cheap, so people could save their money for something better. A railroad flat, a series of five rooms arranged in a straight line, with windows in the end rooms, and no heat but the kitchen stove and a kerosene heater in the livingroom was about twenty dollars a month. A gas heater was only turned on to provide hot water for bathing. Although there were some people on relief, the streets were safe at night, and apparently there were worse places to live, as a friend of the informant always claimed to live in Greenpoint, when she actually lived in Williamsburg (Flora Schaefer, personal communication, 11-13-89).

BUILDING HISTORY

Expansion Site 1

Expansion Site 1, on Block 2491, Lot 101, is bounded by Provost Street on the west, the middle line of the now-demapped Eagle Street, the middle line of now-demapped Duck Street (now Lot 150), and Newtown Creek on the north, and Whale Creek Canal on the east. It also includes the eastern half of former Duck Street (now demapped) and the present Freeman Street, which will be demapped.

According to the 1869 Dripps map, Expansion Site 1 was unoccupied, and was probably still swampland, despite the drawing of a streetgrid over the area. Sections of the study site along Newtown Creek and Whale Creek were still under water, since both creeks had not yet been bulkheaded (See Fig. 10). The swamp and watercourses were drained and filled in between 1869 and 1886, when the first buildings appear (See Fig. 12a).

Due to the complicated shape and history of Site 1, it will be divided into sections, based on the streets and block/lot divisions shown on the 1898 map (See Fig. 14a). Expansion site areas that were formerly city streets (Paidge, Freeman and Duck) will be discussed separately.

Site 1/western section (Provost between Freeman and Eagle)
1898: Block 2507, Lot 2 (Fig. 14a)

Two buildings associated with the "N.Y. Cedar Ware Co." were constructed in this section of Expansion Site 1 between 1869 and 1886 (See Fig. 12a). A 1-story brick building stood at the southwestern corner of Provost and Eagle Streets, and a smaller frame structure at the northwestern corner of Freeman and Provost Streets. The 1887 map shows an additional long narrow, shed, or open-walled building, linking the brick building to the rest of the factory to the east (See Fig. 13a). By 1898, the narrow shed is gone, and a new lot line seems to indicate that the two corner buildings are under different ownership from the rest of the factory (See Fig. 14a). This is confirmed by the 1905 map, in which the brick edifice is labelled "Ambrose Machine Co," and the neighboring factory is no longer present. The buildings are also shown in greater detail. The brick building has two stories, with five small, 1-story frame additions to its east (office) and south (blacksmith, shavings, open-sided shed/porch). The frame building at the corner of Provost and Freeman Streets is a 2-story shed, with two small 1-story additions. The open areas of the property are labelled "stone yard" (See Fig. 15a).

In 1912 the complex has a slightly different configuration. One of the frame buildings on Provost Street has been removed. Most importantly, the main building is labelled "IB," meaning a one-story structure with a basement (See Fig. 16a). This is

probably an error. None of the previous or subsequent maps agree with this. All describe the building as two stories. The most detailed descriptions are from 1905 and 1916, which indicate a machine shop on the first floor, and a pattern room or shop with skylights on the second (See Figs. 15a, 17).

Between 1912 and 1916, the Ambrose Machine Co. became the Provost Engineering Corp., and all of the free-standing frame buildings were removed. An additional frame wing was added to the south side, and one to the north side jutting into Eagle Street, housing the auto repair department (see Fig. 17). These additions were no longer present in 1921, and from 1916 to 1929 the only changes that appear in the atlases are rearrangements of the small 1-story frame ells attached to the brick building. (See Fig. 18a and 19). Between 1929 and 1942 all of the buildings were removed, and the lot was empty (Sanborn 1942:pl.55). The 1942 map shows the lot as part of the Esso Standard Oil refinery, with all of the buildings and tanks concentrated on the eastern half of the block (Sanborn 1942:pl.55). However, in 1950, a 1-story, concrete block, T-shaped structure with no basement was built near the corner of Provost and Freeman, for tank truck filling and office space. A dashed outline appears to indicate parts of the building are open-walled (See Fig. 20). This was razed between 1989 and 1993 (See Fig. 21a). An additional structure was added along Provost, west of the 1950 building in 1954, a 1-story, basementless, concrete block building for offices and truck washing (Sanborn 1989:pl.55). According to the 1993 atlas, and verified by the field inspection, this building still stands alone on this section of the block, although the office wing has been removed (See Photo 3).

Site 1 /eastern section (between Freeman and Eagle Streets, west of Whale Creek Canal)
1898: Block 2507 Lot 3 (Fig. 14a)

The main complex of the N.Y. Cedar Ware Co. was constructed on this section of the block, with no less than eight free-standing buildings (five frame and three brick). Additional factory buildings along Provost Street were previously discussed in the building history of the western part of the block (See Fig. 12a). The 1887 atlas shows similar buildings but in a slightly different configuration. All are 1-story structures, including a "Planing Mill" with "Dry Rooms" at the center, a "Shavings Bin", "Eng." (a power source?), various sheds and open-sided buildings for lumber storage. The open area on the east side of the lot is labelled "Lumber Yard," and "No lumber within 75' of Factory." A 1-story frame, lumber storage structure south of the planing mill appears on the 1887 map for the first time. It extends into Freeman Street. There is no indication of any basements. Sanborn and Hyde atlases seem to disagree on the location of a large shed, the Hydes (Figs. 12a, 14a) placing it within the block area, while the Sanborns site them in the fork of Eagle Street and Paidge Avenue

(See Fig. 13a, 15a, 17). The Sanborns appear to be correct.

By 1898, the western parts of the block appear to have been separated into a different lot, and a long narrow shed crossing the new lot line, linking the buildings along Eagle Street, had been removed. Between 1887 and 1898 the planing mill has also been removed, appearing on the map as an uncolored outline, and by 1905 even the outline is gone (See Figs. 14a, 15a). Before 1905, and possibly before 1898, the Cedar Ware factory left this location. In 1905 the former shavings bin and the empty area north of the old planing mill are labelled "Ruins." A boiler shop and a cabinet maker occupy the building on Eagle Street, now described as two stories. A plaster board manufacturer occupies the remaining buildings on the southern half of the property, along Freeman Street. Although several of the wooden sheds have been razed or replaced, the major buildings are so similar to the structures on the 1887 map in size, construction material and location, that they must be the same buildings (See Fig. 15a). Between 1905 and 1912, all the buildings were torn down, and this part of the expansion site remains empty until 1921 to 1929 (See Figs. 16a, 17, 18a).

Between 1921 and 1929 two small frame buildings appear on this section of the block, possibly associated with the boat building workshop which stood in the middle of Paidge Avenue along Whale Creek Canal (See Fig. 19). These were removed before 1942. By that year, the entire block was part of the Standard Oil refinery (Sanborn 1942:pl.55), and was used for gas storage with numerous gas tanks surrounded by concrete walls, storage buildings and loading racks. No basements are listed for any of the small buildings. Most of the tanks are described as "earth covered," although twenty tanks in the southeast corner of the block are "buried," suggesting a difference between depth of excavation/construction. Of two motor-equipped pump structures, one is linked to Whale Creek Canal, underground water pipes and hoses. Various "nozzle" and hose outlets suggest a more extensive underground pipe network than appears on the maps (See Fig. 20). Between 1951 and 1989, three 1-story structures along Freeman Street were removed, the 2 loading racks (built before 1942) and the storage structure (built between 1942 and 1951). The same complex appears on the current Sanborn (See Fig. 21a), although only one building, a small metal shed on the site of the soil venting system was observed during the field survey (See Photo 2).

Freeman Street (east of Provost)

The 1886 map shows a waterline running from Provost Street to Whale Creek Canal, but this appears on no subsequent map, and was probably never built (See Fig. 12a). Part of the lumber storage of the New York Cedar Ware factory extends into Freeman Street in 1887 (See Fig. 13a), and the 1898 map shows the same or a rebuilt structure crossing Freeman Street and extending into the block to

the south (See Fig. 14a). By 1905 this structure was much reduced in size, and is depicted as an opensided storage structure for plasterboards. Three other wood frame buildings stand in the western half of Freeman Street, a 2- and 1-story frame storage building, a partially open 1-story shed, and a 1-story office (See Fig. 15a).

The first and the third of these remain standing in 1912 (See Fig. 16a), and all are gone by 1916 (See Fig. 17). A four-inch water pipe was installed beneath the western two-thirds of the street by 1929 (See Fig. 19), while in 1951 there is an eight-inch water pipe running the length of the street, and private six-inch line on the eastern half of the street, servicing the oil refinery (See Figs. 20, 21a).

Site 1/northeastern section (Duck Street to Whale Creek Canal)
1898: Block 2501 Lot 1 (Fig. 14a)

The northeastern half of this block was part of the mouth of Whale Creek, and the 1898 map shows the original shoreline in relation to the street grid (See Fig. 14a). This block must have been partially filled between 1869 and 1886, because a 1-story brick building appears in its northern corner in 1886. No basement is indicated. A short arm of Whale Creek Canal extends into the lot, following a small inlet that was present before bulkheading (Compare Figs. 10 and 12a). The 1887 map shows the same block to be a ship yard, and the building a 2-story tool house, partially in Duck Street (See Fig. 13b). By 1905 the (James D. Leary) shipyard's had expanded its facilities. The 1-story brick building was replaced by a long 1-, 2-, and 3-story (actually 2 stories with a height of 3) structure of at least three attached buildings, partially in Duck Street and partially on the block itself. The frame central section of the building was vacant in 1905, while the brick north end housed a blacksmith's shop and storage, and the frame south end rope and tackle storage and "paints." Two small 1-story frame extensions project from the east side of the central section, one an open-walled shelter for a "saw motor." No basements are associated with these structures. A buried 4" water pipe runs along the east side of the building, entering the block from the Paidge Avenue side. The empty sections of the block contain "scattered lumber piles" (See Fig. 15b). By 1912, only the long building is depicted, labelled the "Columbia Foundry" (See Fig. 16b). This building was removed between 1912 and 1916, and the block appears empty of structures to 1951 (See Figs. 18a, 19) (Sanborn 1916:pl.56; Sanborn 1942:pl.56; Sanborn 1951:pl.56). Between 1951 and 1989 this parcel had become part of the oil refinery that controlled the rest of Expansion Site 1. The wide inlet off the canal was filled in, and a cinderblock boiler house was built on that location. No basement is indicated. Although it appears on the 1993 map, it was not present during the 1995 field visit (See, Fig. 21b and Photos 7,8). Also during this period, a group of steel fuel oil tanks were constructed along Duck Street,

under an "earth embankment," only partially buried (Sanborn 1989:pl.56). These tanks have been removed.

Duck Street

Duck Street was laid out on paper before 1869 (See Fig. 10). Before filling, the northernmost one third of the street was part of Newtown Creek (See original shoreline, Fig. 14a). The street remained unpaved and unopened through 1951, as indicated by a dashed line down its center (See Fig. 20 - partially obscured by site boundary outline). As a result, various businesses which occupied the adjacent blocks built on parts of the paper street. Only the southern half of the street, which is part of the study site will be considered.

The first structure in Duck Street was a 2-story brick tool house which was probably present in 1886. It straddles the line between Duck Street and the adjacent study site block to the south (See Fig. 13b). It is joined by 1898 by two 1-story frame structures in Duck Street, and it is perhaps a comment on the quality of landfilling operations that all three buildings lie within the former shoreline (See Fig. 14a). In 1905, study site areas of Duck Street seem to be included with the property of the James D. Leary shipyard. The earlier buildings have been replaced with a long 1-, 2-, and 3-story (actually 2 stories with a height of 3) structure of at least three attached buildings, partially in Duck Street and partially on the project block to the south. The frame central section of the building was vacant in 1905, while the brick north end housed a blacksmith's shop and storage, and the frame south end rope and tackle storage and "paints." Three small, 1-story ells extend from the western side of the building, mostly into the portions of Duck Street outside the study area. No basements are indicated for any of these buildings. In addition, piles of lumber and a "pitch kettle" are noted at the south end of the street (See Fig. 15b). The building was removed between 1912 and 1916, and the street appears empty of structures to the present (See Figs. 18a, 19, 21a) (Sanborn 1916:pl.56; Sanborn 1942:pl.56; Sanborn 1951:pl.56).

Paidge Avenue

Only the section of Paidge Avenue between the midline of Duck Street and Whale Creek Canal is part of Expansion Site 1 (See e.g., Fig. 18a). The eastern edge of this street was part of Whale Creek, and the original shoreline can be seen on the 1898 map (Fig. 14a). A water line appears on Paidge Avenue in the 1886 map, but since it is shown on none of the subsequent maps, it was probably never installed (See Fig. 12a). Lumber sheds were constructed here by 1887 (See Fig. 13b), and although the Hyde 1898 atlas shows the structure south of the street (Fig. 14a), the Sanborn maps

consistently show the shed in Paidge Avenue. In 1905 it is depicted as a frame 1- and 2-story storage and boat building, associated with the shipyard along Whale Creek Canal. A 4" private water line also appears in 1905 at the western end of the street (See Figs. 15a, 15b). The shed remained in place until between 1929 and 1942 (See Fig. 19; Sanborn 1942:pl.55).

Expansion Site 2

Bounded by Greenpoint Avenue, N. Henry Street and Kingsland Avenue

No buildings are present in 1869, paper streets are projected, but an unnamed creek is still present on the study site (See Fig. 10). Site 2 was still empty of buildings in 1886, however, water pipes had already been installed on Kingsland and Greenpoint Avenues, as well as Java, India, Huron and North Henry Streets. These parts of Java, India, Huron and North Henry are now part of the study site (See Fig. 12b).

The first structures on study site 2 appear on the 1887 Sanborn map, when the area was owned by the Sone and Fleming's "Kings County Oil W'ks." These were two aboveground(?) tanks, numbered 21 and 22, at the south east corner of the study site (See Fig. 13c). By 1898 the two 1887 tanks have multiplied to five, shown as made of metal (See Fig. 14b). The 1905 atlas shows five tanks, numbered 21, 22, 39, 61 and 66, with 66 on the block north of the five shown on the 1898 map. A long narrow frame building straddles India Street just west of Kingsland Avenue, built between 1898 and 1905 and removed by 1912 (See Figs. 15c, 16c). The entire oil refinery, then owned by Standard Oil, was surrounded by a fence. It is labelled "Standard Oil Co. Sone & Fleming's Branch Atlantic Works. The fenced section included all of the study site, except for a small area along Kingsland Avenue.

The storage, boxing and shipping section of the plant was immediately northeast of the study site, and the 1905 map shows a railroad siding of at least four tracks passing through or into the northwest quarter of the study parcel. Curiously enough, these tracks appear on plate 58, but not 57 of the 1905 Sanborn atlas, ending in the middle of Huron Street. Although the same buildings pre- and post-date 1905, the tracks are shown on none of the earlier or subsequent atlas plates (See e.g., Fig. 15c, 16c). It is possible that the railroad was an internal system for moving materials to different parts of the refinery, and to and from the barge slip along Newtown Creek. In 1912 the only structures on the study site are six metal tanks, the five remaining from 1905, and a new small one in the northwestern quarter of the site, along North Henry Street (See Fig. 16c).

The 1921 atlas has demapped Huron, Java and India Streets, and Kingsland Avenue has been laid out connecting North Henry Street

with Greenpoint Avenue, outlining the project area boundaries on the north and east. The entire area is taken up by fifteen round oil tanks, which were constructed between 1912 and 1916 (See Fig. 18b). Only tanks 21, 22, 39, 61 and 66 predate 1912. The tanks are unchanged in number and configuration from 1916 up to the present (See Fig. 18b) (Sanborn 1916:pl.57; Hyde 1951:pl.; Sanborn 1951:pl.57; Sanborn 1989:pls.57,58). Between 1929 and 1942, Study area 2, except for North Henry Street was surrounded by a concrete wall, equipped with four "hose carts," which were presumably used to fill and empty the tanks (Sanborn 1942:pl.57). The wall still stands (See Photos 11-14).

North Henry Street (North of Greenpoint Avenue)

Although the 1886 map shows a waterline running the length of North Henry Street, as in the preceding paragraphs, there is no evidence of the presence of this line on subsequent maps (see Fig. 12b). A fence surrounding the oil storage on Site 2 appears in the Street between 1898 and 1905, and the street appears to be open, but not paved at that time (See Fig. 15c). An eight-inch water pipe is shown near the intersection of Greenpoint Avenue in 1951 (Sanborn 1951:pl.57), and in 1993 it runs the length of the project site section of the street. It is joined by a twelve-inch waterline as well (See Fig. 21c).

Expansion Site 3

Block 2491, Lot 51, bounded by Paidge Avenue on the north and northeast, Provost Street on the west, and as far south as the midline of Eagle Street (now demapped) and the lots of Expansion Site 1 to the south. The property was divided between three owners on the 1869 map, and although paper streets are drawn in, the area is probably still swamp east of the unnamed creek which runs north-south west of Provost Street (See Fig. 10). The first recorded construction on Expansion Site 3 is the construction of water lines along Eagle and Dupont Streets which cut through the study area in 1886. However, these water pipes were probably never installed (See Fig. 12a). Later water pipes do appear on these streets, the western edge of Eagle in 1890 (See Fig. 17), and across Dupont by 1921 (See Fig. 18a). A building appears on the corner of Provost and Eagle Streets in 1887 (See Fig. 13a), which is depicted in 1898 as a single-story brick structure. In 1905 it is identified as a 3-story office and storage building for the James D. Leary lumberyard (See Fig. 15a), while subsequent maps show it as a 2-story building with a basement. However, by 1916 it is labelled as vacant (See Figs. 16a, 17). Between 1916 and 1921 the building was torn down (See Fig. 18a).

Broken lines within the lumberyard indicate shed structures for protecting lumber from the elements, or piles of lumber. The lumberyard is surrounded by a fence (See Fig. 15a).

Near the southwest corner of Dupont and Provost a 1-story woodframe building was built between 1887 and 1898 (See Fig. 14a). The building is identified as a carriage shed in 1905. A second frame shed at the northernmost corner of the site was added between 1898 and 1905 (See Fig. 15a). The Sanborn atlas of 1905 shows both of these sheds standing in Provost Street, outside the study site, while the 1898 and 1912 Hyde atlases draw the sheds within Expansion Site 3 (Compare Figs. 15a, 14a and 16a). Between 1912 and 1916 both were removed (See Fig. 17).

According to the available maps, the Block 2491 section of Expansion Site 3 has remained vacant since c.1916-1921 (See Fig. 18a).

Eagle Street saw two construction episodes. According to the 1886 map, water pipes were installed under its entire project site length (See Fig. 12a), although subsequent maps never show water pipes extending more than 150 feet east of Provost Street (See Figs. 14a, 17). The other structures were associated with the main building of the Provost Engineering Corporation, outside Expansion Site 3 (but in Expansion Site 1), at the southeastern corner of Provost and Eagle Streets. This two-story brick building, erected between 1869 and 1886 was originally part of the "N.Y. Cedar Ware Co." (See Fig. 12a). Between 1905 and 1916, a one-story wood frame extension, an auto repair department, was added on the north side of the brick building, extending into Eagle Street (See Fig. 17). The ell is no longer depicted in 1921 (See Fig. 18a), however, between 1921 and 1929, a free-standing 1-story frame building was built in the same general area - the southern half of Eagle Street. This structure was removed before 1942 (Sanborn 1942:pl.55).

The site remained vacant until 1957, when a 1-story building was erected along the Provost Street, a factory building for Williamsburg Steel Products Co. (See Figs. 20, 21a). By this time, Dupont and Eagle Streets had been demapped, and the new building had a 316' frontage on Provost, extending into the former Eagle and Dupont, as well as abutting Paidge Avenue (B2491 L201 Alt.4266-1958). There is no evidence of a basement. In 1959/60, an addition was built, an irregularly-shaped building of 1 and 2 stories, directly east of the original structure. This new factory and lockerroom facility covered most of the remaining open areas of Expansion Site 3. No basement was planned, but the nature of the ground, fill over the former swamp, required the driving of "at least 5,000 wooden piles" - with an average depth of 40-45' (40' piles driven to full refusal for 100 ton stiff leg derrick). Alfred Finkel, the secretary of Samco Realty, signed a pledge assuming full responsibility for damage to the floor from settling, cracking, bulging and any breaking caused by the construction on fill, and proposed the installation of storm and sanitary drainage (Alt.4266-1958). Both buildings still stand today (See Fig. 21a and Photos 2,9,10).

V. CONCLUSIONS AND RECOMMENDATIONS

Historical Potential and Sensitivity

The meadowlands and their unnamed watercourses which once made up Newtown Creek WPCP Expansion Sites 1, 2 and 3 were not drained and filled until the second half of the 19th century, and the first structures did not appear until after 1886. There is no evidence of these lots ever having hosted dwellings, nor do the compiled site histories suggest that the industrial structures which formerly occupied the three expansion sites were of cultural, historical or technological significance. No further consideration is warranted or recommended for buried archaeological resources from the historical period.

Prehistoric Archaeological Potential

Native Americans occupied Western Long Island during various cultural periods prior to European colonization. There are ethnographic and archaeological accounts that place Indian camps, villages, and/or processing sites in Brooklyn and Queens in the vicinity of Newtown Creek. Prior to the late 1800s the project site was a low-lying marshland that would have afforded Native Americans numerous and life-sustaining floral and faunal resources. Excluded from further prehistoric consideration are those sections of Site 1 which were actually part of the natural stream beds of Newtown and Whale Creeks, as indicated on the 1898 map (See Fig. 14a).

As stated in Section III of this report, although the New York State Museum declares that study site physiographic characteristics suggest a high possibility of prehistoric use (See Appendix A), such sensitivity ratings employ a predictive model based in part on proximity to water and mapped on <u>current</u> USGS topographic maps. The predictive model does not take into account the swampy, pre-development conditions which existed on Expansion Sites 1, 2 and 3. It is extremely unlikely that the topography of the project blocks would have induced prehistoric Americans to situate a village or camp there during the late Archaic and Woodland Periods, although resource extraction and processing may have taken place on the marshy sections of the Expansion Sites. It is no coincidence that the only recorded prehistoric site (NYSM# 3613) in the vicinity of the study site and on the Greenpoint side of Newtown Creek, is on high, dry ground, adjacent to, but not in the swamp (1,400 feet west). Prior to the Late Archaic, when sea levels were substantially lower, the expansion sites would have been relatively barren, dry ground. Pre-indundation topography would probably have been a relatively flat plain, without the fresh water and marsh resources so attractive to prehistoric Americans. From what we know of prehistoric settlement patterns, this sort of environment

would not have been the site of large-scale camps or habitations, although it might have supported a temporary processing station during times of lowered sea-level. Such a station would provide only limited processing resources from the earlier cultural periods.

As stated in Section IV of this report, there are no ethnographic or antiquarian accounts of shell middens, the refuse deposits of shellfish harvesting, along Whale Creek. Although the data provided by some of the borings performed on Site 1 and adjacent to Site 3 (including Freeman Street) indicate the existence of a grassy organic layer beneath the thick fill overmantle (EAW-5,-7,-8,-9,-10,-11,-13,-14,-15,-18,-19), there is no evidence of a shell harvesting site or shell midden on or adjacent to Sites 1 and 3. Although the 1942 City of New York Department of Public Works boring logs reported that "plant matter, soft silt, shells" were recovered in three borings (#33, #34, and #35) on Green Street, approximately 300 feet south of Site 1, 1962 borings (City of New York Department of Environmental Protection) (on Block 2525) recorded two locations that yielded a "trace of shells," approximately 85 to 95 feet further south of the earlier shell-bearing borings, and boring B-109 from 1990 WPCP logs reported shells at the intersection of Greenpoint Avenue and Provost Street (about 1,600 feet from Site 1) neither the borings performed on Expansion Site 1, nor those on the block directly south of Site 1, already part of the Newtown Creek WPCP, recovered any evidence of shells or other materials associated with shell middens and processing sites (Kearns Kirkorian and Schaefer 1989:Addendum) (See Appendix B).

Although no borings have been performed on Expansion Site 2, a log from a boring (#38) on the project site - North Henry Street, about 50 feet west of the northern tip of Site 2 - reported the presence of a layer of silt and shells beneath 16 feet of fill. Shells are reported in all the borings in a continuous line west from this location, along Green Street. These data suggest that some shell deposits may exist on Site 2. Although the adjacent areas of the WPCP along the western border of North Henry Street show substantial fill layers (18 feet or greater) but no shell deposits (Appendix B), the 1942 boring location plan indicates that most of that area was flooded by Whale Creek Canal, which had not been sufficiently bulkheaded as late as 1942. This "shoreline" is visible on the 1905 map, where it even extends into North Henry Street (See Fig. 15c). Although this flooding was probably a result of 19th- and 20th-century rechannelling and filling, it identifies the vicinity west of North Henry as a depressed area where water would collect, and perhaps such was the case during the prehistoric period. This interpretation is supported by the fact that the two 1942 borings which were taken under this water are the only two which do not contain shells (B, #36) - one even has no fill (#36) (City of New York Department of Public Works 1942:#33-38,B).

These data indicate that Expansion Sites 1 and 3 have a very low potential, and that Site 2 has a moderate potential for hosting deeply-buried cultural remains from the prehistoric era.

Prehistoric Archaeological Sensitivity

Disturbance

At the same time that this report has documented prehistoric site conditions, the authors have also collected information on site disturbance. The earliest known disturbance to Expansion Sites 1, 2 and 3, was the drainage of the marsh, the rechannelling and draining of the many small streams in the marsh, and the dredging and bulkheading of Whale Creek Canal, which would have very likely disturbed potentially existing evidence of prehistoric land use activities. The Newtown Creek WPCP Expansion Sites were further impacted by the extensive landfill, generally between 10 and 20 feet, placed there during early development. According to borings conducted on Site 1 and adjacent to Sites 2 and 3, the natural water table of the Expansion Sites extends well into the fill layer, with the water level generally fluctuating between 3 and 11 feet below the current surface.

Despite the compressive force of the fill overmantle, it is probable that it has served as a protective layer, buffering the pre-fill surface from subsequent construction activity (reviewed under the Building History heading at the end of the previous section). Furthermore, the high water table has precluded the construction of deep basements, which might have filled with water. Only two buildings with basements have been recorded in the study site, both at the corner of Eagle and Provost Streets, one on the north side in Site 3 (See Fig. 15a) and the other on the south side in Site 1[4] (See Fig. 16a). However, the 14.5- to 15-foot-thick fill layer in these areas (EAW-9 and -10), would have certainly acted as a buffer between any basement disturbance and what remains of the pre-fill surface. Similarly, buried utility pipes, such as the water lines (ranging in diameter from 4 to 12 inches) installed on most of the streets within the project site, would not have made an impact on pre-fill surfaces because they would have been shallowly buried not far below the frost line, which in this area is four feet below the surface.

On the other hand, some of the construction on the project site would have certainly pierced the fill layer and caused disturbance to potential cultural remains surviving below the fill. These disturbances fall into two categories, the sinking of foundation piles and the burial of storage tanks.

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[4]It is noted in the Building History that this basement is mentioned on no other map, and may be a printing error.

On Site 3, the 1959/60 1- and 2-story addition to the Williamsburg Steel building was built directly east of the original structure (See Fig. 21a and Photos 2,9). The nature of the site, fill over swampy ground, and perhaps the weight of the substantial brick building, required the driving of "at least 5,000 wooden piles" - with an average depth of 40 to 45 feet. Apparently, even the large number of piles did not necessarily guarantee stability, since the secretary of Samco Realty (property owner), felt it necessary to sign a pledge assuming full responsibility for damage to the floor from settling, cracking, bulging and any breaking caused by the construction on fill, and proposed the installation of storm and sanitary drainage (Alt.4266-1958). The piercing of the below-fill surface by 5,000 piles constitutes a substantial adverse impact to potential buried archaeological resources. It also suggests that the original building, west of the addition (Provost between Eagle and Paidge, See Fig. 21a and Photo 10), which is the only other building on any of the Expansion Sites that is of similar size and substantiality, would have required a similar number of load-bearing piles to maintain the stability of its foundations.

In addition, a substantial number of buried tanks have been recorded on the eastern three quarters of Site 1. These are depicted on the 1993 map (Fig. 21a, 21b), and all are labelled "earth covered" except for the group of 20 buried tanks which are fully buried at the southeastern corner of Site 1, adjacent to the intersection of Freeman Street and Whale Creek Canal (See Fig. 21a). A more detailed map is provided as a boring location plan in Appendix B (EA 1990). Such buried tanks, with a capacity of 30,000 gallons each, are estimated to penetrate between 15 and 20 feet below the surface, and are still present on site. Their installation would certainly have obliterated any potential prehistoric cultural remains in that location. The other tanks (which have been removed), although only partially buried, would still penetrate from approximately 10 to 12 feet below ground surface (Pers. comm., Ellen Metzger, Senior Geologist, Blasland, Bouck & Lee, 5-31-95),[5] and have a strong potential for the disturbance and/or destruction of the below-fill surface.

Aboveground tanks, and the connecting piping between them, on Sites 1 and 2 (See Fig. 21c and Photos 11-14), would not cause the same depth of disturbance. Presently, oil refinery piping is generally installed above the ground surface, so that leaks can be easily detected and repaired. Subsurface disturbance would only occur during the construction of tank foundations (Pers. comm., Ellen Metzger, 5-31-95), which would probably not penetrate the thick fill layer. However, it has been noted that at least the

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[5]According to Metzger, when Blasland, Bouck and Lee Inc. completes its site assessment, the depth of disturbance caused by tank installation can be defined more accurately.

117).

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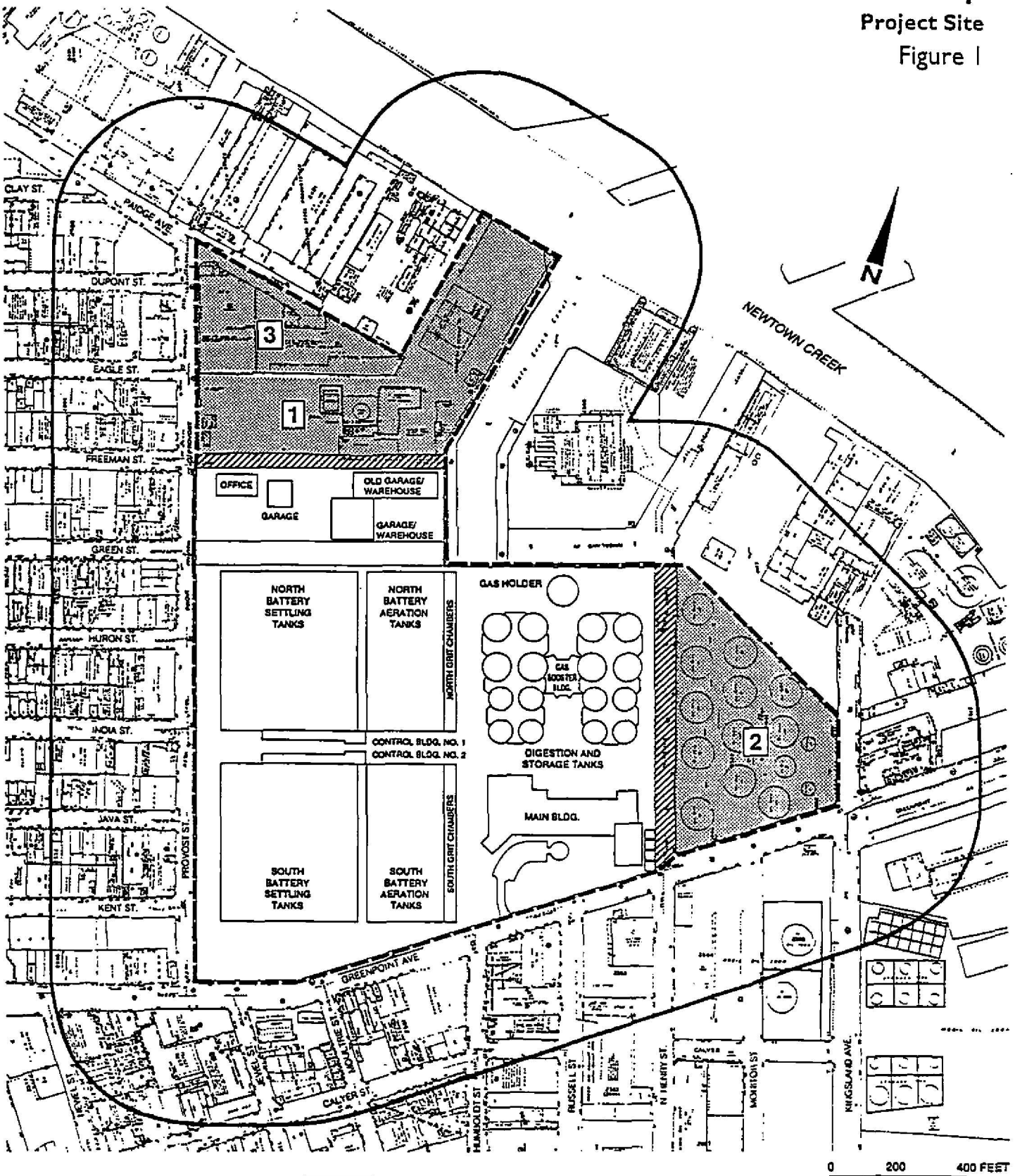
Sanborn Map

Project Site

Figure 1



Project Site Boundary

400-Foot Perimeter

Expansion Site

Street to be Demapped

1 Exxon Site
2 Mobil Site
3 Williamsburg Steel Site

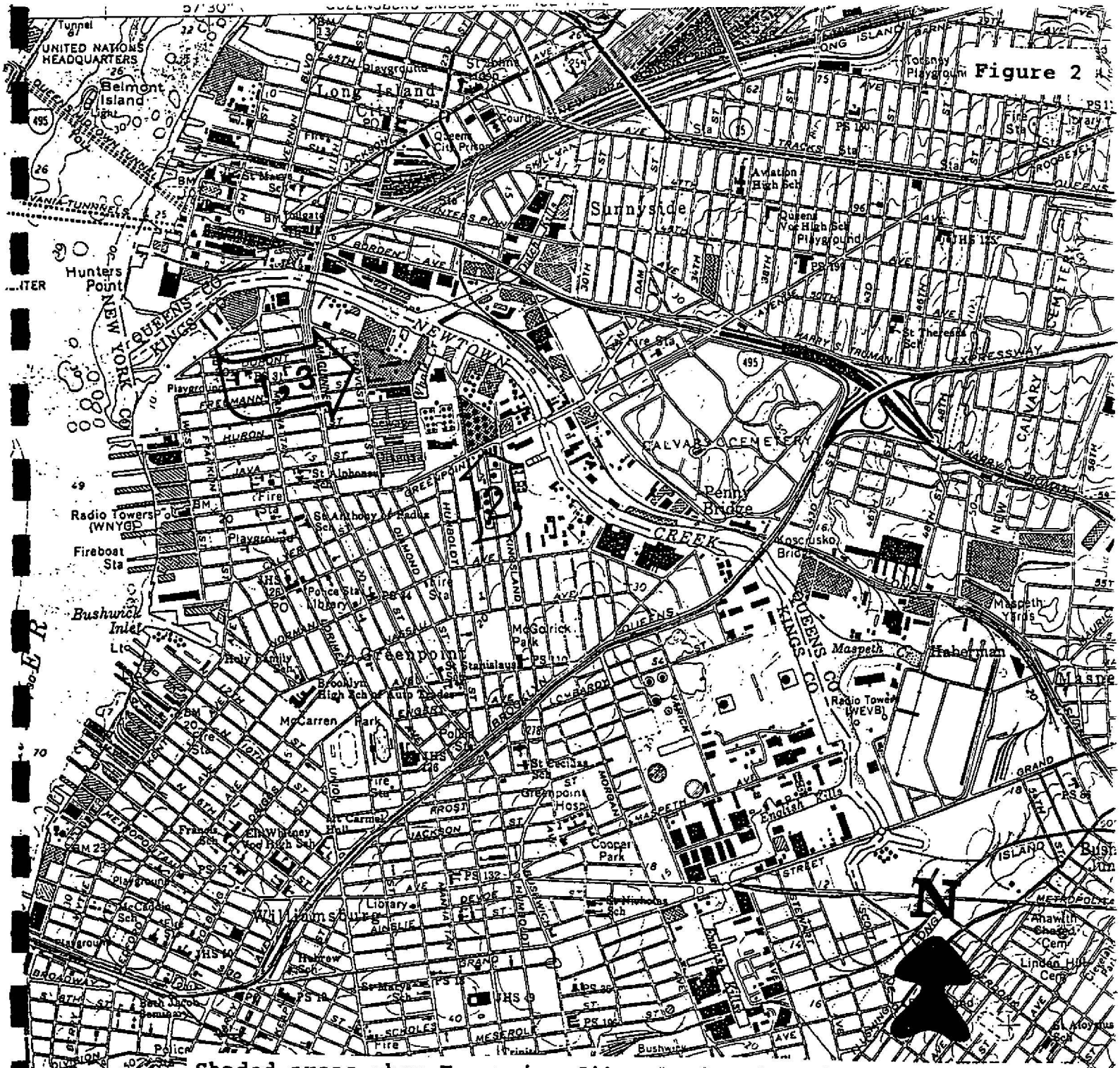
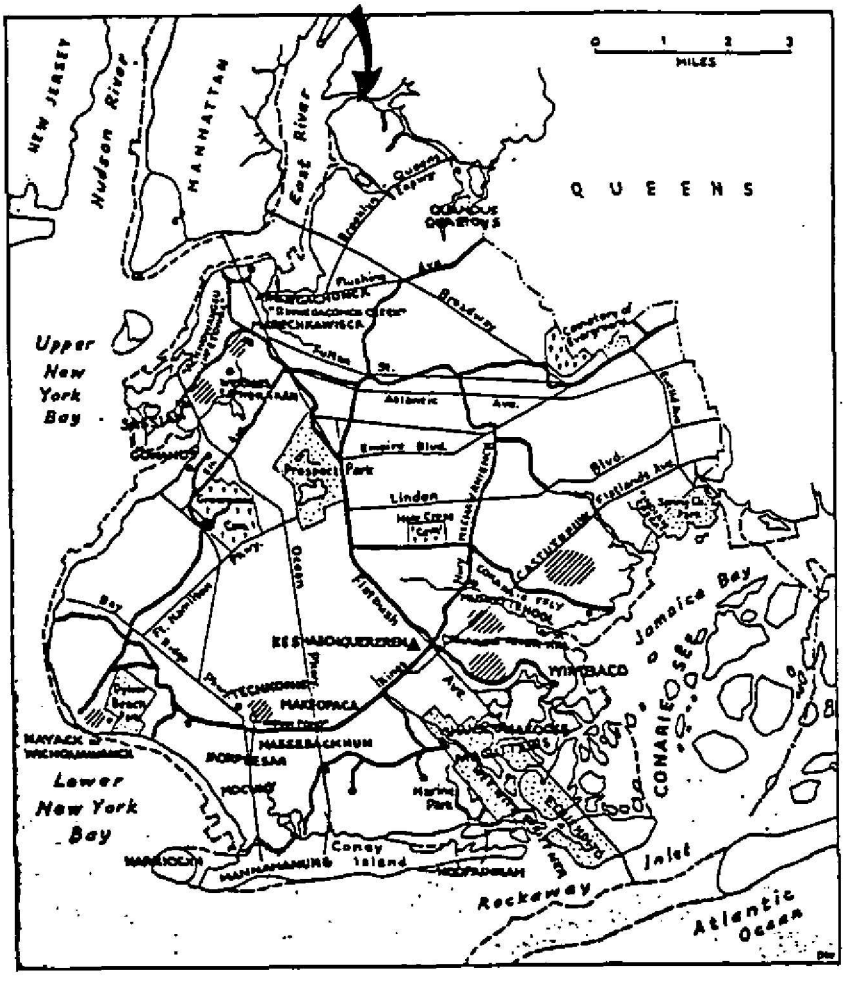


Figure 2
Shaded areas show Expansion Sites 1, 2 and 3, indicated by arrows
SCALE 1:24 000
1 MILE
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 4.2 FEET IN THE EAST RIVER
AND 5.2 FEET IN JAMAICA BAY
U.S.G.S. Topographic Map, Brooklyn Quadrangle, 1979

Figure 3

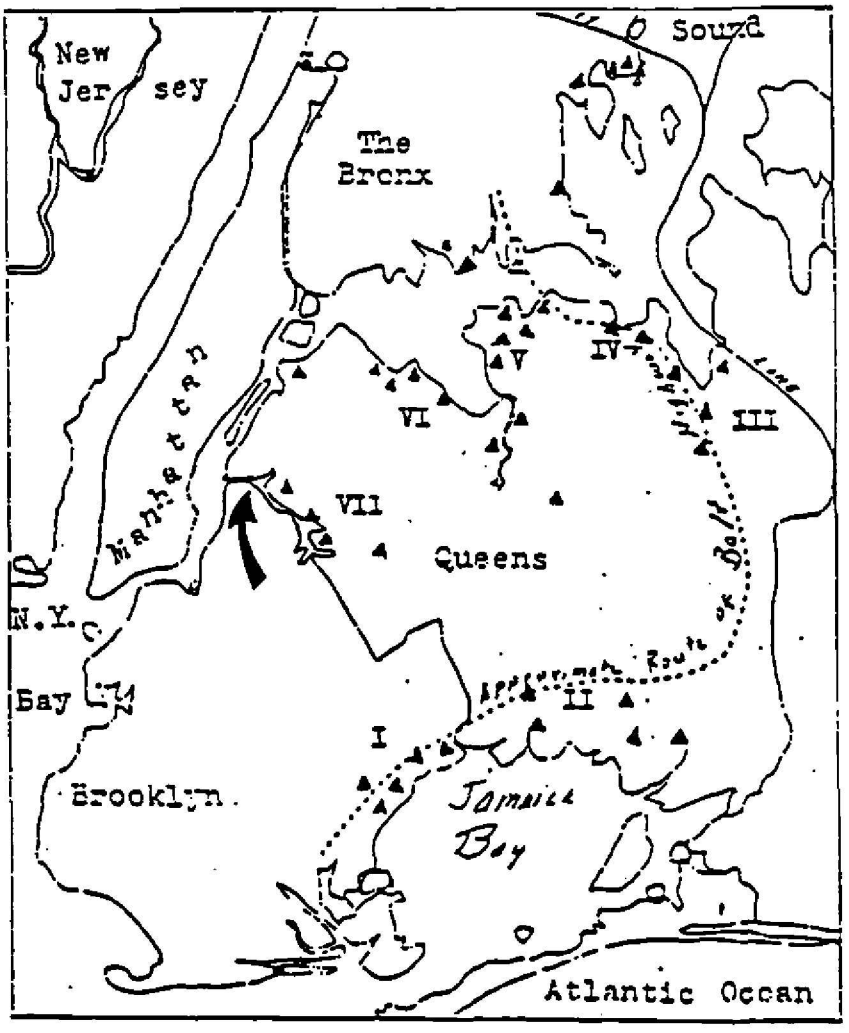


Upper Delawaran Trails and Settlements in New York City, from Grumet (1981:70)

LEGEND

- TRAIL (AFTER BOLTON 1922)
- PLANTING AREAS AND OLD FIELDS
- INDIAN NAMES OF LOCAL ORIGIN
- "Abin" NAMES NOT OF LOCAL ORIGIN
- HABITATION SITE
- PRESENT-DAY CITY PARKS
- MODERN SHORELINE
- CEMETERY

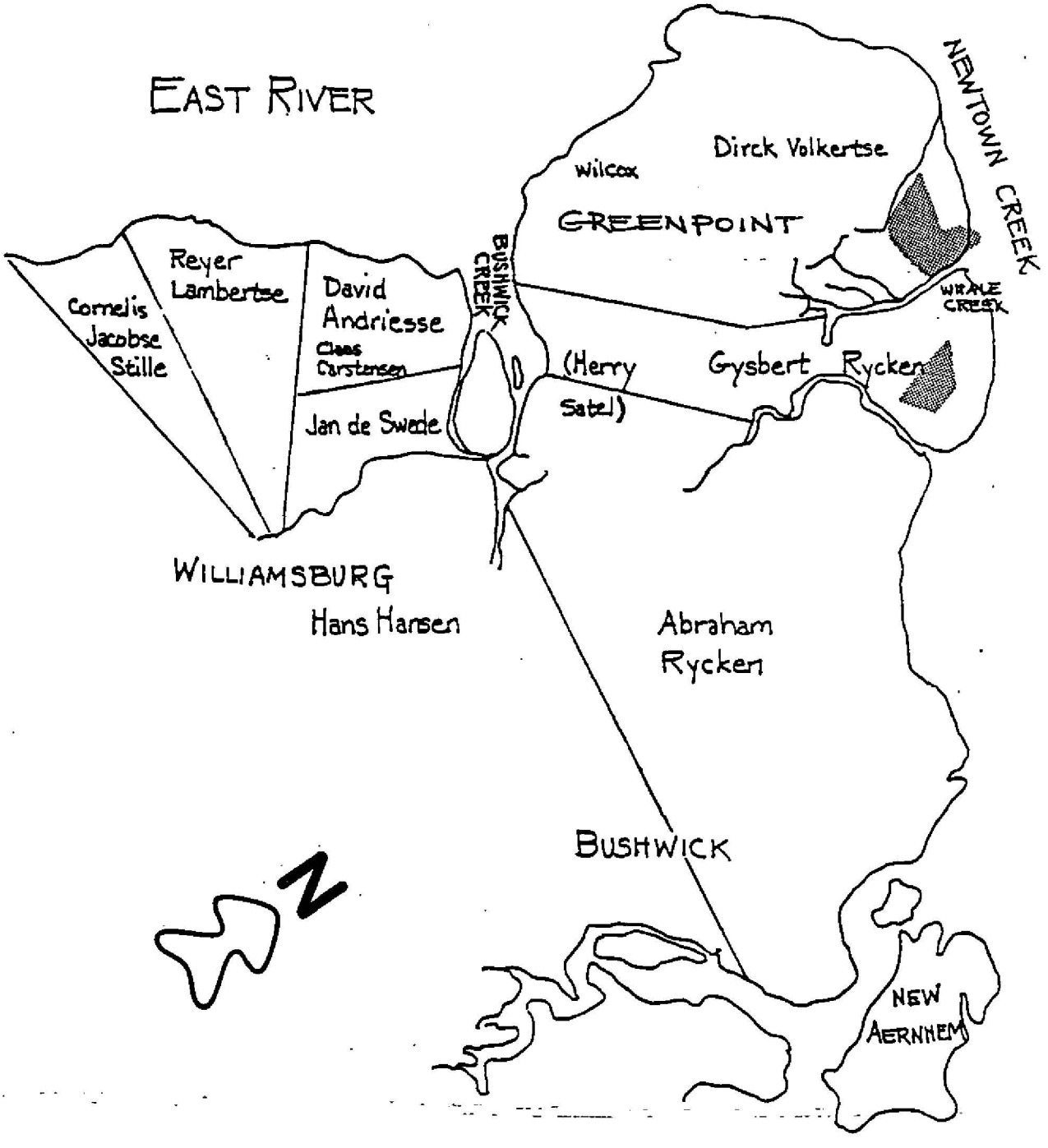
Figure 4



INDIAN VILLAGE SITES: Triangles on diagram indicate sites explored by Committee on American Anthropology of the Flushing Historical Society. Important locations described in accompanying article are numbered.

Indian Village Sites, from Solecki (1941)

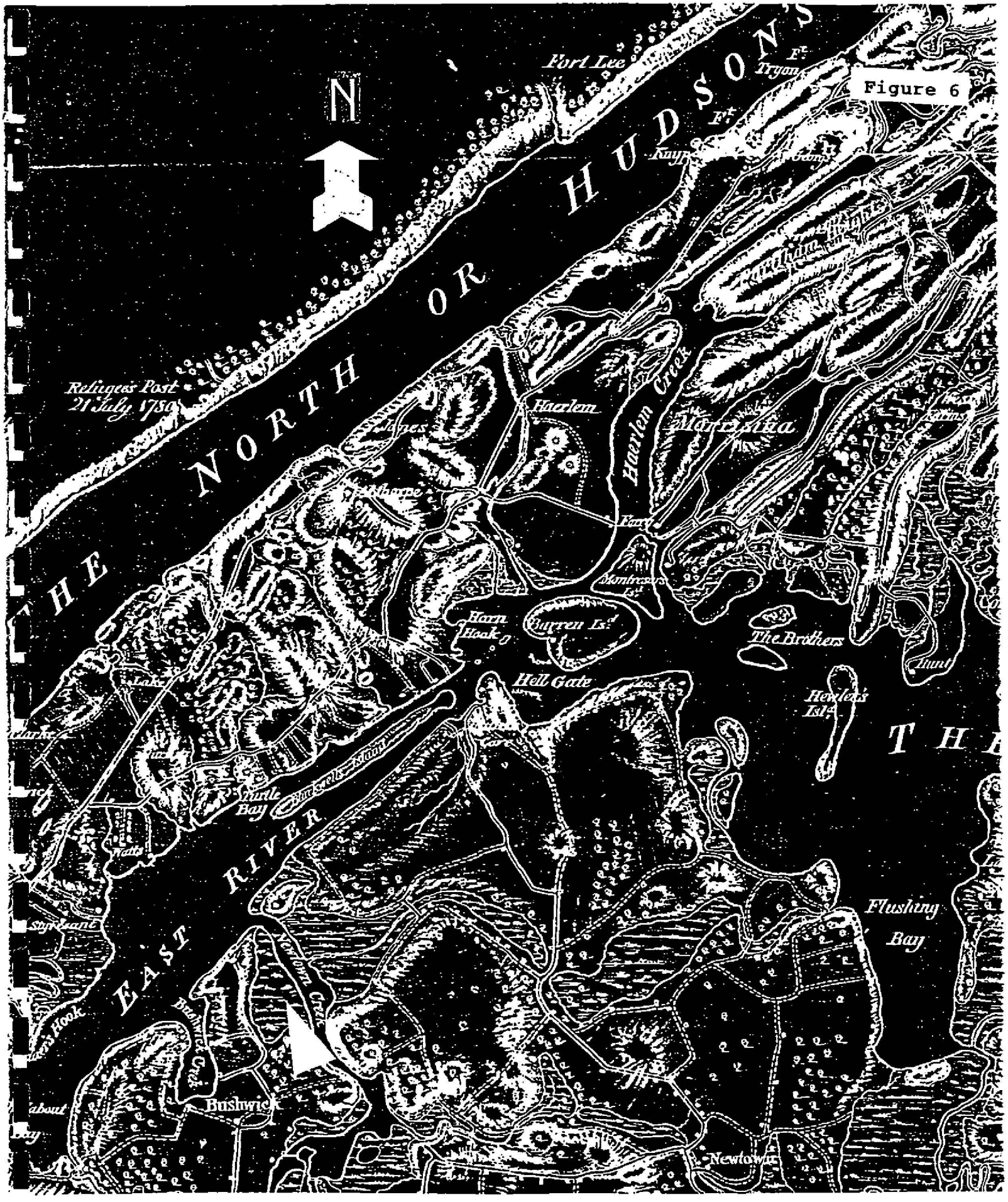
Figure 5



▒ - Shading indicates project area

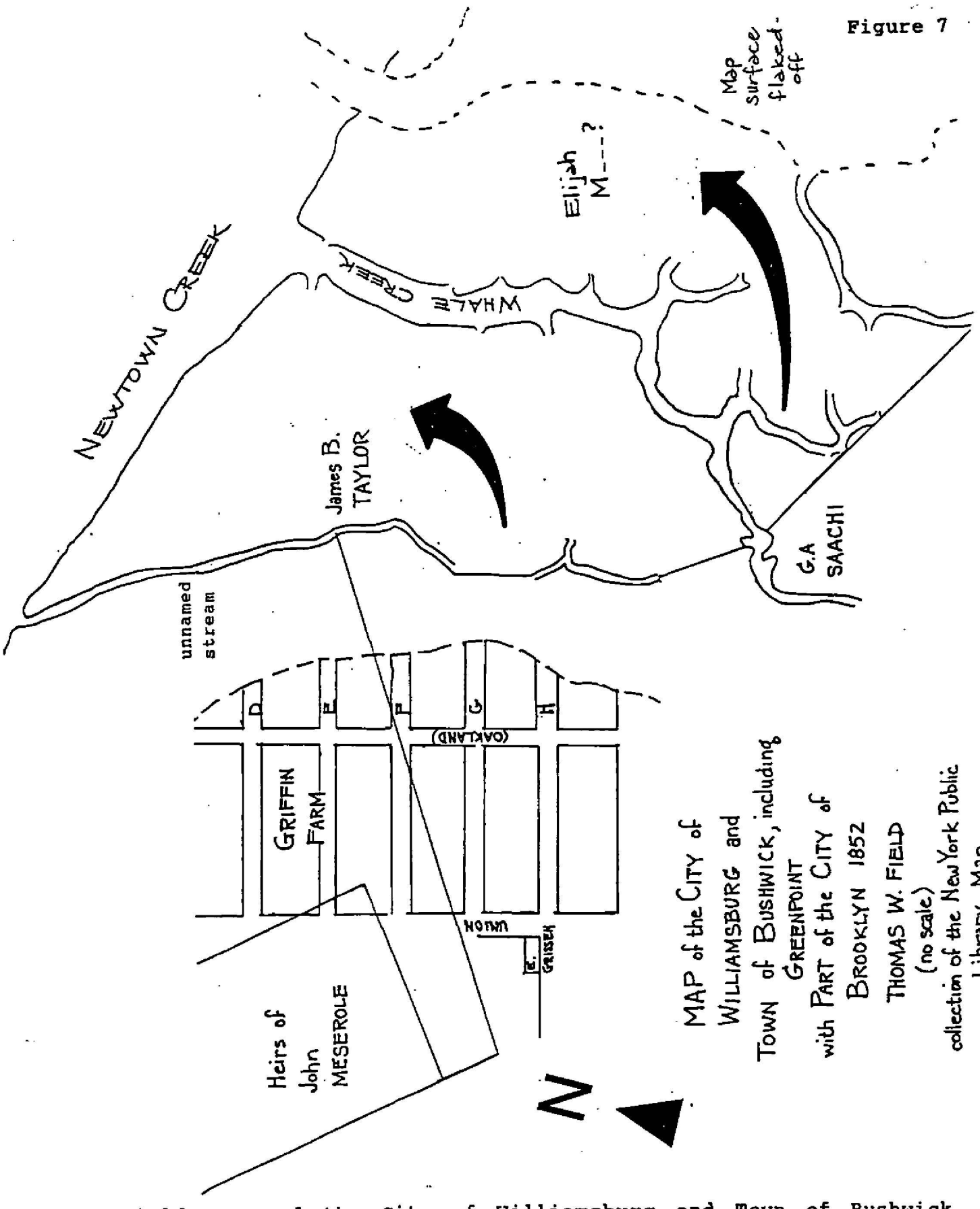
MAP OF ORIGINAL PLANTATIONS
SKETCH OF DRAWING IN: ARMBRUSTER (1912:120)

Figure 6



Taylor and Skinner, Map of New York & Staten Islands and Part of Long Island. Surveyed by order of Sir Henry Clinton, 1781

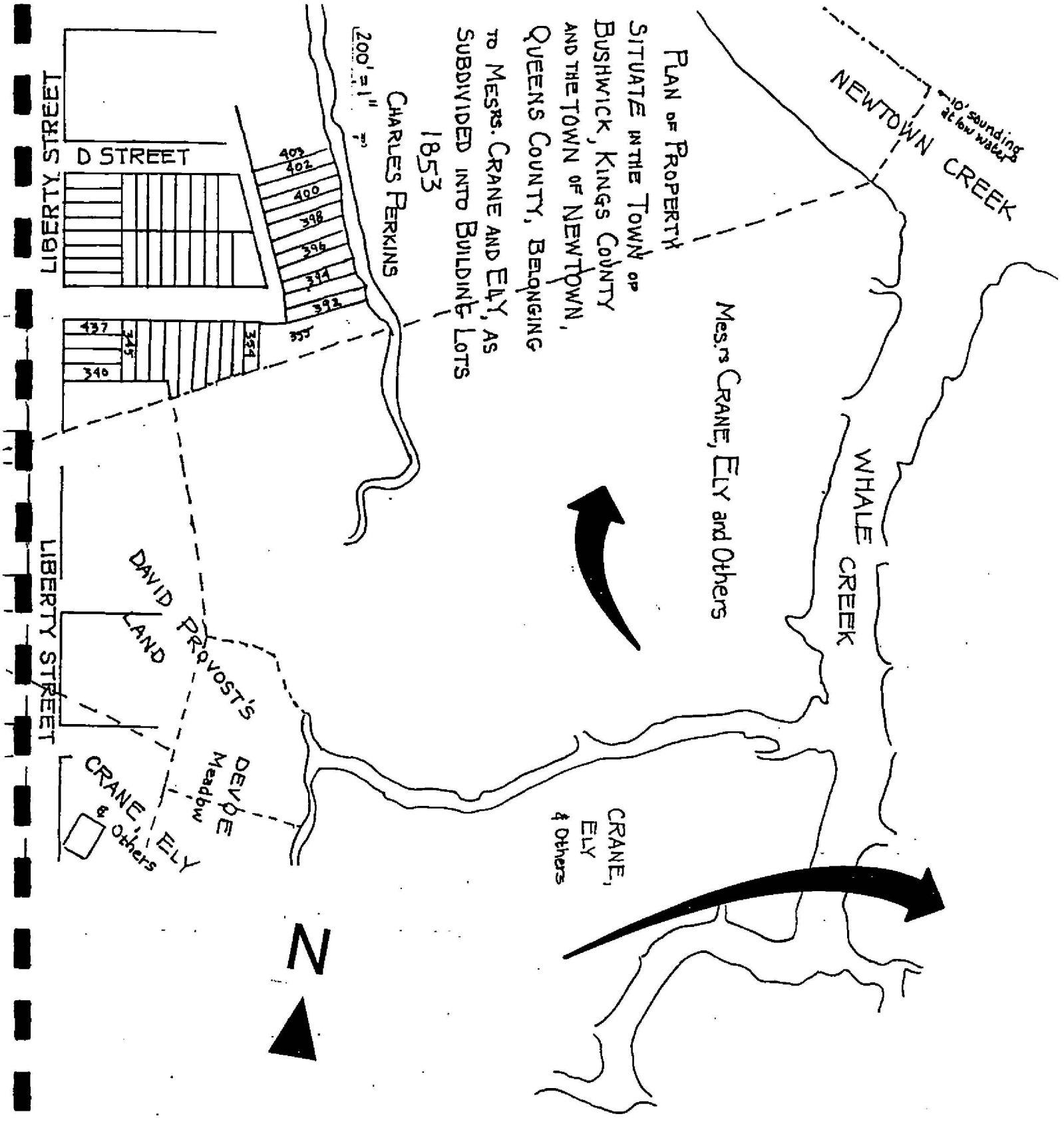
Figure 7



Field, Map of the City of Williamsburg and Town of Bushwick, including Greenpoint, 1852

Arrows indicate approximate position of project area

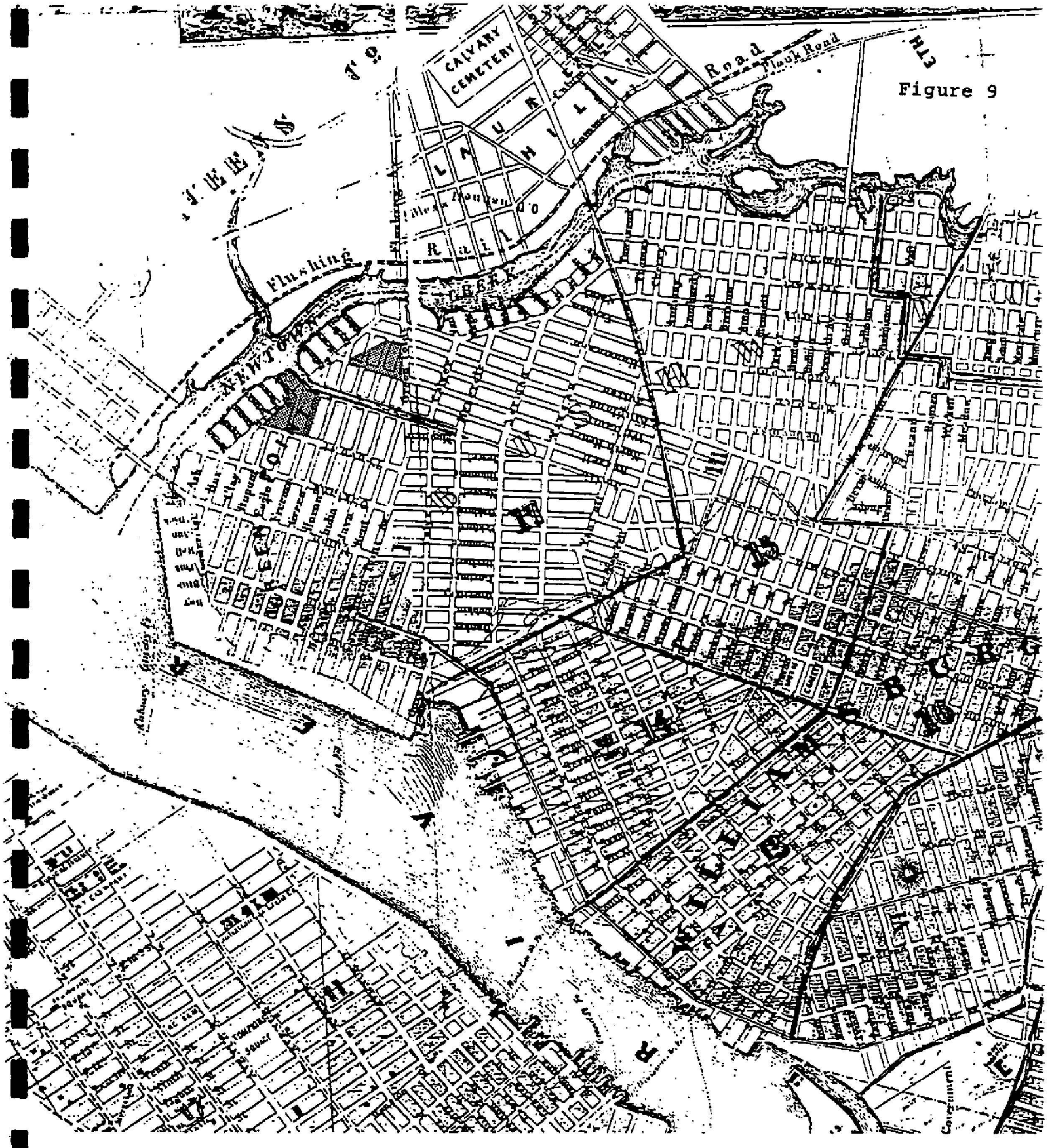
Figure 8



Perkins, Plan of Property Situate in the Town of Bushwick, 1853

Arrows indicate approximate position of project area

Figure 9



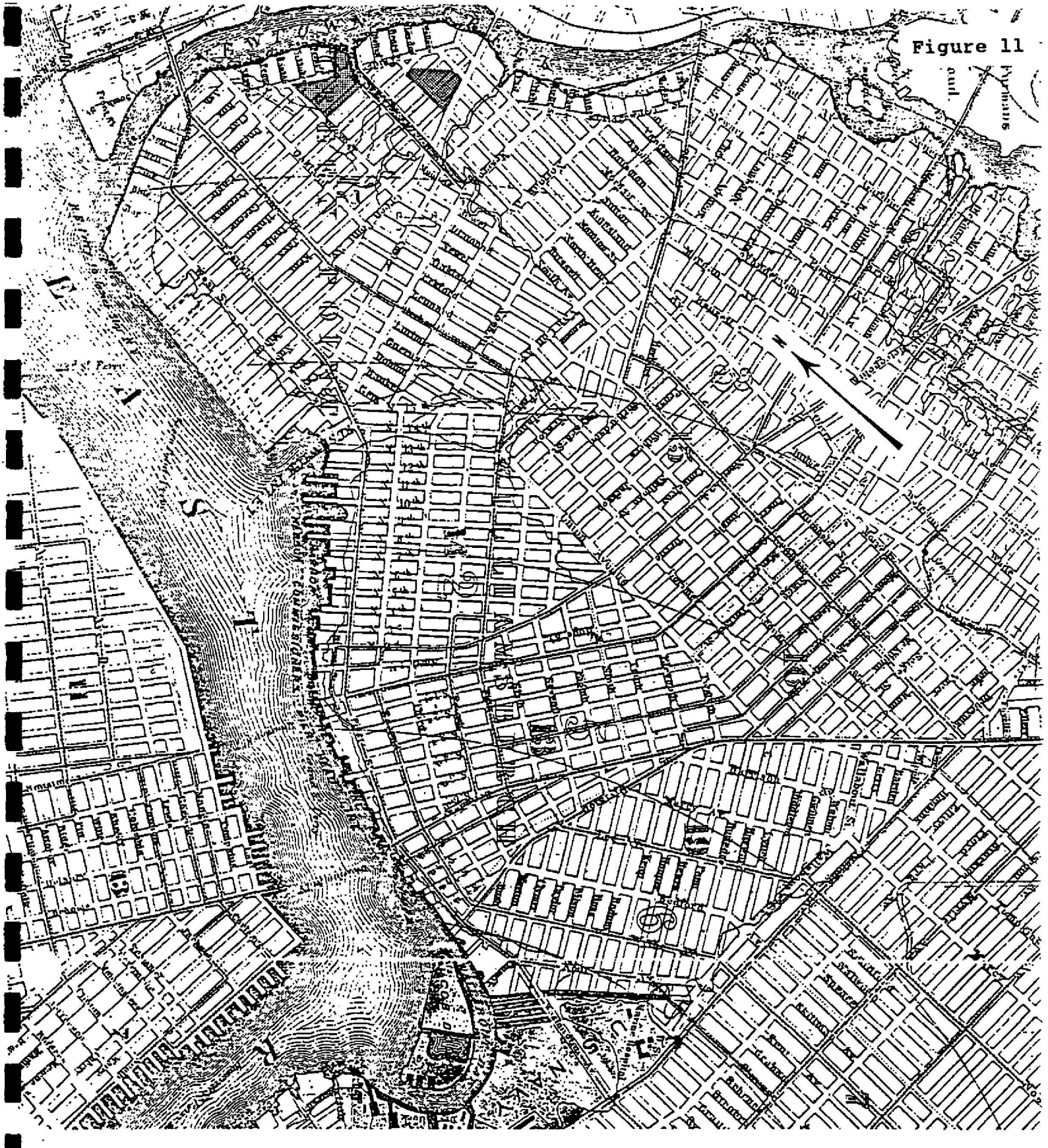
Dripps, Map of the City of Brooklyn, 1855

Figure 10

N

Dripps, Map of Brooklyn and Vicinity. Sheet 8 of 9, 1869
Expansion Sites 1 and 3 (top), Site 2 (bottom)
Project area indicated by shaded areas
Scale varies slightly between maps

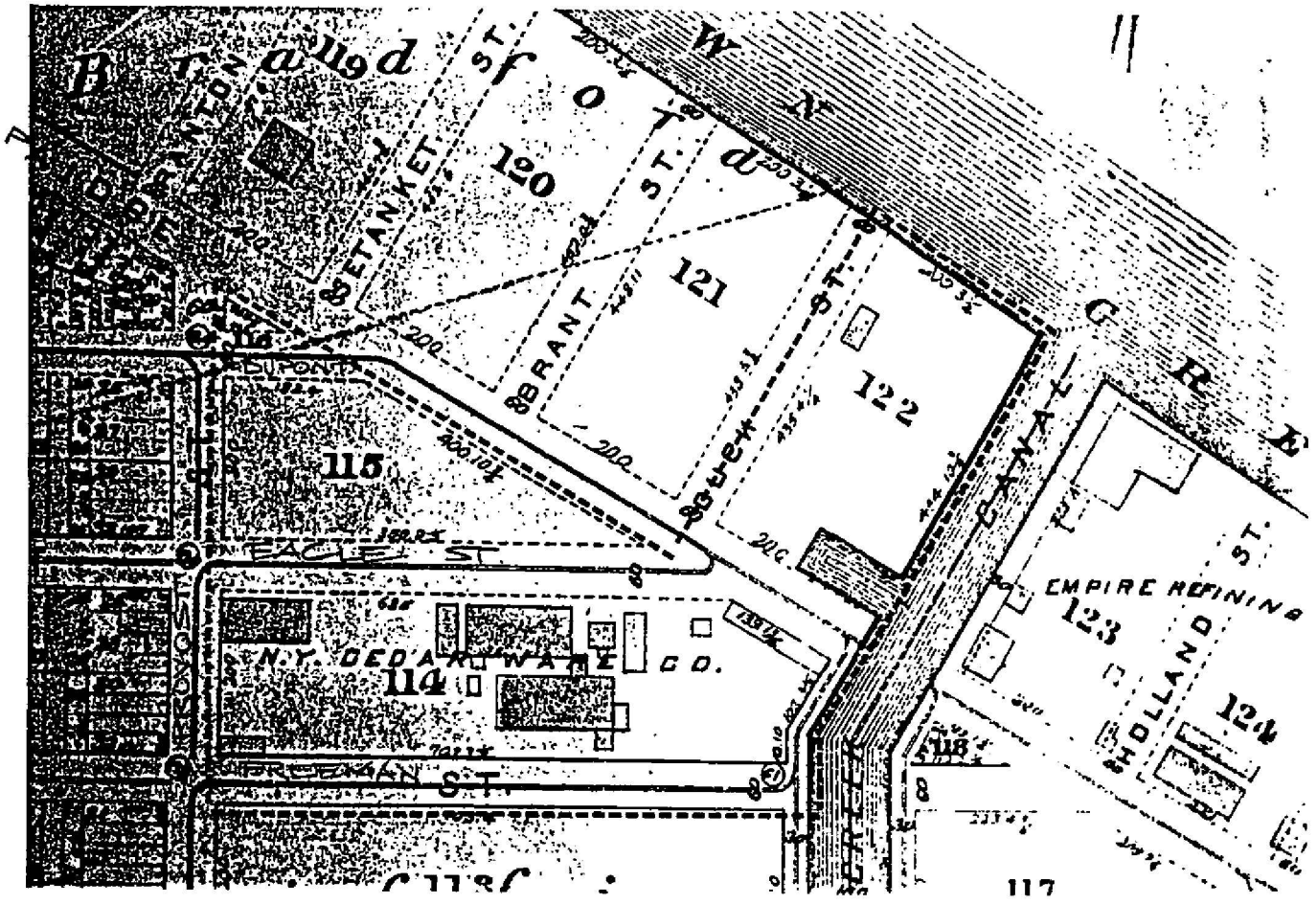
Figure 11



- Shading indicates project area

Beers, Atlas of Long Island, New York: The City of Brooklyn, 1873

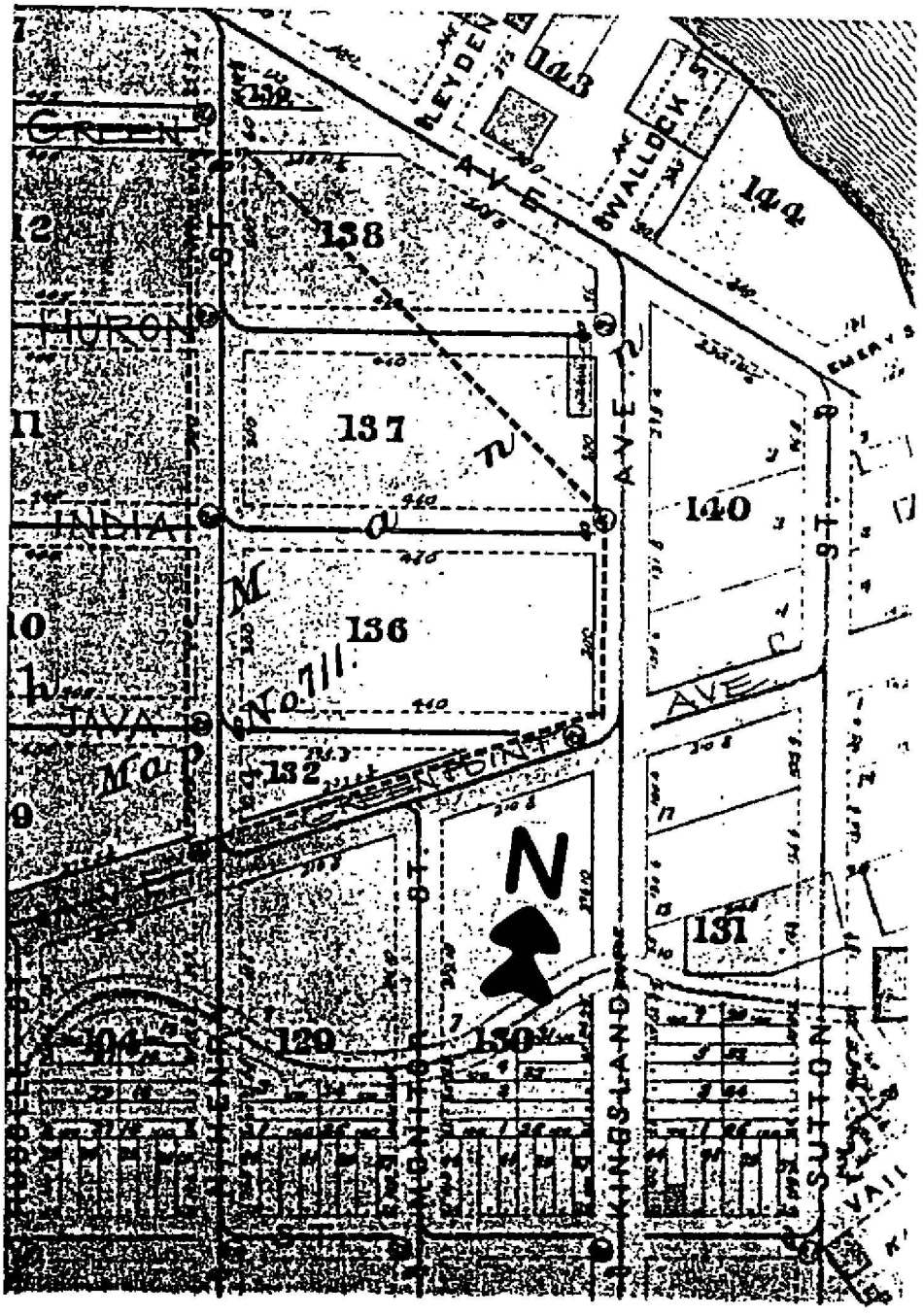
Figure 12a



N

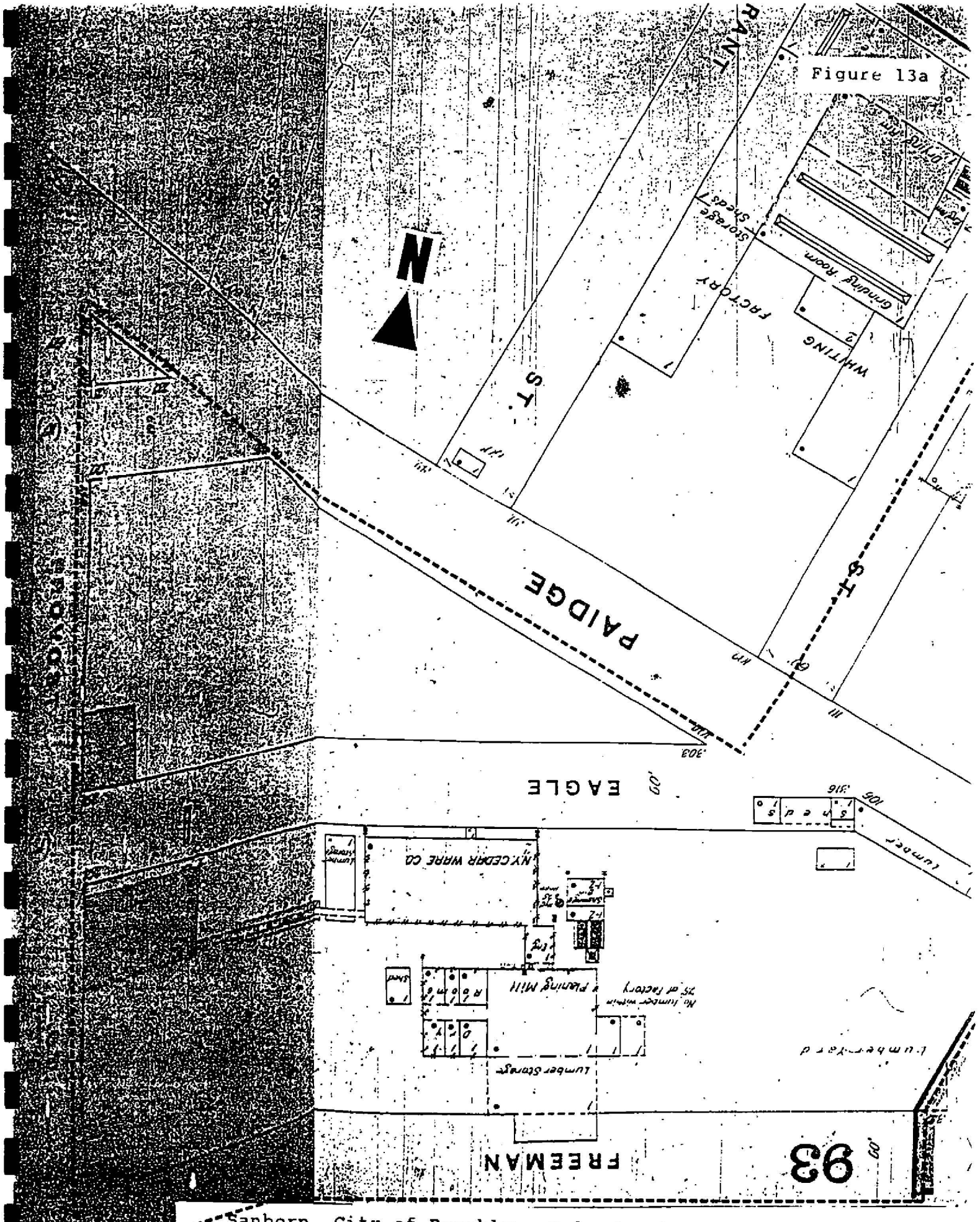
Robinson's Atlas of the City of Brooklyn. Pl. 12, 1886
Expansion Sites 1 and 3 -----

Figure 12b



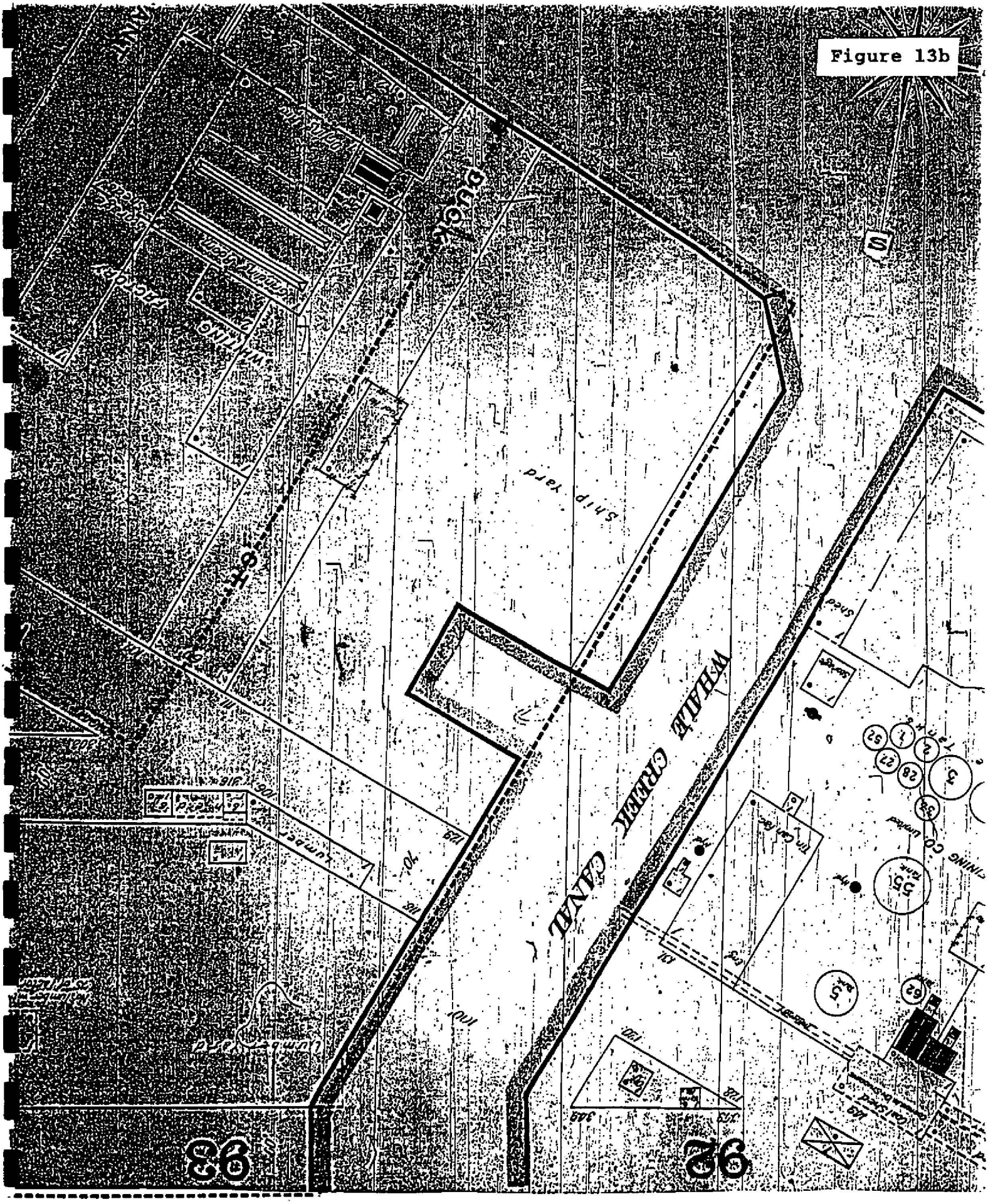
Robinson's Atlas of the City of Brooklyn. Pl. 12, 1886
Expansion Site 2----

Figure 13a



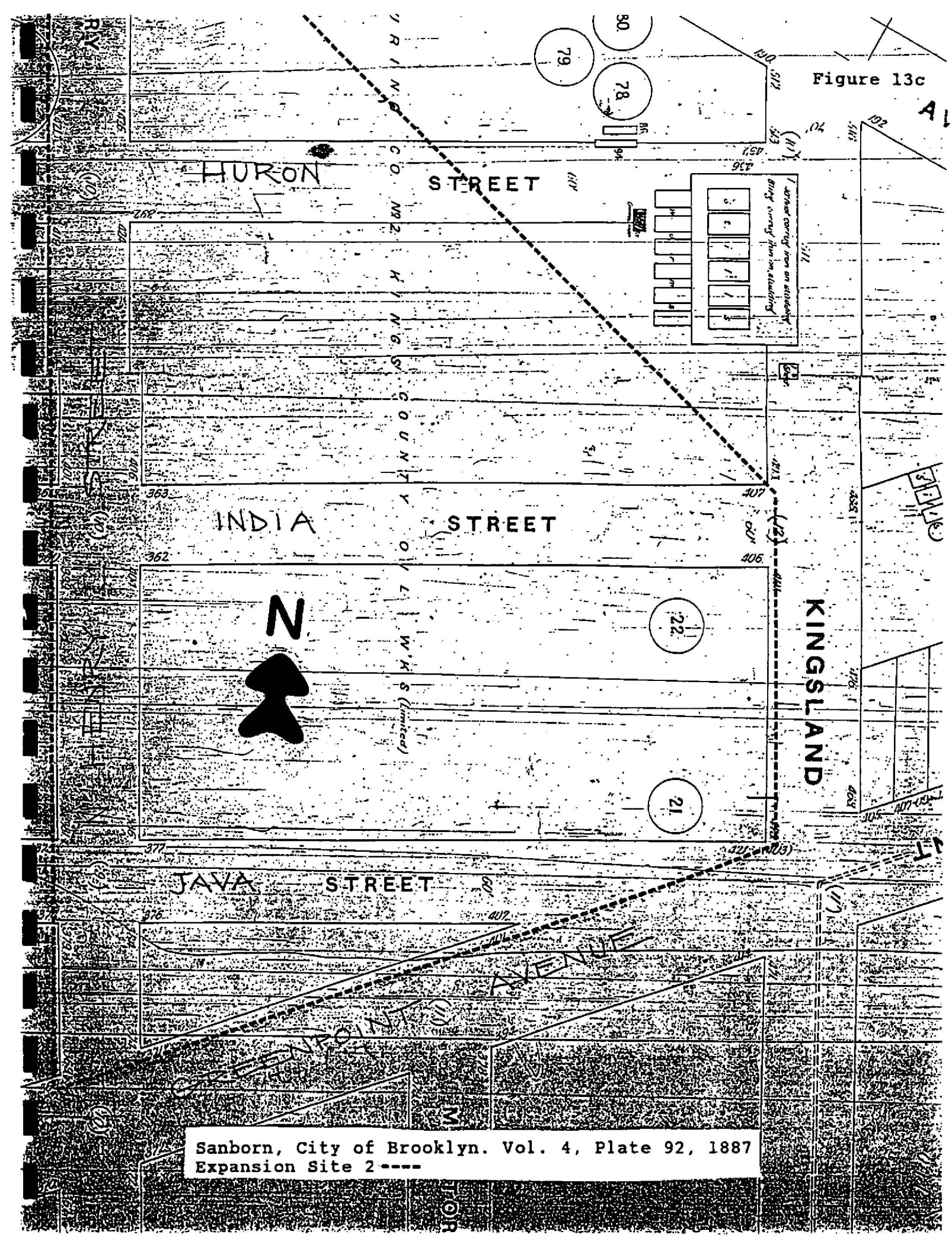
Sanborn, City of Brooklyn. Vol. 4, pl. 91, 1887
Expansion Sites 1 (partial) and 3 -----

Figure 13b



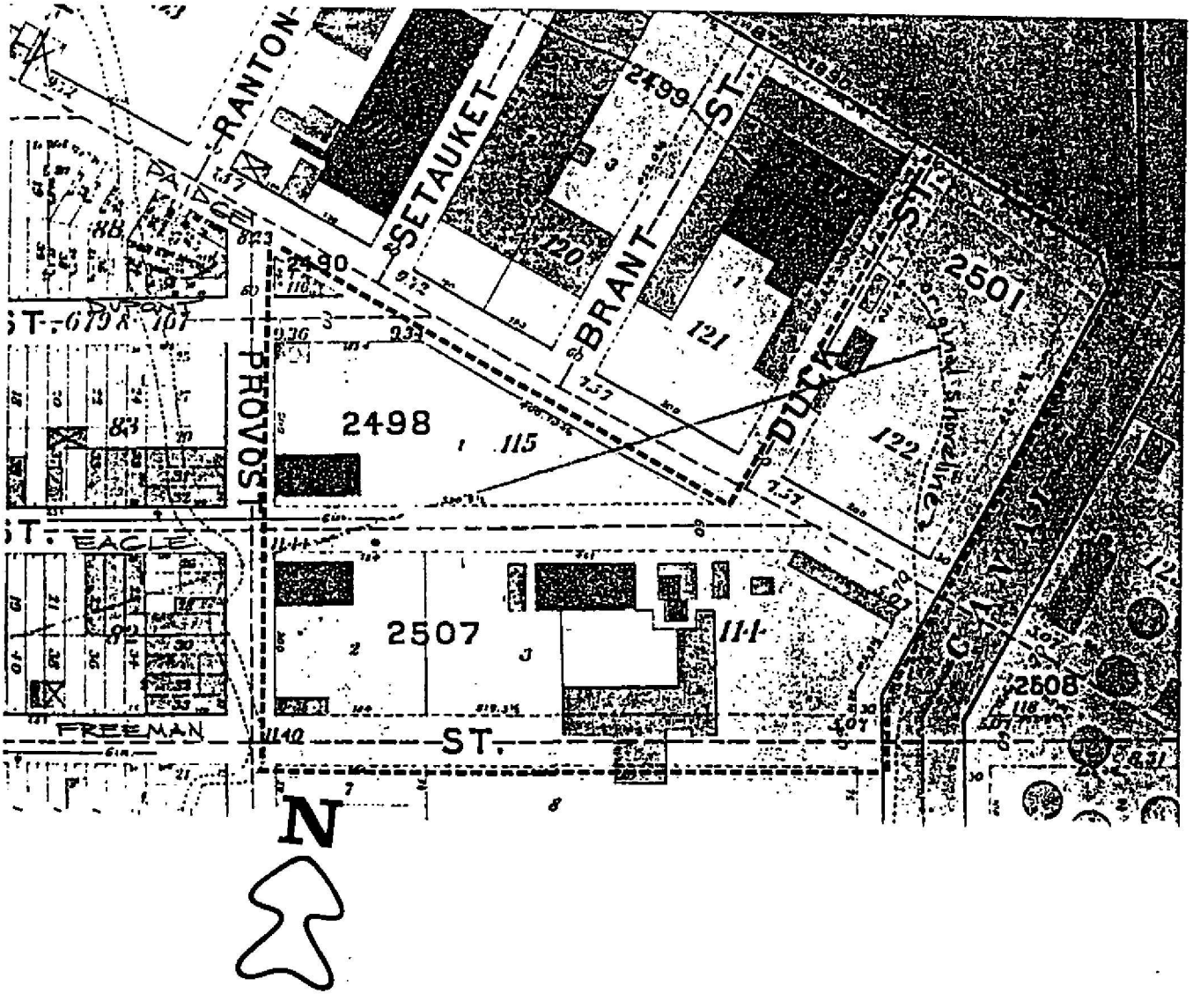
Sanborn, City of Brooklyn. Vol. 4, pl. 91, 1887
Expansion Site 1 (partial) -----

Figure 13c



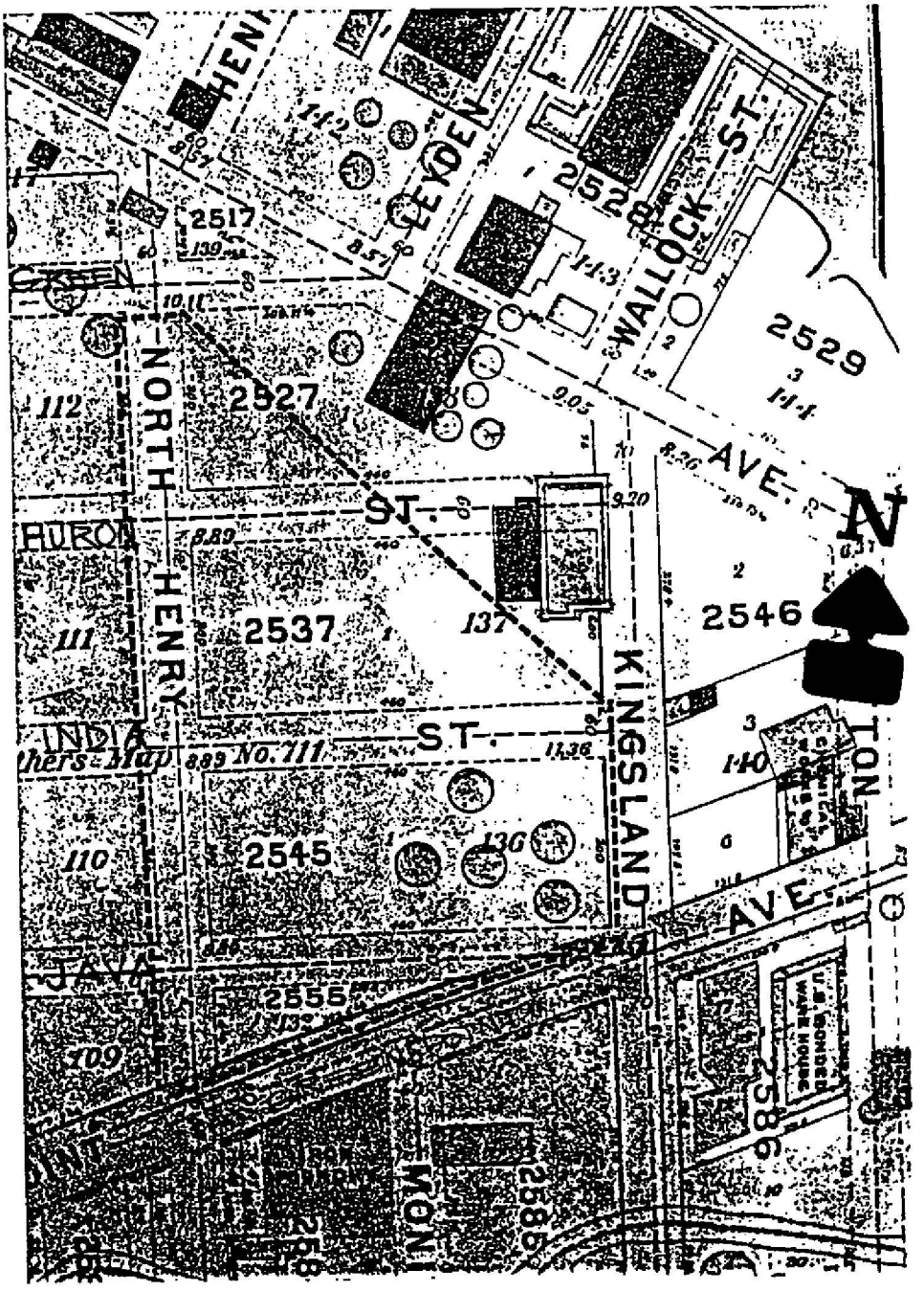
Sanborn, City of Brooklyn. Vol. 4, Plate 92, 1887
Expansion Site 2----

Figure 14a



Hyde, Atlas of the Brooklyn Borough of the City of New York. Vol. 1, pl. 34, 1898
Expansion Sites 1 and 3 -----

Figure 14b.



Hyde, Atlas of the Brooklyn Borough of the City of New York. Vol. 1, pl. 34, 1898
Expansion Site 2 -----

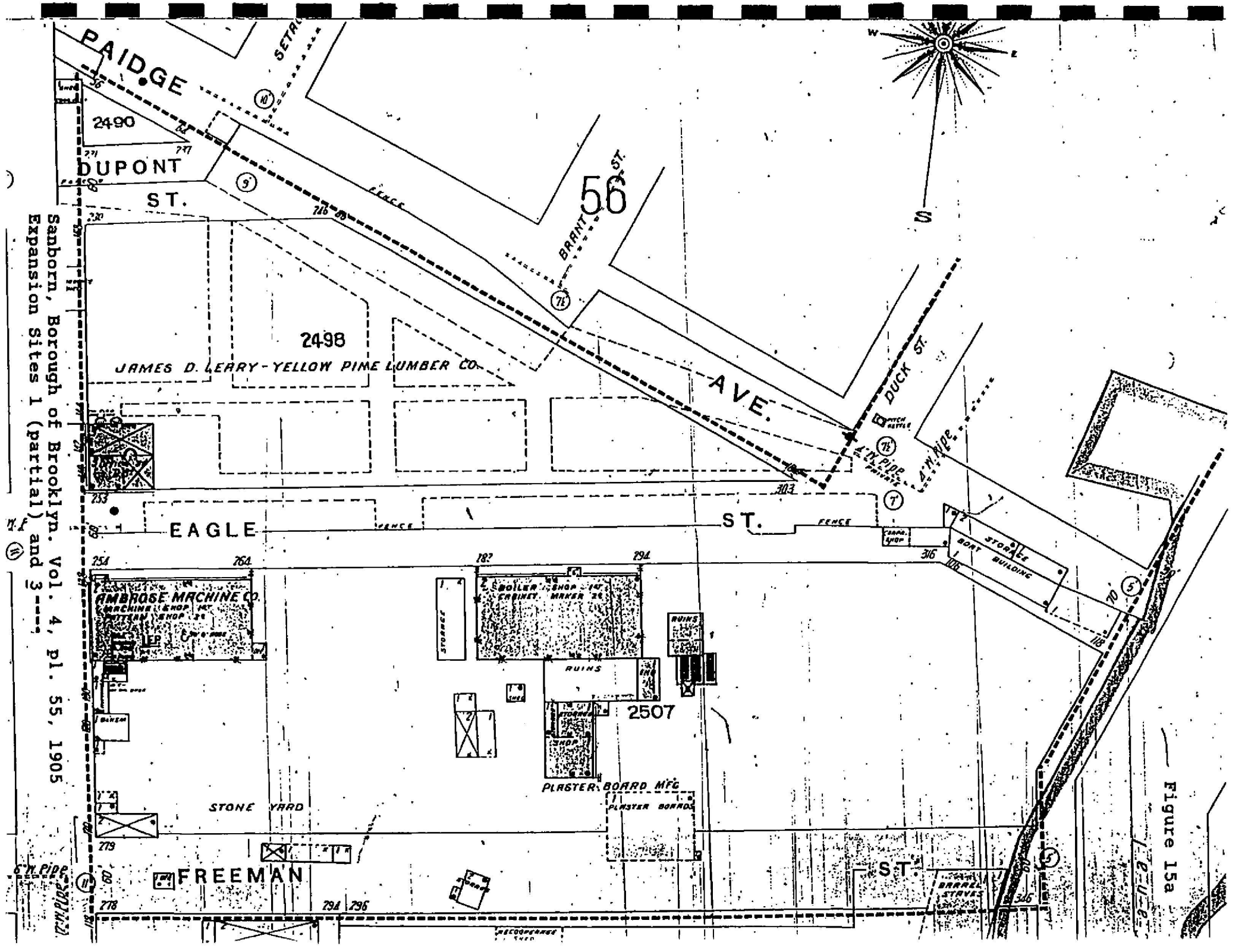
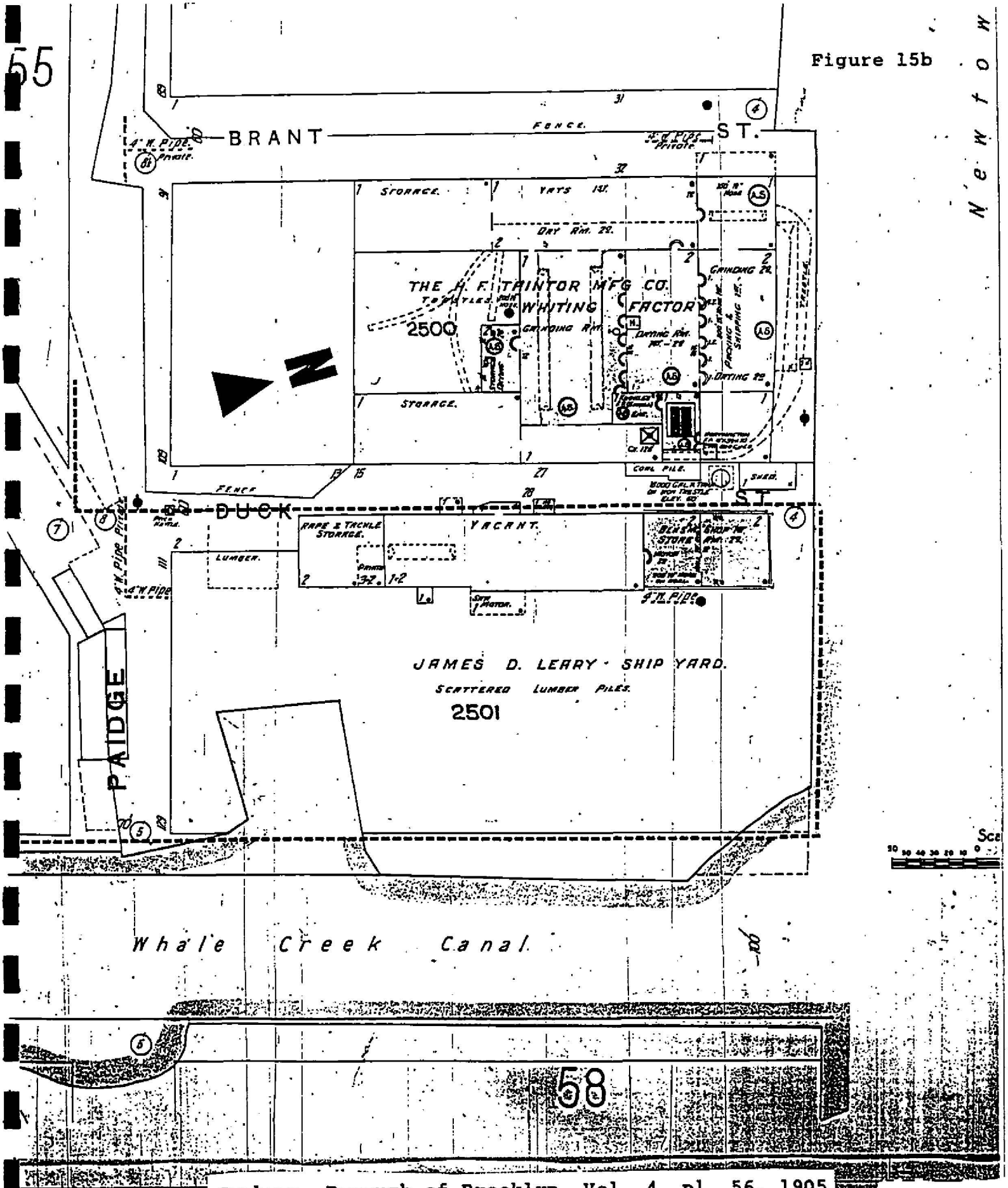
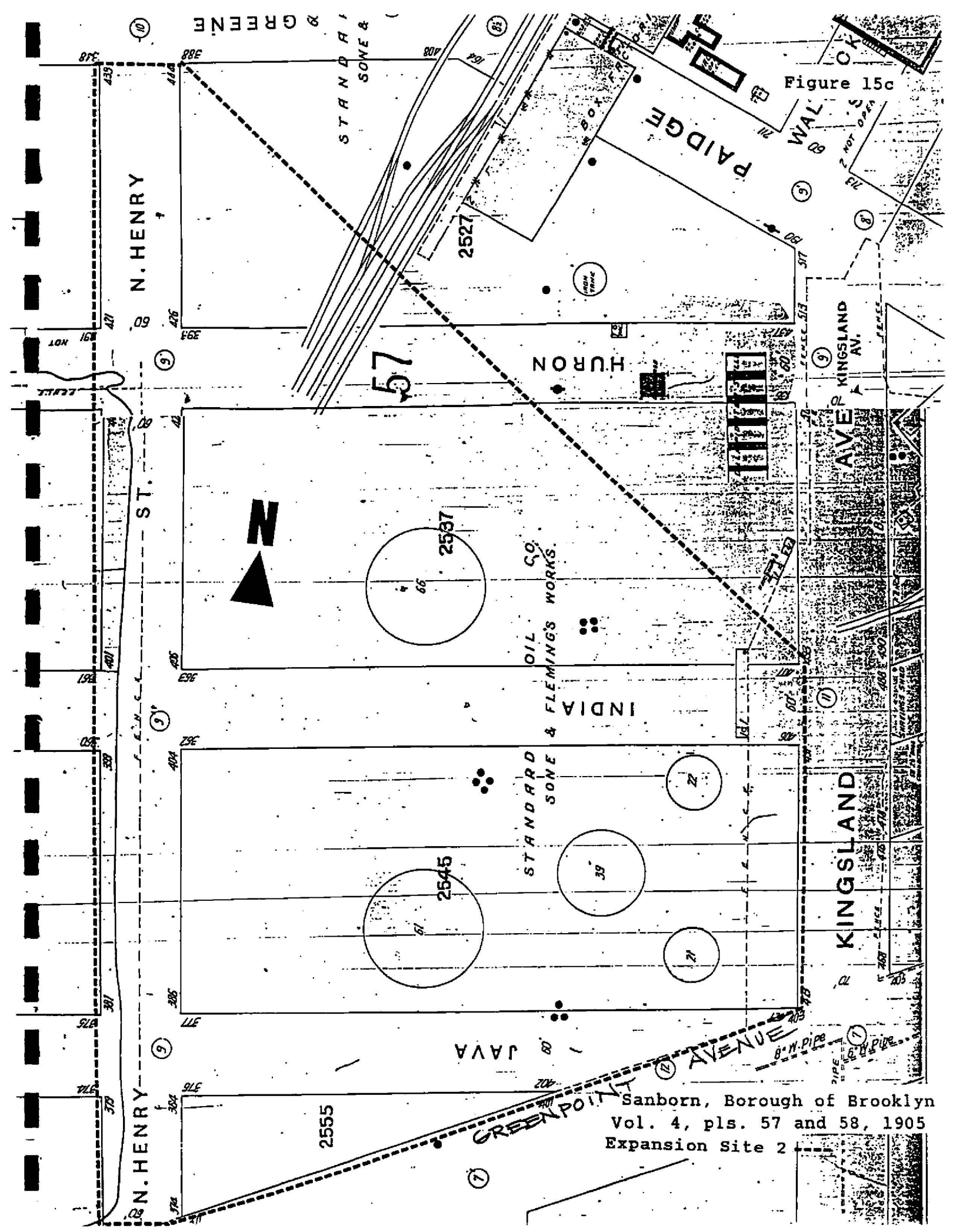

PAIDGE
2490
DUPONT
ST.
56
BRANT
ST.
FENCE
2498
JAMES D. LEARY - YELLOW PINE LUMBER CO.
AVE.
DUCK ST.
4" W. PIPE
EAGLE
ST.
FENCE
AMBROSE MACHINE CO.
MACHINE SHOP
PATTERN SHOP
BOILER SHOP
CABINET MAKER
STORES
RUINS
2507
PLASTER BOARD MFG.
PLASTER BOARDS
STONE YARD
FREEMAN
ST.
BOAT STORAGE BUILDING
BARREL STAVES
Sanborn, Borough of Brooklyn, Vol. 4, pl. 55, 1905
Expansion Sites 1 (partial) and 3
Figure 15a

Figure 15b

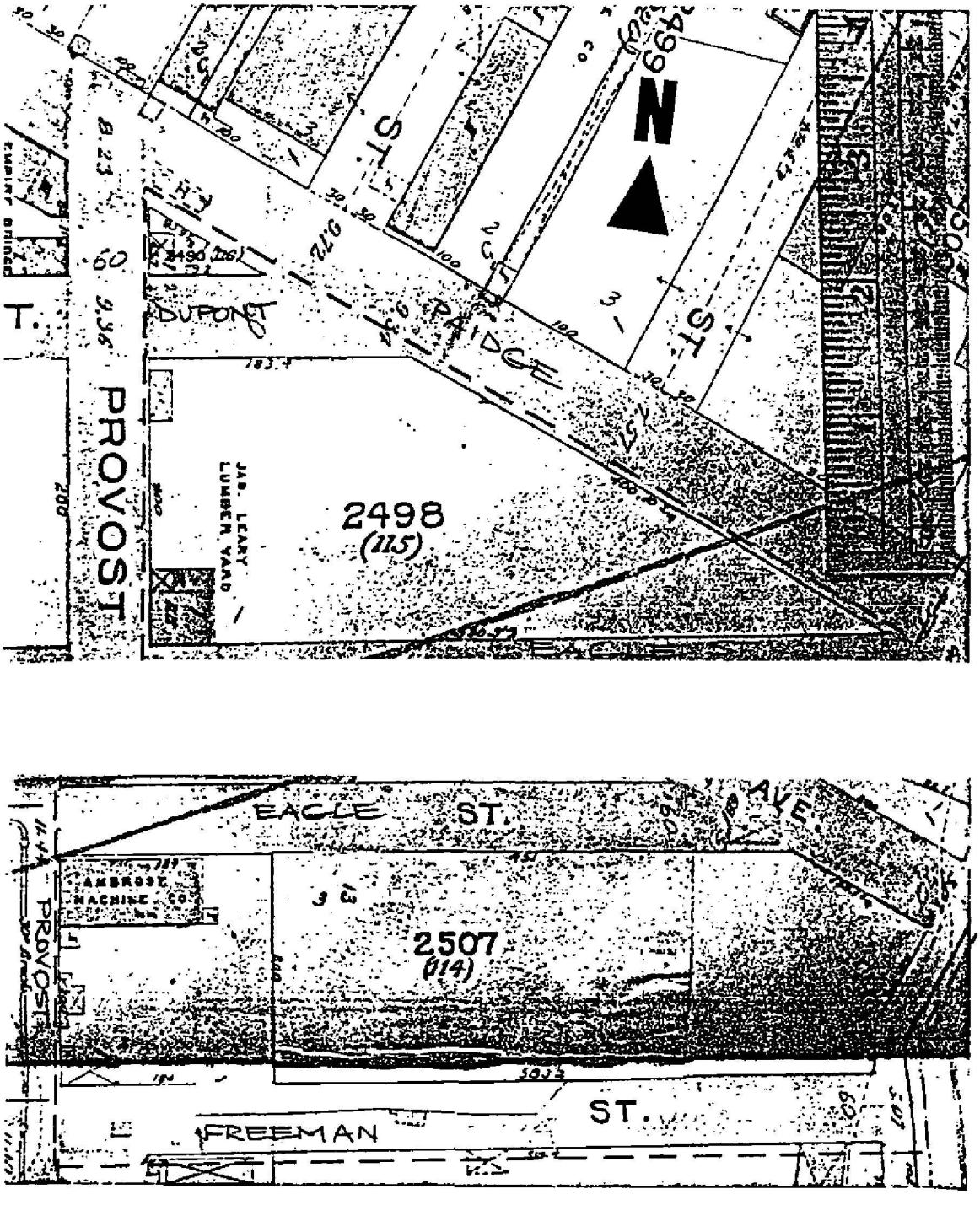


Sanborn, Borough of Brooklyn. Vol. 4, pl. 56, 1905
Expansion Site 1 (partial) -----



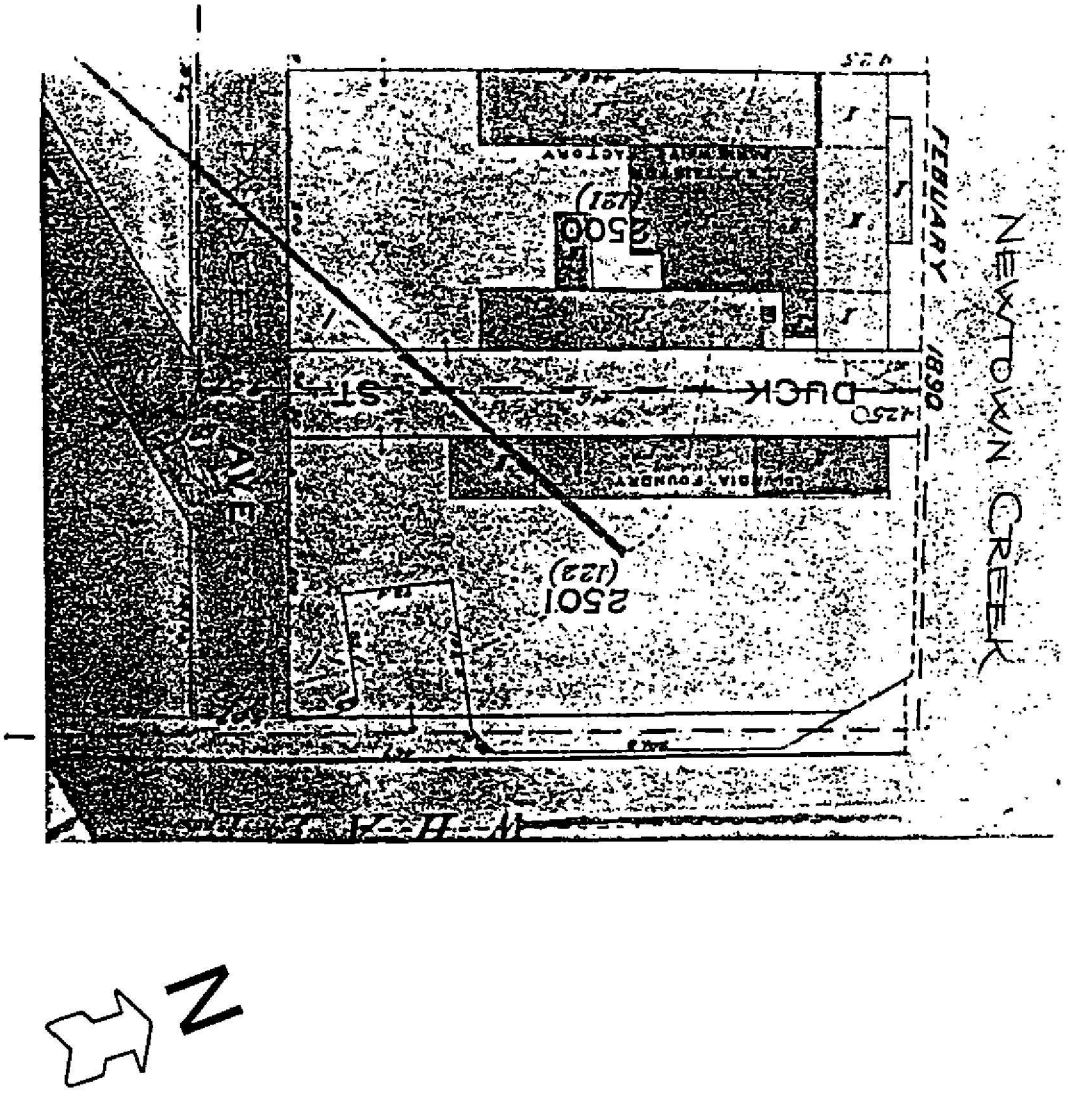
Sanborn, Borough of Brooklyn
Vol. 4, pls. 57 and 58, 1905
Expansion Site 2

Figure 16a



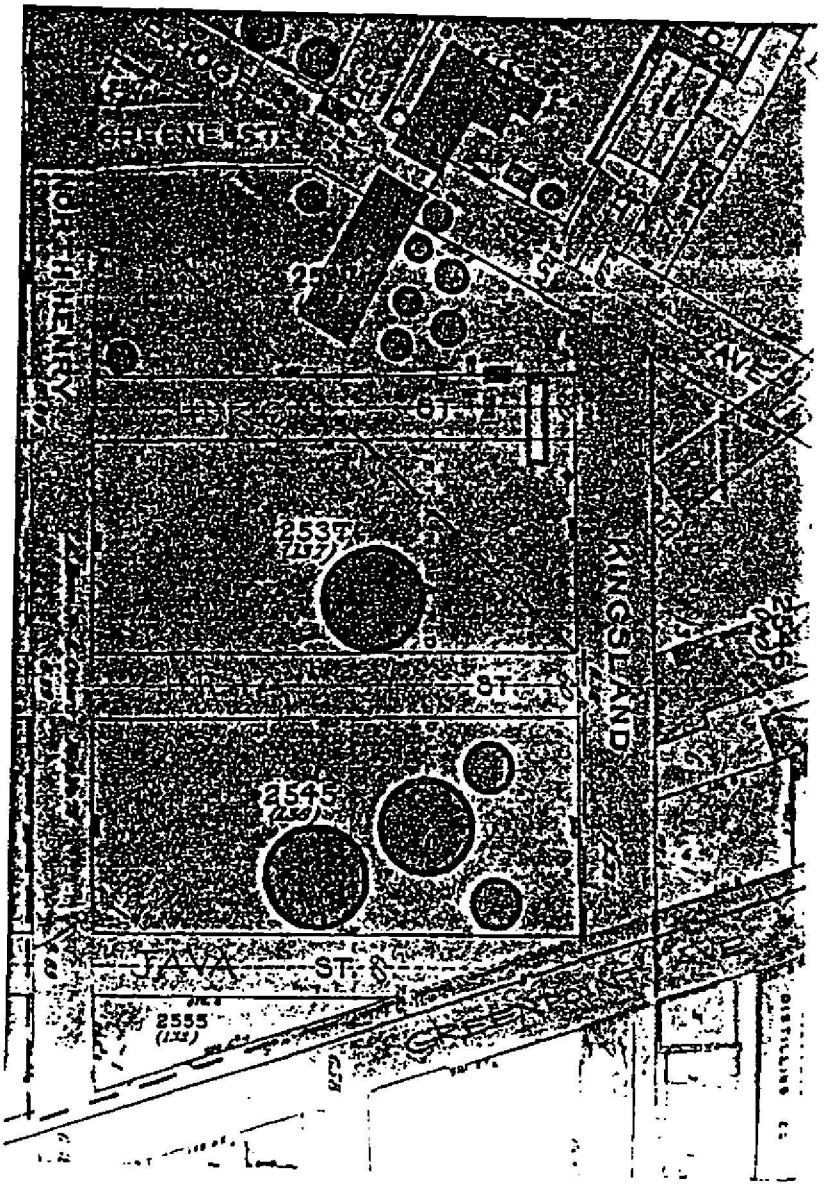
Hyde, Atlas of the Borough of Brooklyn. Vol. 3, pl.14. 1912
Expansion Site 3 (top), Site 1 (partial - bottom) — — — —
Scale varies between maps

Figure 16b



Hyde, Atlas of the Borough of Brooklyn. Vol. 3, pl.14, 1912
Expansion Site 1 (partial) — — —

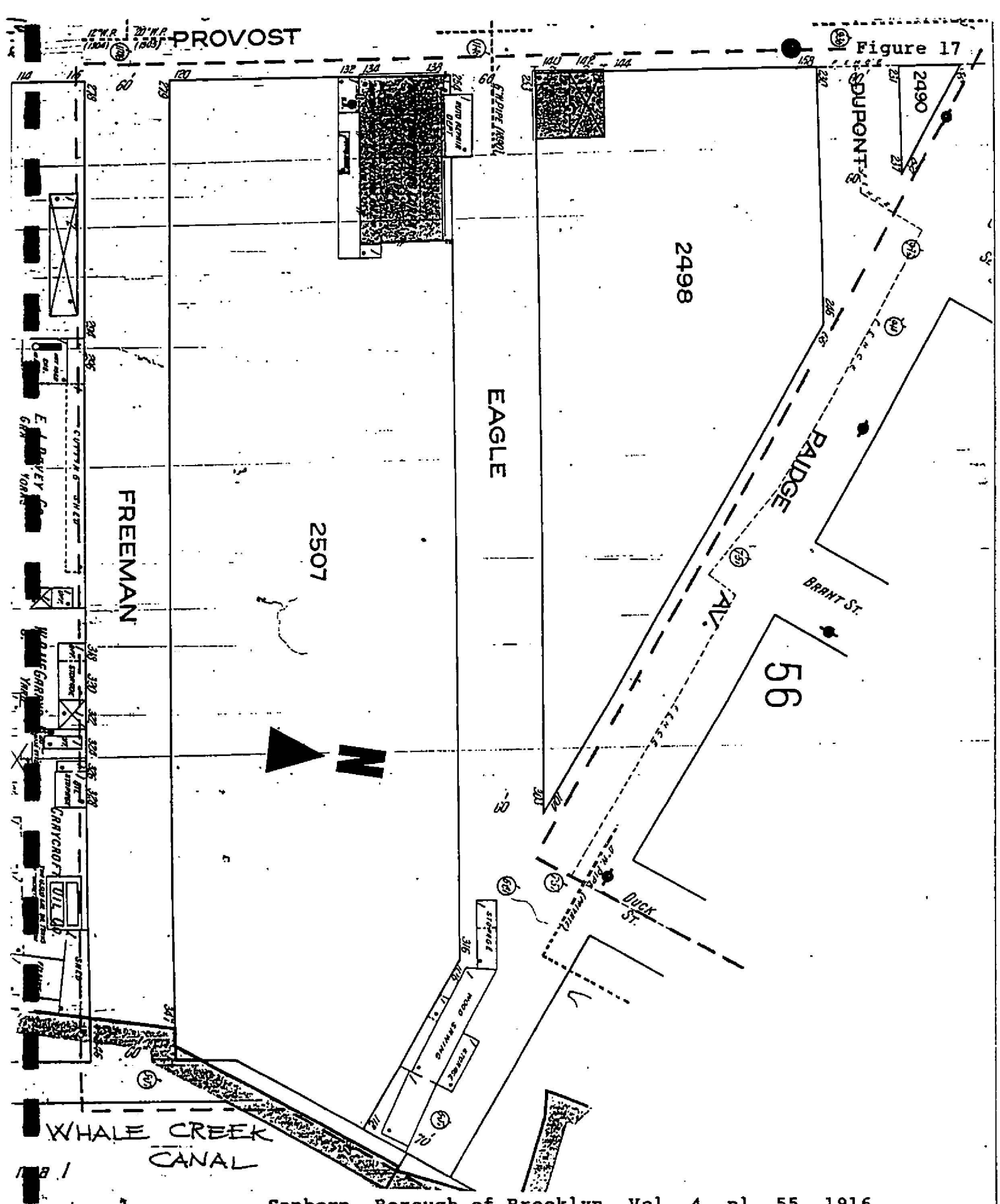
Figure 16c



N

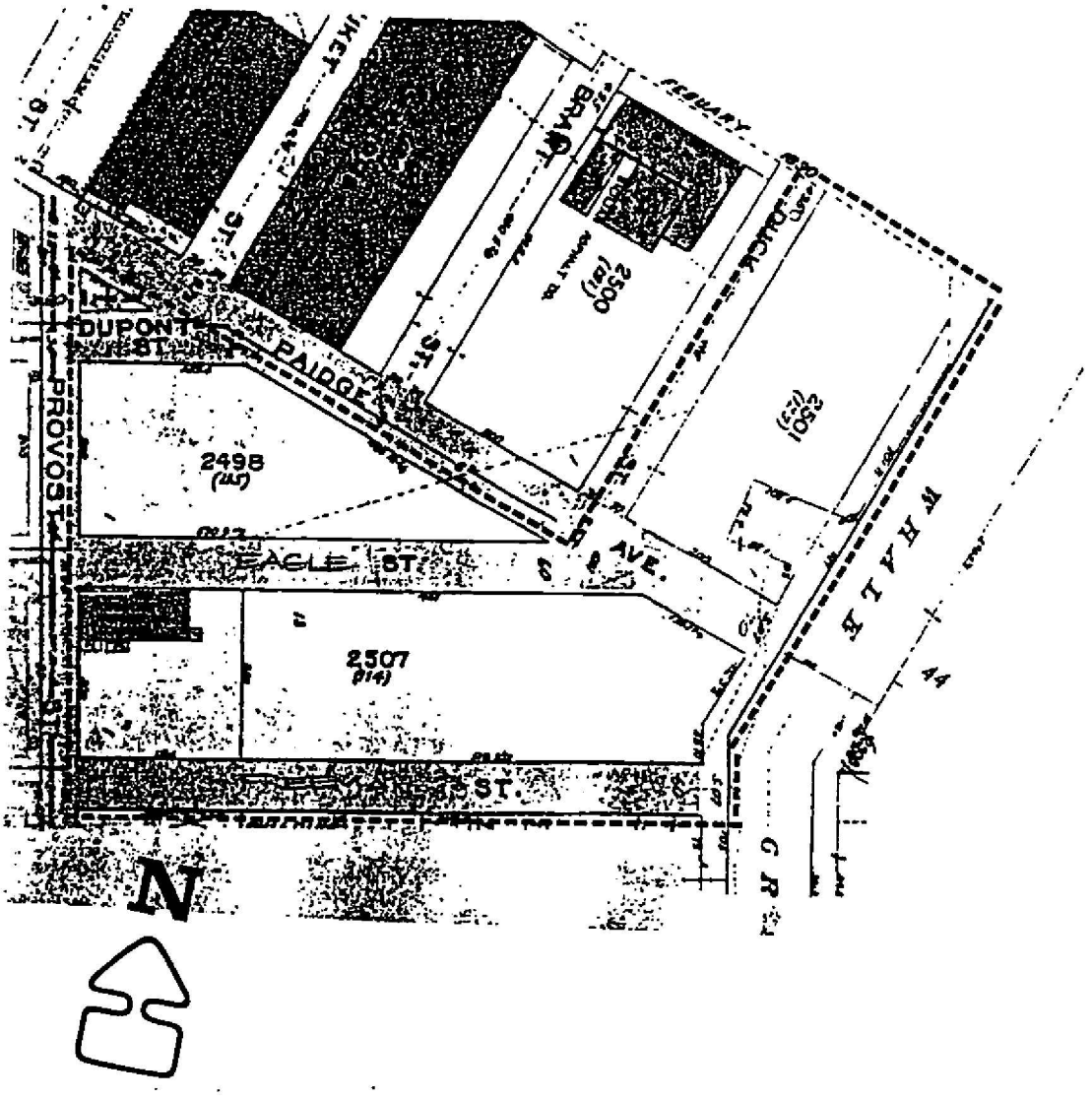
Hyde, Atlas of the Borough of Brooklyn. Vol. 3, pl.14, 1912
Expansion Site 2 — — —

Figure 17



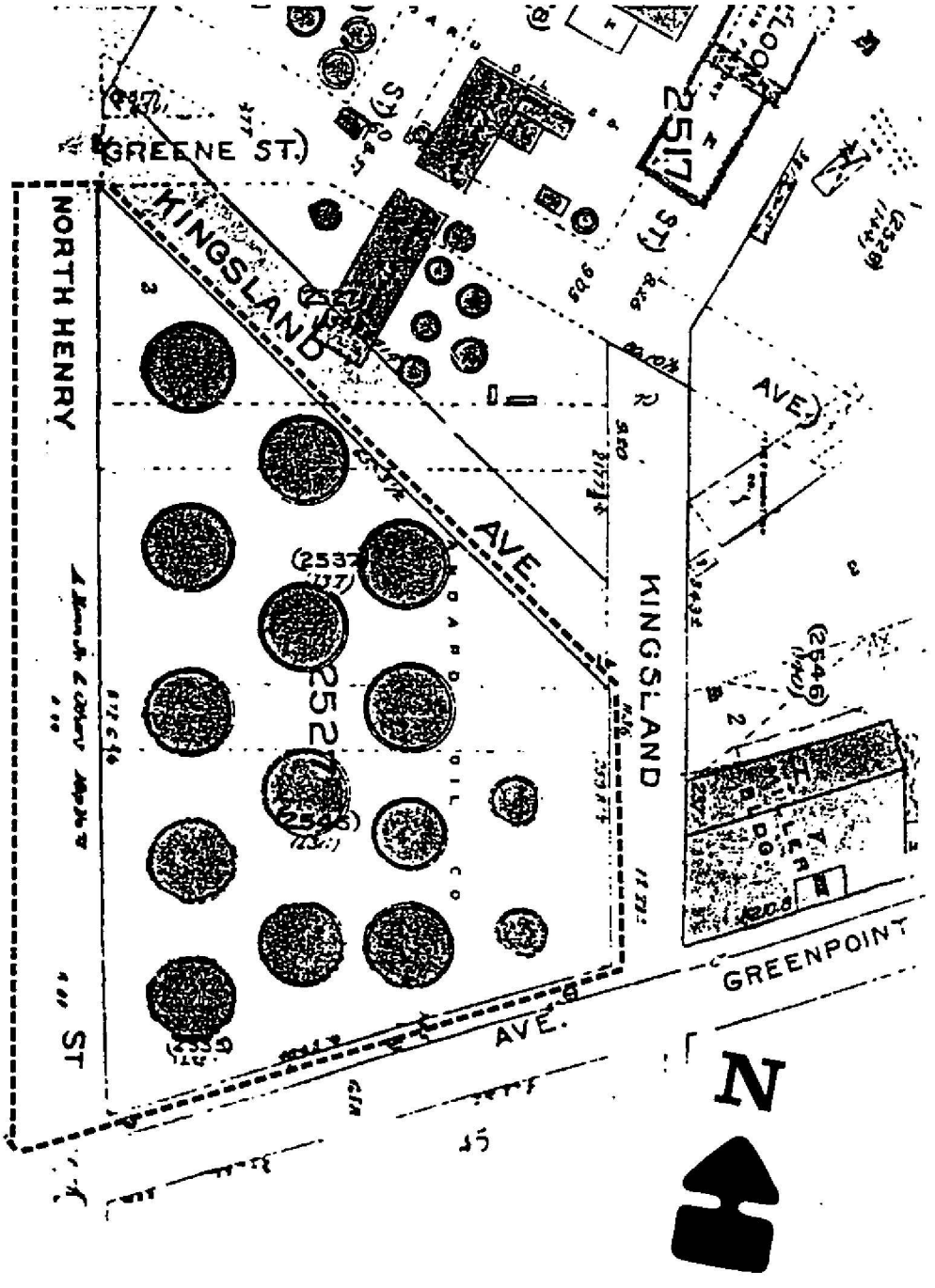
Sanborn, Borough of Brooklyn, Vol. 4, pl. 55, 1916
Expansion Sites 1 (partial) and 3 — — —

Figure 18a



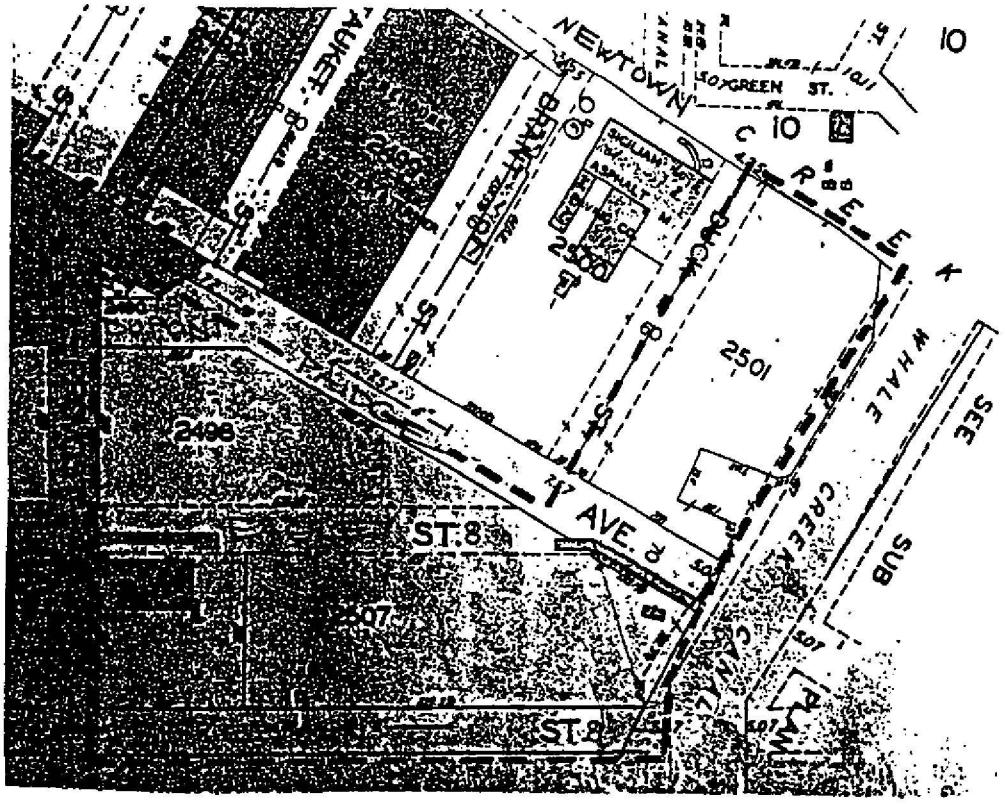
Hyde, Desk Atlas of Brooklyn. Vol. 2, pl. 41, 1921
Expansion Sites 1 and 3 -----

Figure 18b



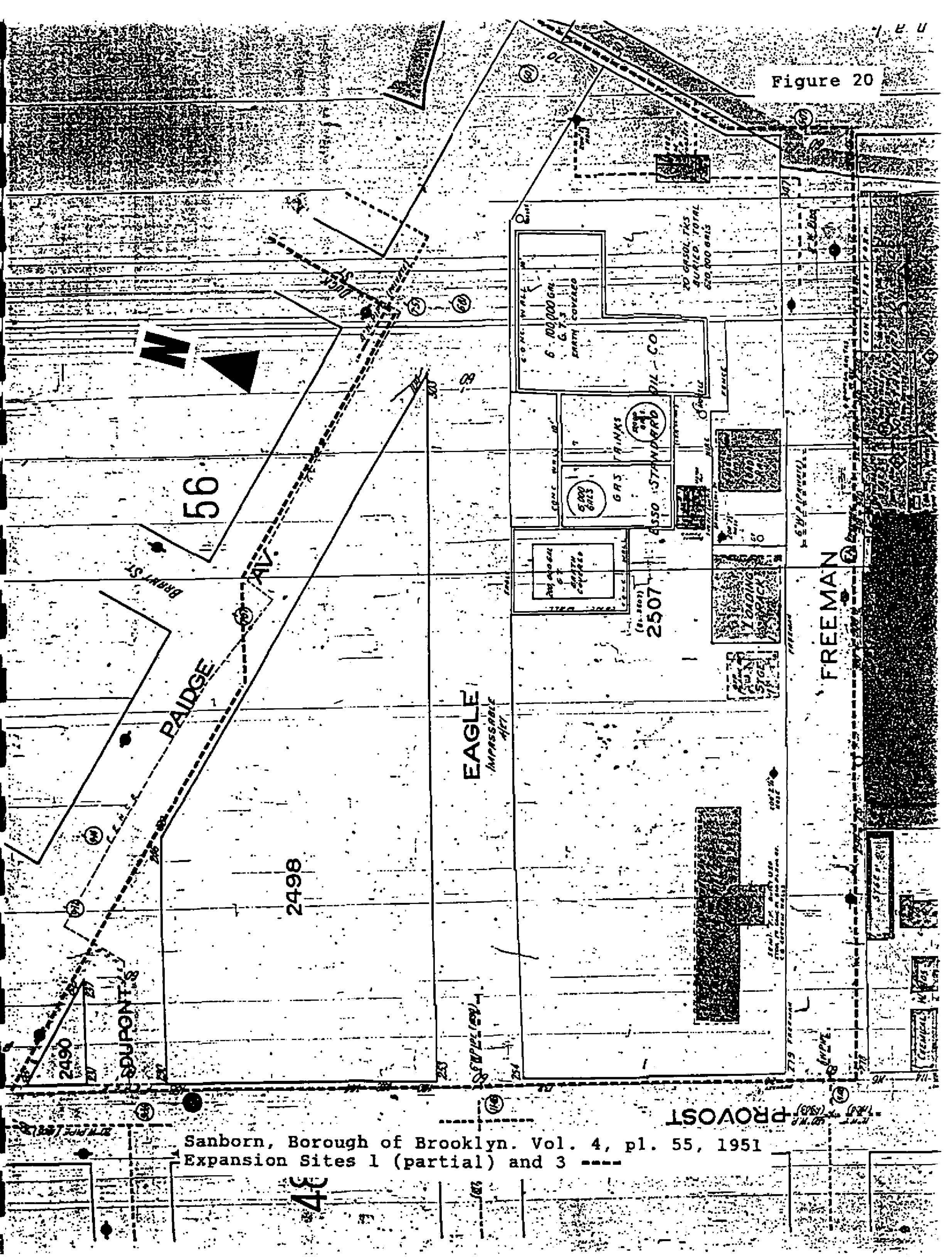
Hyde, Desk Atlas of Brooklyn. Vol. 2, pl. 44, 1921
Expansion Site 2 -----

Figure 19



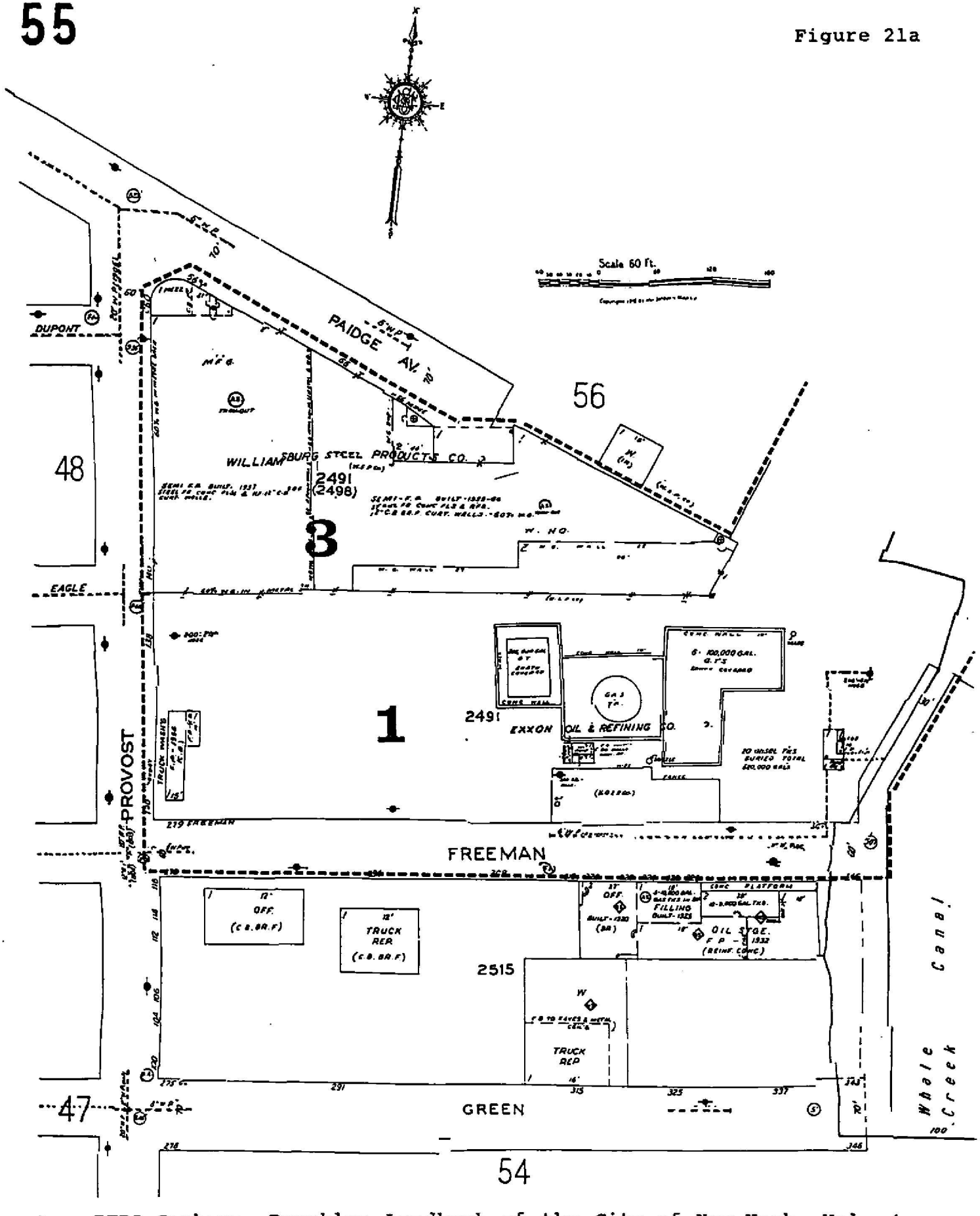
Hyde, Atlas of the Borough of Brooklyn. Vol. 2, pl. 3, 1929
Expansion Sites 1 and 3 ▬ ▬ ▬

Figure 20



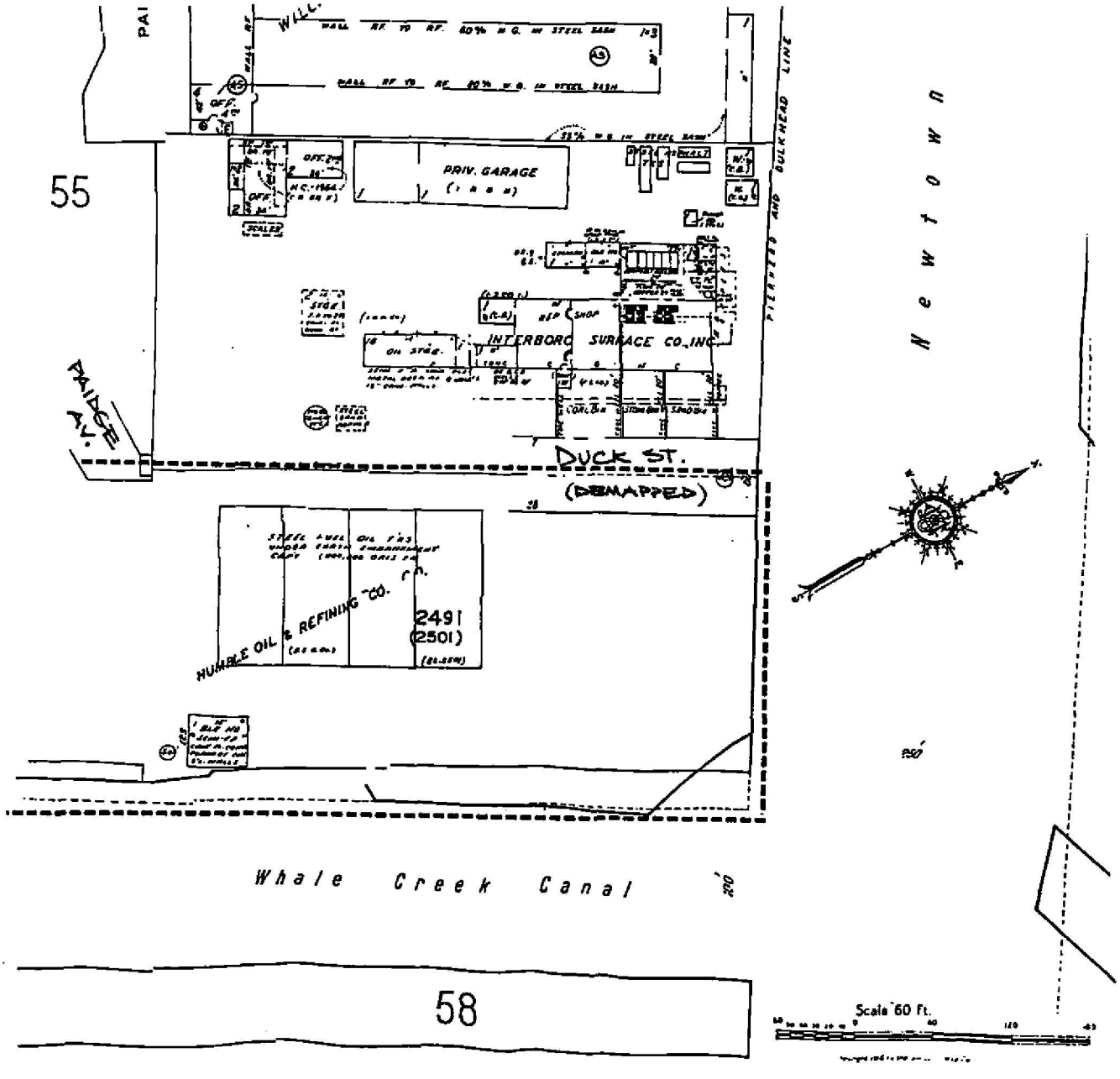
Sanborn, Borough of Brooklyn. Vol. 4, pl. 55, 1951
Expansion Sites 1 (partial) and 3 ----

Figure 21a



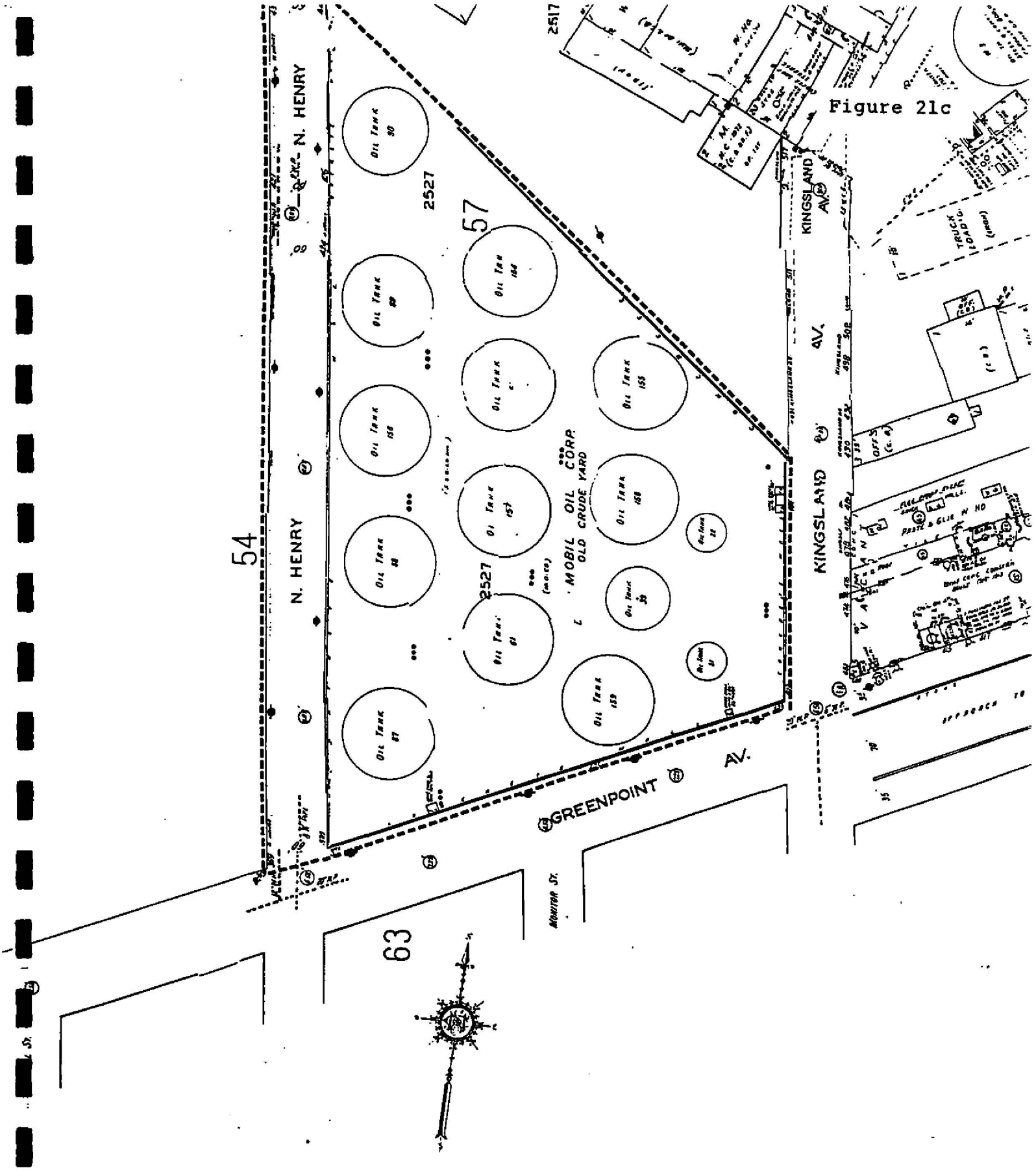
REDI-Sanborn, Brooklyn Landbook of the City of New York. Vol. 4, pl. 55, 1993 Expansion Sites 1 (partial) and 3 -----

Figure 21b



REDI-Sanborn, Brooklyn Landbook of the City of New York, Vol. 4, pl. 56, 1993 Expansion Site 1 (partial)

Figure 21c



REDI-Sanborn, Brooklyn Landbook of the City of New York, Vol. 4, pls. 57 and 58, 1993 Expansion Site 2 ------

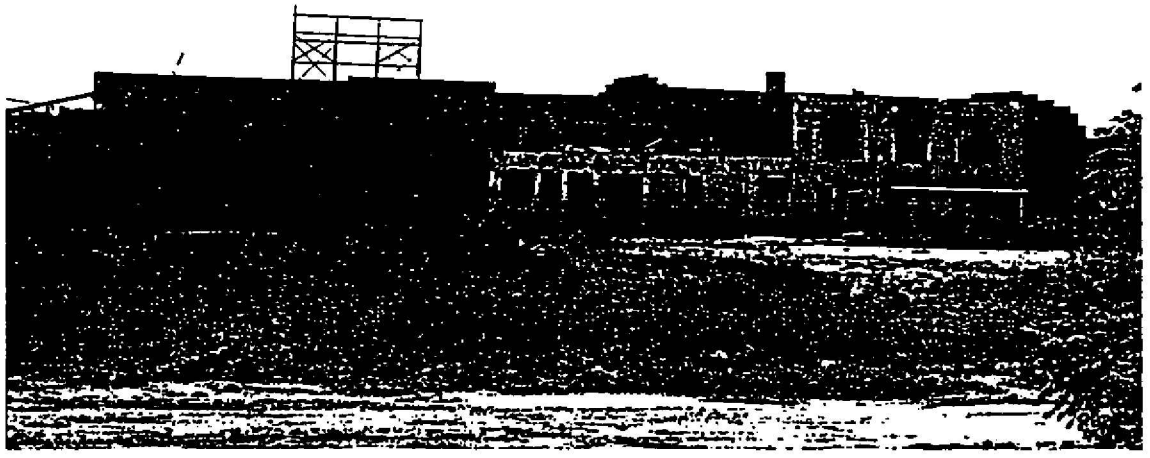


Photo 1: Site 1, looking south toward Freeman Street. Buildings are on south side of Freeman, outside the project site.

Photo 2: Site 1, looking east toward Whale Creek Canal. Canal is in front of incinerator. Small hut at center rear is location of soil venting system. Building at left (north) is the 1959/60 addition to the Williamsburg Steel Comp. plant, on Site 3.

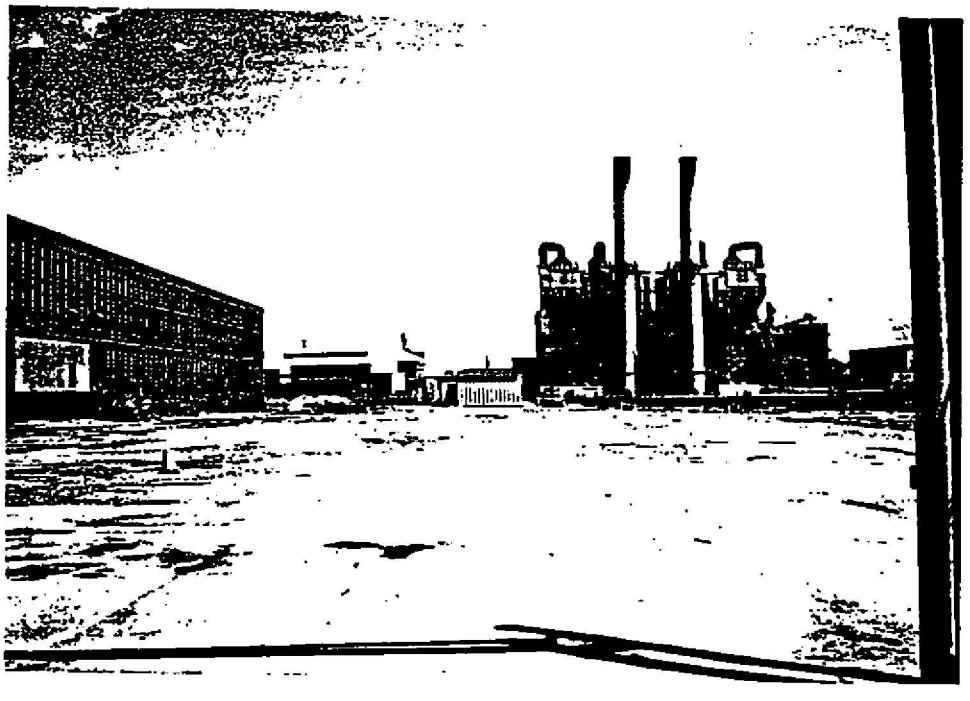


Photo 3: Site 1, looking southwest toward intersection of Provost and Freeman Streets. One-story office building still present from Exxon refinery. Large building at rear is outside project site.

Photo 4: Site 1, looking northwest toward the intersection of Provost and Eagle Streets. Corner of Williamsburg Steel building (Site 3) visible at right

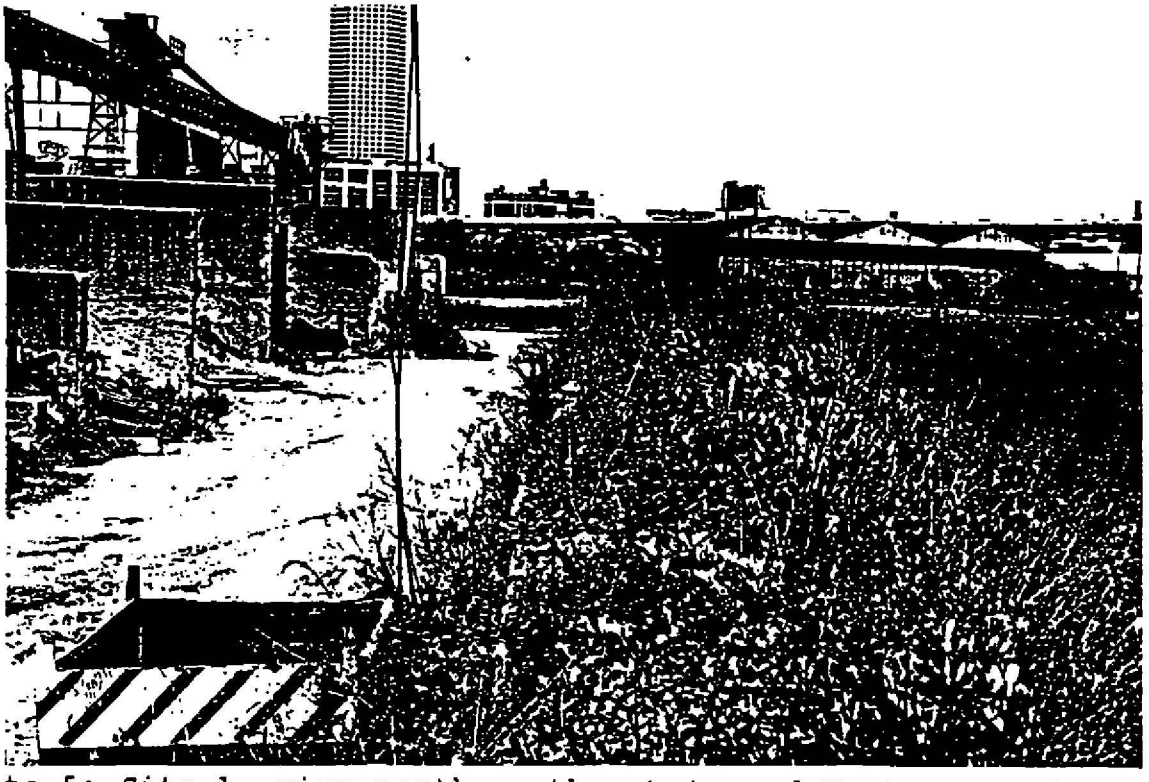


Photo 5: Site 1, view north northeast toward Newtown Creek along the former line of Duck Street, north of former intersection with Paidge Avenue. Site 1 at right, retaining wall/berm on left.

Photo 6: Site 1, view northeast from the former Duck Street, toward Newtown Creek. Whale Creek Canal is at right near barge. Berm/retaining wall at left.

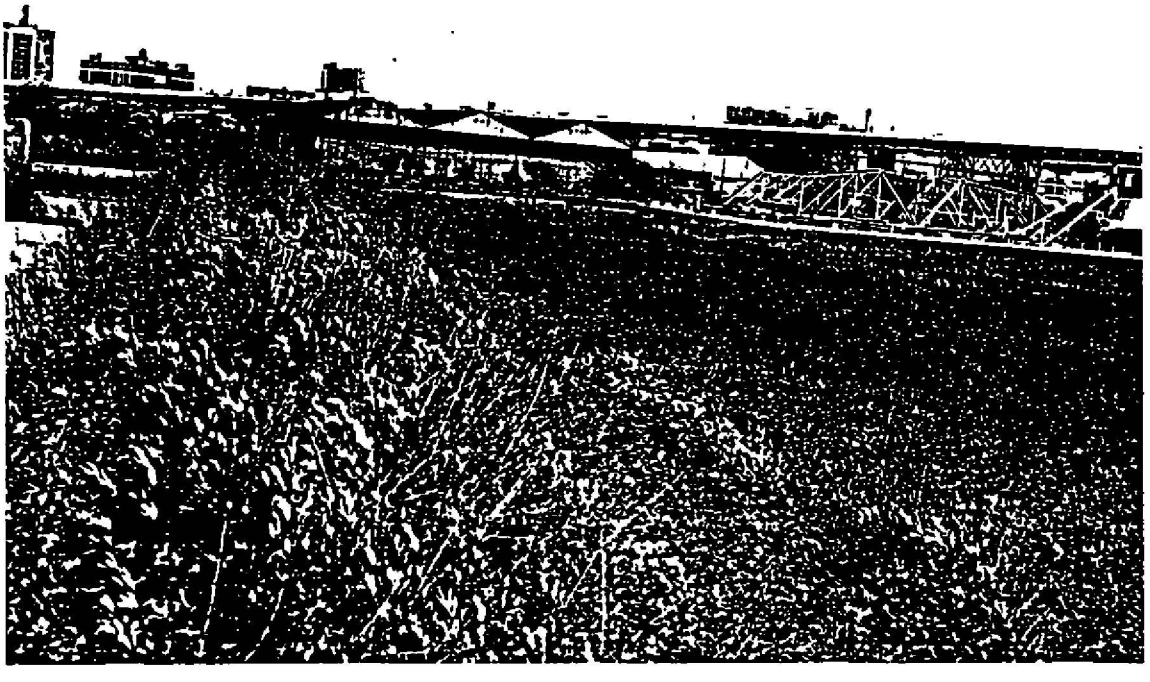


Photo 7: Site 1, looking east southeast from former Duck Street, north of former intersection with Paidge Avenue. Whale Creek Canal at mid-ground. Note piles of fill in foreground.

Photo 8: Site 1, view southeast from former Duck Street. Whale Creek Canal at midground left, buildings to right are on present WPCP, south of Freeman Street.

Photo 9: Site 3, looking southeast down Paidge Avenue from Provost Street. Williamsburg Steel Products Co. building, with 1959/60 addition at midground. Incinerator at rear is outside project site.

Photo 10: Site 3, view south down Provost Street from Paidge Avenue. Williamsburg Steel Products Co., original 1957 building.

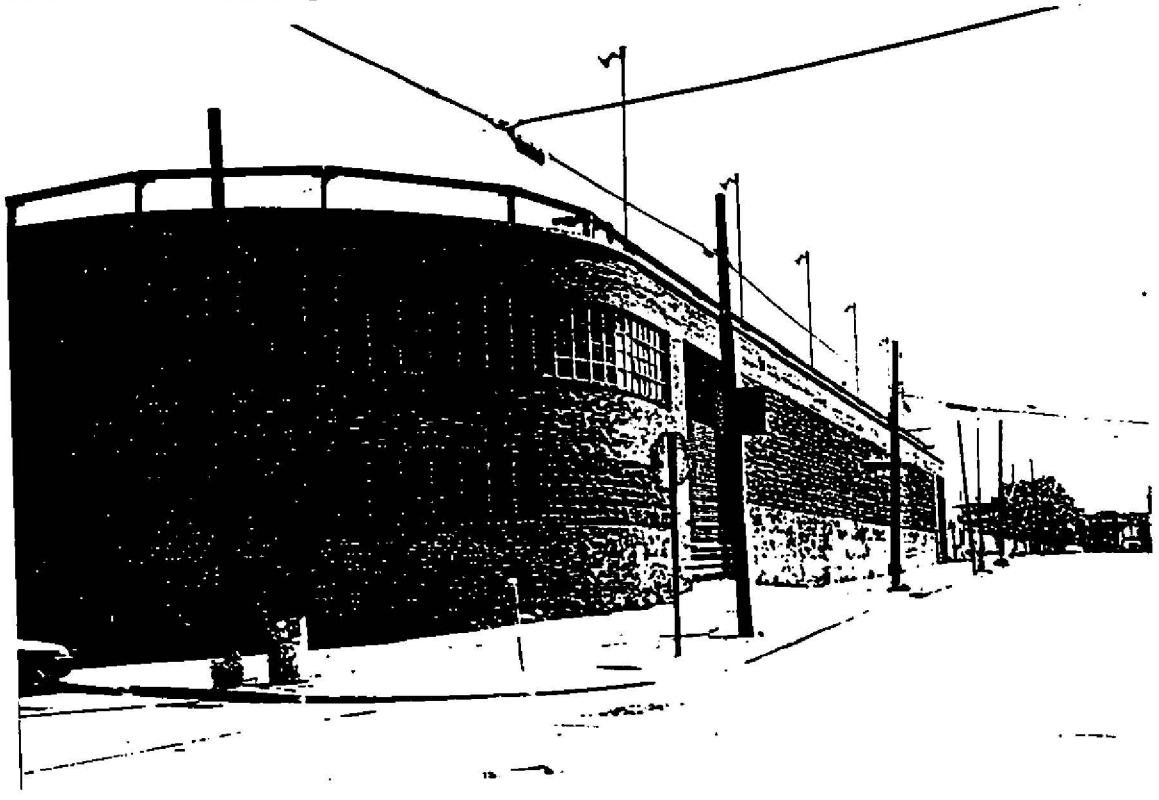
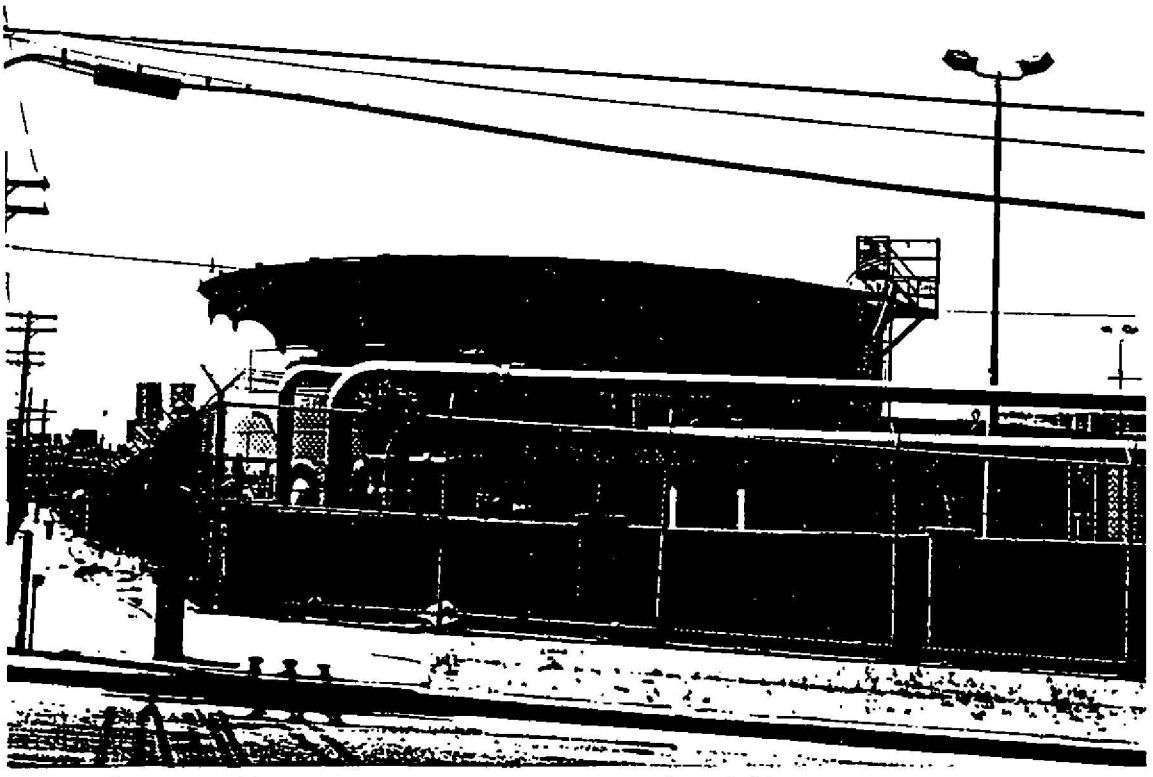


Photo 11: Site 2, view north along North Henry Street from Greenpoint Avenue. Tanks and wall of Site 2 at right.

Photo 12: Site 2, looking northwest from intersection of Greenpoint and Kingsland Avenues.



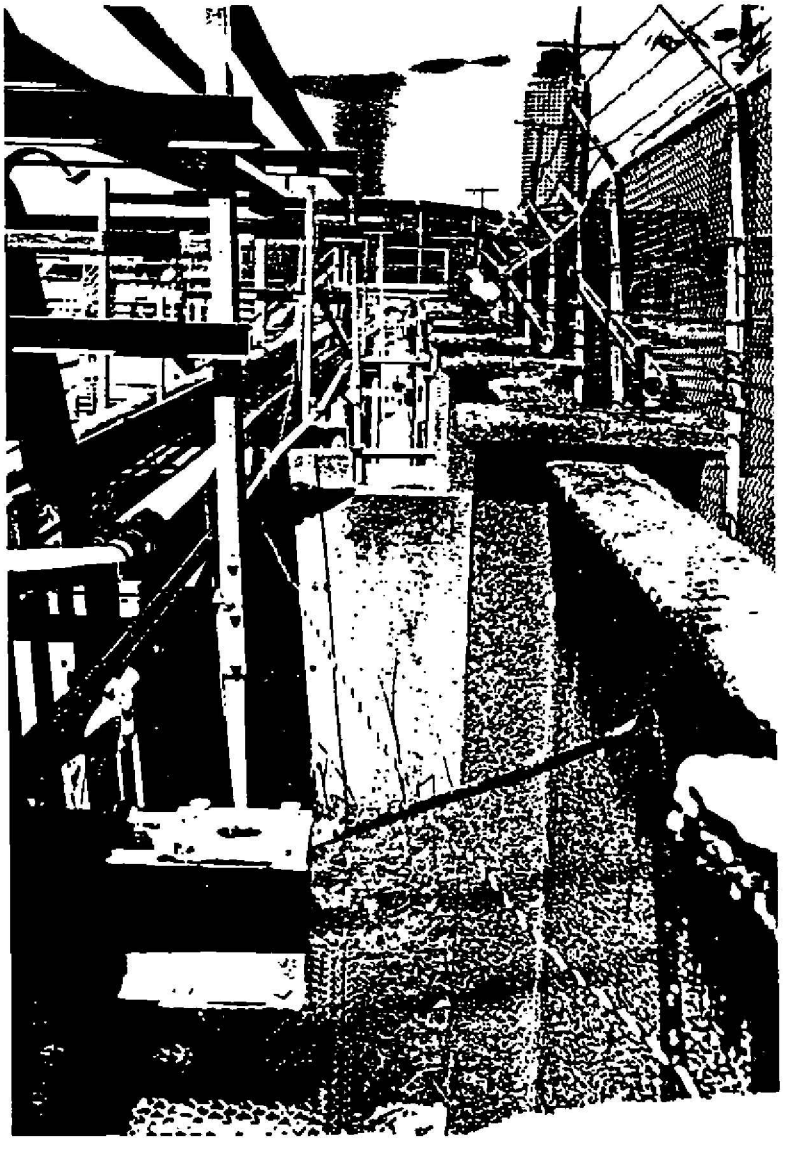


Photo 13: (top) Site 2, view west along Greenpoint Avenue from Kingsland Avenue.

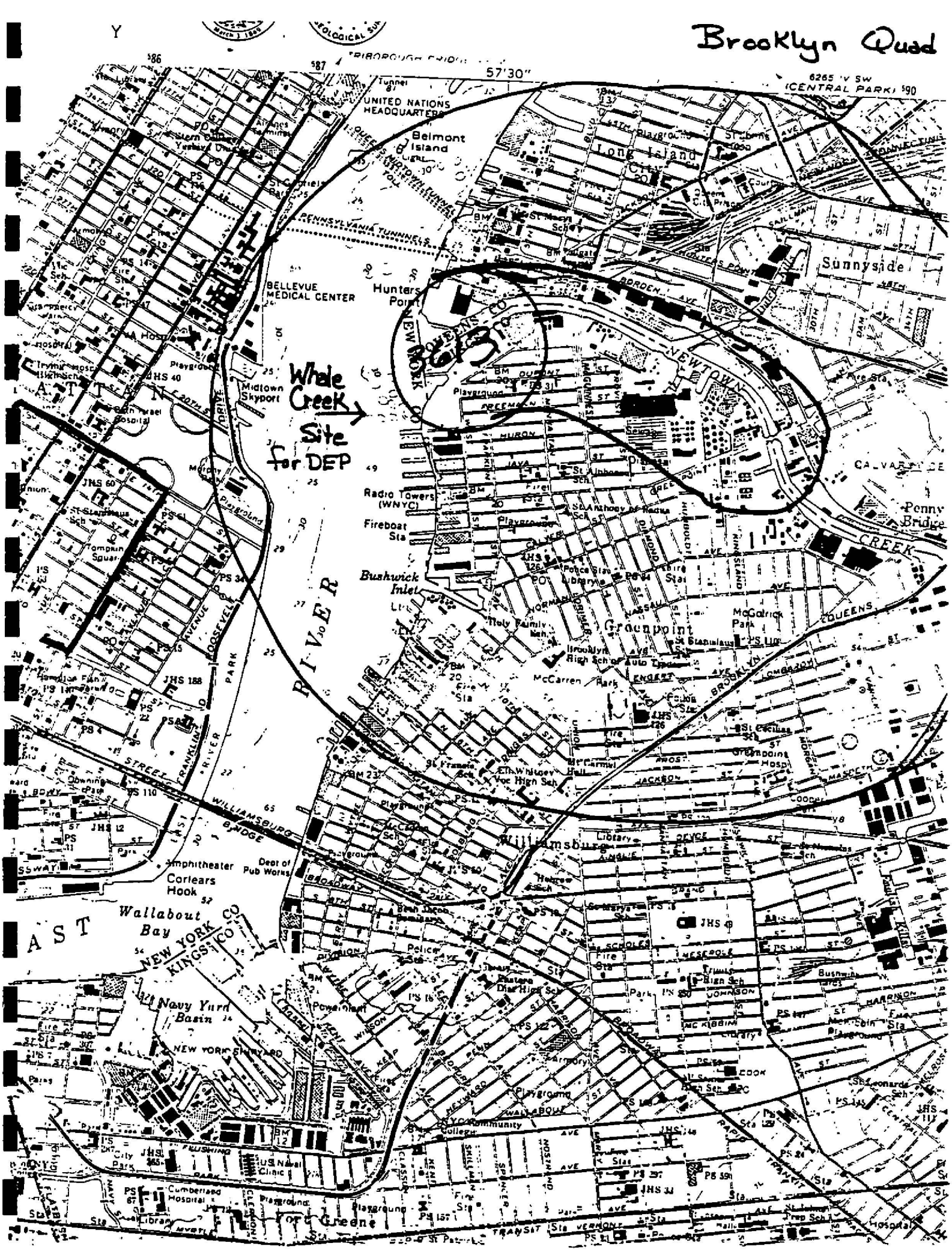
Photo 14: (left) Site 2, View north over fence from corner of Kingsland and Greenpoint Avenues. Note: the base of the wall is approximately 5 feet below sidewalk level.

APPENDIX

CORRESPONDENCE WITH THE NEW YORK STATE MUSEUM

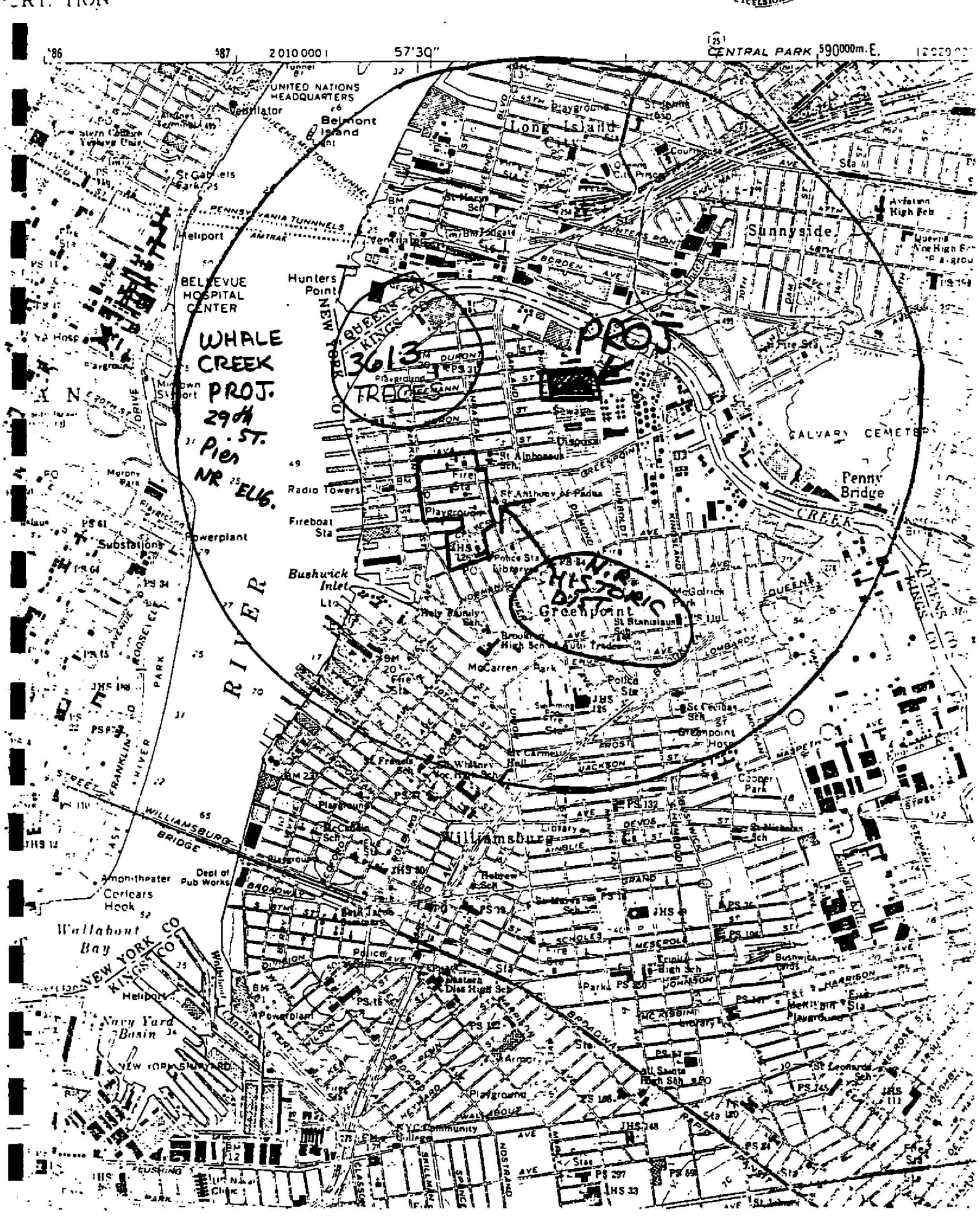
AND THE

STATE HISTORIC PRESERVATION OFFICE


Brooklyn Quad
57'30"
UNITED NATIONS HEADQUARTERS
Belmont Island
Long Island City
Sunnyside
BELLEVUE MEDICAL CENTER
Hunters Point
Whale Creek
Site for DEP
Midtown Skyport
Radio Towers (WNYC)
Fireboat Sta
Bushwick Inlet
Penny Bridge
CREEK
Greenpoint
McCarren Park
McGolrick Park
Williamsburg
Corlears Hook
Wallabout Bay
Navy Yard Basin
Fort Greene
RIVER
EAST
NEW YORK CO
KINGS CO
QUEENS CO
WILLIAMSBURG BRIDGE
FRANKLIN D ROOSEVELT EAST RIVER PARK
QUEENS MIDTOWN TUNNEL
PENNSYLVANIA TUNNELS

NO SHPO ARCH.

RT. TION



NPS Form 10-900
OMB No. 1024-0018
Exp. 10-31-84

United States Department of the Interior
National Park Service

For NPS use only
received
date entered

National Register of Historic Places Inventory—Nomination Form

See instructions in *How to Complete National Register Forms*
Type all entries—complete applicable sections

1. Name

historic

and/or common Greenpoint Historic District

2. Location

street & number see continuation sheet ___ not for publication

city, town Brooklyn ___ vicinity of

state New York code county Kings code 047

3. Classification

Category	Ownership	Status	Present Use	
_x_ district	___ public	_x_ occupied	___ agriculture	___ museum
___ building(s)	_x_ private	___ unoccupied	_x_ commercial	___ park
___ structure	___ both	___ work in progress	___ educational	_x_ private residence
___ site	**Public Acquisition**	**Accessible**	___ entertainment	_x_ religious
___ object	___ in process	___ yes: restricted	___ government	___ scientific
	___ being considered	_x_ yes: unrestricted	___ industrial	___ transportation
	NA	___ no	___ military	___ other:

4. Owner of Property

name various

street & number

city, town ___ vicinity of state

5. Location of Legal Description

courthouse, registry of deeds, etc. King's County Register's Office

street & number Brooklyn Municipal Bldg., Joralemon St.

city, town Brooklyn state New York

6. Representation in Existing Surveys

title Greenpoint Historic District Designation Report (LP-1248) has this property been determined eligible? ___ yes _x_ no

date September 14, 1982 ___ federal ___ state ___ county _x_ local

depository for survey records New York Landmarks Preservation Commission

city, town New York state New York

PROJECT: WHALE CREEK HIST. PERSPECT. CONN.

NEW YORK STATE MUSEUM: OFFICE OF THE STATE ARCHEOLOGIST
PREHISTORIC SITE FILE: FILE USE REQUEST FORM
PROJECT SCREENING FILE

NAME D.E. STANLEY-BROWN

ADDRESS 27 JORDAN ROAD, TROY, NEW YORK 12180

AC PHONE # 518 283-0534

AGENCY/COMPANY/INSTITUTION REPRESENTED _____

The screening file gives site locations within generalized .5 mile circles.

PURPOSE OF REQUEST: (Identify the proposed project and contractor, indicate the nature of the work, depth and extent of ground disturbance)

EVENTUAL DISTRIBUTION OF DATA: (Specify range of data use and distribution, publication, reproduction, etc.).

REQUESTED APPOINTMENT:

1st Choice _____ (date) _____ (time (or any)) 2nd Choice _____ (date) _____ (time (or any))

(Appointments are on the hour between 9 a.m. and 12 noon on Wednesday of each week. Mail this request at least two weeks in advance of the appointment date. You will be notified by mail of your appointment date and time).

U.S.G.S. 7.5' MAPS REQUESTED: (indicate 15' maps)

BROOKLYN _____ _____ _____

FOR THE FOLLOWING attach the project map, site data list and self-addressed envelope to this request. Responses will be mailed or provided on the following day.

The following site(s) may be within or adjacent to the project area. If so, please provide the location of:

SITE #. 7.5' MAP

3613 BROOKLYN

_____ _____

_____ _____

_____ _____

X Please provide a sensitivity rating for the attached project area.

I understand that the information provided is to be used solely for the preparation of an environmental impact statement as required by State or Federal law.

D. E. Stanley-Brown 18 Oct. 1989
(Signature) (Date)

EVALUATION OF ARCHAEOLOGICAL SENSITIVITY FOR PREHISTORIC (INDIAN) SITES
Examination of the data suggests that the location indicated has the following sensitivity rating:

[✓] HIGHER THAN AVERAGE PROBABILITY OF PRODUCING PREHISTORIC ARCHAEOLOGICAL DATA.

[ ] AVERAGE PROBABILITY OF PRODUCING PREHISTORIC ARCHAEOLOGICAL DATA.

[ ] LOWER THAN AVERAGE PROBABILITY OF PRODUCING PREHISTORIC ARCHAEOLOGICAL DATA.

[ ] MIXED PROBABILITY OF PRODUCING PREHISTORIC ARCHEOLOGICAL DATA.

The reasons for this finding are given below:

[✓] A RECORDED SITE IS INDICATED IN OR IMMEDIATELY ADJACENT TO THE LOCATION AND WE HAVE REASON TO BELIEVE IT COULD BE IMPACTED BY CONSTRUCTION.

[ ] A RECORDED SITE IS INDICATED SOME DISTANCE AWAY BUT DUE TO THE MARGIN OF ERROR IN THE LOCATION DATA IT IS POSSIBLE THE SITE ACTUALLY EXISTS IN OR IMMEDIATELY ADJACENT TO THE LOCATION.

[ ] THE TERRAIN IN THE LOCATION IS SIMILAR TO TERRAIN IN THE GENERAL VICINITY WHERE RECORDED ARCHAEOLOGICAL SITES ARE INDICATED.

[✓] THE PHYSIOGRAPHIC CHARACTERISTICS OF THE LOCATION SUGGEST A HIGH PROBABILITY OF PREHISTORIC OCCUPATION OR USE.

[ ] THE PHYSIOGRAPHIC CHARACTERISTICS OF THE LOCATION SUGGEST A MEDIUM PROBABILITY OF PREHISTORIC OCCUPATION OR USE.

[ ] THE PHYSIOGRAPHIC CHARACTERISTICS OF THE LOCATION ARE SUCH AS SUGGEST A LOW PROBABILITY OF PREHISTORIC OCCUPATION OR USE.

[ ] EVIDENCE OF PRIOR DESTRUCTIVE IMPACTS FROM CULTURAL OR NATURAL SOURCES SUGGESTS A LOSS OF ORIGINAL CULTURAL DEPOSITS IN THIS LOCATION.

[ ] THE PHYSIOGRAPHIC CHARACTERISTICS OF THE LOCATION ARE MIXED, A HIGHER THAN AVERAGE PROBABILITY OF PREHISTORIC OCCUPATION OR USE IS SUGGESTED FOR AREAS IN THE VICINITY OF STREAMS OR SWAMPS AND FOR ROCK FACES WHICH AFFORD SHELTER. DISTINCTIVE HILLS OR LOW RIDGES HAVE AN AVERAGE PROBABILITY OF USE AS A BURYING GROUND. LOW PROBABILITY IS SUGGESTED FOR AREAS OF EROSIONAL STEEP SLOPE.

[✓] PROBABILITY RATING IS BASED ON THE ASSUMED PRESENCE OF INTACT ORIGINAL DEPOSITS, POSSIBILITY UNDER FILL, IN THE AREA. IF NEAR WATER OR IF DEEPLY BURIED, MATERIALS MAY OCCUR SUBMERGED BELOW THE WATER TABLE.

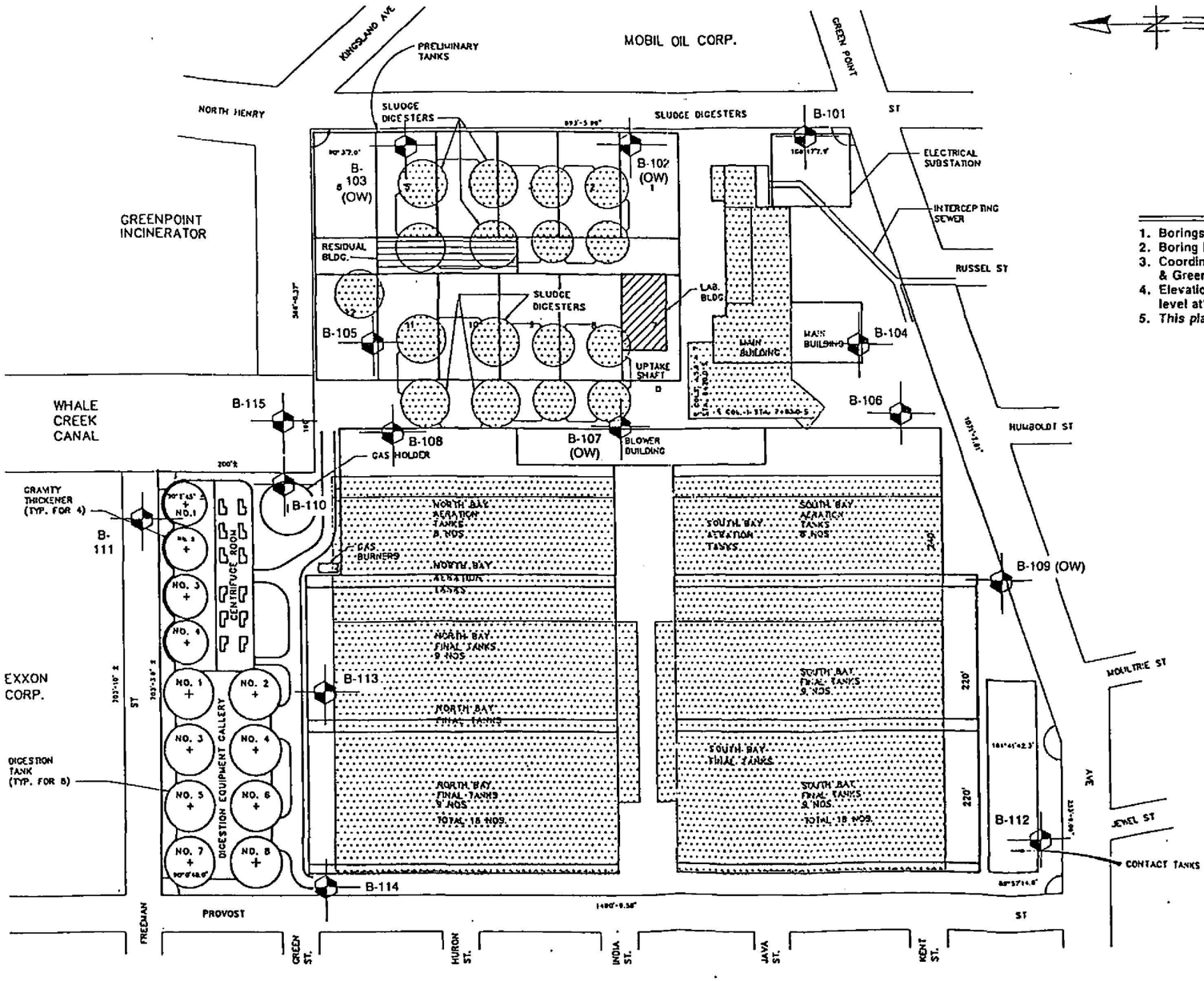
[ ] INFORMATION ON SITES NOT RECORDED IN THE N.Y.S. MUSEUM FILES MAY BE AVAILABLE IN A REGIONAL INVENTORY MAINTAINED AT THE FOLLOWING LOCATION(S). PLEASE CONTACT:

COMMENTS:

APPENDIX B

Boring Logs

Boring Logs conducted at Newtown Creek WPCP by Warren George, Inc., Winter 1990 (Discussed in Kearns, Kirkorian and Schaefer 1989:Addendum 1990).



NOTES

1. Borings drilled by Warren George Inc. Feb-Mar 1990
2. Boring locations surveyed by Howard F. Greenspan Associates
3. Coordinate system is arbitrary. Origin is corner of fence at Provost & Green Streets. Origin coordinates (N1240.00', E0.00)
4. Elevations on Brooklyn Highway Datum, 2.547 feet above mean sea level at Sandy Hook
5. This plan made from site plan by Greeley & Hanson

LEGEND

- EXISTING FACILITIES
- PROPOSED FACILITIES
- SOIL TEST BORING LOCATION
- (OW) OBSERVATION WELL

BECHTEL
GAITHERSBURG, MARYLAND

NEWTOWN CREEK
WATER POLLUTION CONTROL PROJECT

BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
NEWTOWN CREEK	19933	1 OF 4	B-105

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
Plant	N 1169; E 904	Vertical	——

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
3-8-90	3-14-90	WARREN GEORGE	MAYHEW-500	4in	97.5	30.0	127.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
23.0/77	2	20		10.3	▽ 8.0/2.3 wd ▼ 10.2/0.1 24h AD	97.5/87.2 (–)

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs. / 30 inches	none	SCOTT NEWHOUSE

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	STANDARD PENETRATION TESTS 1st 6"	2nd 6"	3rd 6"	4th 6"	ELEV.	DEPTH	GRAPHICS	SAMPLE NO.	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								10.3					
SS	2.0	1.0	35	2	11	24	48				1	Black silty sand with gravel and concrete fragments (FILL)	
													Drilling with roller bit and mud
SS	2.0	1.0	46	6	9	37	26		5		2		
SS	2.0	0.8	8	4	4	4	5		10		3		
SS	2.0	0.8	4	2	2	2	2		15		4		
								-7.7				Dark gray silty clay, trace peat, soft (CL) Strong organic odor	
SS	2.0	1.5	2	1	1	1	2		20		5		
													Qp values in tsf
O	2.0	1.5		P	U	S	H		25		O1		Qp=0.5
													O=Osterberg
								-17.7				Gray clayey coarse silty sand, medium (SC)	
O	2.0	2.0		P	U	S	H		30		O2		
												Becomes medium to fine with depth	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Plant

HOLE NO.: B-105

BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
NEWTOWN CREEK	19933	1 OF 3	B-104

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
Plant	N 359; E 902	Vertical	——

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
2-27-90	2-28-90	WARREN GEORGE	MAYHEW 500	4in	100.2	0.0	100.2

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
0.0/0	0	25		11.5	▽ 7.0/4.5 ws ▽ 16.0/-4.5 24h AD	100.2/88.7 (-)

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs. / 30 inches	none	SCOTT NEWHOUSE

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	STANDARD PENETRATION TESTS 1st 6"	2nd 6"	3rd 6"	4th 6"	ELEV.	DEPTH	GRAPHICS	SAMPLE NO.	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								11.5					
SS	2.0	1.2	27	1	2	25	18				1	Black silty sand fill with gravel and brick fragments (FILL)	
SS	2.0	1.2	71	21	34	37	26				2		Drilling with mud and roller bit
SS	2.0	1.2	25	9	9	16	64		5		3		
SS	2.0	1.5	90	31	60	30	35				4		
SS	2.0	1.5	39	20	26	13	16				5		
SS	2.0	0.8	5	4	3	2	2		10		6		
SS	2.0	1.0	60	3	37	23	15				7		
SS	2.0	0.7	65	26	65/	2"			15		8		
SS	2.0	0.8	11	6	5	6	7				9		
SS	2.0	0.5	19	7	8	11	9				10		
SS	2.0	0.6	19	15	14	5	14		20		11		
SS	2.0	1.0	4	4	2	2	2		25		12	Petroleum odor at 25	
								-18.5	30				
SS	2.0	2.0	4	1	1	3	5				13	Dark gray silty clay, medium (CL)	
								-22.5					
												Dark gray silty fine to medium sand with clay (SM)	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Plant

HOLE NO. B-104

BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
NEWTOWN CREEK	19933	1 OF 3	B-103

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
Plant	N 1132; E 1228	Vertical	-----

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
2-28-90	3-1-90	WARREN GEORGE	CME-75	4in	95.7	0.0	95.7

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
0.0/0	0	23		8.2	▽ 9.0/-0.8 ws ▽ /	95.7/87.5 (-)

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs. / 30 inches	none	SCOTT NEWHOUSE

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	STANDARD PENETRATION TESTS 1st 6"	2nd 6"	3rd 6"	4th 6"	ELEV.	DEPTH	GRAPHICS	SAMPLE NO.	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								8.2					
SS	2.0	1.0		P	U	S	H				1	4 inches clayey topsoil Black silty sand with brick fragments (FILL)	
SS	2.0	0.3	29	17	15	14	15				2		Drilling with roller bit and mud
SS	2.0	1.5	24	6	12	12	8		5		3		
SS	2.0	0.5	27	14	14	13	11				4		
SS	2.0	1.0	22	12	13	9	8				5	Wet, with gravel at 8 ft	
SS	2.0		4	2	2	2	1		10		6	Wood fragments at 10 ft	
SS	2.0	0.0	1	1/24"					15		7		
								-9.8				Gray/black silty clay, trace fine sand, very soft (CL)	
SS	2.0	2.0	WOR	WOR/24"					20		8		
												Becomes sandy, more sand with depth	
O NONE	2.0	1.8		P	U	S	H		25		O1		Too sandy for penetrometer O=Osterberg
								-21.8					
SS	2.0	1.5	31	10	15	16	8		30		9	Gray/black silty fine to medium sand, medium to dense (SM)	(L)

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Plant

HOLE NO. B-103

BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
NEWTOWN CREEK	19933	1 OF 2	B-102

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
Plant	N 744; E 1233	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
3-1-90	3-1-90	WARREN GEORGE	MAYHEW 500	4in	74.0	0.0	74.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
0.0/0	0	19		10.9	▽ 18.0/-7.1 ▽ /	74.0/63.2 (-)

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs. / 30 inches	none	SCOTT NEWHOUSE

SAMP TYPE AND DIAM.	SAMP ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	STANDARD PENETRATION TESTS 1st 6"	2nd 6"	3rd 6"	4th 6"	ELEV.	DEPTH	GRAPHICS	SAMPLE NO.	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								10.9					
SS	2.0	1.0	13	2	7	6	14				1	Black silty sand with clay, gravel and brick fragments (FILL)	
SS	2.0	0.8	34	13	15	19	13				2		Drilling with roller bit and mud
SS	2.0	1.2	21	8	7	14	28		5		3		
SS	2.0	0.8	24	14	15	9	9				4		
SS	2.0	0.5	5	7	1	4	10				5		
SS	2.0	1.3	5	4	2	3	4		10		6		
												Concrete obstruction 13-14 ft	
SS	2.0	1.3	54	43	40	14	9		15		7	wood fragments at 15	
								-8.1					
SS	2.0	1.4	6	4	3	3	3		20		8	Dark gray silty clay, medium to soft (CL)	
O	2.0	2.0		P	U	S	H		25		O1		O=Osterberg Qp=0
								-17.1					
												Dark gray silty fine to medium sand, some clay and gravel with depth, medium (SM)	
O	2.0	1.5		P	U	S	H		30		O2		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Plant

HOLE NO.: B-102

BORING LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
NEWTOWN CREEK	19933	1 OF 3	B-101

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
Plant	N 446; E 1257	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
3-8-90	3-9-90	WARREN GEORGE	CME-75.	4in	90.8	0.0	90.8

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
0.0/0	0	22		9.5	▽ 11.0/-1.5 WS /	90.8/81.3 (-)

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs. / 30 inches	none	SCOTT NEWHOUSE

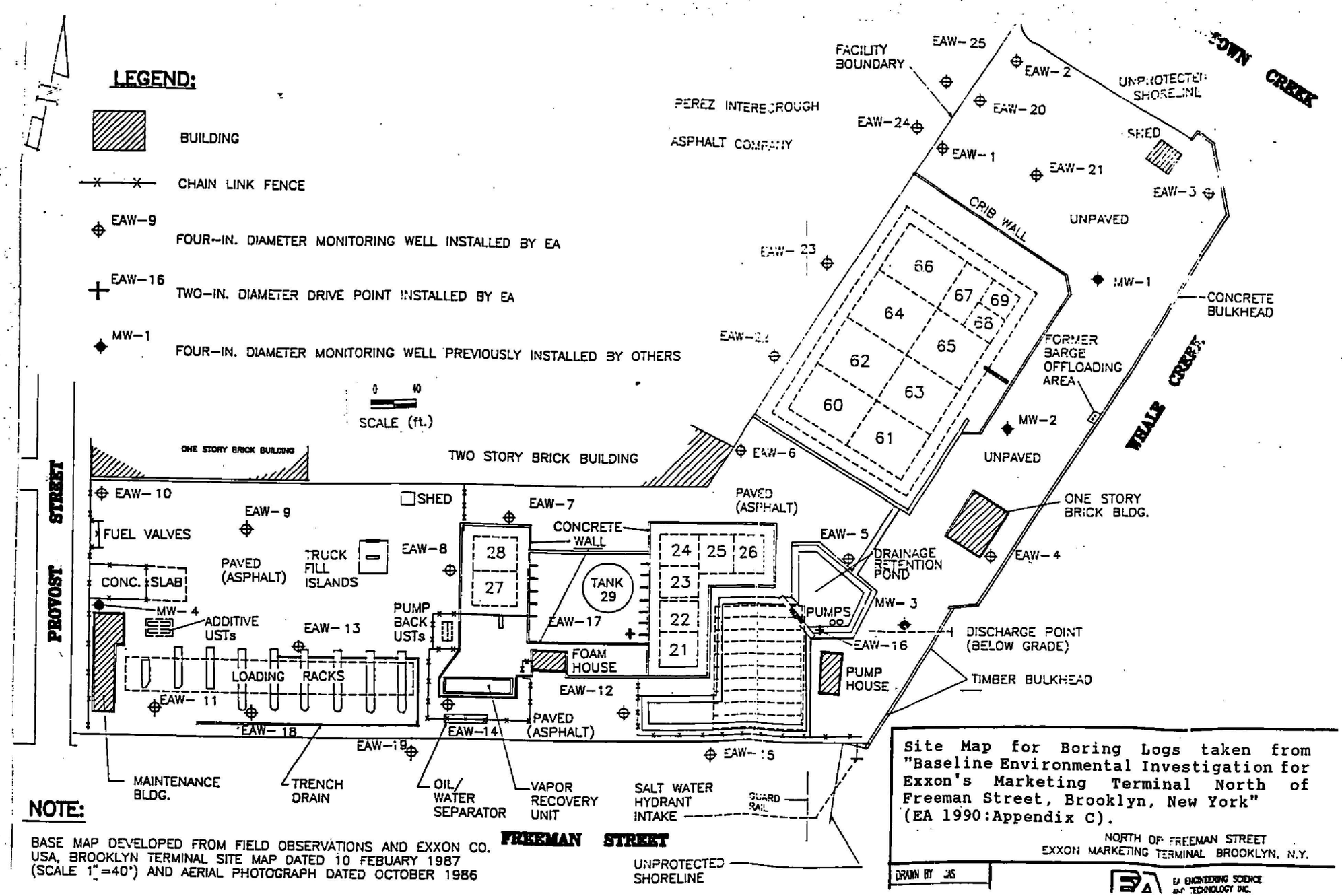
SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	STANDARD PENETRATION TESTS 1st 6"	2nd 6"	3rd 6"	4th 6"	ELEV.	DEPTH	GRAPHICS	SAMPLE NO.	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	2.0	1.0		P	U	S	H	9.5			1	Black silty sand with gravel and brick fragments (FILL)	Drilling with roller bit and mud
SS	2.0	1.7	86	65	42	44	32				2		
SS	2.0	1.8	104	37	42	62	73		5		3	Concrete fragments 4-6 ft	
SS	2.0	1.8	133	40	46	87	62				4		
SS	2.0	1.5	89	33	41	48	50				5		
SS	2.0	1.0	76	48	41	35	25		10		6	Becomes gravelly and wet	
SS	2.0	1.3	5	10	3	2	2		15		7	Becomes black clayey medium to coarse sand, petroleum odor (probable FILL)	
								-8.5				Dark gray silty clay, soft to medium (CL)	
SS	2.0	2.0	WOH	WOR	/6"	WOH	/18"		20		8		
O	2.0	1.5		P	U	S	H		25		O1		Qp = 1.0 tsf (L) O = Osterberg
								-18.5				Dark gray silty fine to medium sand with clay, medium (SM)	
O	2.0	2.0		P	U	S	H		30		O2		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: Plant

HOLE NO.: B-101

Boring Logs taken from "Baseline Environmental Investigation for Exxon's Marketing Terminal North of Freeman Street, Brooklyn, New York" (EA 1990:Appendix C).



NOTE:

BASE MAP DEVELOPED FROM FIELD OBSERVATIONS AND EXXON CO. USA, BROOKLYN TERMINAL SITE MAP DATED 10 FEBUARY 1987 (SCALE 1"=40') AND AERIAL PHOTOGRAPH DATED OCTOBER 1986

Site Map for Boring Logs taken from "Baseline Environmental Investigation for Exxon's Marketing Terminal North of Freeman Street, Brooklyn, New York" (EA 1990:Appendix C).

NORTH OF FREEMAN STREET
EXXON MARKETING TERMINAL BROOKLYN, N.Y.

DRAWN BY JAS

EA ENGINEERING SCIENCE AND TECHNOLOGY INC.

LOG OF BORING EAW - 1

EA Engineering, Science & Technology

Coordinates: Adjacent to Northwest Corner of Mounded Tanks 60-69
Top of Well Casing Elevation: 98.54 ft
Surface Elevation: 99.21 ft
Well Casing_Below_Surface: 0.67 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 29 November 1989
Completion Date: 29 November 1989

Location: Exxon Marketing Terminal, Brooklyn, New York

Job No. 10983.12
Client: Exxon
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Dry sand

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		
SPT	24	4	0	1	0-2	7 28 17 19		F I L L	Dark brown fine-coarse sand with little concrete, rubble and brick, trace fine gravel and silt. (Moist, Hnu 0.5 ppm.)
SPT	24	16	0	2	2-4	8 5 5 4			Dark brown fine-coarse sand with some silt, trace fine gravel and rubble. (Moist, petroleum odor, Hnu 100 ppm.)
SPT	24	16	4	3	4-6	2 5 7 13	5		Black fine-medium sand, with some silt, little fine-coarse gravel and coarse sand, trace rubble. (Dry to moist, petroleum odor, Hnu 130 ppm.) (Sample collected for chemical analyses.)
SPT	24	10	6	4	6-8	8 9 11 11			Black fine sand, with some silt, trace medium-coarse sand, fine gravel, rubble and glass. (Bottom 1 in. of spoon saturated, petroleum odor, Hnu 70 ppm.)
SPT	24	6	10	5	10-12	4 4 4 3	10		Black coarse-fine gravel, coarse-medium sand and wood, with some silt. (Wet, petroleum odor, Hnu 70 ppm.)
SPT	24	16	13	6	13-14	1 1 1			Black fine sand with some wood fragments, little silt and medium sand, and trace coarse sand. (Wet, petroleum odor, Hnu 40 ppm.)
				7	14-15		15		Black fine-coarse sand with little silt, fine-coarse gravel and wood fragments. (Wet, petroleum odor, Hnu 90 ppm.)
SPT	24	2	16	8	16-18	4 4 3 1			Black coarse-fine sand and fine gravel with some silt and wood fragments. (Wet, petroleum odor, Hnu 20 ppm.)
									Ended boring at 18 ft.
							20		WELL INSTALLATION Fifteen ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 18 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box. Sand: 2 to 18 ft BG. Bentonite pellets: 1.5 to 2 ft BG Flush-mounted steel box set in grout on top of bentonite and cemented to grade

NOTE: Ground-water depth 10.91 ft. below top of well casing on 18 January 1990.

LOG OF BORING EAW - 2

EA Engineering, Science & Technology

Coordinates: Northwest Property Boundary, Adjacent to Newtown Creek
Top of Well Casing Elevation: 96.84 ft
Surface Elevation: 97.87 ft
Well Casing_Below_Surface: 1.03 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 30 November 1989
Completion Date: 30 November 1989

Location: Exxon Marketing Terminal, Brooklyn, New York

Job No. 10963.12
Client: Exxon
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Frozen sand and gravel

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		
SPT	24	8	0	1	0-2	9		F	Medium brown silt and fine-medium sand, with little coarse sand, and trace fine gravel.
						21		I	
						22		L	Grades to dark brown with some rubble (1.75-2 ft below grade.) (Dry, Hnu 2ppm.)
						25		L	
SPT	24	24	0	2	2-4	15			Dark brown fine-medium sand and silt, with little coarse sand, trace fine-coarse gravel and rubble. Concrete pieces 2.5-3.0 ft below grade (bg.) Grades to fine sand and silt with some medium sand, trace coarse sand and fine-coarse gravel. (Moist, petroleum odor, Hnu 20 ppm.)
						7			
						8			
						12			
SPT	24	14	4	3	4-6	9			Dark brown fine sand, with little medium sand and silt, trace coarse sand, and fine gravel. (Moist, petroleum odor, Hnu 60 ppm.)
						18	5		
						11			
						9			
SPT	24	4	6	4	6-8	5			Black fine-medium sand with some silt, little coarse sand and fine-coarse gravel, and trace wood fragments. (Moist, petroleum odor, Hnu 70 ppm.) (Sample collected for chemical analysis.)
						7			
						2			Rubber and Wood coming out of hole (6-7 ft bg.)
						3			
SPT	24	3	8	5	8-10	5			Red brick (Water on spoon, but not in sample, Hnu 25 ppm.)
						5			
						5			
						5	10		
SPT	24	18	10	6	10-12	7			Black, grey, red and brown mottled silt and fine sand with trace medium-coarse sand and fine gravel. Mica chips 10.5-10.75 ft bg.
						4			
						6			Grades to fine sand and silt with little medium-coarse sand and fine gravel, and trace wood fragments. (Wet, petroleum odor, Hnu 30 ppm.)
						6			
SPT	24	10	12	7	12-14	6			Black, grey, and brown mottled fine sand and silt with little medium-coarse sand, and fine gravel, brick, wood and coal pieces, trace coarse gravel. (Wet, petroleum odor, Hnu 6 ppm.)
						6			
						5			
						7			
							15		
SPT	24	1	18	8	16-18	5			Black silt and fine sand with trace coarse-medium sand and fine gravel. (Wet, petroleum odor, Hnu 7 ppm.)
						2			
						1			
						8			
									Ended boring at 18.5 ft.
							20		

WELL INSTALLATION

Fifteen ft of 4-in. diameter schedule 40 threaded joint PVC well screen set at set at 18 ft below grade (BG). Four-in. PVC riser set to ground surface with locking cap. Well completed at surface in flush steel box.
Sand: 2.5-18 ft BG.
Bentonite pellets: 1.5-2.5 ft BG.
Flush-mounted steel box set in grout on top of bentonite and cemented to grade.
Note: Well settled approx. 0.5 ft after installation due to tidal fluctuations.

NOTE: Ground-water depth 9.40 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 3

EA Engineering, Science & Technology

Coordinates: Northeast Property Boundary, Adjacent to Mouth of Whale Creek Canal
Top of Well Casing Elevation: 93.30 ft
Surface Elevation: 93.89 ft
Well Casing_Below_Surface: 0.59 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 1 December 1989
Completion Date: 1 December 1989

Location: Exxon Marketing Terminal, Brooklyn, New York

Job No. 10983.12
Client: Exxon
Drilling Method: Failing F-7 truck-mounted rig using 8-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Frozen sand and gravel

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows/ 6-in.	Depth Feet	Graph Log	Description
							0		
SPT	24	16	0	1	0-2	6 15 13 7		F I L L	Brown silt with some coarse-fine sand, trace fine gravel and brick pieces. [Frozen, Hnu 220 ppm. (no odor nor visual evidence of contamination, Hnu reading presumed to be erroneous.)]
SPT	24	8	0	2	2-4	6 5 5 18			Brown and white mottled fine-coarse sand and silt wth little to some fine gravel and rubble (2-3.9 ft below grade). Grades to coarse-fine sand with some fine gravel and little silt (Dry, Hnu 3 ppm.)
SPT	24	2	0	3	4-6	20 18 15 17	5		Brown fine-coarse sand, silt, and fine-coarse gravel with little concrete, rubble and brick. (Bottom 2-in. spoon wet, Hnu 1.8 ppm.)
SPT	24	18	8	4	6-8	15 25 33 47			Dark brown rubble (6-6.3 ft below grade.) Concrete (6.3-6.8 ft below grade.) Wood (6.8-8 ft below grade) (Wet, creosote odor, Hnu 7.1 ppm.)
SPT	24	6	8	5	8-10	25 6 3 2	10		Wood shavings and fine gravel, some fine sand and silt, trace coarse-medium sand. (Wet, creosote odor, Hnu 6 ppm.)
SPT	24	2	10	6	10-12	6 4 3 2			Wood shavings and fine gravel, with some fine sand and silt, trace coarse-medium sand. (Wet, creosote odor, Hnu 5 ppm.)
GRAB				7	12-16				Wood shavings and fine gravel, with some fine sand and silt, trace coarse-medium sand. (Wet, creosote odor, Hnu 18 ppm.) (Sample obtained from prug in augers at 16 ft.) (Sample collected for chemical analysis.)
							15		
									Auger refusal 16 ft (large concrete block in augers). Ended borehole.
							20		WELL INSTALLATION Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 12.5 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box. Sand: 1.75-12.5 ft BG. Bentonite pellets 1.25-1.75 ft BG. Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 6.24 ft below top of well casing on 16 January 1990.

LOG OF BORING EAW - 4

EA Engineering, Science & Technology

Coordinates: Eastern Property Boundary, West of Mounded Tanks 60-69, and Adjacent to Whale Creek Canal
Top of Well Casing Elevation: 93.53 ft
Surface Elevation: 94.00 ft
Well Casing_Below_Surface: 0.47 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 4 December 1989
Completion Date: 4 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon
Drilling Method: Failing F-7 truck-mounted rig using 8-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Frozen gravel

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows/ 6-in.	Depth Feet	Graph Log	Description
							0		
SPT	24	4	0	1	0-2	22		F	Grey fine-coarse gravel (top 1-in.). Brown fine sand and silt with some
						18		I	medium-coarse sand. Grades to white medium-coarse sand with little
						17		L	fine sand (1.9-2.0 ft below grade.)
						17		L	(Dry, Hnu 1ppm.)
SPT	24	2	0	2	2-4	14			Brown fine-coarse sand and silt, with trace fine gravel and brick pieces.
						6			(Dry, Hnu 1 ppm.)
						4			
						4			
SPT	24	8	0	3	4-6	4			Brown silt and fine-coarse sand with some to and fine
						2	5		gravel, little rubble and trace coarse gravel. (Bottom 2-in. of
						3			spoon wet, Hnu 1 ppm.)
						5			
SPT	24	5	6	4	6-8	50/6,12			Wood (6.0-6.5 ft below grade.)
						13			Brown rubble and fine-coarse sand and fine gravel with some silt.
						50/0			Wood (7 ft below grade.)
									(Dry, Hnu 2 ppm.) (Sample collected for chemical analysis.)
									No sample obtained. Augers hit wood at 8 ft below grade. Tried to take
									sample at 8-10 ft, but augers dropped 1 ft and spoon dropped to 11 ft
									below grade (bg.) Pulled out spoon and hole was open to 14 ft bg.
							10		
SPT	24	0.1	9	5	11-13	5			No sample obtained.
						0			
						1			
						0			
SPT	24	18	14	6	14-16	9			Black fine-coarse gravel with some silt and coarse-fine sand, and little
						13	15		rubble (tile pieces.) (Wet, petroleum odor, Hnu 6 ppm.)
						4			(Not enough sample collected for chemical analysis.)
						6			
									Auger refusal 16.5 ft. Ended borehole.
									WELL INSTALLATION
									Fourteen and one-half ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 16.5 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box.
									Gravel: 2-16.5 ft BG.
									Bentonite pellets 1.5-2 ft BG.
									Flush-mounted steel box set in grout on top of bentonite and cemented to grade.
							20		

NOTE: Ground-water depth 7.50 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 5

EA Engineering, Science & Technology

Coordinates: Adjacent to Northeast Berm of Drainage Retention Basin
Top of Well Casing Elevation: 94.09 ft
Surface Elevation: 94.53 ft
Well Casing_Below_Surface: 0.44 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 4 December 1989
Completion Date: 5 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows/ 6-in.	Depth Feet	Graph Log	Description
							0		Asphalt 0-0.5 ft below grade (BG.)
SPT	18	10	0	1	0.5-2	13			Grey coarse-fine sand and fine-coarse gravel with some silt. Grades to brown
						45		F	silt and fine sand with some medium-coarse sand little fine gravel
						48		I	and brick pieces (1.0 ft BG) (Dry, Hnu 1.5 ppm.)
SPT	24	24	2	2	2-4	40		L	Brown fine-medium sand and silt, with little coarse sand, and trace fine gravel.
						32		L	Grades to silt and fine-medium sand with little coarse sand, brick pieces
						37			and trace fine gravel (3.5 ft BG.) (Moist, petroleum odor, Hnu 20 ppm.)
						45			
SPT	24	8	4	3	4-6	12			Brown medium-fine sand with some silt, trace coarse sand and fine gravel.
						7	5		Wood shavings bottom 2-in. of spoon. (Moist, petroleum odor, Hnu 70 ppm.)
						4			(Sample collected for analysis.)
						5			
SPT	72	30	8	4	6-12	9			Black fine-coarse sand and silt, with trace fine gravel (6.0-6.75 ft BG.)
						1			Greybrown silty clay with grass (6.75 ft bg.) (Moist, Hnu 20 ppm.)
						1			Spoon advanced to 12 ft BG on 11th blow
								CL	
							10		
SPT	72	30	11	5	11-18	1			Greybrown silty clay with grass. (Moist, Hnu 2.5 ppm.)
						0			
						0			
						0			Spoon advanced to 18 ft on 1st blow.
									Ended borehole at 13 ft.
							15		
									WELL INSTALLATION
									Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 12.75 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box.
									Sand: 2-12.75 ft BG.
									Bentonite pellets 1-2 ft BG.
									Flush-mounted steel box set in grout on top of bentonite and cemented to grade.
							20		

NOTE: Ground-water depth 5.21 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 7

EA Engineering, Science & Technology

Coordinates: Adjacent to Northern Wall of Mounded Tanks 27 and 28.
Top of Well Casing Elevation: 96.84 ft
Surface Elevation: 97.14 ft
Well Casing_Below_Surface: 0.30 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 5 December 1989
Completion Date: 6 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10883.12
Client: Exxon Company, U.S.A.
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		
SPT	18	8	0	1	0.5-2	11 16 18		F I	Asphalt 0-0.5 ft below grade (BG.) Dark brown mottled with white silt and fine-coarse sand with little fine gravel, brick, cinders, wood, and mica chips. (Dry, Hnu 20 ppm.)
SPT	24	10	0	2	2-4	20 20 7 5		L L	Dark brown silt and fine-medium sand with little coarse sand and fine gravel, brick, mica, and rubble (2-2.3 ft below grade.) White/tan medium sand with little fine sand and trace coarse sand. (Moist, petroleum odor. Hnu 20 ppm.)
SPT	24	6	0	3	4-6	6 6 7 9	5		Tan medium sand mottled with dark brown silt and fine sand, little fine-coarse gravel and coarse sand. (Moist, petroleum odor, Hnu 80 ppm.)
SS	30+	10	6	4	6-8	11 32 25 30			Dark brown fine-coarse sand and silt with little fine gravel. Brick from 6-6.2 and 6.4-6.5 ft below grade. (Spoon wet at 7 ft bg., petroleum odor, Hnu 160 ppm.) Sample collected for chemical analysis.)
							10		
SPT	24	4	11	5	11-16	9 5 1 1		CL	Dark brown fine-coarse sand and silt with some fine gravel. Grades to tan fine sand (bottom 2-in. of spoon.) (Coarse gravel in spoon basket, not much sample obtained.) (Wet, petroleum odor, Hnu 110 ppm.) Gray/brown silty clay w/rn grass on auger (12-14 ft bg.)
							15		Ended borehole at 14 ft.
							20		WELL INSTALLATION Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 13.5 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box. Sand: 3-13.5 ft BG. Bentonite pellets 2.0-3.0 ft BG. Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 6.87 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 8

EA Engineering, Science & Technology

Coordinates: Adjacent to Western Wall of Mounded Tanks 27 and 28.
Top of Well Casing Elevation: 97.11 ft
Surface Elevation: 97.96 ft
Well Casing_Below_Surface: 0.87 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 6 December 1989
Completion Date: 6 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		Asphalt 0-0.5 ft below grade (BG.)
SPT	18	10	0	1	0.5-2	15			Dark brown coarse-fine sand with some silt, and little fine gravel (0.5-0.75
						20		F	ft bg.) Grades to silt and fine-medium sand with little coarse sand.
						40		I	Yellow fine-medium sand and silt (bottom 2-in. of spoon.) (Dry, Hnu 4.5 ppm.)
SPT	24	18	0	2	2-4	12		L	Dark brown coarse-fine sand with some fine gravel (rubble) and silt
						22		L	(2-2.5 ft bg.) Grades to fine sand and silt with some medium
						14			sand, and little coarse sand.
						12			Brick 3.5-4.0 ft bg. (Dry, Hnu 2.5 ppm.)
SPT	24	18	0	3	4-6	9			Brick 4.0-4.3 ft bg.
						9	5		Dark brown coarse-fine sand, silt, and fine gravel, with some fibrous
						6			fill, and rubble (4.3-4.8 ft below grade.)
						7			Light brown peat(4.8-5 ft bg.)
SS	72	3	6	4	6-12	9			Dark brown coarse-fine sand, silt and fine gravel with some rubble. (Moist, Hnu 25 ppm.)
						2			
				5	7-12	1			Brown/grey mottled with red, green and yellow fine-medium sand and silt with
						1			little coarse sand and fine gravel.
									Wood fragments (bottom 2-in. of spoon.) (Wet, Hnu 1.5 ppm.)
							10		
SPT	24	2	13	6	13-15	1			Brown fine-medium sand and silt with little fine gravel and coarse sand.
						0			(Wet, Hnu 2 ppm.)
						0			Grey/brown silty clay and grass on auger (14-18 ft bg.)
						0	15	CL	
									Ended borehole at 18 ft.
							20		WELL INSTALLATION
									Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 15 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box.
									Sand: 3.5-15.5 ft BG.
									Bentonite pellets 2.5-3.5 ft BG.
									Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 7.02 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 9

EA Engineering, Science & Technology

Coordinates: Paved Lot North of Loading Racks, Near Northwest Property Boundary.
Top of Well Casing Elevation: 99.19 ft
Surface Elevation: 99.69 ft
Well Casing_Below_Surface: 0.50 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 6 December 1989
Completion Date: 6 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon Company, U.S.A.
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows/ 6-in.	Depth Feet	Graph Log	Description
							0		
									Asphalt 0-0.5 ft below grade (BG.)
SPT	12	8	0	1	1-2	7		F	Dark brown fine-medium sand and silt with little coarse sand, and trace fine gravel. (Moist, Hnu 8 ppm.)
						14		I	
SPT	24	14	0	2	2-4	30		L	Dark brown fine sand wth little silt (2-2.1 ft bg.) Grades to
						25		L	brown and then tan (2.1-2.5 ft bg.) Grades to red and white mottled
						15			fine sand with little medium-coarse sand and trace silt.
						13			Brick (3.7-4.0 ft below grade.) (Moist, Hnu 11 ppm.)
SPT	24	9	0	3	4-6	8			Brick 4.0-4.25 ft below grade, grades to brick mottled with white fine-medium sand, and trace fine gravel.
						6	5		
						5			Light brown fine-medium sand (bottom 1-in. of spoon.) (Moist, Hnu 2 ppm.)
						7			
SPT	24	2	6	4	6-7	4			Brick 6.0-6.1 ft bg.
						10			Dark brown coarse-fine sand with some silt (Moist, Hnu 11 ppm.)
SS	24	18	7	5	7-9	15			Dark brown silt and fine-coarse sand with little fine gravel, rubble and
						24			and wood chips. (Moist, petroleum odor, Hnu 60 ppm.)
SPT	24	24	9	6	9-11	13			Dark brown grading to tan and dark brown coarse-fine sand with some silt
						8	10		and fine gravel, and little mica. (Wet, petroleum odor, Hnu 200 ppm.)
						10			(Sample collected for chemical analysis.)
						5			
SPT	24	3	13	7	13-15	20			Wood and fine gravel wth some silt, and little fine-coarse sand.
						11			(Wet, Hnu 180 ppm.)
						7			
						7	15		
								CL	Greybrown silty clay and grass on auger (15 ft bg.)
									Drilled to 15.5 ft below grade, but borehole was open to 17.3 ft.
									End borehole at 17.3 ft.
							20		WELL INSTALLATION
									Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 17.3 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box.
									Sand: 5-17.3 ft BG.
									Bentonite pellets: 4-5 ft BG.
									Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 9.34 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 10

EA Engineering, Science & Technology

Coordinates: Northwest Corner of Paved Lot, North of Loading Racks, adjacent to Provost Street.
Top of Well Casing Elevation: 99.05 ft
Surface Elevation: 99.65 ft
Well Casing_Below_Surface: 0.60 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 7 December 1989
Completion Date: 7 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon Company, U.S.A.
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		Asphalt 0-0.5 ft below grade (BG.)
SPT	12	12	0	1	1-2	15 15		F I	Dark brown mottled with white/tan fine-coarse sand and silt with some brick, tile and glass, and trace fine gravel. (Dry, Hnu 2.5 ppm.)
SPT	24	12	0	2	2-4	9 12 42 33		L L	Dark brown, mottled with white, black, and tan coarse-fine sand with some fine gravel, silt and rubble, trace coarse gravel. (Dry, Hnu 3.5 ppm.)
SPT	24	9	0	3	4-6	8 4 3 3	5		Dark grey fine-coarse gravel (top 3 in.), grades to dark brown fine-medium sand and silt with some coarse sand, and little fine gravel. (Dry, Hnu 6 ppm.)
SPT	24	3	0	4	6-8	2 1 1 2			Dark brown coarse-fine sand with some silt and fine gravel, trace coarse gravel (Moist, Hnu 5 ppm.)
SS	24	24	8	5	8-10	4 3 2 8	10		Dark brown coarse-fine sand, fine gravel, and silt (top 2-in.) Grades to brown and tan mottled fine-medium sand and silt (8.1-8.6 ft bg.) with some clay (8.5-8.6 ft bg.) Grades to fine gravel and coarse sand with some silt and medium-fine sand. (Wet, petroleum odor, Hnu 400 ppm.) (Sample collected for chemical analysis.)
SPT	24	3	13	6	13-15	3 1 2 1	15	CL	Dark brown mottled with white fine-medium sand and silt, with little coarse sand and fine gravel. (Wet, petroleum odor, Hnu 165 ppm.) Grey/brown silty clay with grass on auger 14.5-15.5 ft bg.
									Ended borehole at 15.5 ft.

WELL INSTALLATION

Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 15 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box.

Sand: 4-15 ft BG.
Bentonite pellets: 2.5-4 ft BG.
Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 9.32 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 11

EA Engineering, Science & Technology

Coordinates: Southwest of Loading Racks, North of Freeman Street.
Top of Well Casing Elevation: 98.82 ft
Surface Elevation: 99.30 ft
Well Casing_Below_Surface: 0.48 ft
Reference Elevation: 100.00 (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 7 December 1989
Completion Date: 7 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon Company, U.S.A.
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Recvd.	Casing Depth	Sample No.	Sample Depth	Blows/ 6-in.	Depth Feet	Graph Log	Description
							0		Asphalt 0-0.5 ft below grade (BG.)
SPT	15	9	0	1	0.75-2	15/3			Tan fine-medium sand (top 3 in.)
						31		F	Dark brown silt and fine sand, with some cinders, glass, rubble and
						43		I	white powder, trace fine gravel and coarse sand. (Dry, petroleum odor, Hnu 150 ppm.)
SPT	18	9	2	2	2-3.5	12		L	Dark brown fine-medium sand with some silt, little fine-coarse gravel
						19		L	and brick. (Dry, petroleum odor, Hnu 40 ppm.)
						50/6			
SPT	24	7	4	3	4-6	20			Medium brown fine-coarse sand with little fine gravel and silt.
						50	5		(Dry, petroleum odor, Hnu 85 ppm.)
						52			Metal fragments coming out of hole (5-6 ft below grade.)
						25			
SPT	24	6	6	4	6-8	10			Dark brown mottled with white, orange, and tan fine-coarse sand, with some
						20			fine gravel, little silt, rubble, and metal fragments.
						25			(Moist, petroleum odor, Hnu 200 ppm.)
						7			
SS	24	0	8	0		19			No sample obtained. Collected drill cuttings 8-13 ft bg.
						17			
						16			
						30	10		
SPT	24	9	13	5	13-15	9			Dark brown/black fine-coarse sand with some silt and fine-coarse gravel.
						18			Fine sand and silty clay (bottom 1-in. of spoon.) (Wet, petroleum odor, Hnu 700 ppm.)
						5			(Sample collected for chemical analysis.)
						5	15	CL	Grey/brown silty clay with grass on auger 14.5-15.5 ft bg.
									Ended boring at 15.5 ft.
							20		

WELL INSTALLATION

Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 15 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box.

Sand: 3-15 ft BG.
Bentonite pellets: 2-3 ft BG.
Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 8.94 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 12

EA Engineering, Science & Technology

Coordinates: Adjacent to Western Edge of Drainage Retention Basin
Top of Well Casing Elevation: 94.22 ft
Surface Elevation: 95.08 ft
Well Casing_Below_Surface: 0.86 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 7 December 1989
Completion Date: 11 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon Company, U.S.A.
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows\ 6-in.	Depth Feet	Graph Log	Description
							0		Asphalt 0-0.5 ft below grade (BG.)
SPT	12	3	0	1	1-2	5			Concrete 0.5-1 ft. bg.
						2		F	Dark brown medium-coarse sand, with some fine sand, and little fine gravel.
						50/0		I	Grades to fine sand and silt (1.75 ft bg.) (Dry, Hnu 900 ppm),
								L	and brick. (Dry, petroleum odor, Hnu 40 ppm.) (Not enough sample collected for analysis.)
								L	Concrete (2-3 ft bg.)
SPT	24	12	0	2	3-5	5			Dark brown silt and fine-medium sand, with trace coarse sand (top 3-in.)
						5			Grades to dark brown/black coarse-fine sand, with some silt, and trace
						4			fine gravel. (Moist, petroleum odor, Hnu 200 ppm.)
						3	5		
SS	24	10	5	3	5-7	8			Dark brown fine-medium sand and silt with little coarse sand and trace
						7			fine-coarse gravel (5-5.5ft bg.) Grades to dark brown mottled with
						7			tan and green above with little clay (5.5-6 ft bg.) Grades to black silt
						9			and fine sand with some cinders (6-6.3 ft bg.) and grades to mottled
									dark brown, green, and tan fine sand and silt, with little medium-coarse
									sand, and trace fine-coarse gravel. (Wet at 6 ft bg., petroleum odor,
									Hnu 250 ppm.) (Sample collected for chemical analysis.)
							10		
SPT	24	2	10	4	10-12	4			Dark brown fine-coarse sand and silt, with some fine gravel.
						2			(Wet, petroleum odor, Hnu 300 ppm.) (Not enough sample collected for chemical analysis.)
						2			Dark brown silty clay on auger at 11-13 ft bg.
						2		CL	
									Ended boring at 13 ft.
							15		
							20		WELL INSTALLATION
									Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 12 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box.
									Sand: 1.5-13 ft BG.
									Bentonite pellets: 1-1.5 ft BG.
									Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 4.21 below top of well casing on 18 January 1990.

LOG OF BORING EAW - 13

EA Engineering, Science & Technology

Coordinates: Just North of Loading Racks

Location: Exxon Marketing Terminal, Brooklyn New York

Top of Well Casing Elevation: 99.90 ft
Surface Elevation: 99.40 ft
Well Casing_Below_Surface: 0.50 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Job No. 10983.12
Client: Exxon Company, U.S.A.
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Start Date: 8 December 1989
Completion Date: 8 December 1989

Sample Type	In. Driven	In. Recvd.	Casing Depth	Sample No.	Sample Depth	Blows 6-in.	Depth Feet	Graph Log	Description
							0		Asphalt 0-0.5 ft below grade (BG.)
SPT	12	8	0	1	1-2	13 8		F I	Dark brown coarse-fine sand, with some fine gravel, and little silt. (1-1.75 ft bg.) Grades to fine sand and clayey silt, little coarse-medium sand and fine gravel. (Moist, Hnu 900 ppm
SPT	24	16	0	2	2-4	9 10 19 20		L L	Dark brown coarse-fine sand, with little silt and fine gravel (2-2.25 ft bg.) Grades to red, white, and black fine-medium sand, with little coarse sand, silt, rubble, cinders, and brick. (Moist, petroleum odor, Hnu 200 ppm.)
SPT	24	10	0	3	4-6	8 7 4 2	5		Dark brown coarse-fine sand, with little fine gravel and silt (4-4.5 ft bg.) Grades to light brown fine sand and silt with little medium-coarse sand. (Moist, petroleum odor, Hnu 70 ppm.)
SPT	24	10	0	4	6-8	5 9 5 9			Dark brown, purple, yellow and white mottled fine-coarse gravel with some coarse-fine sand and silt (6-6.25 ft bg.) Grades to black, green, brown, and tan medium-fine sand with some silt little coarse sand and clay. (Moist, petroleum odor, Hnu 170 ppm.)
SS	24	20	8	5 6	8-9 9-10	9 8			Black, light brown, and red mottled clayey silt and fine sand, with some brick, trace fine gravel and coarse-medium sand. (Wet at 8.5 ft bg., petroleum odor, Hnu 140 ppm
						24 35	10		Black fine-course sand with some fine gravel, and little silt. Grades to coarse-fine sand with some fine gravel (9.5 ft bg.) (Wet, petroleum odor, Hnu 900 ppm. (Sample collected for chemical analysis.)
SPT	24	5	13	7	13-15	8 16 24 20	15		Brown, tan and black mottled clayey silt and fine sand with brick pieces, little fine gravel and medium-course sand. Wood in bottom 2-in. of spoon. (Wet, petroleum odor, Hnu 166 ppm.)
								CL	Greybrown silty clay with grass on auger 15-18 ft bg.
									End borehole at 18 ft.
							20		WELL INSTALLATION Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 18.2 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box. Sand: 4-18.2 ft BG. Bentonite pellets: 3-4 ft BG. Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 9.09 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 14

EA Engineering, Science & Technology

Coordinates: Adjacent to Vapor Recovery Unit, North of Freeman Street.
Top of Well Casing Elevation: 96.96 ft
Surface Elevation: 97.77 ft
Well Casing_Below_Surface: 0.81 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 11 December 1989
Completion Date: 14 December 1989

Location: Exxon Manuring Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows/ 6-in.	Depth Feet	Graph Log	Description
							0		
SPT	18	6	0	1	0.5-2	9 4 3		F I	Asphalt 0-0.5 ft below grade (BG.) Light brown, orange, and tan mottled fine-coarse sand and silt, with some fine gravel, and little coarse gravel (0.5-2.5 ft bg.) Grades to silt and fine-coarse sand with some fine gravel. (Dry, Hnu 6 ppm.)
SPT	24	7	0	2	2-4	5 5 3 3		L L	Dark brown fine-coarse sand and silt with some coarse-fine gravel (marble pieces in spoon basket.) (Dry, Hnu 3ppm.)
SPT	24	6	0	3	4-6	11 2 3 2	5		Dark brown fine-medium sand and coarse-fine gravel, with little silt (4-4.25 ft bg.) Grades to coarse-fine sand with some silt, little fine gravel, trace coarse gravel and clay (4.25-4.5 ft bg.) Grades to black coarse-fine sand with some silt. (Moist, Hnu 2 ppm.)
SPT	24	18	0	4	6-8	6 12 37 14	10		Light brown fine-coarse sand, silt, and fine-coarse gravel with little white chalky substance (top 2-in.) Grades to dark brown/black with some rubble and brick. Wood from 8.7-8.9 ft bg. (Moist, Hnu 6 ppm.) (Sample collected for chemical analysis.)
SPT	24	0	11	5	11-13	6 4 5 2		CL	Grey/brown silty clay with grass on auger from 11-14 ft bg.
							15		Ended borehole at 14 ft.
							20		WELL INSTALLATION Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 14 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box. Sand: 3-14 ft BG. Bentonite pellets: 2-3 ft BG. Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 7.00 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 15

EA Engineering, Science & Technology

Coordinates: Eastern End of Freeman Street, South of Drainage Retention Basin.
Top of Well Casing Elevation: 93.35 ft
Surface Elevation: 93.89 ft
Well Casing_Below_Surface: 0.54 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 12 December 1989
Completion Date: 12 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon Company, U.S.A.
Drilling Method: Failing F-7 truck-mounted rig using 8-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Sand by roadside.

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows/ 6-in.	Depth Feet	Graph Log	Description
SPT	24	20	0	1	0-2	18 16 8 8	0	F I L L	Dark brown fine sand and silt, little medium-coarse sand (0-0.75 ft bg.) Grades to orange, brown, and white fine-coarse sand with little fine gravel, rubble and silt (0.75-1.25 ft bg.) Grades to dark brown fine-coarse sand with some fine gravel, and little silt (Dry, petroleum odor, Hnu 250 ppm.)
SS	24	18	0	2	2-4	10 14 11 11			Dark brown fine-coarse sand with some silt, and little fine-coarse gravel (2-2.5 ft bg.) Grades to coarse-fine sand and fine gravel with little coarse gravel. (Wet at 3 ft bg., petroleum odor, Hnu 300 ppm.) (Sample collected for chemical analysis.)
SPT	24	12	4	3	4-6	8 6 4 4	5		Dark brown coarse-fine sand with little fine gravel and silt. (Wet, petroleum odor, Hnu 180 ppm.)
								CL	Grey/brown silty clay with grass on auger from 8-12 ft bg.
SPT	24	0	9	4	9-11	5 1 1 1	10		
									Ended borehole at 12 ft.
							15		
							20		WELL INSTALLATION Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 12.5 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box. Sand: 1.4-11.5 ft BG. Bentonite pellets: 0.9-1.4 ft BG. Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 2.83 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 18

EA Engineering, Science & Technology

Coordinates: -South of Loading Racks, North of Freeman Street.
Top of Well Casing Elevation: 98.21 ft
Surface Elevation: 98.78 ft
Well Casing_Below_Surface: 0.57 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 14 December 1989
Completion Date: 14 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10983.12
Client: Exxon Company, U.S.A.
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Rcvd.	Casing Depth	Sample No.	Sample Depth	Blows 6-in.	Depth Feet	Graph Log	Description
							0		
									Asphalt 0-0.5 ft below grade (bg.)
SPT	12	8	0	1	1-2	18		F	Medium-dark brown fine-coarse sand with some to and silt, little fine-coarse
						11		I	gravel, rubble, brick, wood and concrete. (Dry, Hnu 96 ppm.)
SPT	24	18	0	2	2-4	14		L	Dark brown fine-medium sand with some silt and fine-coarse gravel (top 3-in.)
						14		L	Grades to tan fine sand and clayey silt (2.25-3.25 ft bg.) Grades to dark
						12			brown/black fine-coarse sand with some silt, fine gravel, wood, rubble,
						13			and concrete. (Moist, Hnu 50 ppm.)
SPT	24	20	4	3	4-6	8			Dark brown fine-medium sand with some silt (top 3-in.) Grades to tan
						6	5		and green mottled fine sand and silt (4.25-5.25 ft bg.) Grades to black silt and
						9			fine-coarse sand, with little fine gravel and rubble. (Moist, petroleum odor, Hnu 50 ppm.)
						8			
SPT	24	20	6	4	6-7	3			Tan fine sand with trace fine gravel (Moist, petroleum odor, Hnu 100 ppm.)
						3			
				5	7-8	9			Rubble with white, black and tan mottled clayey silt and fine-medium sand.
						8			(7-7.3 ft bg.) Grades to black fine sand with little silt. (Moist, petroleum odor, Hnu 60 ppm.)
SS	24	16	8	6	8-10	10			
						9			
SPT	24	2	9	4	9-11	5			Medium brown fine-medium sand with little fine gravel, silt, glass and
						4	10		rubble (9-9.75 ft bg.) Grades to above with white chalky substance and
									clayey silt (9.75-9.25 ft bg.) Grades to black coarse-fine sand and rubble
									with some silt, and little fine-coarse gravel. (Bottom 6-in. of spoon wet,
									petroleum odor, Hnu 220 ppm.) (Sample collected for chemical analysis.)
SPT	24	4	13	7	13-15	3			Dark brown coarse-fine sand and fine gravel with some silt and little wood.
						4			(Wet, petroleum odor, Hnu 120 ppm.)
						2			
						1	15		
								CL	Grey/brown silty clay with grass on auger from 15-16 ft bg.
									Ended borehole at 16 ft.
							20		WELL INSTALLATION
									Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size-0.01 in.) set 15 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box.
									Sand: 3-15 ft BG.
									Bentonite pellets: 2-3 ft BG.
									Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 8.33 ft below top of well casing on 18 January 1990.

LOG OF BORING EAW - 19

EA Engineering, Science & Technology

Coordinates: Center of Freeman Street, South of Loading Racks and Vapor Recovery Unit
Top of Well Casing Elevation: 96.79 ft
Surface Elevation: 96.06 ft
Well Casing_Below_Surface: 0.27 ft
Reference Elevation: 100.00 ft (assumed)
Reference Description: Top of well casing at MW-4

Start Date: 15 December 1989
Completion Date: 15 December 1989

Location: Exxon Marketing Terminal, Brooklyn New York

Job No. 10963.12
Client: Exxon Company, U.S.A.
Drilling Method: Failing F-7 truck-mounted rig using 6-in. ID hollow-stem augers

Sampling Method: 2-in. diameter Standard Penetration Test (SPT) and 3-in. diameter Split-spoon (SS) driven by 140 lb hammer falling 30 in.
Surface Conditions: Asphalt

Sample Type	In. Driven	In. Recvd.	Casing Depth	Sample No.	Sample Depth	Blows/ 6-in.	Depth Feet	Graph Log	Description
							0		
							~		Asphalt 0-0.5 ft below grade (bg.)
SPT	18	10	0	1	0.5-2	7			Medium brown fine-coarse sand with some silt and trace fine gravel (0.5-1.1 ft bg.)
						6	~	F	Grades to black, brown and green silt and fine sand with little medium sand, and
						8		I	trace coarse sand and clay. Brick (bottom 2-in. of spoon.) (Dry, Hnu 25 ppm.)
SPT	24	18	0	2	2-4	6	~	L	Medium brown silt and fine sand with some brick pieces, little medium-coarse
						6		L	sand, and trace fine-coarse gravel (2-2.3 ft bg.) Grades to light brown mottled with dark brow
						4	~		fine sand and silt with trace medium-coarse sand. Grades back to above medium brown silt
						6			etc. with cinders in bottom of spoon. (Moist, petroleum odor,Hnu 50 ppm.)
SPT	24	24	0	3	4-6	6	~		Brick (top 2-in.)
						18	5		Medium brown fine-coarse sand with some silt, little fine gravel, and trace coarse gravel.
						18	~		Dark brown silt with some fine sand, little medium-coarse sand, cinders and
						10			rubble. Wood bottom 1-in. of spoon. (Moist, petroleum odor; Hnu 100 ppm.)
SPT	24	5	0	4	6-8	10	~		Dark brown/black coarse-fine sand and fine gravel with some silt.
						15			(Wet, petroleum odor, Hnu 160 ppm.) (Sample collected for chemical analysis.)
						6	~		
						16			
SPT	24	24	8	5	8-10	12	~		Medium brown fine-coarse sand and silt with trace fine gravel.
						8			Brick (9 ft bg.), underlain by 1-in fine-coarse sand and silt.
						5	~		Wood, cinders and rubble grade (9.1-9.2 ft bg.) Grades to coarse-fine sand, fine gravel and s
						4	10		Wood in bottom 1-in. of spoon. (Wet, petroleum odor, Hnu 70 ppm.)
							~		
							~		
							~		
SPT	24	24	13	6	13-15	1			Greybrown silty clay with grass on auger (13-15 ft bg.). (Moist, Hnu 4 ppm.)
						0	~	CL	
						0			
						0	15		
							~		Ended borehole at 15 ft.
							~		
							~		
							~		
							~		
							20		
							~		
							~		
							~		
							~		

WELL INSTALLATION

Ten ft of 4-in. diameter Schedule 40 threaded-joint PVC well screen (slot size=0.01 in.) set 15 ft below grade (BG). Four-in. diameter Schedule 40 PVC riser set below grade with locking cap. Well completed at surface in flush-mounted steel box.

Sand: 3-15 ft BG.
Bentonite pellets: 2-3 ft BG.
Flush-mounted steel box set in grout on top of bentonite and cemented to grade.

NOTE: Ground-water depth 5.98 ft below top of well casing on 18 January 1990.