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FINAL REPORT
NATIONAL REGISTER OF HISTORIC PLACES ELIGIBILITY EVALUATION AND CULTURAL RESOURCES ASSESSMENT FOR THE GOWANUS CANAL, BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK IN CONNECTION WITH THE PROPOSED ECOSYSTEM RESTORATION STUDY

Contract Number: DACW51-01-D-0017
Delivery Order No. 0027

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U.S. Army Corps of Engineers
New York District
26 Federal Plaza
New York, New York 10278-0090

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Hunter Research, Inc.
Raber Associates
Northern Ecological Associates, Inc.

MAY 2004 [REVISED DECEMBER 2004]

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Richard W. Hunter
Principal Investigator

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MANAGEMENT SUMMARY

This report describes an evaluation of the eligibility for inclusion in the National Register of Historic Places and a cultural resources assessment for the Gowanus Canal and Bay, Brooklyn, New York. The work was undertaken in support of a feasibility study of ecosystem restoration of Gowanus Canal and Bay (formerly Gowanus Creek). The scope of work included background research, acquisition of historic maps, field investigations, data analysis and report preparation. These investigations were mandated under Section 106 of the National Historic Preservation Act of 1966, as amended, and as implemented by 36 CFR 800, the Advisory Council on Historic Preservation's Procedures for the Protection of Historic and Cultural Properties. This work was undertaken for the New York District, Corps of Engineers under Contract No. DACW51-01-D-0017, Delivery Order No. 0027. Work was performed by Hunter Research, Inc., and Raber Associates. Hunter Research served as the principal cultural resource consultant reporting to Northern Ecological Associates, Inc., the overall project prime consultant.

The Gowanus Canal, created in the middle of the 19th century by bulkheading and dredging a tidal creek and wetland, quickly became a busy arm of New York harbor, the destination for building materials and fuel that went into the blocks of new houses built on the filled land behind it. It was also the final resting place for tons of household and industrial waste, and before the end of the century the public was clamoring for it to be filled. Instead, a pumping station at the head of the canal and a flushing tunnel under Degraw Street, completed in 1911, sent canal water into the Upper Bay until the pump was disabled in 1960. Because of its role in the development of Brooklyn from rural backwater to major city, the Gowanus Canal is recommended as eligible for inclusion in the National Register as an historic district. In addition to the waterway and the associated pumping station and flushing tunnel, two bridges and five buildings adjacent to the canal contribute to its significance and are considered part of the district, as are the sites of the filled 1st Street and 5th Street basins.

Ecosystem restoration projects, specifically bank softening and habitat creation, have the potential to adversely affect the eligible resource. Adverse effects, if unavoidable, can be mitigated by a combination of photographic recording and archaeological excavation and/or monitoring.

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ACKNOWLEDGMENTS

This report reflects the contributions of several individuals and institutions. Special thanks are extended to Beth Stuba of Northern Ecological Associates, and to Lynn Rakos of the U.S. Army Corps of Engineers, New York District. Ms. Rakos' knowledge of the canal and vicinity, and the history of Corps dredging projects and policies, helped shape the course and outcome of the project.

Assistance has been received from the staffs of the New York State Historic Preservation Office, the Brooklyn Historical Society, the Brooklyn Public Library, and the New York Public Library, all of which is gratefully acknowledged. Susan Wedgle and Barbara Thayer, of Barbara Thayer, P.C., graciously provided descriptive and historical material on Gowanus Canal bridges. Michael Abrahams, of Parsons Brinckerhoff Quade & Douglas, Inc., provided other information from a recent study of the canal's bridges.

Overall direction for this project was provided by Richard Hunter. Background research was performed by Michael S. Raber, Thomas R. Flagg (Raber), James Cox and Charles Ashton (Hunter). Fieldwork was conducted by Charles Ashton, James Lee (Hunter), Michael S. Raber and Thomas R. Flagg. Photographs are the work of Thomas R. Flagg, James Lee and Charles Ashton. The report was authored by Michael S. Raber and Charles Ashton. Report graphics were produced by Michael Murphy (Hunter) and Michael S. Raber. Final report coordination and assembly was accomplished by James Lee.

Charles H. Ashton
Architectural Historian

Chapter 1

INTRODUCTION

The New York District, U.S. Army Corps of Engineers (ACOE) is currently conducting a feasibility study that focuses on ecosystem restoration of Gowanus Bay and Canal (formerly Gowanus Creek), located in the Upper Bay of New York Harbor (Figures 1.1 and 2.1). The overall study area includes Gowanus Canal from Gowanus Bay to its inland terminus at Butler Street in Brooklyn, New York; the canal's six-square-mile watershed area; and Gowanus Bay, from Bay Ridge Channel to the Gowanus Canal.

This report presents the results of a study focused on a part of that project. It was conducted to assess the eligibility of the Gowanus Canal for inclusion in the National Register of Historic Places. These investigations were mandated under Section 106 of the National Historic Preservation Act of 1966, as amended, and as implemented by 36 CFR 800, the Advisory Council on Historic Preservation's Procedures for the Protection of Historic and Cultural Properties. This work was undertaken for the New York District, U.S. Army Corps of Engineers (ACOE) under Contract No. DACW51-01-D-0017, Delivery Order No. 0027. Work was performed by Hunter Research, Inc., and Raber Associates. Hunter Research served as the principal cultural resource consultant reporting to Northern Ecological Associates, Inc., the overall project prime consultant.

The Gowanus Canal, created in the 19th century from the main channel and tidal wetlands formerly known as Gowanus Creek, is an arm of the Upper Bay of New York Harbor (Figures 1.1 and 1.2; Plate 1.1). The canal's sole function is transportation (as opposed to providing power). From its mouth to the upstream dead-end at Butler Street its total length is less than a mile and a half.

The area encompassed by this study is smaller than that of the ecosystem restoration feasibility study. Originally the study area consisted of the main channel of the canal and its basins from its upper terminus at Butler Street to 15th Street, with limited investigation of the potential for submerged resources from 15th Street to Bay Ridge Channel. Research in the course of the study showed that historically the canal can be considered to extend to about 1,100 feet below Hamilton Avenue (approximately opposite Percival and 17th Streets). Canalside sites and structures were also taken into account in assessing the eligibility of the resource as a whole, to a minimum of 20 feet from the waterway.

No specific locations or tasks associated with the Gowanus Canal ecosystem restoration have been selected, pending completion of ongoing studies. However, projects could include:

Selective and careful removal of undesirable fill and sediments from the channel;

The restoration of water flow to enhance aquatic habitat and water quality;

The integration of ecosystem restoration with local plans;

The re-establishment of greenway and buffer areas;

The re-contouring of the canal bottom to create natural creek depths; and

Habitat creation and restoration.

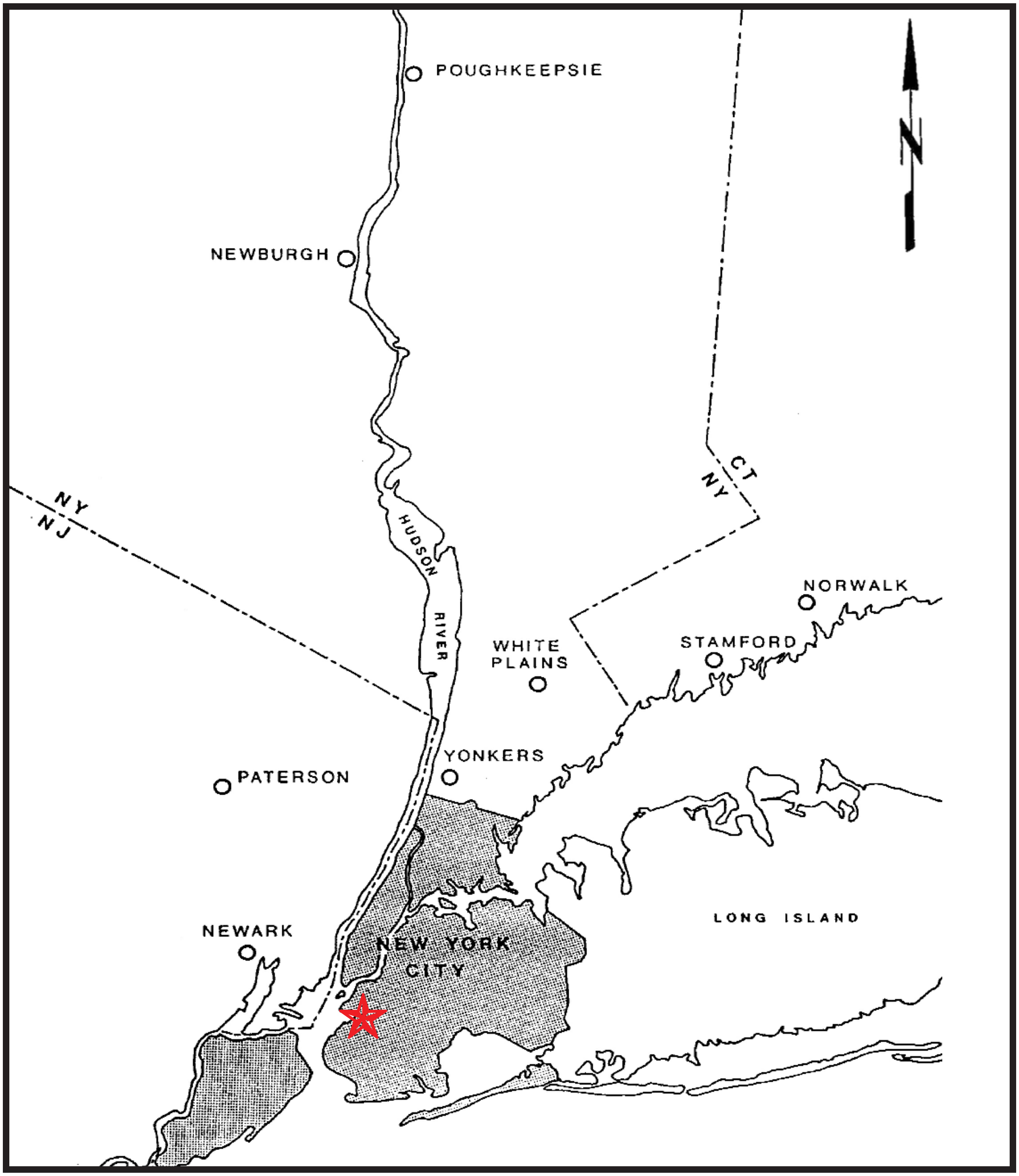


Figure 1.1. Gowanus Canal Assessment of Eligibility: General Location of Project Area (Starred).

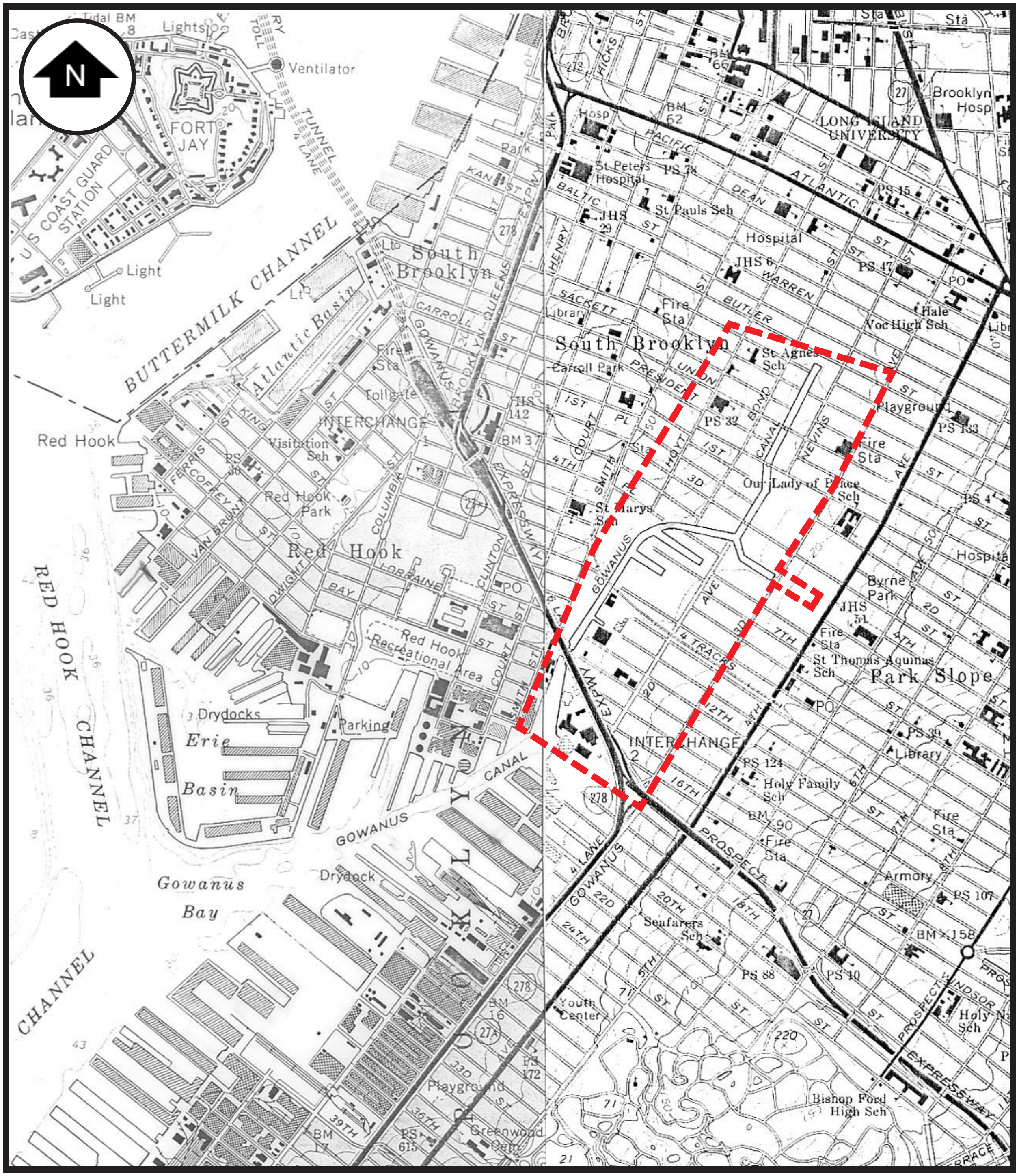


Figure 1.2. Gowanus Canal Assessment of Eligibility: Detailed Location of Project Site (outlined). Scale: 1 inch= 2000 feet. Source: USGS 7.5' Topographic Series, Brooklyn, N. Y. (1967 [photorevised 1979]) and Jersey City, N.J. -N. Y. Quadrangles (1967 [photorevised 1981]).

There is the potential for the canal to be dredged from the northern end, at Butler Street, into the Bay. Canal banks may be "softened" in selected area which would require the removal of bulkheads and limited quantities of fill. There is also the potential that basins, most which contain considerable deposits of sediment, be considered for habitat creation. This work would entail capping the basins with clean fill and planting vegetation.

A. METHODS

This study consisted of background research, field investigation, data analysis, and preparation of this report.

The goal of the background research was to obtain historic maps, photographs, and primary and secondary source material related to the study area before, during and after the canal's construction, as well as information on any previous studies. Research was conducted at the following repositories:

New York Public Library (physical and on-line)

New York State Historic Preservation Office, Peebles Island

Brooklyn Public Library on-line (notably the *Brooklyn Daily Eagle)*

Library of Congress (on-line)

Brooklyn Historical Society

Brooklyn Public Library

Historic maps were emphasized in order to relate the canal's alignment to the pre-existing landscape. Several maps were located showing the location of the creek and the street grid before the canal was built, and modern maps show the canal, but no suitable map was found showing all three. Accordingly, a composite map was generated by Raber Associates by overlaying the canal onto an earlier map (see below, Figure 2.4).

The Scope of Work also called for digital copies of Sanborn fire insurance maps for the canal and vicinity. Accordingly, a compact disc accompanying this report contains Sanborn maps for 1886, 1904, 1915, 1938, 1950, 1969, 1977, 1986 and 1996.

Fieldwork was conducted in two parts. Because some canal features (most notably the bulkheads) are best observed from the water, a low-water inspection by boat trip took place on November 5, 2003 to view and photograph the canal and proximate resources from the water. Staff from ACOE, Hunter Research and Raber Associates participated. Digital and film photographs were taken for use in the analysis and report phases. Canalside resources were the subject of a pedestrian field survey of canal margins and proximate resources on January 9, 2004, during which field notes and digital photographs were taken.

Analysis
The information generated by this study was considered in terms of the criteria for evaluation outlined by the U. S. Department of the Interior, National Register Program. The criteria are found at 36 CFR 60.4 and are as follows:

The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and

> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or

Plate 1.1. Gowanus Canal Assessment of Eligibility: Aerial photograph showing existing conditions on the Gowanus Canal and environs. 2003. Source: U.S. Army Corps of Engineers.

(b) that are associated with the lives of persons significant in our past; or

(c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(d) that have yielded, or may be likely to yield, information important in prehistory or history.

B. CRITERIA CONSIDERATIONS

Ordinarily cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions ,or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria of if they fall within the following categories:

(a) A religious property deriving primary significance from architectural or artistic distinction or historical importance; or

(b) A building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or

(c) A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life.

(d) A cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or

(e) A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or

(f) A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or

(g) A property achieving significance within the past 50 years if it is of exceptional importance.

C. DEFINITION OF TERMS

The following definitions are from the Department of the Interior, National Register of Historic Places (36 CFR 63):

1. A “district” is a geographically definable area, urban or rural, possessing a significant concentration, linkage or continuity of sites, buildings, structures, or objects which are united by past events or aesthetically by plan or physical development. A district may also be comprised of individual elements which are separated geographically but are linked by associations or history.

2. A “site” is the location of a significant event, or prehistoric or historic occupation or activity or a building or structure whether standing, ruined, or vanished where the location itself maintains historical or archaeological value regardless of the value of any existing structures.

3. A "building" is a structure created to shelter and form of human activity such as a house, barn, church, hotel or similar structure. "Buildings" may refer to a historically related complex, such as a courthouse and jail or a house and barn.

4. A "structure" is a work made up of interdependent and interrelated parts in a definite pattern or organization. Constructed by man, it is often an engineering project large in scale.

5. An "object" is a material thing of functional, aesthetic, cultural, historical, or scientific value that may be, by nature or design, movable yet related to a specific setting or environment.

D. ASSESSMENT OF EFFECTS AND ADVERSE EFFECTS

Effects are discussed at the conclusion of this report. In that discussion, assessments of effects and adverse effects are based upon the following criteria contained in 36 CFR 800.5 (a)(1) and (2), as follows:

(a)(1) *Criteria of adverse effect.* An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

(2) *Examples of adverse effects.* Adverse effects on historic properties include, but are not limited to:

(i) Physical destruction of or damage to all or part of the property;

(ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's standards for the treatment of historic properties (36 CFR part 68) and applicable guidelines;

(iii) Removal of the property from its historic location;

(iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;

(v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;

(vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and

(vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

Recommendations are discussed in detail at the end of this report. In general terms, the canal and a small number of buildings comprise a historic district. Some of the potential work items proposed as part of the ecosystem restoration study have the potential to adversely affect the district.

E. PREVIOUS RESEARCH

Previous studies have identified several historic sites and a prehistoric site in the vicinity of the Gowanus Canal. These are discussed below.

The New York State Museum site files contain an entry (#3606) for a site mentioned in the *New York State Archaeological Bulletin* of September-October, 1920 (p. 582). With no location given, the site is described thus: "*Camp site.* A barren sand hill in Brooklyn in 1826 was covered with vitrified and decomposed stones. From 1 ½ to 4 feet below the surface was a layer of ashes and cinders with broken clay pipes, coarse pottery and arrowheads." Accompanying this is a map of Kings County with no scale and showing little detail, but the "Camp site" is shown in the general vicinity of the upper reaches of Gowanus Creek. While the exact location cannot be pinpointed, dead reckoning based on physical features such as the coastline suggests that the site as mapped is on the order of a mile from the canal.

A New York State Archaeological Survey form (04701.014947) exists for a possible Revolutionary War burial ground near 426 Third Avenue. The form contains little data other than an article from the *New York Times* of May 26, 1998 concerning the halting of demolition at a fire site because of concerns expressed by the New York City Landmarks Preservation Commission that burials may be nearby. The address is near 7th Street, about 500 feet south of the 4th Street basin.

The Carroll Street Bridge over the canal, the oldest of three surviving retractile bridges in the country, was built in 1889 by the New Jersey Iron & Steel Company. It was designated a New York City Landmark in 1987 and has received an opinion of eligibility for inclusion in the National Register from the New York State Historic Preservation Office. It was rehabilitated in 1989. It is within the study area and is discussed in more detail below.

Several historic architectural resources are listed in the National Register in this part of Brooklyn, but these generally are located on the high ground at some distance from the creek/canal. These include the Park Slope, Cobble Hill and Carroll Gardens Historic Districts; Green-Wood Cemetery; Litchfield Villa in Prospect Park; Old First Reformed Church, 729 Carroll Street; Public Bath No. 7, 227 Fourth Avenue; St. Paul's Protestant Episcopal Church, 199 Carroll Street; South Congregational Church Complex, President and Court Streets; Prospect Hall, 263 Prospect Avenue; the William B. Cronyn House, 271 9th Street; the Weir Greenhouse, 750-751 Fifth Avenue; and the John Rankin House, 440 Clinton Street.

Two cultural resources studies have been conducted in the immediate vicinity of the canal. A Stage I archaeological survey was conducted along Nevins Street from Butler Street to President Street in 1977 by Ralph S. Solecki, Ph.D. in conjunction with the Red Hook water pollution control project. The study discussed Freeke's and Denton's mills, the construction of the canal (and the resulting fill adjacent to it), and the possibility of prehistoric resources nearby. Dr. Solecki's research, citing earlier sources, identified a Native American village—"the village of Werpos"—at Hoyt Street between Butler and Warren Street, about .2 miles from the head of the canal. He concluded that the Nevins Street work would not affect the archaeology or history of the area (Solecki 1977).

In 1978, the Army Corps of Engineers commissioned a cultural resources survey of the Gowanus Creek Channel in conjunction with a proposed dredging project (including spoil disposal at two upland sites). This study was largely documentary in nature, since the area to be dredged is by definition inaccessible. Pedestrian surveys were undertaken at the disposal sites, some distance from the present study area. The dredging and disposal were expected to have no effect on significant cultural resources (Kopper and Black 1978).

F. PRINCIPAL INFORMATION SOURCES

A principal source on Brooklyn up to 1870 is the three-volume *History of the City of Brooklyn* by Henry R. Stiles. The *Brooklyn Daily Eagle* online, covering the years 1841 to 1902, proved to be a major research tool; it was the source of much of the information in Chapter 2 on the evolution of the canal and contemporary reactions to it.

Brooklyn was well mapped, particularly toward the end of the 19th century as it developed into a thriving city. Beginning in 1880, atlases were published about every five to seven years, and Sanborn fire insurance map coverage began in 1886 (and continuing through the 20th century). These provided valuable information on the development of the neighborhood around the canal and its basins.

Finally, historic photographs on file at the Brooklyn Public Library illustrate dramatically the information conveyed by text and atlases. While photographic coverage is somewhat sparse in the late 19th century, photographs taken in the early 20th century convey the character of the canal at its peak far better than words can, and have been included here at length.

Chapter 2

BACKGROUND RESEARCH AND HISTORIC CONTEXT

A. ENVIRONMENTAL SETTING

The project site is located on the present-day coastal margin of western Long Island, just north of the terminal moraine that defines the furthest limit of the Wisconsinan ice sheet. The terminal moraine survives today as a linear landform of low irregular hills with two principal ridges (referred to as the Ronkonkoma and Harbor Hill ridges) that runs from southwest to northeast along the spine of Long Island. The moraine was deposited at the limit of the advancing ice sheet and has subsequently provided the dominant geomorphological structure for Long Island into the modern era (Cressey 1977:43).

At the time of the ice sheet's maximum extent, *circa* 18,000 B.C., the Atlantic shoreline lay some 50 miles further to the east, thus leaving exposed a vast portion of the Continental shelf. The Gowanus Creek vicinity would not have been tidal marshland during this period and most likely would have existed as a wooded coastal plain coursed by meandering rivers and home to migratory herds of megafauna, numerous smaller animal species and a rich plant environment. As the ice receded, increased meltwaters caused the sea level to rise and the shoreline gradually moved westward, inundating and foreshortening the coastal plain environment. Roughly 5,000 to 6,000 years ago (circa 3,000 to 4,000 B.C.), the shoreline lay some 25 miles to the east; by around A.D. 500 to 1000, less than 1,500 years ago, the coastline began to roughly resemble that of the present day, and the Upper Bay and its neighboring drainages will have been largely tidal (Edwards and Merrill 1977; Kraft 1986).

The Gowanus Canal vicinity—today commonly thought of as an urban neighborhood—was, when Europeans arrived, a lush saltwater marsh about ¾ of a mile wide, drained by a meandering tidal stream. Until the mid- to late 17th century, land use would have consisted largely of seasonal fishing and shellfish gathering by bands of Native Americans. The arrival of European pioneers was followed in turn by farmers, townspeople, suburbanites, real estate speculators, and bulk materials shippers (all of which is discussed in detail below). Land uses today are typical of a major post-industrial urban area. Several tracts are vacant or underutilized. Low-rise housing is interspersed with large, underutilized buildings originally engaged in activities such as warehousing, coal storage, or manufacturing, all of which is constrained by the city's street grid.

B. PREHISTORIC AND PROTO-HISTORIC BACKGROUND OF THE PROJECT AREA

Throughout the Paleo-Indian, Archaic, and Early Woodland periods (12,000 to 2,000 years ago), the Native American life style was predominantly one of hunting, gathering and fishing. The population was organized into mobile bands whose movements in the landscape were strongly influenced by the migratory patterns of game and fish, the seasonal availability of plant resources, and the locations of lithic raw materials. Few sites of these periods are known in western Long Island, in part because of the intensity of historic period land use prior to the early 20th century, when notice began to be taken of archaeological resources.

From the Middle Woodland period onwards (circa AD 500), the population base appears to have expanded steadily and become increasingly sedentary. By around AD 1250, incipient agriculture was being practiced and semi-permanent settlements become visible in the archaeological record of the Lower Hudson valley. Coastal areas and back bay environments like Gowanus Creek came to play an important role in the seasonal round as Native American groups followed well worn trails to the shore where shellfish, chiefly clam and oyster, could be harvested (Ceci 1980; Brennan 1977).

Towards the end of the Late Woodland period, continuing into the 17th century when contact with Europeans was occurring on a regular basis, the Native American population of Long Island begins to come more clearly into focus as a part of recorded history. The Brooklyn area was inhabited by a people known as the Canarsee, a branch of the Algonquian-speaking Lenape, a series of loose-knit and semi-sedentary tribes spread across much of the area between the Delaware and Lower Hudson Rivers and extending east into Long Island. In the 17th century, the Canarsee participated in a complex web of trading relationships involving the Lenape, other Native American peoples further to the west and north, the Dutch and eventually the English. The two key commodities traded by the Canarsee for European goods were furs and wampum (polished shell beads used for jewelry and as currency), the latter being of particular importance in view of the abundance of shellfish in and around Gowanus Creek. In the 1630s and 1640s, however, the Canarsee began to lose their hold over land on Long Island, ceding property to Dutch farmer-settlers. By century's end, their numbers, probably never more than a few thousand, were severely reduced as a result of disease, conflict (notably Kieft's War of 1643-46) and the general dislocation visited upon them by Europeans. Over the course of the 18th century, the surviving Canarsee moved west and out of the Hudson Valley altogether (Salwen 1978; Black 1981; Becker 1984).

C. HISTORY OF THE PROJECT AREA BEFORE THE GOWANUS CANAL

1. Early Settlement

European settlement in the vicinity of New York City began with Dutch and English farmers and traders. Generally, well-organized congregations and companies of English settlers began towns on eastern Long Island and at Gravesend. The Dutch settlements around New Amsterdam, on the other hand, grew and developed in a rather piecemeal fashion (Howard 1893:41; Stiles 1867:48). In 1636, Jacob Van Corlaer, an official in the Dutch colonial administration, made the first recorded purchase from the Gowanus Indians in present Kings County. (Gowane was the name of a leader of the Canarsee at that time, and his name was corrupted by the Dutch into the familiar—and probably unique—Gowanus.) Before the year was out, four other individuals—including Wouter Van Twiller, Director of the Province of New Netherland— owned some 15,000 acres. This huge tract was located in what is now Flatlands and Flatbush, with Van Twiller's land including all of Red Hook and Governor's Island. Although these purchases occurred without the consent or knowledge of the Directors of the Dutch West India Company in Holland, in 1638 the Company granted Van Twiller the right to occupy and use Red Hook until the Company required its return. The Company granted Van Twiller a patent for this land in 1643 (Ment 1979: 12; Stiles 1867: 60, 23).

While these large, early purchases may have been motivated by speculative concerns, agricultural development began almost at once on an individual basis. The patroonship system of settlement, under which the Dutch West India Company granted large tracts of land to companies that organized and transported fifty or more settlers to New Netherland, failed completely on Long Island. In response, the Amsterdam chamber of the West India Company issued a proclamation in 1638 which attempted to encourage individual settlement, offering free passage and other inducements to farmers deemed "respectable." Every emigrant, after signing a pledge of obedience to the local representatives of the Company, was to be provided, in exchange for an annual payment of a quit-rent, "according to his condition and means, with as much land as he and his family can properly cultivate." By assuring colonists legal and inheritable estates, this change in policy resulted in a slow but steady increase in the number of settlers. By the early 1640s, Dutch farmers settled on much of the land along the Brooklyn shore south of what is today Fulton Street, although there was some squatting prior to purchase and some absentee ownership (Stiles 1867: 27, 23; Ment 1979:11-13).

Warfare between the Dutch and local Delaware groups from 1643-45, precipitated by Governor William Kieft's abysmal management and his massacre of friendly Delaware near present-day Jersey City, soon disrupted Dutch settlement south of Gowanus Creek. The early farmsteads were destroyed. Renewed settlement began after a 1645 peace agreement. Breukelen received a town charter in 1646, for an area that encompassed what is now the Brooklyn Heights Landmark Historic District. To the south, Red Hook remained in the hands of the now ex-governor Van Twiller until 1652, when the Dutch West India Company—concerned over the amount of land held by past and current Company officials—revoked Van Twiller's patent for this and other tracts of land. Governor Stuyvesant, Van Twiller's successor, transferred title to Red Hook to the town of Breukelen in 1657 (Stiles 1867: 52, 60; Sherman 1965:4; Ment 1979:15; Ment and Donovan 1980:50-51).

The area was visited in 1679 by Jasper Danckaerts, a Dutch missionary searching the East Coast for a suitable site for a settlement who kept a detailed journal of his travels. The fecundity of the country is illustrated by a few often-quoted passages:

> It is not possible to describe how this [the Upper] bay swarms with fish, both large and small, whales, tunnies and porpoises, whole schools of innumerable other fish, which the eagles and other birds of prey swiftly seize in their talons when the fish come up to the surface, and hauling them out of the water, fly with them to the nearest woods or beach, as we saw (Dankaerts 1913 [1680]: 36).

His description of a visit to a house in the neighborhood provides a glimpse of the region's natural and cultivated abundance:

> We proceeded on to Gouanes, a place so called, where we arrived in the evening at one of the best friends of Gerrit, named Symon. He was very glad to see us, and so was his wife. He took us into the house, and entertained us exceedingly well. We found a good fire, halfway up the chimney, of clear oak and hickory, which they made not the least scruple of burning profusely. We let it penetrate us thoroughly. There had been already thrown upon it, to be roasted, a pail-full of Gouanes oysters, which are the best in the country. They are fully as good as those of England, and better than those we ate at Falmouth. I had to try some of them raw. They are large and full, some of them not less than a foot long, and they grow sometimes ten, twelve and sixteen together, and are then like a piece of rock. Others are young and small. In consequence of the great quantities of them, everybody keeps the shells for the purpose of burning them into lime. They pickle the oysters in small casks, and

> send them to Barbados and the other islands. We had for supper a roasted haunch of venison, which he had bought of the Indians for three guilders and a half of *seewant*, that is, fifteen stivers of Dutch money, [thirty cents] and which weighed thirty pounds. The meat was exceedingly tender and good, and also quite fat. It had a slight spicy flavor. We were also served with wild turkey, which was also fat and of a good flavor; and a wild goose, but that was rather dry. Everything we had was the natural production of the country. We saw here, lying in a heap, a whole hill of watermelons, which were as large as pumpkins, and which Symon was going to take to the city to sell. They were very good, though there is a difference between them and those of the Caribbee Islands; but this may be owing to its being late in the season, and these were the last pulling (*Ibid.*: 53-54).

The larger tracts of the early settlers were long and narrow, more or less perpendicular to the shore. This configuration featured use of multiple environments by domestic agrarian economies: the west edge of the plots fronted on the bay, an important market route to Manhattan; the marsh grass at the shore made good cattle fodder; above the shore were fine pasture lands; and further inland, sloping upwards to a long ridge which crested at what is today Sixth Avenue, the wooded terrain became woodlots for the early inhabitants.

2. Early Mills

The Dutch settlements near Gowanus Creek, and their exploitation of its resources, were governed by the location of the creek and its adjacent lowlands, illustrated by a map made in 1767 (Figure 2.1). Gowanus Creek and its numerous small tidal tributaries dominate the landscape; roads run generally near the edge of the fastland, including one south of the creek labeled "Road to the Narrows." Scattered farms with cleared fields and orchards are shown along the roads. Upon very close examination, the most striking aspect of the map is the relatively large number of mills, at least five in just the small area shown in the figure, including two on Gowanus Creek. Each has its associated dam and pond. The more downstream mill on the Gowanus, at the mouth of the larger pond, was Denton's Mill (also known as the Yellow Mill). Farther upstream, with a smaller pond, was Freeke's (or Freek's) Mill, also called the "old Gowanus Mill." Denton's Mill, built in 1709 by brothers Adam and Nicholas Brower, was between what is now Third Avenue and the canal, between Carroll Street and the now-filled First Street Basin. Denton's house was nearby, on the south side of Carroll Street between Second and Third Avenues; it burned down in 1852. Freeke's Mill, described as "probably the oldest in the town of Breukelen," was extant in 1661; it stood just north of Union Street, possibly on what is now the east bank of the canal or within the canal itself (Stiles 1867 pp. 99-100). Freeke's dam also provided the only crossing of the creek.

Because the Gowanus drainage was (and is) tidal, with virtually no head available, both mills were tide mills (as undoubtedly were the others in Figure 2.1). Unlike more traditional water-powered mills that rely on a falling stream or river for their power, tide mills literally harness the unlimited free power of the moon. They operate by storing the incoming tidal flow behind a dam by means of one-way tide gates; when the tide ebbs, the miller opens sluice gates, directing the water to the mill wheel as it flows back to the sea. The principle was known in Europe in the Middle Ages, and is suited for locations with little topographic relief and significant tidal range (i.e., a sizable difference between the height of low and high tides). Historically tide mills were numerous on the East Coast, particularly in New England where the tidal range tends to be greater than in Middle Atlantic states

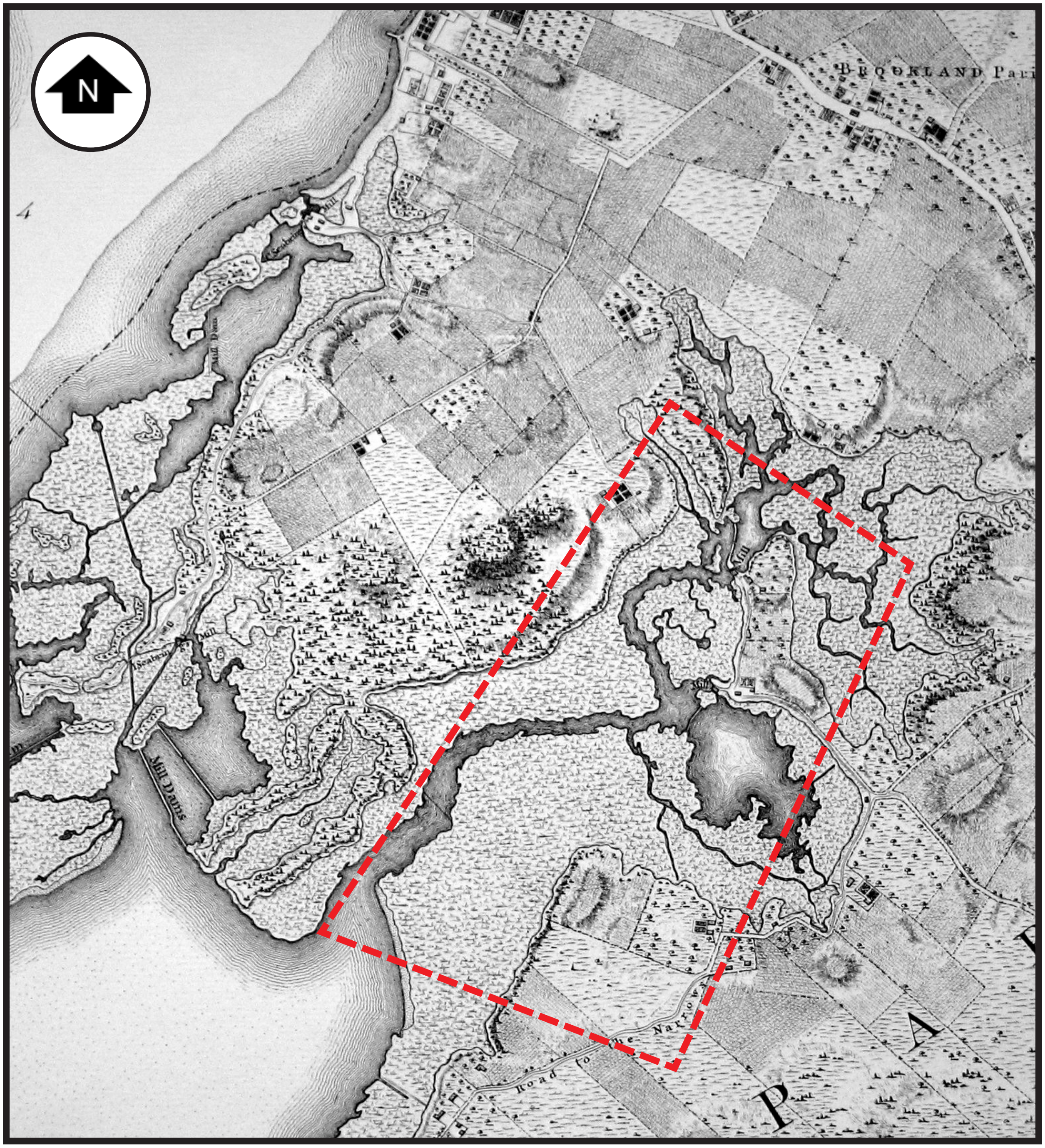


Figure 2.1. Gowanus Canal Assessment of Eligibility: Ratzer, Lt. Bernard. *Plan of the Town of Brooklyn and part of Long Island.* 1767. Scale: 1 inch= 1230 feet (approximately). Project area indicated. The meandering Gowanus Creek and its associated lowlands dominate the landscape. Both Denton's and Freeke's mills are shown.

(due in part to the higher latitude). A small number survive, including the Van Wyck-Lefferts Tide Mill in Lloyd Harbor, New York.

While tide mills have the advantage of an unfailing and cost-free water source, unlike riverine mills, they have several disadvantages: First, although immune to droughts and less susceptible to freezing, they are only able to operate from the time when the tide has receded sufficiently to create a usable difference in height between the stored water and the outgoing tide, until the next incoming tide again reduces this difference. In other words, the mills could only grind for part of the two daily tides. The restored Eling Mill in England, as an example, grinds in two five-hour shifts per day. Furthermore, since the daily tide cycle is about 25 hours, each day's usable times are an hour later than the previous day's, regardless of whether these times are convenient for the miller.

Nehemiah Denton, proprietor of Denton's (or Yellow) Mill, was near the forefront in adopting modern milling technology. In 1812 he paid $240 to Oliver Evans of Philadelphia "to construct and use patented machines and patented improvements in the art of manufacturing flour and meal…For grain elevation and meal and conveying same from one part of the mill to another and for cooling the meal and attending the bolting hoppers." Denton's license was applicable to his mill "…consisting of one waterwheel driving not more than two pair of millstones at the same time" (Rakos 2004). Oliver Evans (1755-1819) was a native of Delaware who profoundly affected American industry with the publication in 1795 of his *Young Mill-Wright & Miller's Guide.* This volume described his design of the first automatic flour mill, in which the grain is elevated, cleaned, ground, cooled, sifted and packed by mechanical equipment driven by the mill's water wheel. Two men could do work that had previously employed four men and a boy, since the grain, meal and flour no longer had to be moved manually. Evans obtained a patent in 1790, the third issued by the new Patent Office (Evans 1990 [1795]).

3. The Revolutionary War

The Gowanus Creek drainage was the scene of part of the Battle of Long Island on August 27, 1776. American troops fleeing northward ahead of the British crossed Gowanus Creek at the Freeke's mill dam, and the mill and the bridge were burned by the Americans. The scene of the battle is shown in Figure 2.2, a detail from a map drawn shortly after the battle; the blue rectangles represent the American forces, and the dotted line across "the Swamp" toward "Gen'l Putnam's Camp" (behind a fortified line) shows the Americans' route. Denton's millpond is also discernible, below the word "Swamp."

It is worth noting that, although not strictly within the present study area, American battle dead were reportedly buried nearby: "There was then in the vicinity a sort of island rising from the marsh, and there these gallant young soldiers' mangled bodies were interred. This place was but an acre in extent and is now inclosed by the lines of Third avenue, Seventh and Eighth streets, and was afterward used as a negro cemetery" (*Brooklyn Eagle* 1891). This is the same burial that was the subject of the *Times* article in May, 1998 (*op. cit.*).

The site of the battle was visited by Benson Lossing in 1850, at which time he sketched the rebuilt Freeke's Mill "before it was destroyed" (Plate 2.1). Lossing's own caption describes the scene: it is "…a view of the old mill on the site of that of the Revolution," as seen…"from the west side of Gowanus Creek, looking southeast. In the extreme distance is seen the 'Yellow Mill'…The upper [i.e., Old Gowanus] mill was fired by Captain Ward on the 27th (Lossing 1860, note 17 to vol. 2, Chapter 55).

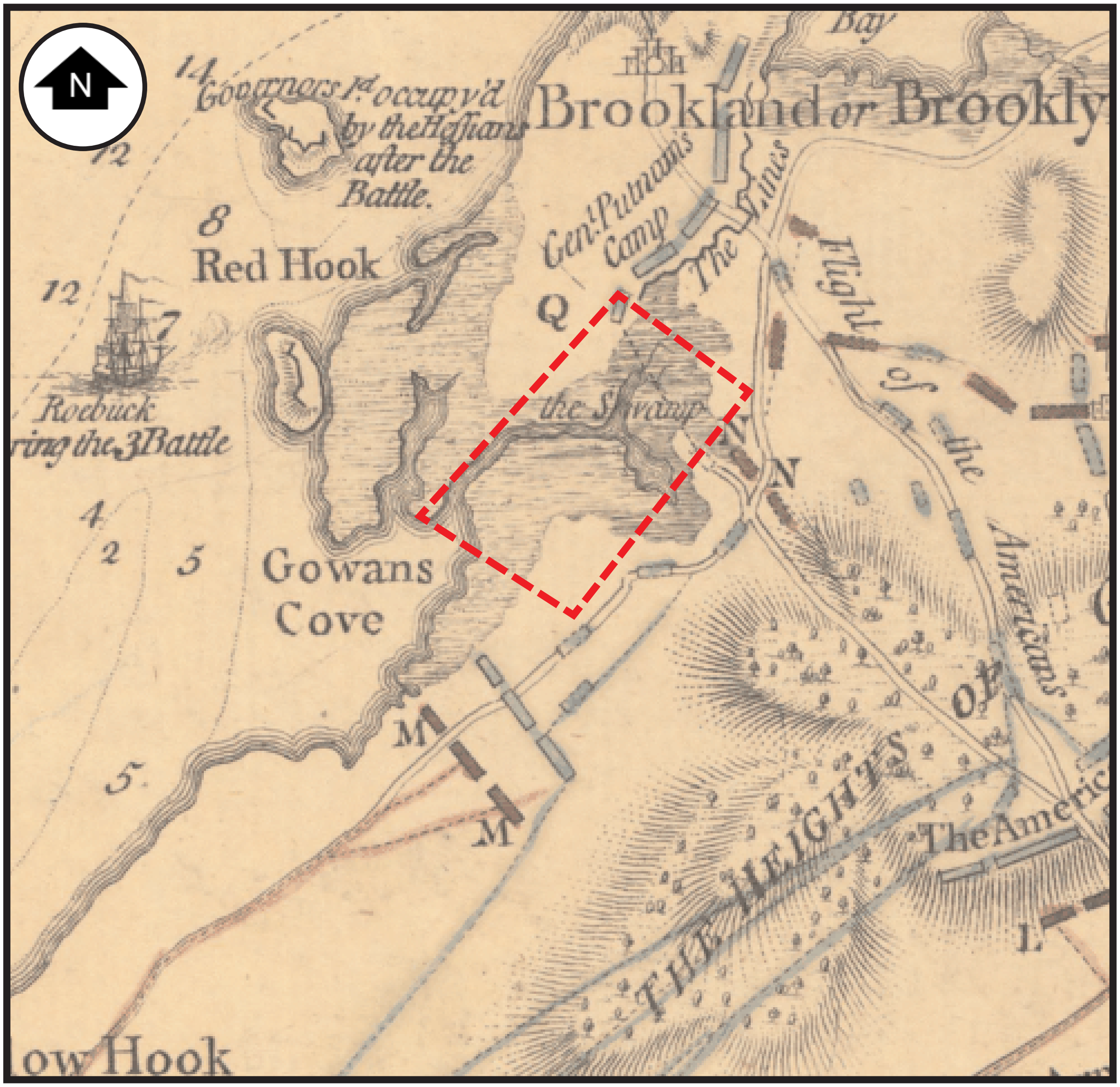


Figure 2.2. Gowanus Canal Assessment of Eligibility: Faden, William. *A Plan of New York Island, with part of Long Island, Staten Island & east New Jersey…* 1776. Scale: 1 inch= 2650 feet (approximately). Project area indicated. This map, drawn after the Battle of Long Island, shows the role the creek and its wetlands played in the course of the battle. The dotted line indicates the location of Freeke's mill dam where the retreating Americans crossed the creek.

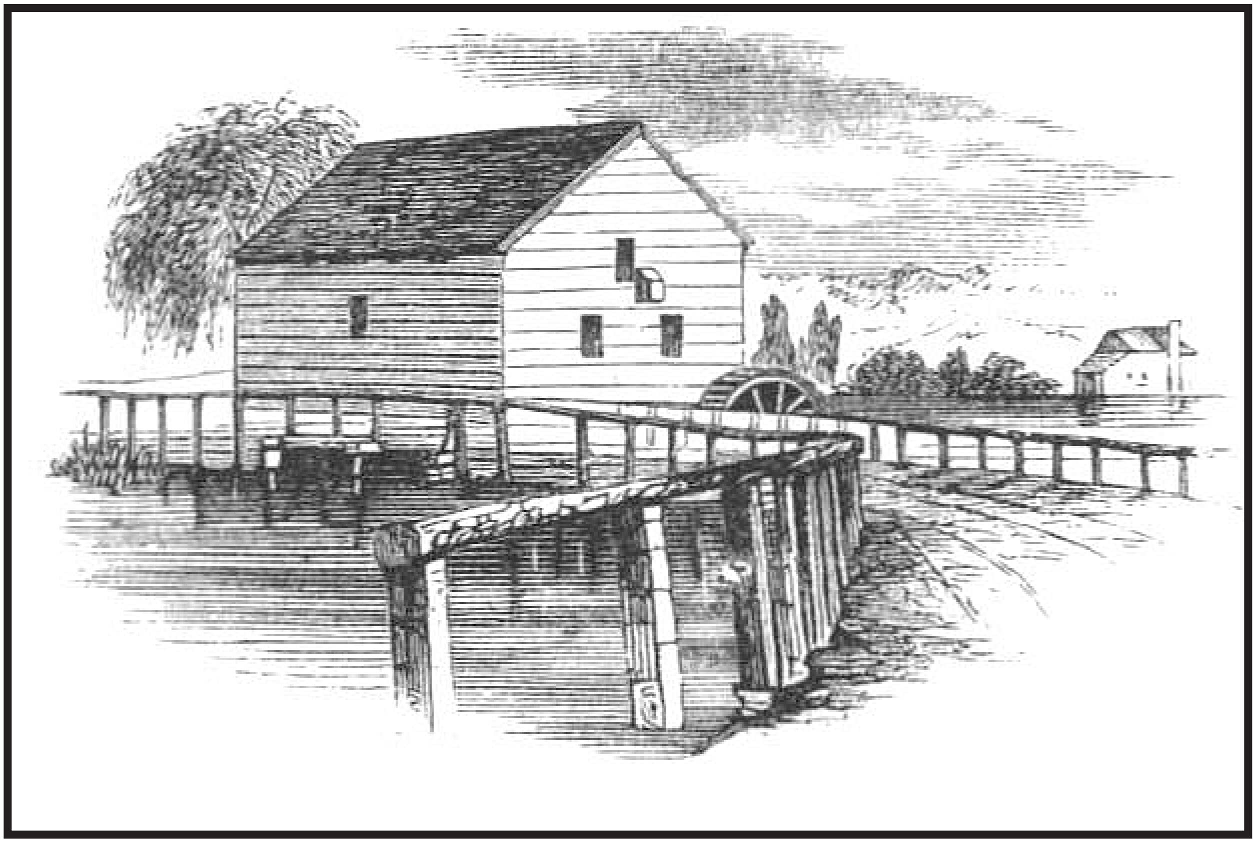


Plate 2.1. Gowanus Canal Assessment of Eligibility: Lossing, Benson J. "Brower's Mill". The structure in the foreground is the mill built to replace the one burned in August of 1776 during the Battle of Long Island. In the distance is Denton's mill. Source: *Pictorial Field Book of the Revolution* (Volume II), 1860.

4. The Growth of Brooklyn

Grain was always the preeminent commercial product on the farms of Brooklyn and the rest of Long Island, and remained so until the great influx of grain from further west on the Erie Canal beginning about 1846. Gowanus Road (Ratzer's "Road to the Narrows"), established in 1704, ran from the settlement at New Utrecht north to Gowanus Creek and these mills. The farming community known as Gowanus became prosperous in its early years. A 1675 tax assessment noted seven Gowanus men as "well off." The community continued its slow growth and development through the 17th and 18th centuries little troubled by external events. Dutch culture and ethnicity remained dominant through the period of English rule beginning in 1664. (Stiles 1867:61-62,66-68; Howard 1893: 41-42; Ostrander 1894,I: 64; Ment and Donovan 1980: 50; Sherman 1965: 9-10; Raber, Flagg, Parrott, et al. 1984: 19-20, 95).

Brooklyn's waterfront was the principal entrept for the rest of Long Island by the early 19th century. The agricultural produce from the eastern portion of the island flowed toward the markets of Brooklyn and Manhattan. Stiles notes that the "... travel of Long Island Farmers, gardeners and dairymen across the East River..." increased four times in the third decade of that century (1870:558). Throughout the 19th century, the western shore of Long Island dominated the local commercial sector, in marked contrast to the agricultural character of the rest of the island. As the Port of New York became America's premier harbor after 1815, Brooklyn began its rise as the port's major warehousing, storage and receiving center for bulk products. In that year, many of Brooklyn's citizens petitioned for a village charter covering the area now encompassed within the Brooklyn Heights Historic District. This movement met with rapid success: in 1816, the state legislature granted a charter to the Village of Brooklyn (Weld 1938: 15-17; Ment 1979: 30-31). Waterfront development strongly affected industrial and residential growth patterns. Before 1840, this development was somewhat sporadic, and featured a variety of industrial, commercial and residential uses. Larger and more systematic development after 1840 eliminated most of the earlier mixed waterfront uses, leaving bulk products handling almost exclusive control. The decades before 1840 were critical in establishing private and municipal conditions for the greater projects of later years.

Brooklyn's population and waterfront activity accelerated dramatically in the 1820s and 1830s, in response to the growth of the Port of New York and to the village's suburban attractions for Manhattanites. The port by this time was already the dominant national distribution point for foreign imports, and with the new Erie Canal was becoming the principal produce exporter as well. Population in Brooklyn more than doubled, to over 15,000, between 1820 and 1830; another such decade brought the 1840 figure to 36,233. The town and village became a city in 1834, as local developers pushed for greater control of potential commercial growth. Initially, settlement spread to the north and east. Although there was little change south of Red Hook before mid-century, the new city rapidly surveyed the modern street grid to accommodate prospective subdivision and housing. Real estate speculation began immediately in Red Hook, accompanied by filling of marshes and ponds. The creation of Greenwood Cemetery in 1840, on woodland east of 5th Avenue, reflected the outlying rural character of the area south of Red Hook. Urban and waterfront development came later, in response to dramatic changes in the older parts of Brooklyn after 1840. Gowanus retained its rural character well into the century, continuing as an important supplier of fresh produce, dairy products and agricultural staples for the markets of Manhattan and the more urban areas of Brooklyn. The farmers—most being descendents of the first settlers—clung to their heritage; many spoke Dutch in the home until about 1850. A map made in 1833, Figure 2.3, shows that while New

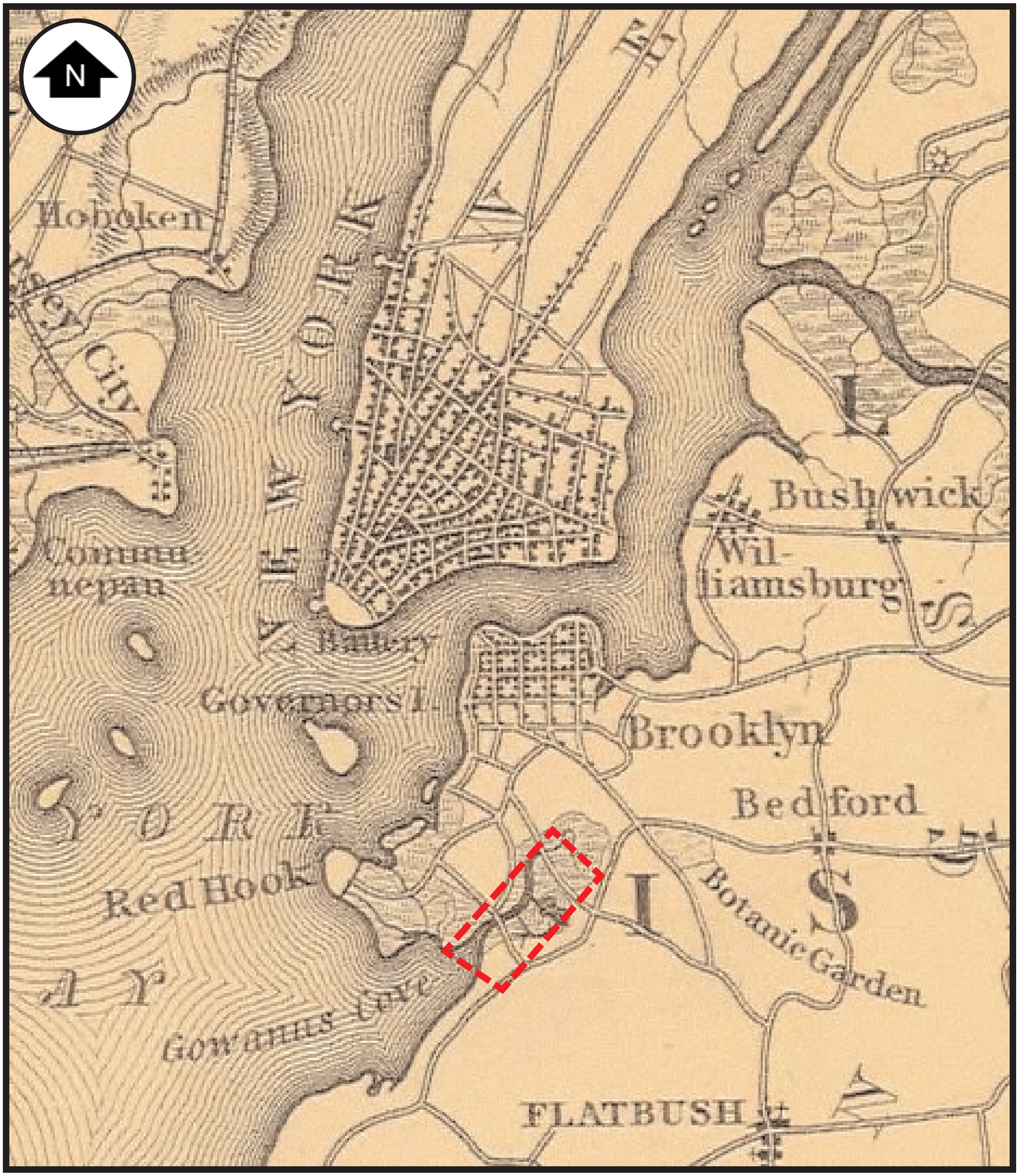


Figure 2.3. Gowanus Canal Assessment of Eligibility: Gordon, Thomas. Detail from *Map of the State of New Jersey...* 1833. Scale: 1 inch= 1 mile (approximately). Project area indicated. Although Brooklyn was a growing town with a neat grid of streets, the Gowanus area remained rural, two centuries after Dutch settlement began.

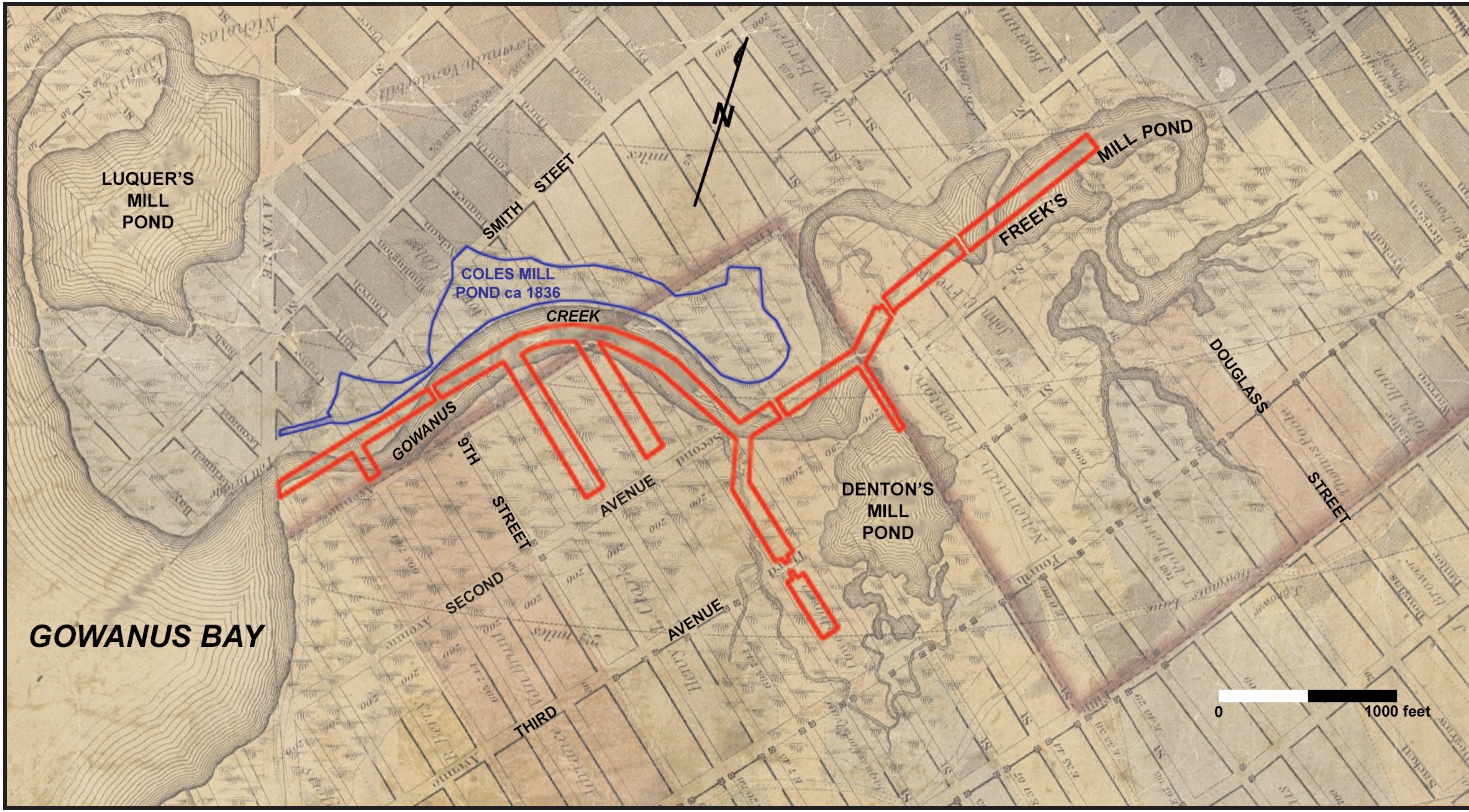


Figure 2.4. Gowanus Canal Assessment of Eligibility: Historic Creek, Marsh, and Mill Pond Environment of the Gowanus Canal (base map: Colton 1849; Coles mill pond from Bleecker 1836; canal outline in red from U.S. Army Corps of Engineers 1942). Base map notation indicates it was probably prepared ca.1839, and prior to completion of the first Hamilton Avenue bridge over Gowanus Creek. The detailed street grid, very close to the urban landscape actually created later, makes this map especially useful for understanding the route taken by canal engineers. The apparently rapid disappearance of Coles mill pond from the landscape after circa 1836 suggests the ephemeral nature of ponds created in salt marsh environments.

York and Brooklyn proper were places of some consequence, the Gowanus Creek drainage most certainly was not (Stiles 1869: 61; Sherman 1965: 6, 20; Ment and Donovan 1980: 52-54; Raber, Flagg, Parrott *et al*. 1984: 24-27).

In the Gowanus area, the principal improvements before the late 1840s were the straightening of the colonial shore road, and completion of the Gowanus Toll Road (Hamilton Avenue) and the first Hamilton Avenue Bridge over the mouth of Gowanus Creek (Stiles 1869: 250-52; 1870: 543). Maps suggest the bridge, built under an 1833 state charter granted to the Brooklyn and Gowanus Toll Bridge Company, was probably not completed until *circa* 1837-1844. It was evidently a four-span structure with three piers, and one of the spans probably had a draw since the act mandated vessel passage (Colton 1849; U.S. Coast Survey 1844; Parsons Brinckerhoff Quade & Douglas, Inc. 2003). Plate 2.2 postdates construction of this bridge; the view is across the mouth of the creek from the north and Gowanus Bay is to the right. Two hundred years after the first Dutch settlers had arrived, the wilderness had become a rural backwater.

Although the creek had very limited navigability, it is possible sloops could reach landings near the creek mouth for transshipment of grain and other produce. The creek was contemplated for canal development as early as 1837, when the state authorized the city to improve the waterway, but this appears to have been entirely speculative as the earliest real plans for canal development were a decade later (Whitford 1905-1906: 760).

The 1841-47 construction of Atlantic Basin (or Atlantic Docks) south of Hamilton Avenue on Buttermilk Channel began a period of accelerated waterfront, industrialization and residential construction. Atlantic Basin became the center of a new industrial and residential area on Red Hook, aided by the Hamilton Avenue ferry established in 1846 with help from the basin owners. Stone and brick structures, with mill type construction, arose to house foundries, lead works, boiler shops, machine shops and various smiths, surrounded by coal and lumber yards. Most of the housing around mid-century clustered between DeGraw Street and Hamilton Avenue. Recent Irish immigrants did much of the new construction work. Lacking the industrial skills of longer-settled groups, they found employment in labor-intensive activities such as canal building and housing construction. Many of these workers settled in and around Gowanus Creek, then still an undeveloped, marshy area. Living in impromptu squalor beyond the edge of speculative energies, they were considered squatters; their community was referred to as Tinkersville (Perris 1855; *New York Times* 1856; Stiles 1869: 29, 1870: 558,571; Ment and Donovan 1980:53-55; Sherman 1965:15,28).

The squatters moved in when the creek was perhaps at its least developed, since by the 1840s the tide mills were evidently out of operation. By 1836, when the Jordan Coles property including a mill near the creek mouth was put up for sale by his executors, there were three mill sites including those at the older Denton and Freek ponds. The demise of the mills is not well documented, but may reflect the increasing importance of western grain delivered on the Erie Canal for metropolitan markets and coastal export; by the late 1840s Brooklyn was a center of grain transshipment from the canal to trans-Atlantic buyers. The combination of rising property values on western Long Island and cheaper grain produced on large farms in the catchment of the canal did not encourage Gowanus Creek mill owners to maintain operations. The end of the Gowanus Creek tide mills was a necessary precursor to the advance of real estate and navigation interests into the marshes (Figure 2.4).

The 1836 sale of the Coles mill property was accompanied by a map to assist prospective buyers; a detail of the map, shown in Figure 2.5, besides showing

Figure 2.5. Gowanus Canal Assessment of Eligibility: Bleecker, J. Detail from *Executor's Sale of Property belonging to the Estate of Jordan Coles Dec'd*. 1836. Scale: 1 inch= 140 feet. Gowanus Creek is at the bottom of the figure.

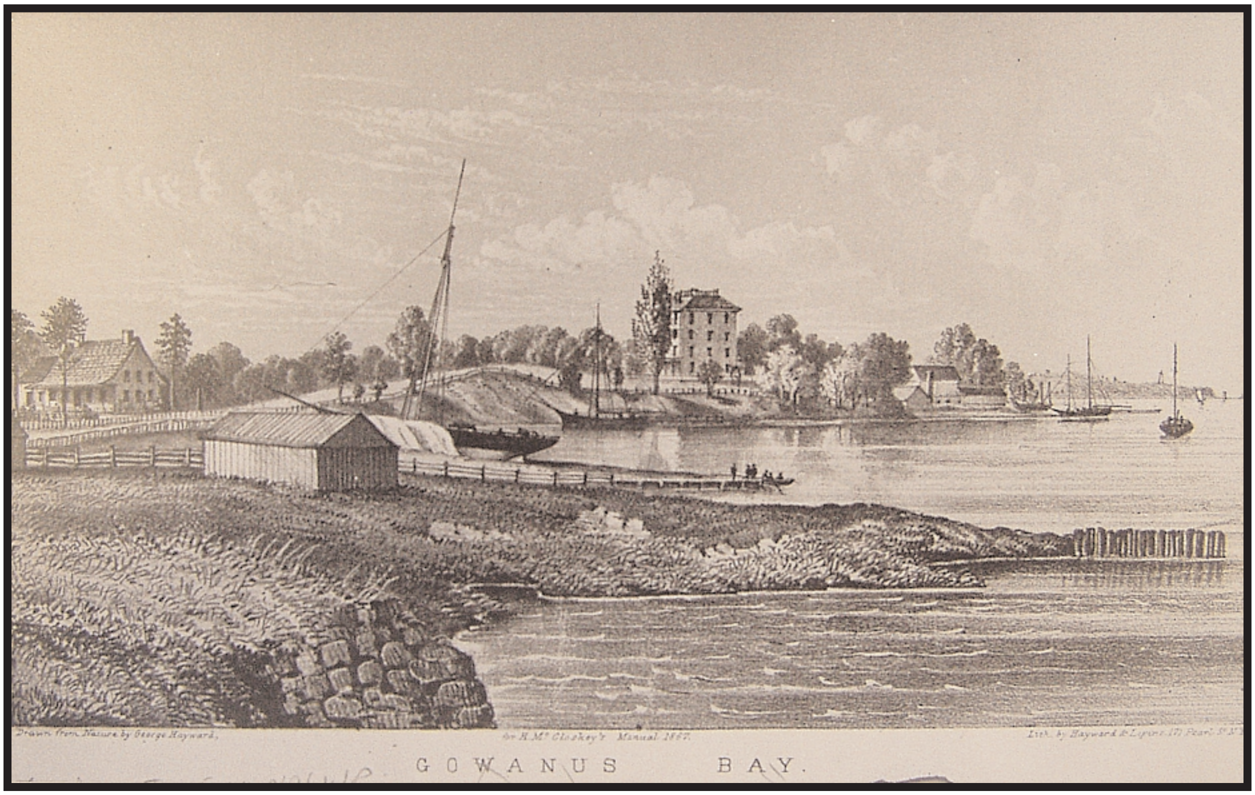


Plate 2.2. Gowanus Canal Assessment of Eligibility: Hayward, George. "Gowanus Bay". A view of Gowanus Bay in the early- to mid 19th century. Source: Brooklyn Public Library.

Coles' holdings, also illustrates the near absence of built streets. The core of the property was located on the north side of Gowanus Creek in the vicinity of Smith, Centre, Mill and Hall Streets, but the improvements on the property bear no relationship to the overlying grid of paper streets. Three major structures are mapped: a house on what is now the western corner of Smith and Mill Streets; a "Mansion" in the middle of Hall Street between Smith Street and the creek; and a mill at the foot of Hall Street, at the mouth of a large millpond separated from the creek by a narrow berm. The tide gate is clearly visible as a break in the berm just upstream from the mill. There are also three subsidiary structures, unlabeled as to function. Neither the mill nor the pond appeared on the 1767 map, the last map with sufficient detail to show them had they existed.

Cole's millpond was shown and labeled on a city map published the same year (Figure 2.6), although no streets in the immediate vicinity were shown except Smith Street. Streets—undoubtedly existing in plan only—were, however, shown throughout the wetlands that extended from "Freek's Mill Pond" all the way to the bay, even though the only high ground was a hillock below Denton's pond and the other higher places where the old roads still ran. The Hamilton Avenue bridge had become the second crossing of the Creek.

The absence of most of the streets is made even more evident by a U. S. Coast Survey map published in 1844 (Figure 2.7). Intended principally for use by mariners, it shows topography and development in great detail to aid in coastal navigation. Clearly, in spite of the grandiose urban aspirations implied by the two 1836 maps, there were still virtually no streets near the creek, other than the old road to the Narrows and the Hamilton Avenue bridge crossing the creek at its mouth. More farmsteads were appearing along these roads, and cleared fields are distinguishable from marsh and forest. Freeke's, Denton's and Cole's mill ponds are shown, and for the first time, Gowanus appears as the name of a place, not just a bay and a creek.

D. DESIGN AND CONSTRUCTION OF THE GOWANUS CANAL

1. Planning *circa* 1847-1849

By 1846, the Gowanus marshes were perceived as a hindrance to local development, but also as a possible solution to a by-product of Brooklyn's rapid growth nearby: lack of adequate drainage for sewerage and storm water. The first plans for the marshes called for using them as a glorified sewer with commerce a secondary consideration, but the city government quickly shifted the emphasis towards filling the marshes for development and creating a tidewater canal that would somehow cleanse itself of urban wastewater. For over two decades beginning in the late 1840s, real estate and related commercial interests drove development in the marshes through a combination of private interest and public authority. Use of the canal as a sewer proceeded as an unplanned, increasingly noxious by-product of this development, and was only addressed after decades of public outcry.

At the direction of the Brooklyn Common Council, the initial plan for using the waterway as a drain was devised in 1846-1847 by Maj. David B. Douglass (1790-1849). A West Point-trained engineer who had been in charge of several canal projects including supervision of the Morris Canal inclined planes *circa* 1829-1831, Douglass was involved in early plans for Croton River water supply to New York City *circa* 1833-1835 and laid out Brooklyn's Greenwood Cemetery in 1838 (Wilson and Fiske, eds., 1887-1889; Kalata 1983). He prepared two variants of a plan calling for collection of Gowanus Creek tidewater in a large basin equipped with one or more sluice gates at the head of the creek, from which controlled

Figure 2.6. Gowanus Canal Assessment of Eligibility: Colton, J. H. Detail from *City and County Of New - York*. 1836. Scale: 1 inch= 1210 feet (approximately). Project area indicated.

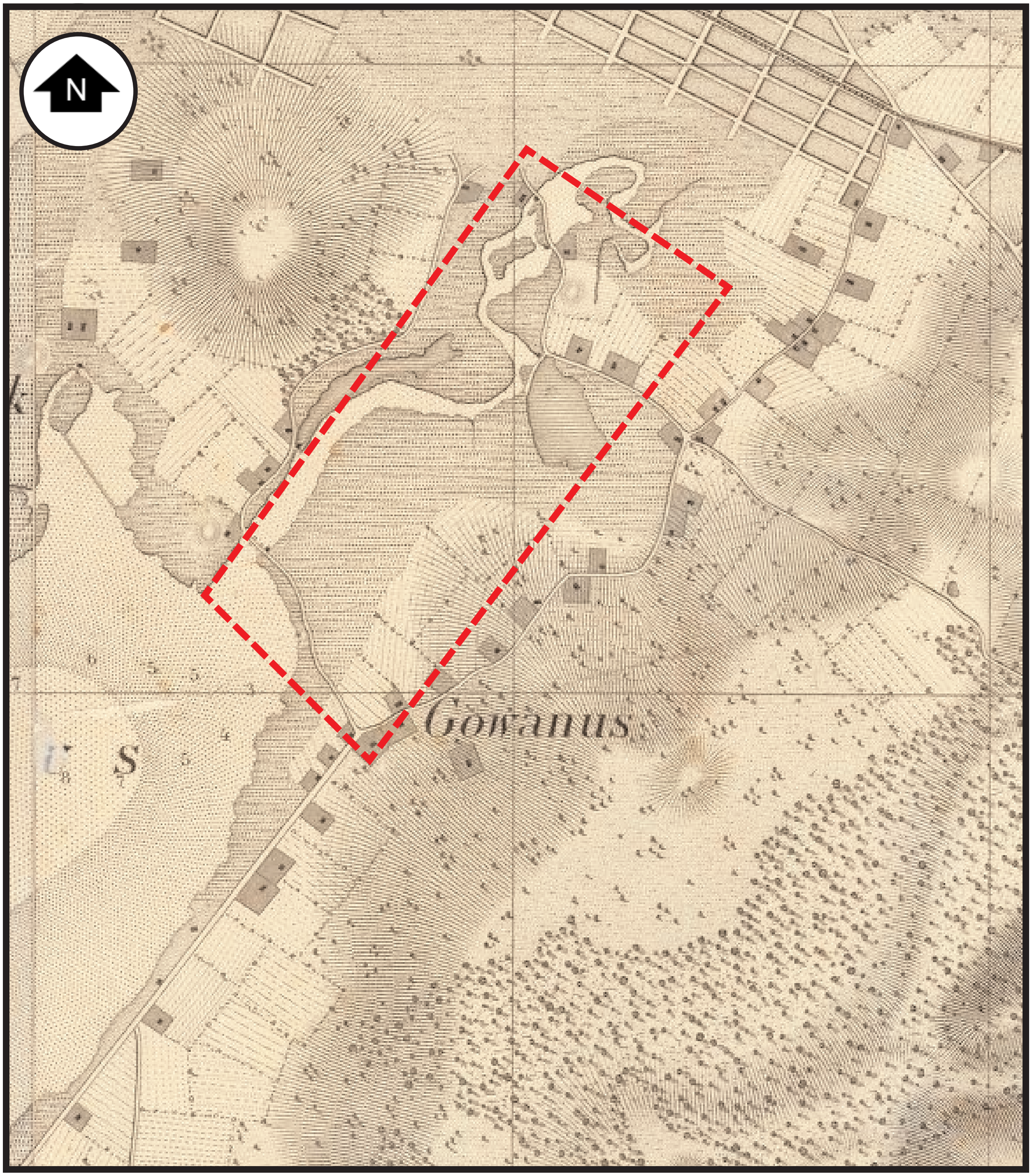


Figure 2.7. Gowanus Canal Assessment of Eligibility: U.S. Coast Survey. Detail from *Map of New-York Bay and Harbor...* 1844. Scale: 1 inch= 1325 feet (approximately). Project area indicated. Although intended to guide mariners, the chart nonetheless shows landforms and improvements in great detail. While most of the area in the immediate area of Gowanus Creek was still vacant lowland, much of the adjacent high ground was under cultivation.

Figure 2.8. Gowanus Canal Assessment of Eligibility: Douglass, Maj. D.B. Plan for Canal from Gowanus to Wallabout Bays. 1870. Scale: 1 inch= 870 feet (approximately). Project area indicated. This is a reprint of the second of Maj. D.B. Douglass' plans for a canal system in Gowanus Creek, including a canal from Wallabout Bay to flush out the Gowanus Creek canal. Dark line around creek and mill ponds is border between marsh areas and slightly higher fast land. Although the Gowanus Canal was not built to this or Douglass' other 1847 plan prepared for the City of Brooklyn, his work presaged the flushing system built in the early twentieth century.

release of water into an excavated channel would flush away sewerage deposited into the channel rather than the basin. His basin was planned for the approximate location of the end of the canal as later built, and was anticipated as a commercial center for barge traffic. One variant called for using only the Gowanus Creek drainage, through which he proposed two parallel canals—one for intake and one for release of tidewater, each with lift locks as gates to accommodate barge traffic into the basin. The second variant involved excavating a smaller single channel through the meadows and flushing it out with water from Wallabout Bay, to which a canal about a mile long would be built. With hindsight, Douglas' second idea was more effective as a flushing system and was similar to the solution to Gowanus Canal pollution built in the early 20th century. He implied the Wallabout Bay variant was less feasible, however, because of deep cuts involved and the need for thirteen bridges in heavily-developed urban areas. The flushing system completed in 1911, discussed below, used a tunnel rather than an open cut. Lack of any municipal action on Douglas' plan may reflect the fact that his proposed channels through the meadows had prismatic-section open cuts with sloped earthen banks, and that he also proposed lowering the grade of the meadows to reduce embankment heights. Focused almost entirely on upland drainage and initial costs, Douglass wanted to avoid the expense of timber-and-stone cribwork walls, which he believed could be built by future commercial interests (*ibid;* cribwork structures are discussed below in Chapter 3). Lowering meadow grades and leaving all wharf construction to private development probably inhibited any support for these plans by large landowners who hoped to convert the meadows into usable real estate. At least one of his plans, for the canal to Wallabout Bay, also contemplated excavation along a straight line through the meadows, with minimal use of Gowanus Creek. Despite his low proposed canal sides, such a plan probably seemed more expensive than maximizing use of the available natural channel (Figure 2.8; *Brooklyn Daily Eagle* 1847a, 1847b; Stiles, ed., 1884: 643).

Within about a year of Douglas' proposals, one of the city's most prominent landowners and developers introduced a plan for a canal which would drain the meadows and allow them to be filled, using as much of the creek as possible. Daniel Richards, chief proponent and builder of Atlantic Basin, also served as an alderman, and in this capacity he worked with the city surveyor, Willard Dey, to present the Common Council with a route for a 5,400-foot-long, 100-foot-wide canal approximately 14 feet deep, excavated to five feet below mean low water with walls at four feet above mean high water. This plan, adopted by the Common Council by early 1849, defined the alignment of the main canal as later completed, and clearly called for raising adjacent land above the saltmarsh elevations. (Assuming today's average 4.4-foot tidal range at the Battery applies to Gowanus Creek, these specifications would have put Richards' canal walls at least 6.5 feet above what was then mean sea level. Current canalside elevations appear to be eight to ten feet above mean sea level, which seems to confirm the overall conformity of the Richards plan with the main line of the canal as completed *circa* 1870).

Probably to avoid the expense of cribwork, Richards evidently proposed timber sheet piling to retain vertical canal banks, which as discussed below proved insufficient. He also planned a publicly-constructed basin at the head of the canal and projected a number of other privately-built basins. While the former basin was never built, several of the others shown on his plan closely anticipate the locations (although not the dimensions) of the private basins completed during the 1870s (Figure 2.9; Richards 1848; *Brooklyn Daily Eagle* 1849).

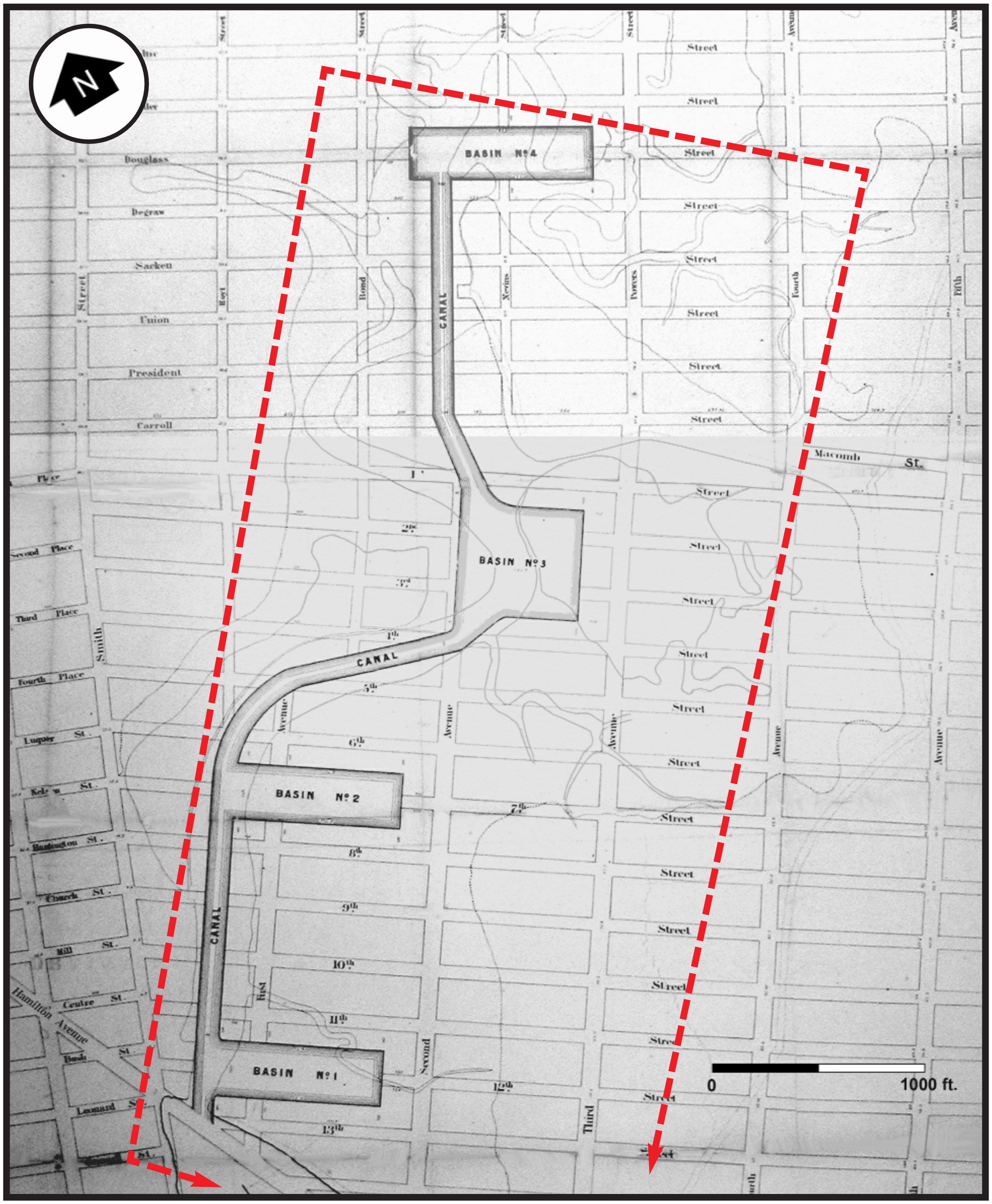


Figure 2.9. Gowanus Canal Assessment of Eligibility: Richards, Daniel. *Gowanus Canal Plan*. 1848. Project area indicated. Daniel Richards plan, prepared for the City of Brooklyn, defined precisely the alignment of the Gowanus Canal's main section as approved in 1849 by the State of New York, and as built in several episodes between 1853 and 1870.

The canal alignment was conspicuous for its curved, multi-angled course. The southern half ran almost entirely within the tidal channel to 4th Street and Second Avenue, minimizing dredging requirements, from where it cut across two meanders in three different straight alignments to end within the former Freek's mill pond. The street grid converging on the meadows from the uplands met at an angle about where these straight cuts through saltmarsh began, and it can be surmised that the northern half of the canal was laid out to conform to the grid and allow for rectilinear lot development along the new waterfront. One later source claims that the creek only ran to 4th Street, which would also explain why the sharp change in direction was taken (*Brooklyn Daily Eagle* 1868b; Figures 2.4 and 2.9).

The canal was intended not only to drain the meadows, but to receive waste and storm water run-off from the nearby fast land. Contemporary description of the Richards plan heralded a variety of potential benefits:

> The great object to be attained in making this important work, is the removal of the marsh miasma which hangs about Prospect Hill and other portions of the city, making them liable to intermittent fevers and other diseases; and thus shutting them out from improvement. [The plan] would also lay the lands open to use, and make that portion of the city valuable for purposes of commerce and the mechanic arts...The expense of filling up the Gowanus meadows to a reasonable height of grade would...probably not be accomplished in a hundred years, and any plan which can at once—as this canal would—do away their pestiferous miasmata by draining the marshy grounds, ought to be hailed with enthusiasm by all whose property is within their influence (*Brooklyn Daily Eagle* 1849).

The same article addressed the expected

> ...accumulation of filth from the high grounds [which] would take place in the canal and basins sufficiently to make their vicinity unhealthy and [the problem] that the low lands should be filled up and the drainage effected through underground sewers...

with the assurance that

> ...the vicinity of bodies of salt water is never unhealthy; and the supposition that such accumulations of filth must be exceedingly slow, as at every flood tide five feet of good clean water would be carried up from the bay, which would return with sufficient velocity to carry off most of the deposits that may take place.

To pay for construction, shortly after he secured city approval Richards arranged for an act of the state legislature (Ch. 79, Laws of 1849) authorizing property assessments of lots along the canal and the approximately 1,700 acres expected to be drained. Running sewerage into the canal was not sanctioned under this act. Of more immediate significance, neither this act nor Common Council actions evidently created a mechanism for administering or executing construction. Richards, whose primary personal enterprises were in deepwater coastal and international shipping facilities, soon parted company with the meadows' owners when he attempted to build a pier across Gowanus Bay to create a large basin. This design would have diminished the value of canalside lands or canal basins, and the owners of these projected lots defeated his plans in the legislature. He appears to have had no further involvement with the canal he planned (Stiles, ed., 1884: 578; *Brooklyn Daily Eagle* 1878b).

The only public improvement in the vicinity of the proposed canal between the time of Richards' plan and the earliest work on the waterway was the 1849 construction of a bridge over Gowanus Creek at 9th Street, a drawbridge built by or in association with the Coney Island Plank Road Company. The 30-foot draw was likely required because of the creek's status as a canal. The Brooklyn City Railroad Company used this bridge *circa* 1854 and rebuilt it by 1861, when it was abandoned in an open position (Parsons Brinckerhoff Quade & Douglas, Inc. 2003).

2. Initial Construction *circa* 1853-1854

Land sales along or near the proposed canal quickened even before any work was done on the waterway, and it was one or more optimistic landowners who financed the earliest waterway improvements. The most prominent buyer was Edwin C. Litchfield (1815-1885), a lawyer rich from work with railroads, who in 1852 acquired nearly a square mile of land southeast of the canal from the Cortelyou estate including about 1,000 feet of designated canal frontage between 5th and 1st Streets. Half this area was marsh, and of little value without the canal (*Brooklyn Daily Eagle* 1869a; Stiles 1870: 583). Another nearby landowner, "Mr. Fisk,"—possibly Edward W. Fiske, a prominent local politician at the time—funded some or all of the poorly-documented initial attempt to improve the waterway, from about May 1853 through perhaps 1854; a description of the work fifteen years later claimed several owners were involved. A dredge and gangs of (probably Irish) laborers evidently created a 100-foot-wide channel to about the present end of the canal, stimulating attempted sales of some canalside lots in late 1854 with a 16-to 20-foot wide "timber and stone dock" which was probably cribwork. Most of the 1853-1854 canal work was evidently of more speculative than navigational value, however, creating a few feet of draft at low water. The waterway in most places had no finished walls, or was lined with timber sheet piling which could not withstand stormwater washing mud into the canal (*Brooklyn Daily Eagle* 1853, 1854, 1868b). The situation of Irish squatters along the canal in 1856, living in one-room shanties "...about eight feet below the curb stone.." subject to frequent tidal inundation, clearly indicates minimal modifications to the marsh along the creek (*New York Times* 1856).

3. Gowanus Area Development and Authorization of Canal Improvements *circa* 1855-1866

The principal administrative problem with the work in the early 1850s was the absence of any agency to design, fund, or build a usable waterway. Despite the city's 1849 authority to assess property owners, the Common Council evidently made no immediate attempts to direct canal improvements. In 1855, the city secured an amendment to the 1849 canal act (Ch. 431, Laws of 1855) allowing for appointment of commissioners to direct canal work and fund it with city-issued bonds paid by property assessments. Private owners could reduce their assessments by completing necessary canal work—probably wharf construction—on their own (*Brooklyn Daily Eagle* 1878b). Public improvements made by special commissions, often composed of interested landowners, were common in this period of Brooklyn's history, but no commission to improve the canal was formed until 1866 (Stiles 1870: 583). While not well documented, this lack of action may reflect landowners' resistance to paying for a canal when their adjacent or nearby properties were not suitable for sale or immediate canal benefits. A burst of enthusiastic private activity near the meadows in the early 1850s, reflected in the land sales noted above, evidently did not create adequate political conditions for significant canal work. Beginning *circa* 1853, landowners like Edwin Litchfield improved streets on upland tracts near the meadows, and ran some streets across the meadows and to the canal. West of the canal, these private efforts before 1860 sometimes involved cutting down hills, which had the dual development advantage of creating level grades on the upland and filling the lowland. Prior to the late 1860s, however, the only apparent development along the canal was the plant of the Citizens Gas Light Company (later the Brooklyn Union Gas Company), opened in late 1859 along about 700 feet of waterfront between 4th and 7th streets on the west side of the canal (*Brooklyn Daily Eagle* 1853, 1859b; Stiles 1870: 583).

In a long prelude to creation of a canal commission, there was a series of improvements in street, landfilling, sewer, and bridge conditions by municipal or special commission action *circa* 1857-1865. These actions drained much of the meadows and imposed more of the street grid on the original lowlands. The earliest municipal involvement in this period was a requirement that lots along privately-developed streets through the meadows be filled to within three feet of street grades, possibly to reduce hazards along elevated earthen causeways through the wetlands (*Brooklyn Daily Eagle* 1857, 1858). The city graded Hamilton Avenue from the canal to Third Avenue and completed a new wooden swing bridge on that road in 1859. Late in 1858, the Board of Sewer Commissioners began to lay out sewers into the canal, which by *circa* 1878 included lines along Bond, President, Sackett, and Centre streets. Although of uncertain legal status relative to the canal, the sewers drained much of the expanding upland. In 1860, a 3rd Street Commission spearheaded by Edwin Litchfield was established under state authority (Ch. 741, Laws of 1860) to widen and improve that road from Smith Street to Ninth Avenue, including construction of a bridge over the canal. Bonds for the work were backed by assessments of adjacent property owners, a majority of whom had to approve the work. The new 80-foot-wide street was to have a grade 20 feet above the meadow, although this elevation was probably not reached in all places. Completed *circa* 1864, the 3rd Street Bridge was a pipe-truss swing structure about five feet above the water. The first poorly-documented bridge at Carroll Street, built privately, was completed by the early 1860s. Thus four of the five eventual street crossings of the canal (all but the one at Union Street) were first built before the major canal improvements. Although these four were swing or draw structures to accommodate canal traffic which was extremely limited in this period, the fact that the street grades at these crossings pre-dated most of the canal construction had significant effects on later canal and street traffic, as discussed below (*Brooklyn Daily Eagle* 1859a, 1860, 1861, 1862b, 1865; 1869a, 1878b; Stiles 1870: 583; Parsons Brinckerhoff Quade & Douglas, Inc. 2003).

By 1866, landowners in the shrinking meadows had several somewhat conflicting reasons to complete the canal. The improvements of the preceding decade had created more accessible land for development, but also provided better access to South Brooklyn where the on-going construction of Prospect Park (built 1866-1874) sparked speculative interest as well as the promise of public recreation. Some argued that the Gowanus section would be better served if the canal were filled and the whole meadows available for residential development (e.g., *Brooklyn Daily Eagle* 1866; Stiles 1870: 619-19; White and Willensky 1978: 436). The canal-area landowners probably realized that development in Gowanus and in South Brooklyn could not proceed quickly without cheap water access for fuel and building materials, and that they could no longer wait if public disapproval of the small waterway and its remaining marshes might grow. In April 1866, they secured state approval for public and private entities to complete the main canal as proposed by Daniel Richards, and to build several private basins. The Gowanus Canal Improvement Commission, whose members included the mayor of Brooklyn and the Kings County treasurer, was empowered to create a channel approximately 6,000 feet long from Douglass Street at the north to Percival

Street about 600 feet outshore of Hamilton Avenue, and was placed in charge of all bridges over the canal. The commission's work, whose cost under a series of 1867-1869 state amendments was not to exceed $450,000, was financed by bonds backed by assessments on properties within 200 feet of the waterway. The fact that the area subject to assessment was much smaller than the 1700 acres evidently proposed for assessment under the act of 1849 probably contributed to political support for the 1866 commission. At the same time, the private Brooklyn Improvement Company, headed by Edwin Litchfield, was incorporated to build docks or basins along the canal and adjacent areas. Working more or less simultaneously, the commission and the company completed the canal and four of its eventual six basins *circa* 1866-1870; other local owners completed a fifth basin *circa* 1872-1874 (Brooklyn Daily Eagle 1867a-c, 1869a, 1870b; 1872b; Stiles 1870: 583-4; Stiles, ed., 1884: 643).

4. Gowanus Canal Improvement Commission Work *circa* 1866-1870

By 1868, seven state-sanctioned commissions had been created to make improvements in Brooklyn. Despite their ties to municipal authorities, commissions such as the one authorized for the canal were agents of the state and subject to limited local accountability. Their sometimes secretive means of operation, and resistance to public complaints, led to investigations spearheaded by State Senator Henry C. Murphy and to the closing by 1870 of most Brooklyn commissions including the one for the canal (*Brooklyn Daily Eagle* 1868c, 1869d, 1870a). Before turning over responsibility for the canal to the city, the canal improvement commission appears to have completed the following work under the general engineering authority of L.N. Vibbard:

❖ A channel 100 feet wide between Hamilton Avenue and Douglass Street, and 300 feet wide from Hamilton Avenue to Percival Street, was created with low-water depths ranging from seven feet at the north end to 12 feet at Percival Street. Much of the dredging was probably done by the dock contractors noted below. The commission evidently did some channel deepening in Gowanus Bay more than 4,000 feet beyond Percival Street, but, as discussed below, local interests appealed to the federal government for channel maintenance in the bay by the 1880s (*Brooklyn Daily Eagle* 1868b, 1873b).

❖ At least inshore of Hamilton Avenue, the commission built canal walls where none existed previously or were not being built by private interests. Some landowners such as Edwin Litchfield built cribwork walls along their own frontages, often using these walls to fill extensive areas away from the canal. While the authors have found no explicit descriptions of commission-built walls, existing conditions strongly suggest that the commission walls built 1866-1870 were also cribwork, based in part on the poor performance of sheet pile structures in the marsh environment. The commission employed dock contractors including J.B. Wood & Co. and William H. Beard. Beard is best known as the chief builder of Erie Basin *circa* 1855-1880, where he erected what were then the largest crib-retained breakwaters and piers in the port. The clay bottoms of the Gowanus Creek marshes and the absence of nearby fill material, which challenged Litchfield's work with the Brooklyn Improvement Company, would have also made the commission's wall construction difficult. Some earlier Gowanus Canal bulkheads remained in place, one of which evidently collapsed by 1878 (Plate 2.3; *Brooklyn Daily Eagle* 1868b-c, 1878a; Raber *et al*. 1984).

- ❖ The first bridge at Union Street, an iron pipe-truss swing structure with a central stone pier, was completed in 1868 (*Brooklyn Daily Eagle* 1868a, 1868d; Parsons Brinckerhoff Quade & Douglas, Inc., 2003).

By 1868, before channel work was complete, perhaps a half dozen businesses operated along the canal despite the still-limited navigability of the waterway. Canal traffic prior to creation of full canal depths created unaddressed problems which angered the public and probably contributed to the calls for the commission's retirement. With navigation effectively limited to a few hours a day, boats using the canal swarmed the bridges waiting for opportunities to travel, requiring long periods of bridge openings which greatly inhibited street traffic. Although the state legislature authorized raising the canal bridges five feet to allow most craft to pass under without opening a crossing, the canal commission refused to proceed with such a program as it would have required raising street approaches and nearby building lots. Public opposition to movable bridges became intense, as the Brooklyn Improvement Company found when it built basins past Third Avenue, discussed below. Completion of the main canal minimized bridge openings when depths were maintained, but existing street grades and the need for movable bridges created continual demands for municipal bridge work which continue today (*Brooklyn Daily Eagle* 1868b, 1868d; Parsons Brinckerhoff Quade & Douglas, Inc., 2003).

The canal commission intended to stop sewerage deposits into at least one point on the canal, and the city's sewerage board planned to run all lines into the East River rather than the canal. These projects were never completed, with long-term consequences for canal navigation and water quality (*Brooklyn Daily Eagle* 1868a). During the canal commission's work, the city also succeeded in running a number of public streets without canal crossings from Fifth Avenue to the waterway, including 1st Street, 8th Street, and Second Avenue. State-authorized street commissions improved Union Street and Fourth Avenue, in addition to the work noted above for 3rd Street. Although in places opposed by canalside landowners who feared loss of warehouse space, public streets laid out on the east side of the canal benefited those interested in the ambitious plans of the Brooklyn Improvement Company (*Brooklyn Daily Eagle* 1868a, 1868e, 1869f).

5. Private Basin Construction *circa* 1868-1874

The Brooklyn Improvement Company, most or all of whose work was intended to develop Edwin Litchfield's personal holdings in the meadows, filled extensive areas adjacent to four 100-foot-wide basins the company built off the east side of the canal between 8th and 4th Streets. Totaling over 2,600 feet in length exclusive of a controversial crossing of Third Avenue, these channels were later known as the 7th, 6th, 4th, and 5th Street basins, with the latter two in a continuous angled line from the main canal at 4th Street to a point about 400 feet southeast of Third Avenue (Figure 2.10). Although the company's contractor(s) and engineer(s) remain unidentified, there are more detailed descriptions available for this work than for that of the canal commission, which probably differed somewhat in method. Charged only with channel dredging and channel wall construction in the main canal, J.B. Wood & Co. and William Beard would most likely have used floating bucket dredges to excavate from Gowanus Creek (e.g., Raber et al. 1996: 107). The Brooklyn Improvement Company drove piles into clay deposits in large continuous arrays at 11-foot centers except within the proposed basins, and used the piles to support movable railway systems on which dredges (probably bucket types) were mounted. The dredges removed mud from the basin channels and dumped it in the surrounding areas to be filled, providing about two thirds of the fill.

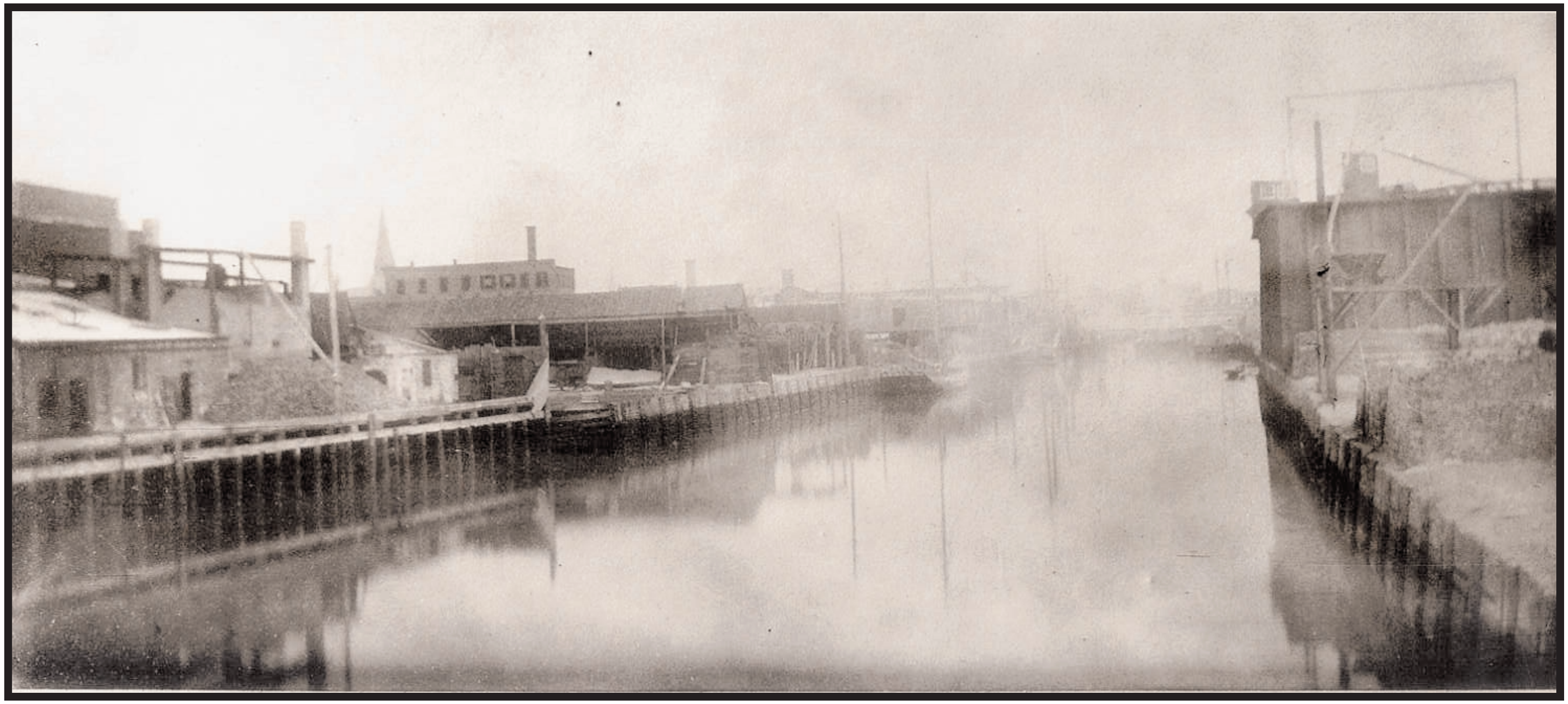
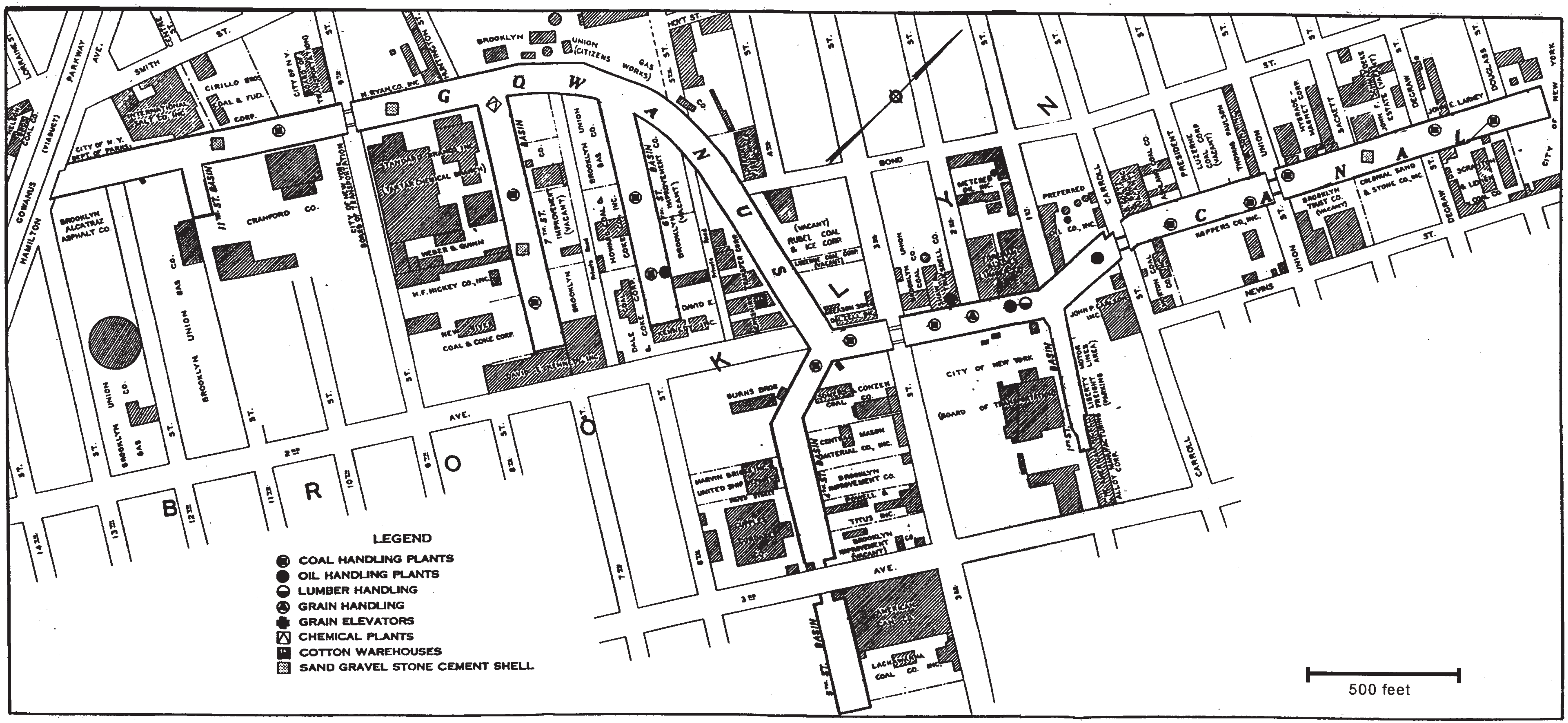


Plate 2.3. Gowanus Canal Assessment of Eligibility: View of an unidentified section of the Gowanus Canal. *Circa* 1877. Taken within about a decade of completion of the main canal, this view suggests the rapid industrial growth along the waterway. Most of the canal walls shown appear to be cribwork with timber fenders, but those at left may be timber sheet piling. Source: Brooklyn Public Library.



GOWANUS CANAL AND ITS INDUSTRIES ca. 1942
adapted from map prepared by U.S. Army Corps of Engineers

Figure 2.10. Gowanus Canal Assessment of Eligibility: U. S. Army Corps of Engineers. *Map of Gowanus Canal and its Industries*. 1942.

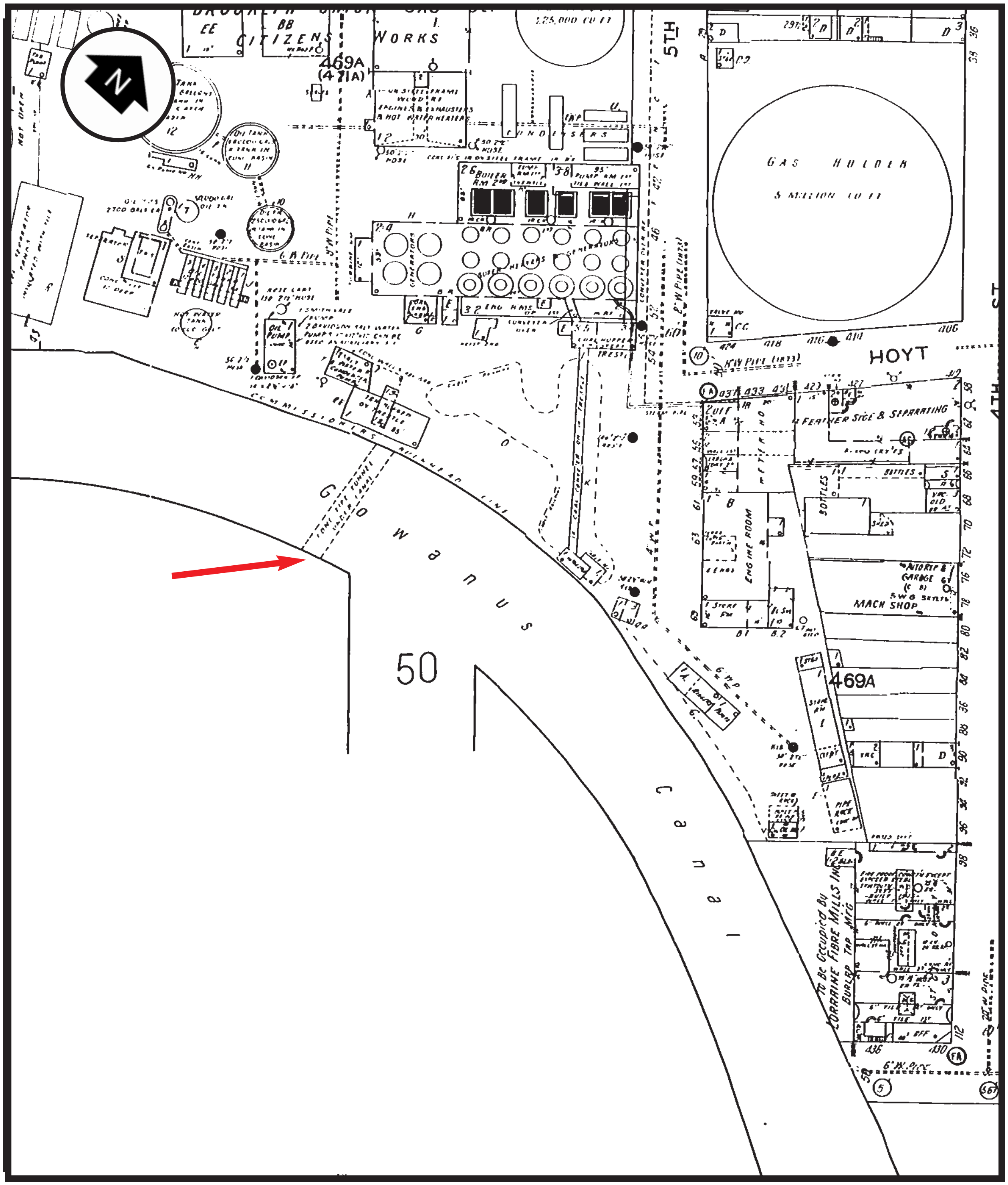


Figure 2.11. Gowanus Canal Assessment of Eligibility: Sanborn Map Company. *Insurance Maps, Borough of Brooklyn*. 1938. Scale: 1 inch= 130 feet (approximately). Area shown entirely within project area. Fire Insurance Map showing location of tunnel under canal (indicated by arrow).

(Unless the rail-mounted dredges had bucket arms exceeding 50 feet, some floating dredges may also have been used.) Most of the remaining fill came from sand deposits cut from hills south of Fifth Avenue. At least along the 4th and 5th Street basins, and along Litchfield's frontage on the main canal, filled land extended back 250 to 300 feet, so that the basins had available land areas reaching 3rd and 6th Streets east to Fourth Avenue. It is probable that similar methods used around the 6th and 7th Street basins filled most or all of the area between the main canal, Second Avenue, and 8th Street. Some of this work involved filling the remains of Denton's Mill Pond as well as previously-unused marshlands. Description of the basin projects in 1869 suggest the Brooklyn Improvement Company may have originally planned to use sheet pile bulkheads, but the basins as built by late 1870 clearly had 20-foot-wide cribwork sides resting on clay bottoms 18 to 22 feet below the surface, with stone-filled cribs whose upper faces were finished with solid timber to 5 feet above mean high water (original surface elevations in the marsh were presumably at about mean high water). As discussed below in Chapter 3, this was standard contemporary waterfront technology. The basins when first completed were nine to 12 feet deep at low water, with those off Fourth Avenue evidently shallower (Figure 2.4; *Brooklyn Daily Eagle* 1869a, 1870b, 1873a).

Company attempts to secure authorization in 1869 for basins along 2nd Street met significant opposition, especially over bridge crossings, and in 1871 the legislature prohibited any further canal construction across Third or Fourth Avenues. Third Avenue was finished shortly before the Brooklyn Improvement Company started its basin work, and soon became an important route to Fulton Ferry for many South Brooklynites as well as a planned alignment for new sewer and gas utilities. The company's plan to cut through Third Avenue for the 5th Street Basin, although legislatively mandated to include a fixed bridge with at least 10 feet of clearance, sparked large public meetings and municipal legal challenges. Appalled by delays of 30 to 45 minutes at the Gowanus Canal drawbridges, many feared the company planned to install a drawbridge on Third Avenue. The crossing completed in 1870, and turned over to the city in 1871, was a 36-foot-wide culvert with 80-foot-long granite abutments and nine feet of clearance at mean high water. The fixed roadway consisted of eight 3-foot-high iron beams linked by brick arches, above which were three feet of earth and sand in which gas and water lines were laid. As discussed below, this crossing was heavily rebuilt in 1889 (Plate 2.4; *Brooklyn Daily Eagle* 1869b, 1869c, 1869g, 1870b, 1871a).

Shortly after the city took over canal and bridge maintenance in 1870, landowners along 1st Street secured legislative permission to build a private basin at least 50 feet wide, six feet deep at low water, to a point 50 feet west of Third Avenue. Approved in 1872, what became known as the 1st Street basin was completed *circa* 1874, 60 feet wide and about 553 feet long (*Brooklyn Daily Eagle* 1872b, 1873a; Sanborn Map & Publishing Company 1886).

6. Canal Construction During the Era of Municipal Control *circa* 1870-Present

The most important municipal work related to canal traffic was the maintenance and replacement of the canal's bridges. Four of the five movable bridges over the main canal have been completely rebuilt several times. After considering a tunnel in 1875, the city rebuilt the 1859 Hamilton Avenue bridge with an iron swing structure in 1877. The crossing was rebuilt in bascule form in 1905 and 1942. Somewhat similar sequences occurred at the 3rd Street, 9th Street and Union Street bridges, all of which were replaced with bascule structures in 1905 (Plate 2.5). The bridges at 9th and 3rd Streets have been rebuilt since 1980, and the major components of the Union Street Bridge have

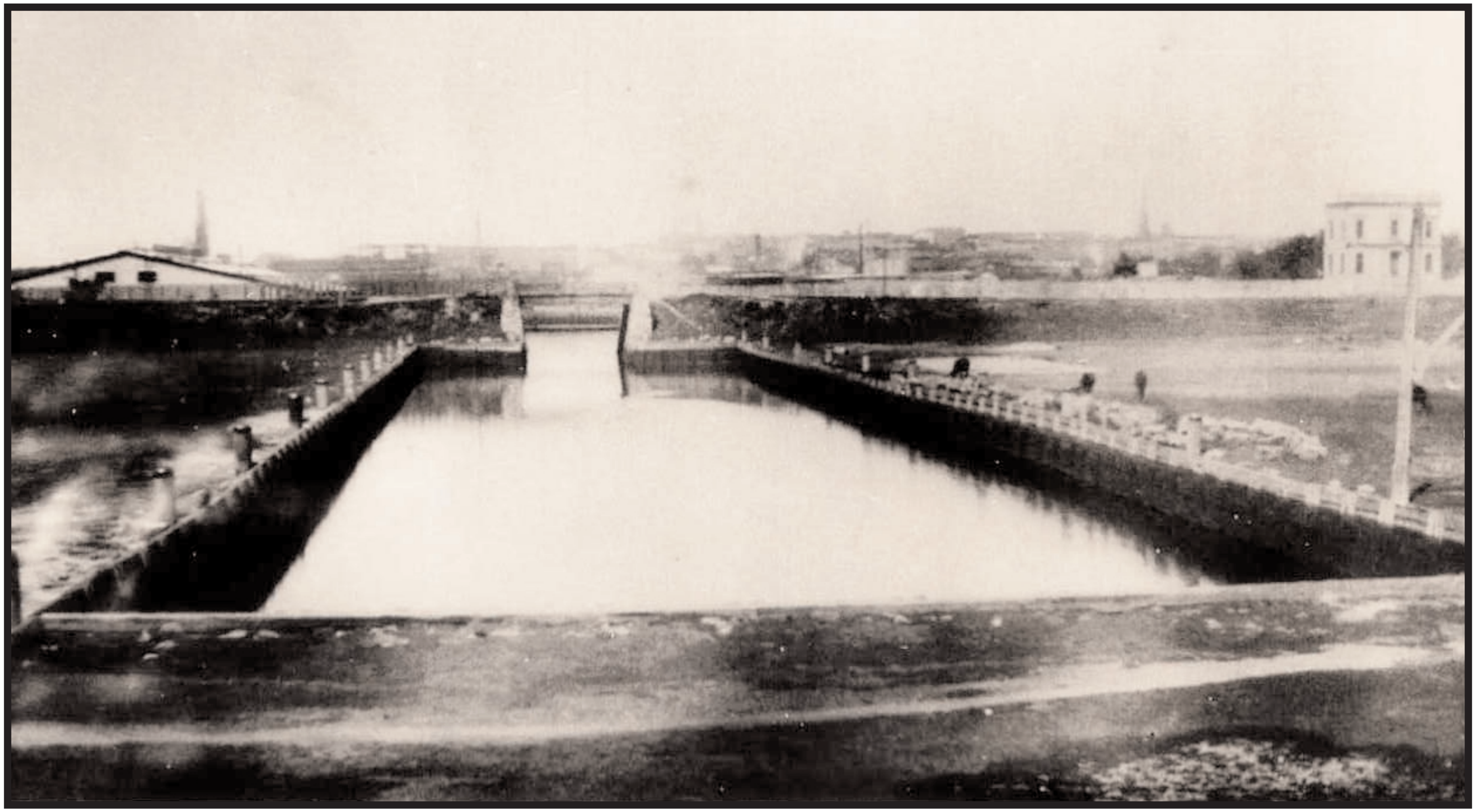


Plate 2.4. Gowanus Canal Assessment of Eligibility: View northwest of 5th Street Basin and Third Avenue. *Circa* 1876. Water beyond the bridge is the 4th Street basin, along which stood the large shed of the New York & Long Island Coronet Stone Company (left). The Brooklyn Improvement Company's office (right) still stands at the southwest corner of Third Avenue and 3rd Street. Source: Brooklyn Public Library.

Plate 2.5. Gowanus Canal Assessment of Eligibility: View southwest of the Union Street Bridge nearing completion. *Circa* 1905. The Carroll Street Bridge is visible beyond. Source: Brooklyn Public Library.

been replaced over the last century although the abutments retain most of their 1905 fabric. Of the movable bridges, only the one at Carroll Street, replaced in 1872 as an iron swing bridge and then in 1889 in its present retractile steel-plate girder-type form with a timber deck and steel I-bar stays, retains any historical significance. The one-lane, two-span structure is approximately 105 feet long. The movable span slides along steel rails at a skew to the longitudinal axis to allow for the passage of canal traffic. The last major replacement of components was in 1915, when new tracks and track foundations were installed (Plates 2.6 and 2.7). After a long period of deterioration that resulted in the bridge being kept in the open position from 1985 to 1989, the Carroll Street Bridge was rehabilitated in time for re-opening on its centennial birthday on September 25, 1989. It remains one of only four surviving retractile bridges in the United States and, as noted earlier, is a New York City Landmark and has been found eligible for inclusion in the National Register (Parsons Brinckerhoff Quade & Douglas, Inc. 2003).

The City of Brooklyn rebuilt and enlarged the Third Avenue Bridge between the 4th and 5th Street basins in 1889, installing a 65-foot-long, 70-foot-wide plate girder deck with a clearance of 13 feet above mean high water. The navigable distance between abutments remained 36 feet, but the 1870 abutments were evidently raised and rebuilt for a total length of approximately 120 feet. The 1889 structure remains in place (Plate 2.8; Sanborn Map Company 1904, 1915; City of New York 1949-1958: 1954, pages 154-5).

Work on the main canal was probably not complete when the Gowanus Canal Improvement Commission resigned and the state transferred the commission's duties to the city. The city continued some repairs to walls completed by the commissioners into the early 1870s under an 1871 state law (Ch. 839, Laws of 1871; *Brooklyn Eagle* 1878b), but soon established that it had no responsibility for canal walls fronting private property. In the mid-1870s, walls along the frontage of the Brooklyn Saw Mill Company collapsed, in a section evidently left undone by the commission. The company's suit against the city failed, partly in the face of an 1862 state law under which "...Brooklyn is not responsible to private parties for the ...malfeasance of her agents," but more significantly because the Court of Appeals held that city authorities succeeding the canal commission were state agents and not acting for the city. The work represented by the canal walls "...did not of right belong to it as a corporation [and] the improvement of the canal was performed not for the benefit of the city but for that of private owners..." (*Brooklyn Daily Eagle* 1878a). While the municipal governments of Brooklyn and the consolidated City of New York did some maintenance dredging and other work related to canal water quality, discussed below, it does not appear that any additional public canal wall construction or repair occurred except at the ends of streets or along city-owned parcels. Some bulkheads remained insubstantial sheet piling, subject to collapse or to stormwashed sediments deposited into the canal, into at least the mid-1890s (U.S. Army 1872-1950: 1894, i, pp. 91-2).

The Brooklyn Saw Mill Company, earlier known as the New York and Brooklyn Saw Mill & Lumber Company, had a sawmill at the west end of 10th Street and appears to have occupied the canal frontage between 11th and 9th Streets from sometime before 1873 to *circa* 1881-1886 (Boyd's 1873; Bromley and Robinson 1880; U.S. Army 1872-1950: 1881, i, 637; Sanborn Map and Publishing Company 1886). The break in their wall, which may have been an older section of sheet piling erected in the 1850s not far from the mouth of the canal, may also have represented the first phase of what became the canal's last basin. While an 1880 atlas shows no breaks in canal walls, an 1886 insurance map shows the same frontage vacant with a break in the wall at 11th Street and an

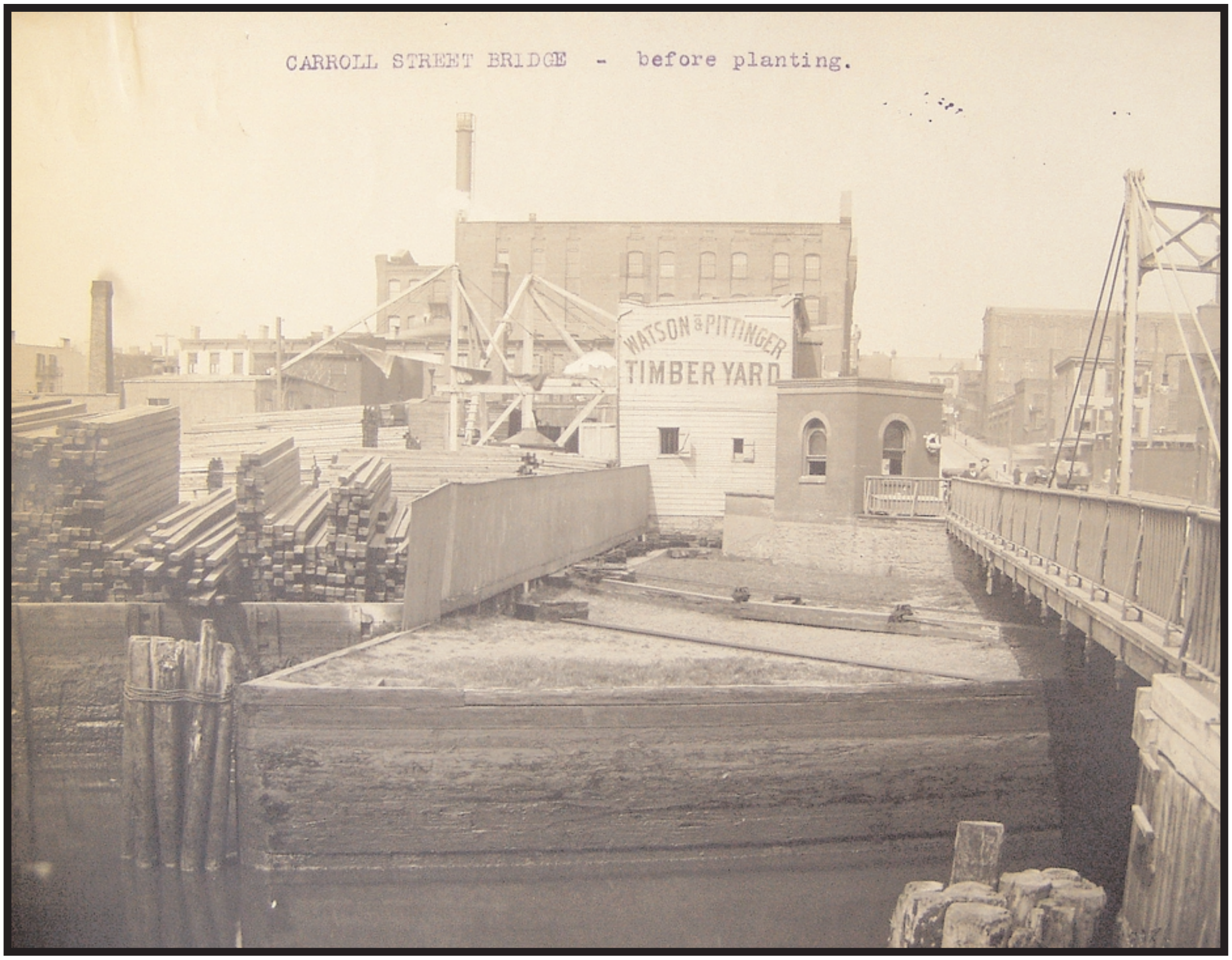


Plate 2.6. Gowanus Canal Assessment of Eligibility: View northwest of the Carroll Street Bridge tracks and the adjacent lumber yard. 1912. Source: Brooklyn Public Library.

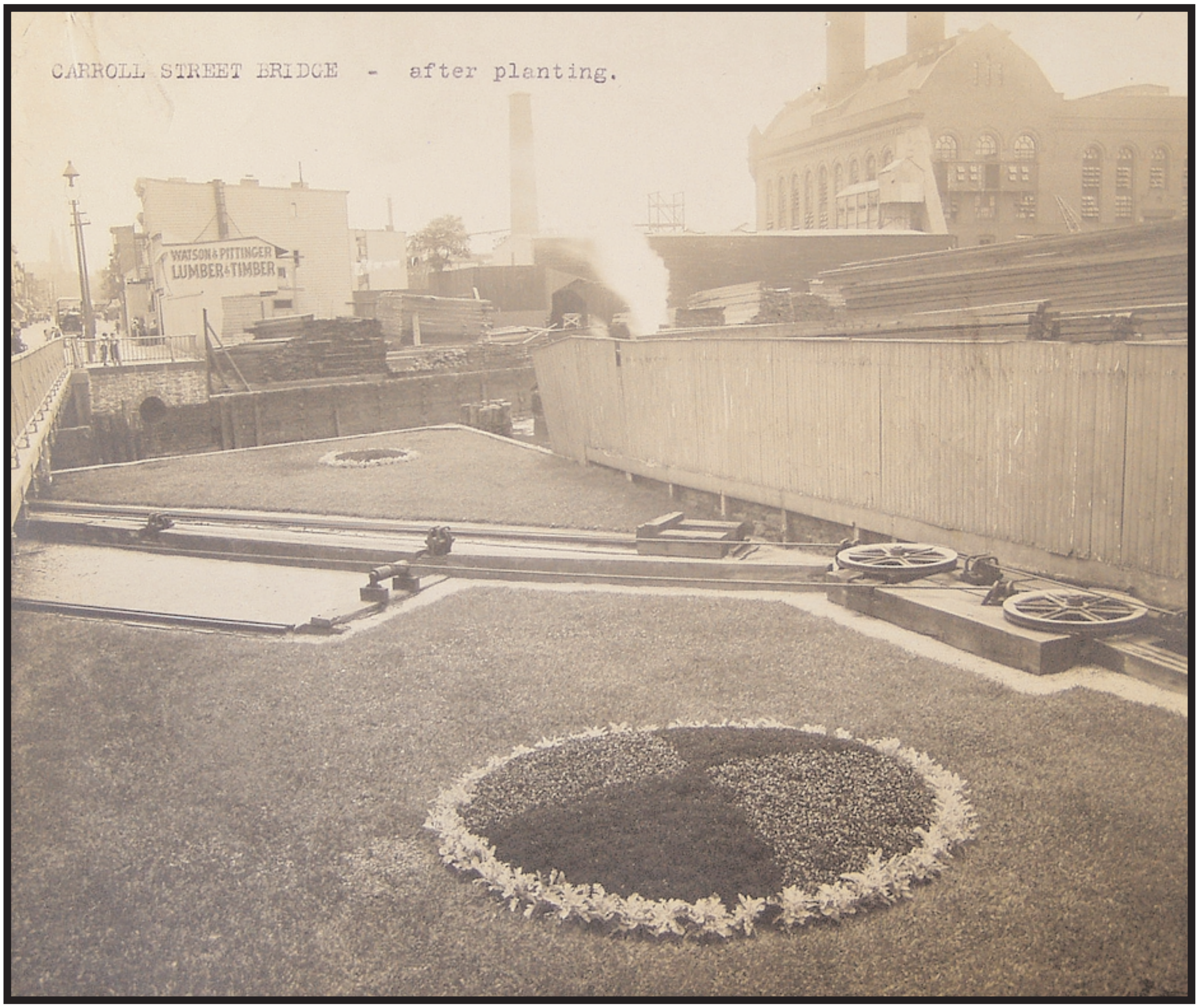


Plate 2.7. Gowanus Canal Assessment of Eligibility: View southeast of the Carroll Street Bridge tracks. 1912. The Brooklyn Rapid Transit Railroad powerhouse complex is at the right of the view, across the Gowanus Canal. Source: Brooklyn Public Library.

Plate 2.8. Gowanus Canal Assessment of Eligibility: View southeast of Third Avenue Bridge. The filled 5th Street basin is visible in the background (Photographer: Thomas Flagg, November 2003) [Source: Raber Associates].

irregular basin extending towards 10th Street behind no more than about 30 feet of wall, fill or slope fronting the waterway. Between 1898 and 1904, the basin north of 11th Street was filled in and the canal wall away from the street probably rebuilt by the Cranford Company for its asphalt plant, but at the end of 11th Street a basin with the street's 60-foot width and an irregular length was left in place. Stabilized by 1915 at about 150 feet long, the 11th Street Basin may reflect gradual private construction around an area the city chose not to refill or repair (Figure 2.10; Bromley and Robinson 1880; Sanborn Map and Publishing Company 1886; E. Belcher Hyde 1898; Sanborn Map Company 1904, 1915).

There has been much private repair and, in places, replacement of canal walls since 1870. Most of this activity remains undocumented (see Chapter 3). The largest private project was probably the 1924 construction by Brooklyn Union Gas Company of a concrete-lined, steel gas main tunnel under the canal, opposite the end of the 6th Street Basin. Installed with open-cut work, the 136-foot-long oval tunnel is 10.8 feet high and 16.1 feet wide, and with its steel sheathing reaches a depth approximately 36 feet below mean sea level. Earlier timber canal walls were replaced in concrete for this work (Figure 2.11; Stiles 1926).

7. Industrial Development and Marine Traffic

Brooklyn grew very rapidly during the half century before its consolidation with the City of New York in 1898. In 1855 the population was 205,250, more than doubling to 566,663 by 1880. Geographically, the city also expanded, incorporating Bushwick and Williamsburgh within its jurisdiction. The ethnicity of the population diversified, with 177,694 foreign-born residents by 1880. Many of the newcomers settled first along the waterfront where work was available. The thriving waterfront presented a poignant contrast to "the sheds and shanties of squatter pioneers..." who resided in the marshy inland parts of southern Red Hook (Stiles 1870:582). As late as 1880, most of the residential development of South Brooklyn remained north of Hamilton Avenue or west of Dwight Street (Bromley and Robinson 1880; Stiles 1870:582). In the middle of the 19th century, most of the migrants were Irish and many settled in and around the eastern part of Red Hook, working on the Gowanus Canal. The latter part of the century saw the influx of Italians to South Brooklyn and Scandinavians and Poles to Bay Ridge. The urban, industrial history of Brooklyn was greatly shaped by these and other groups (Rosenwaike 1972:31,63,70).

The canal was a focus for new industrial and residential growth. Behind the canal, especially to the south towards Gowanus village, worker housing quickly transformed farmland to city lots between the bay and Fifth Avenue. By 1870, these houses extended to 36th Street, and population south of Red Hook had grown from about 1,370 in 1845 to about 9,500 (Ment and Donovan 1980:54, 59; Stiles 1870: 582-4; Brockett 1884: 643). Although the canal shorelines were not fully occupied until very late in the 19th century, the waterway attracted a large number of bulk-products businesses soon after it opened. By 1880, there were 31 firms handling lumber, coal and firewood, hay and grain, oil, building materials, and chemical fertilizers on the canal, participating in the general expansion of Brooklyn industries, commerce, and residential construction (U.S. Army 1872-1950:1881; Stiles, ed., 1884). (The number of reported businesses for 1880 does not match the numbers shown in Tables 2.1-2.5 below because the tables are based on historical maps, and the maps do not consistently identify all businesses).

The canal's low land costs, sheltered waters, and accessibility to canal barge and schooner traffic made it an extremely valuable artery into a rapidly-developing city ("Wanderer" 1890). Other canal industries established by *circa* 1890 included gas and electric utilities requiring coal and coke, and a small number of other manufacturers.

The largest coal user was probably the Brooklyn Rapid Transit Company, which in 1896 took over the operations of the Atlantic Avenue Railway Company and its powerhouse at Third Avenue and 1st Street, along with other street railway systems. Improvements in electrical generation and transmission technology, and the fast-growing BRTC system, led to the 1902 completion of a new central station on the canal. Coal delivered from the canal fueled thirty-boilers in a two-story boiler house, adjacent to a power house with eight 4000-hp vertical cross-compound condensing steam engines. The engines were arrayed in four pairs direct connected to 2700-kw AC and DC generators. The power house survives today and discussed in Chapter 3 below (*Power* 1903; Murray 1910: 113-38).

Industrial use of the canal peaked in the period *circa* 1900-1932, when between 50 and 60 operations used the waterway with about 65-75% of these in bulk products (Tables 2.1-2.5). The number of active waterway sites dropped approximately 50% by World War II, stabilized at between 15 and 20 until the mid-1960s, and then fell to just five operations by 2000 (Plates 2.9-2.11; see also Figure 2.10). There is little summary data available on causes of the decline, but the most likely factors were diminishing marine access conditions, completion of pre-World War II urban development in the canal vicinity and decreased demand for building materials, declining use of coal fuel and manufactured gas production, and increased use of trucks. Siltation in the canal, associated with pollution and flushing problems discussed below, limited marine operations to less cost-effective small vessels. Increased use of trucks for products such as fuel oil began in the 1930s, and the completion of the Gowanus Expressway in 1964 provided highway access to canalside industries for the first time (Seaton 1986). The five waterside industries active in 2000 handled oil, stone, and other building material. Three have been in continuous operation under different owners since the 1950s and 1960s, and the other two began by the mid-1970s.

In the absence of federal data on Gowanus Canal-specific vessel traffic, there is little available summary information on historical maritime activity other than the number of vessels recorded passing through or under the five movable crossings. Freight type and tonnage entering Gowanus Bay cannot be distinguished for canal operations (U.S. Army Corps of Engineers 1950-1997). From the time the canal opened into the early 20th century, and probably until the Great Depression, a wide variety of vessels used the waterway including schooners, sloops, sail and steam lighters, tugboats, barges hauling coal and sand, and canal boats (e.g., U.S. Army 1881; City of New York 1900; Plate 2.12). At the apparent peak period of traffic in the 1920s, the number of recorded vessel trips at the crossings indicates that perhaps 23,000 to 25,000 vessels per year used the waterway (Tables 2.1-2.5). Today, there are perhaps 1,000 commercial round trips in the canal by tugs and barges, with slowly increasing recreational traffic as the canal evolves into a somewhat cleaner attraction for local residents and tourists.

8. Maintenance Dredging and Gowanus Creek Channel

When the City of Brooklyn took over canal maintenance in 1870, completed dredging included the 100-foot-wide canal upstream of Hamilton Avenue, a channel perhaps 300 feet wide to Percival Street, and poorly-documented work for over 4,000 feet beyond Percival Street (*Brooklyn Daily Eagle* 1868b, 1873b). Within a decade, navigation conditions within the canal deteriorated, due primarily to inflows from city-built sewers and from stormwater deposits through

Table 2.1. Maritime Industry & Traffic Numbers, Gowanus Canal Between Hamilton Avenue and Ninth Street Bridge Crossings.

Industry Types	1880	1893	1907	1924	1932	1942	1953	1965	1978	1986	1998
Lumber	2	1	1								
Building Materials		2	3	2	2						
Coal	1	1	1			1					
Coal for Powerhouse				1	1						
Manufactured Gas	1	1	1	1	1						
Stone, Sand & Gravel				1	1	1	1	1	1	1	1
Oil	1	1					1	1	1	1	1
General Lighterage				1	1						
Other	1	1	2	1	1	1	1				
Total Industries	6	7	8	7	7	3	3	2	2	2	2
Vessel Numbers	NA	NA	1600*	27,050*	21,500*	18,000*	10,100*	NA	NA	524*	<900*

Table 2.2. Maritime Industry & Traffic Numbers, Gowanus Canal Between Ninth Street and Third Street Bridge Crossings.

Industry Types	1880	1893	1907	1924	1932	1942	1953	1965	1978	1986	1998
Lumber	1			1	1			1			
Building Materials		1	6	6	5		1	1			1
Coal	1	1	6	11	15	5	2				
Manufactured Gas	1	1	1	1	1	1	1				
Stone, Sand & Gravel	1			4	3	3	2	1	1	2	1
Oil			2			1	2				
General Lighterage			1	1	1		1				
Other	2	5	8	6	5	5	3	7			
Total Industries	6	8	24	30	31	15	12	10	1	2	2
Vessel Numbers	NA	NA	11,220*	11,100*	8900*	9900*	6500*	NA	NA	NA	NA

Table 2.3. Maritime Industry & Traffic Numbers, Gowanus Canal Between Third Street and Carroll Street Bridge Crossings.

Industry Types	1880	1893	1907	1924	1932	1942	1953	1965	1978	1986	1998
Lumber	1			1							
Building Materials			2								
Coal	1				1	1					
Coal for Powerhouse		1	1	1	1						
Stone, Sand & Gravel			2	2	2						
Oil		1	1	2	2	2	1				
Other	1	1	2	2	2	1		1			
Total Industries	3	3	8	8	8	4	1	1			
Vessel Numbers	NA	NA	6250*	3200*	1780*	2300*	NA	NA	NA	NA	8

Table 2.4. Maritime Industry & Traffic Numbers, Gowanus Canal Between Carroll Street and Union Street Bridge Crossings.											
Industry Types	1880	1893	1907	1924	1932	1942	1953	1965	1978	1986	1998
Lumber	1	1	2								
Building Materials	1	1	1	1	1						
Coal			2	2	3	2	1				
Other				1	1	1	1	2			
Total Industries	2	2	5	4	5	3	2	2			
Vessel Numbers	NA	NA	650*	1000*	2300*	1500*	428	NA	NA	NA	14

Table 2.5. Maritime Industry & Traffic Numbers, Gowanus Canal Upstream Of Union Street.											
Industry Types	1880	1893	1907	1924	1932	1942	1953	1965	1978	1986	1998
Lumber		1		1	1						
Building Materials	2	2	2								
Coal	2	1	3	4	4	3	1				
Manufactured Gas	1	1	1	1							
Stone, Sand & Gravel						1					
Oil								1	1	1	1
Other			1	1	1						
Total Industries	5	5	7	7	6	4	1	1	1	1	1
Vessel Numbers	NA	NA	7300*	4650*	3500*	2300*	1106	NA	NA	918*	121

Notes to Tables 2.1-2.5:

Industry types and locations from Bromley and Robinson 1880, G.W. Bromley & Co. 1893, E. Belcher Hyde 1907, U.S. Army Corps of Engineers 1926-1988.

* = estimated vessel numbers. Vessel numbers are total trips between bridge crossings, taken from City of New York 1898-1958 and 1998 NYCDOT logs. Vessel numbers assume all vessels made round trips, and upstream counts are subtracted from downstream counts to isolate estimated use between crossings. There are no federal vessel traffic data for the Gowanus Canal. Recreational traffic is not distinguished in these data, but until recently has been limited.

NA = information not available.

Plate 2.9. Gowanus Canal Assessment of Eligibility: Aerial view north of the upper half of the Gowanus Canal. *Circa* 1960. From bottom, bridges shown at 3rd, Carroll, and Union Streets. Burns Bros. Coal pockets visible at lower left, which survive today, are near the head of the 4th Street basin (visible at bottom of view). The limited number of visible vessels is in striking contrast to earlier views, reflecting the declining commercial use of canal. Source: Brooklyn Public Library.

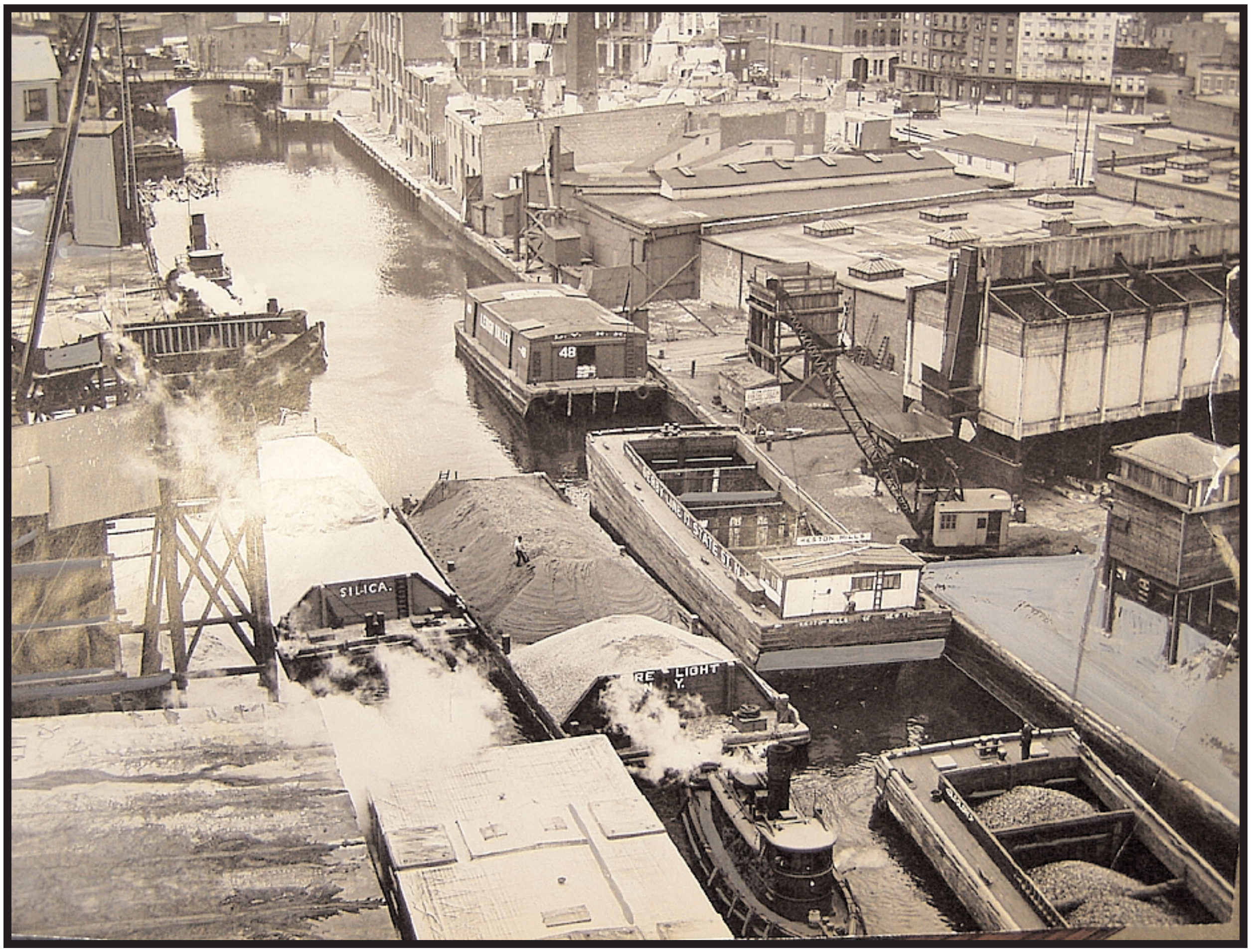


Plate 2.10. Gowanus Canal Assessment of Eligibility: View southwest of Gowanus Canal traffic near Hamilton Avenue. 1940. In this view from the 1933 rapid transit trestle over 9th Street, Hamilton Avenue Bridge is in the background and the 11th Street basin is at left center. On north side of canal (right), the Devoe & Reynolds paint factory next to bridge is under demolition; Independent Salt Company structures are at right center, and part of the B.Goetz & Bro. masons' materials yard is at right. Vessels on the north side from left to right include a covered barge and two hold barges. A tug pulls a sand barge through the center of the canal. Another sand barge and part of another covered barge are visible on the south side of the canal. Source: Brooklyn Public Library.

Plate 2.11. Gowanus Canal Assessment of Eligibility: Aerial view north of the uppermost section of the Gowanus Canal. *Circa* 1945. Carroll Street Bridge in the foreground, Union Street Bridge is at upper right center. Most vessels at lower left are tugboats, probably used to haul oil barges to the adjacent Preferred Oil Company terminal for transshipment to trucks. Source: Brooklyn Public Library.

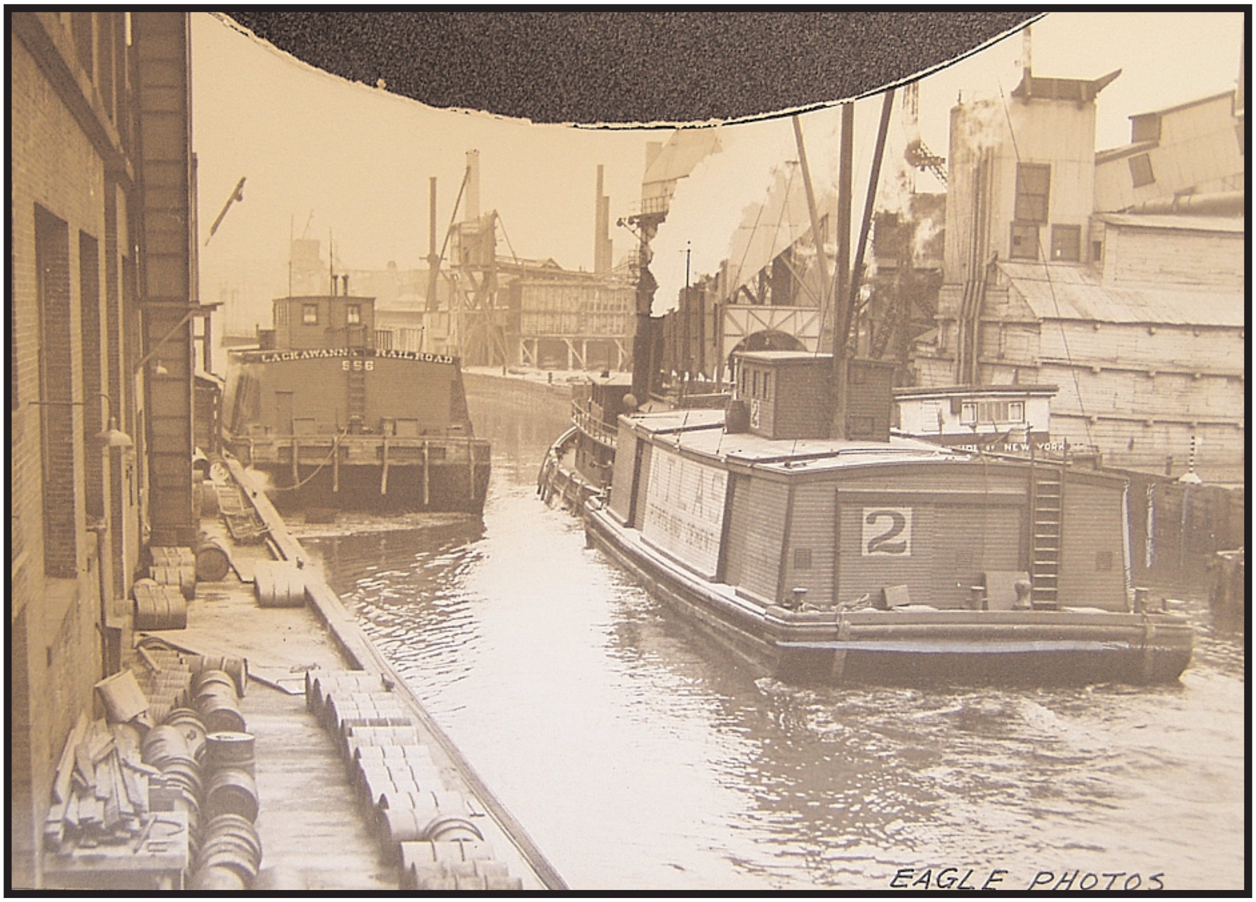


Plate 2.12. Gowanus Canal Assessment of Eligibility: View of covered barges in the Gowanus Canal. 1928. View appears to be to southwest around 10th Street. Source: Brooklyn Public Library.

some poorly-built canal walls. At least initially, municipal funding for dredging "and for any wall maintenance" was supposed to come from assessments on canal-side property owners. Many owners joined forces to extend the assessment district into the bay, through the channel completed beyond Percival Street, thus vitiating the amounts assessed on canal-side land and transferring costs to the city or other owners of property that was primarily under water. The City of Brooklyn delayed maintenance dredging until sufficient funds could be raised from these assessments, inhibiting navigation and exacerbating sewerage problems discussed below (*Brooklyn Daily Eagle* 1872a, 1874, 1884). The history of maintenance dredging within the canal, by the cities of Brooklyn and New York or by private owners, remains incomplete but appears to be one of irregular or very occasional work, concentrated around the outlets of public sewers and leaving other dredging to private parties. One public official complained that "[t]he dredge cannot be used successfully as the filth slides from the shovel back into the water as soon as it is displaced" (*Brooklyn Eagle* 1877a).

Federal channel dredging programs under the U.S. Army Corps of Engineers, an important component of maritime commercial growth throughout much of the Port of New York, did not apply to virtually all of the canal. Upstream of Hamilton Avenue, restrictions against work between piers along a wharf eliminated the eligibility of the narrow waterway for federal support (U.S. Army 1872-1950: 1884, i, 713-14). At the urging of local interests using Gowanus Bay and the canal by *circa* 1880, however, the Corps was authorized as early as 1881 to improve channels in the bay. Although the initial authorization called for work as far inshore as Hamilton Avenue, for approximately seventy years no work was done beyond Percival Street. While never so stated in published Corps documents, it is likely that the state-authorized canal construction from Douglass to Percival streets in the 1860s became a basis for federal reluctance to work within an area supposedly under local dredging authority. By 1889, federal work in the Gowanus Creek Channel to Percival Street created a channel at that point 21 feet deep at mean low water, extending into the bay with a wider and deeper profile about 2,900 feet to 28th Street. The City of Brooklyn by this time disclaimed responsibility beyond Hamilton Avenue, with the result being a bar with a low-water depth of only seven feet between Hamilton and Percival by the mid 1890s. This bar, and the federal channel beyond, were continually worsened by deposits flowing out of the Gowanus Canal. An 1895 attempt by local congressional representatives to extend the dredging to Hamilton Avenue did not succeed, but may have influenced an 1896 authorization for a 26-foot-deep channel from 28th to Percival Streets. Completed in 1904, this project created a channel narrowing from 300 to 200 feet in width, linked directly to the Bay Ridge and Red Hook channels. Only in 1952 was federal work to Hamilton Avenue authorized, with a 100-foot-wide, 18-foot-deep channel from there to Sigourney Street, deepening to 30 feet from Sigourney to Percival Streets, and continuing from Percival to 28th Streets at this depth with a channel widening from 200 to 500 feet (U.S. Army 1872-1950: 1881, i, 634; 1889, i, 78-9; 1894, i, 91-2; *New York Times* 1895; Smith, ed. 1919: 66; U.S. Army Corps of Engineers 1988: 14).

9. Gowanus Canal Pollution and the Flushing Tunnel

The Gowanus Canal served as an open sewer even before it was completed for navigation purposes, with the City of Brooklyn laying out sewers emptying into the canal as early as 1858. The 1848 Richards plan upon which all canal construction was based made no provisions for flushing out wastes other than by natural tidal action. This turned out to be wishful thinking. Landfilling and bulkheading contributed directly to shoaling and siltation by reducing channel widths and tidal scouring. By the late 1870s, sewers entering the canal on Bond, President, Sackett, and Centre Streets were creating shoals or bars which disrupted traffic, and the combination of household waste, industrial effluent from gas works and other industries, and material washed into the canal after heavy rains made for increasingly bad water quality as well as widespread aromas which gained regional fame for their foulness. The canal's sewerage was regarded as a public health hazard as well as a navigational issue. Canal-side landowners noted that the city never had the authority to run sewers into the canal, as legislation enabling canal construction referred only to the use of the canal to carry off surface drainage (*Brooklyn Eagle* 1877a, 1877b, 1878b).

Despite these claims, and the city's incomplete plan to run the largest of the sewers (Bond Street) into New York Bay instead of the canal, no action was taken for many years. Whether intentionally or not, ideas raised in the 1880s revived elements of Maj. Douglas' 1847 plans for flushing out the canal, including a tunnel to Wallabout Bay (rejected for expense) and a lock midway along the canal's main line to store and release tidal waters (rejected as an impediment to navigation). A short-lived state commission to review canal conditions in 1889 noted that the canal was largely a private waterway benefiting less than one hundred parties or companies, befouled with sewerage as well as industrial wastes sometimes dumped at night, and an impediment to health and public travel. The commission recommended that the best means of improving the canal was to fill it up, but acknowledging the high cost of buying out the owners of canal-front property, their alternative recommendations were the establishment of municipal control and police of the canal; the "absolute cutting off of all discharges into the canal"; repair of bulkheads, whose often dilapidated condition contributed to uncontrolled run-off into the canal; dredging to hard bottom; construction of flushing gates and conduits for cleansing of the canal; and the replacement of the movable bridges with fixed spans (New York Times 1889a, 1889b; *Brooklyn Eagle* 1889).

In its last years of existence, the City of Brooklyn pursued only one of these measures: building new storm sewers intended to relieve a large surrounding area as well as flush out the canal. The five square miles drained by the Greene Street Sewer project, built 1891-99 with an outlet into the head of the canal off Butler Street, was more than double the area drained by the original Gowanus Creek marsh. The project completed by 1899 included a 17-foot-wide rectangular sewer (equivalent to a 10.3-foot-diameter pipe) near the outlet, which enlarged to a 15-foot-diameter brick sewer ending in a 72-by-100-foot rubble-walled silt and trap basin which spanned the innermost canal end wall. From this basin, one row of 20 three-foot-diameter pipes penetrated a timber bulkhead at the end of the canal. It was soon clear this project was not flushing the canal to any worthwhile extent. Rains heavy enough to provide significant flushing only occurred three or four times a year, and brought in additional unwanted material. Reconstruction of the same project began almost immediately under the Borough of Brooklyn's chief sewer engineer, Henry R. Asserson. Between 1902 and 1904, flow from the Greene Avenue sewer was tapped at two points for entry into the canal: on the east side of the canal at the end of Degraw Street, and at the innermost canal bulkhead as completed *circa* 1899 (Figure 2.12). At Degraw Street, a new 7.5-foot-diameter brick sewer entered a reinforced-concrete, 30-by-60-foot silt and trap basin, from which 13 three-foot-diameter cast-iron pipes in two tiers entered the canal through a pile-supported reinforced-concrete bulkhead with granite block coping (Plate 2.13). At the end of the canal, the silt and trap basin was rebuilt along with the sewers entering the basin, including installation of a new, upper tier of 16 three-foot-diameter pipes through the

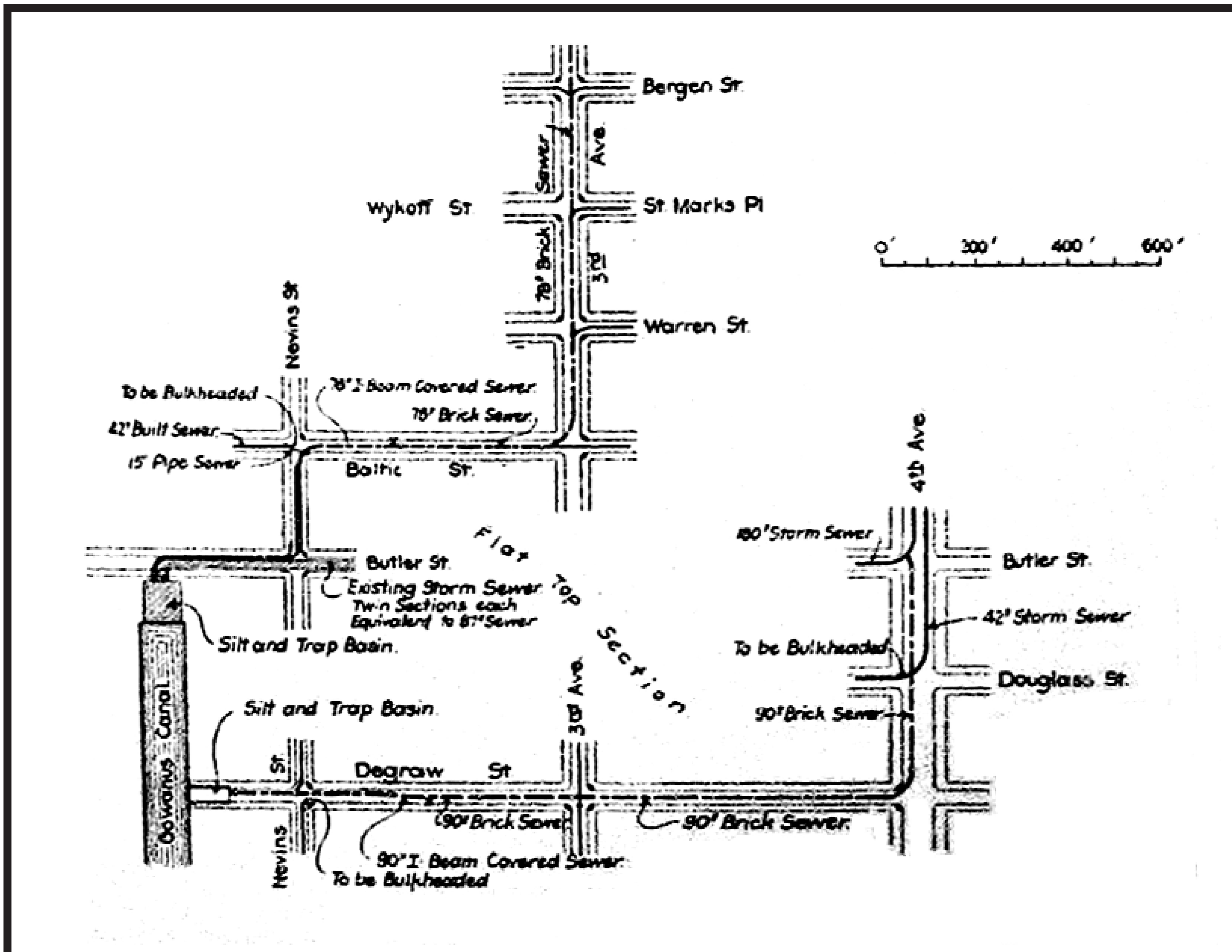


Figure 2.12. Gowanus Canal Assessment of Eligibility: Relief sewers entering Gowanus Canal in 1904. Source: *Engineering Record*, 1904.

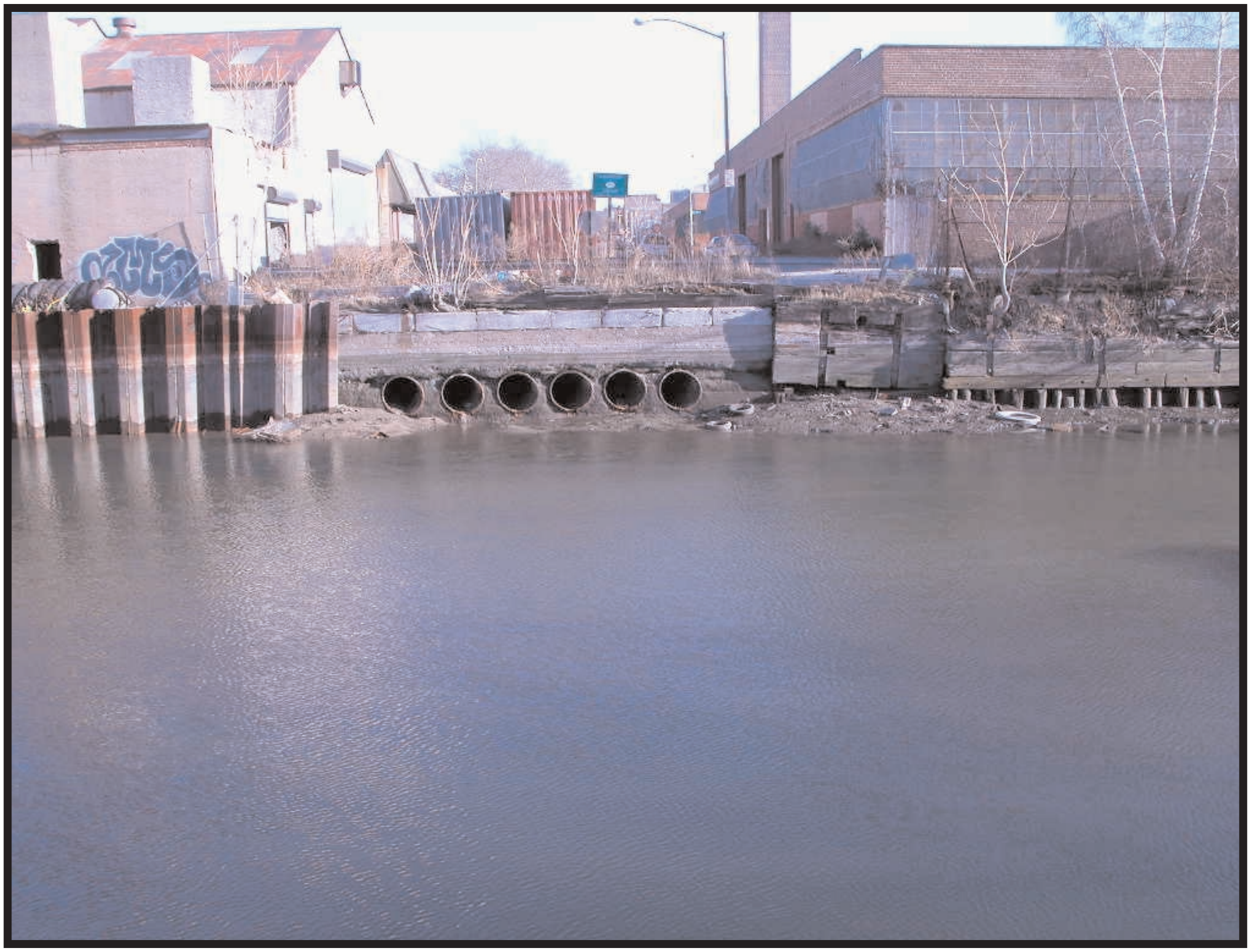


Plate 2.13. Gowanus Canal Assessment of Eligibility: View southeast of storm sewer outlet at Degraw Street (Photographer: Charles Ashton, January 2004) [HRI Neg.# 03070 D3-31].

canal bulkhead wall, which was rebuilt in concrete with a new total of 36 pipe outlets (Plate 2.14; *Engineering Record* 1904).

The work completed in 1904 also failed to flush the canal to any beneficial extent, and the borough's chief sewer engineer Edwin J. Fort immediately began a six-year period of study and construction to create an entirely new flushing system. After reviewing flushing systems used in Milwaukee and Chicago, Fort and his staff recommended removing sewer outlets into the canal and building a flushing tunnel to Upper New York Bay in Buttermilk Channel. Once again, the new work was completed but the sewer outlets remained in place, although storm sewer flow was somewhat reduced by diverting some of the Greene Avenue sewer system into a new Gold Street sewer. The flushing system, built 1905-1911, had two main components: a 6,280-foot-long brick tunnel and a pumping station. After some debate, borough engineers decided to pump water from the canal to the bay, largely to minimize the dispersal of pollutants towards the mouth of the canal and to create a current working to the advantage of loaded barges that almost always moved upstream. The flow direction, as well as the tunnel route, differed from Maj. Douglas' 1847 flushing plan, but Fort and his staff designed the pumping arrangements to allow for reversal of flow if desired (Figure 2.13; *Engineering Record* 1908, 1911).

The tunnel, built through sand by the John Pierce Company and consulting engineer E.C. Moore with a 12-foot internal diameter and 1.33-foot-thick walls, runs primarily under Degraw Street on a flat gradient, with the invert approximately 16 feet below mean sea level and the top of the tunnel nine to 50 feet below the surface (*Engineering Record* 1908). As originally built, the pumping station built by Henry E. Fox had electric-powered equipment and included the following major components (Figure 2.14; *Engineering Record* 1911; Rakos 2002):

- ❖ A 400-hp Westinghouse AC induction motor direct-connected on an eight-inch-diameter steel shaft to a nine-foot-diameter, four-blade, cast-steel propeller. Running at 120 rpm, the propeller was designed to move at least 500 cfs of canal water. The 29-foot-internal-diameter motor pit reached an elevation 10 feet below mean sea level (about 15 feet below the surface), with an outer shell of steel sheet piling almost two feet thick and a two-inch-thick inner lining of concrete. The motor pit center was 44.33 feet from the center of the brick wheel pit, in which the propeller was set in a cast-iron casing. At Fox's suggestion, the propeller casing was installed in a narrowed tunnel section to enhance flow. Propeller blades were removable, allowing for replacement and for reversal of flow if required in the future.

- ❖ In the tunnel, which curved at the pumping station to accommodate the propeller drive shaft, two electric-motor-operated vertical gate valves were installed to cut off the wheel pit if needed. The tunnel between the valves could be drained through a 12-inch pipe connected to a submerged-type centrifugal pump, with the pump in a drainage well that discharged into the canal through a six-inch line (Figure 2.14).

- ❖ A high one-story 67-by-63-foot brick pump house, with a truss-supported gable roof, was built over the motor pit, drainage well, and the northern gate valve. A low one-story, 26-foot-square brick gatehouse was built over the wheel pit and the southern gate valve.

Although the flushing system operated more or less continuously until 1960, pollution and siltation problems in the canal remained severe due to the continued inflow of waste and storm water, and to the relative absence of canal dredging. The propeller drive shaft was disabled in that year when an employee dropped an access manhole cover into the operating system.

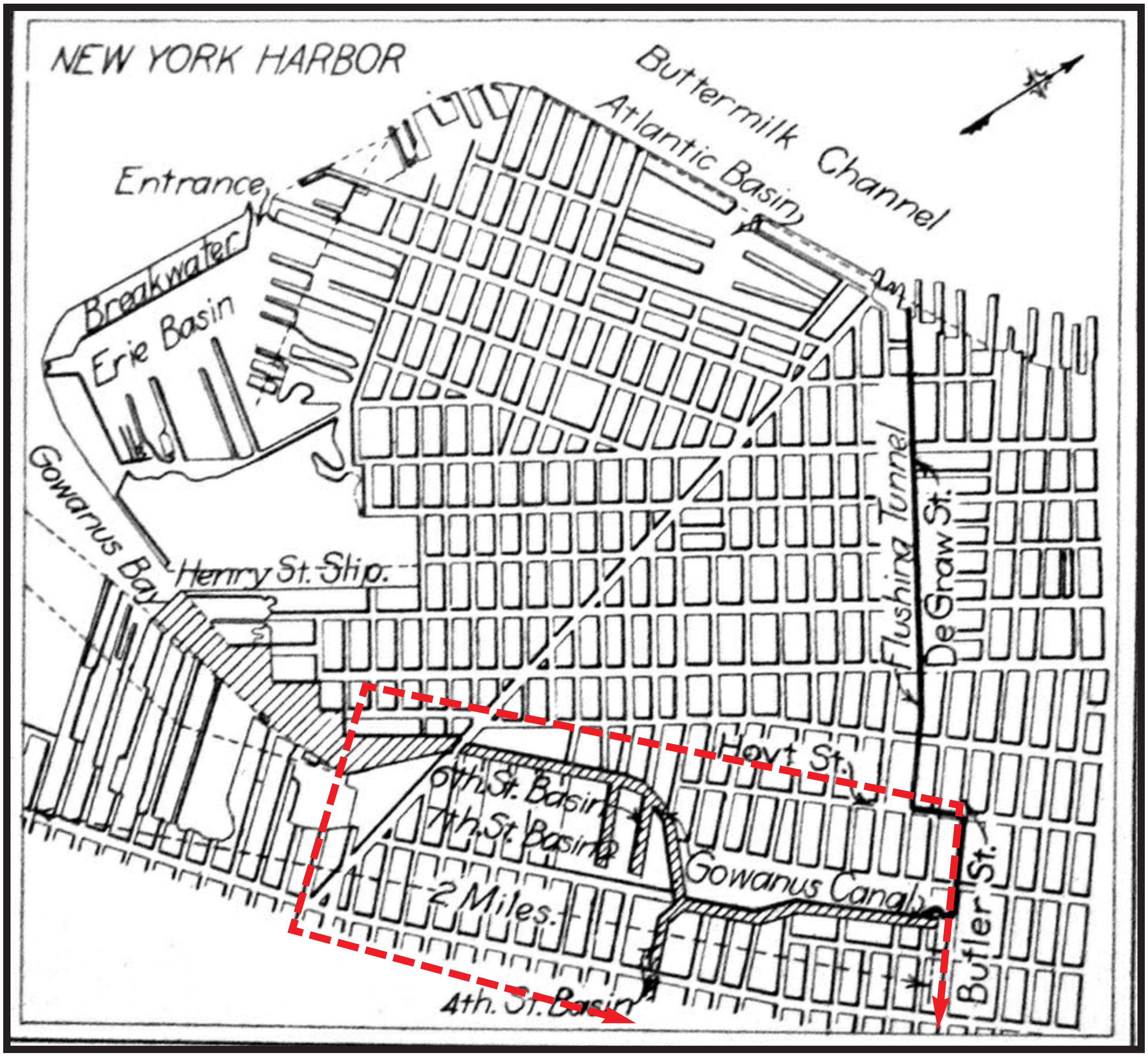


Figure 2.13. Gowanus Canal Assessment of Eligibility: Gowanus Canal And Flushing Tunnel. Scale: 1 inch= 1550 feet (approximately). Project area indicated. Source: *Engineering Record,* 1911.

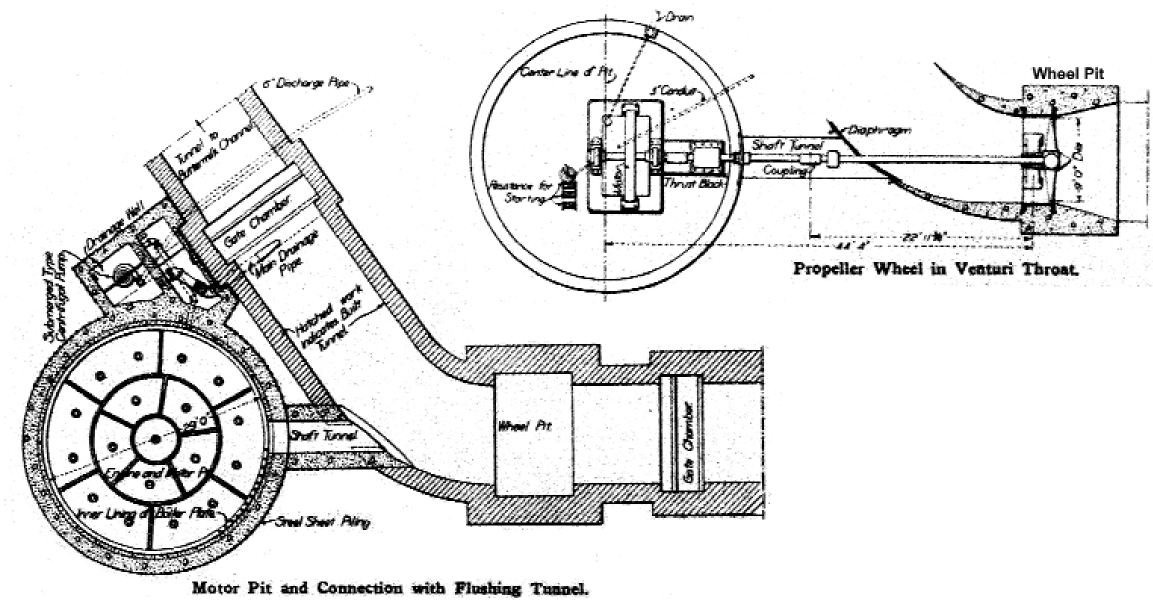


Figure 2.14. Gowanus Canal Assessment of Eligibility: Mechanical Details Under Pump House And Gate House At End Of Flushing Tunnel. Source: *Engineering Record,* 1904. Pump house sits above motor and pump at left; gate house sits above wheel pit at right.

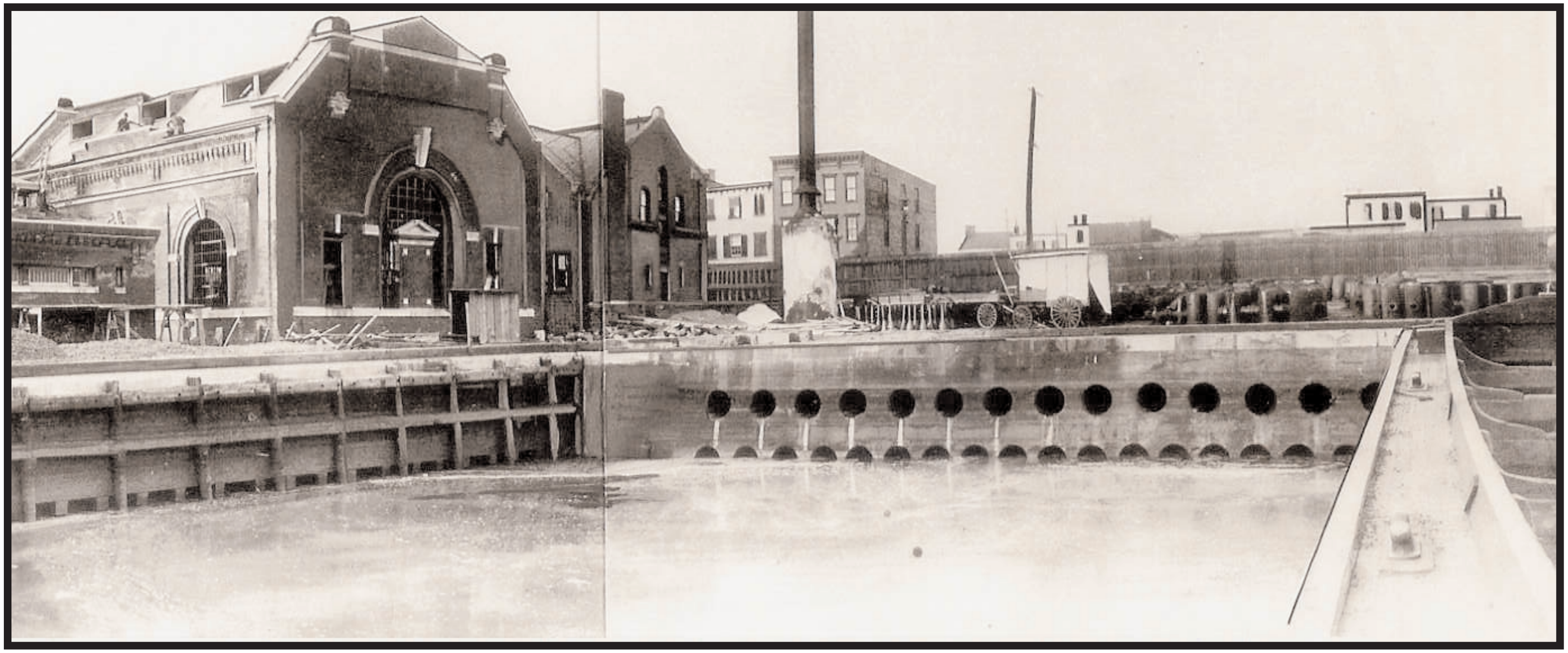


Plate 2.14. Gowanus Canal Assessment of Eligibility: View northwest at the end of the Gowanus Canal, with the Flushing Tunnel Pumping Station nearing completion. 1911. Canal end wall at the center of the view was rebuilt as an outlet for the relief stormwater sewer *circa* 1891-99 and 1904 . Source: Brooklyn Public Library.

The city delayed any repairs, anticipating that a proposed Red Hook Water Pollution Control Plant would finally eliminate wastewater deposits in the canal. The plant did not open until 1987, so that the declining industrial neighborhood around the canal remained plagued by the area's infamous water and odors, and even when in operation the new plant did nothing to restrict the continued inflow of water during heavy storms. The New York City Department of Environmental Protection began designing a flushing system reconstruction in 1992, completing the work between 1995 and 1999. Much of the original operating equipment was removed or refurbished. With very limited canal traffic and more controls over polluted water inflows, the principal 1904 rationales for flushing water from the canal no longer applied, and the new system pumps an average of 200 million gallons a day from Buttermilk Channel into the canal. About 2,000 cubic yards of polluted sediment was removed from the head of the canal before reactivating the system, to preclude dispersing the material into the waterway. Since stormwater continues to flow into the head of the canal at Degraw and Butler Streets, a boom was set across the canal just downstream of these outlets and the surface is periodically skimmed of floatable debris. The 100-foot-wide outlet at the innermost canal wall was rebuilt sometime in the 20th century with more restricted flow (City of New York 1999; Rakos 2002).

The reconstruction of the flushing system, and the decline of canalside industry, has somewhat ironically revived one of Maj. Douglas' plans after more than 150 years, with relatively clean seawater maintaining water quality in a waterway which functions more as a surface drainage system than a transportation canal. As discussed in Chapter 3, much of the historic industrial character of the canal remains intact despite these changes.

Chapter 3

FIELD RESULTS AND RESOURCE INTEGRITY

A. FIELD METHODS

The study area was visited twice in the course of this investigation. On November 5, 2003 staff from Hunter Research, Raber Associates and the U. S. Army Corps of Engineers traveled the entire navigable length of the main canal at low tide on the Corps vessel *Hocking*, as far as a floating boom north of Union Street. The less navigable 4th Street basin was also inspected to its terminus at the Third Avenue bridge in a Corps Boston whaler. The canal, its related features such as bridges, and canal-side environs were recorded with field notes and approximately 150 digital and 35mm. photographs.

This field visit was complemented by a land-based survey on January 9, 2004 by Hunter Research, accompanied by Corps staff. The purpose of this visit was to inspect and photographically record those buildings having direct historical links to the Canal and its role in the development of South Brooklyn. A total of seven sites emerged from this two-pronged survey approach, discussed below in section C.

B. ANALYSIS AND INTEGRITY OF THE GOWANUS CANAL AS A WATERWAY

Field data and a recent aerial photograph were used to compile a graphic inventory of existing canal conditions (Figure 3.1). Comparison of this inventory to historical maps, information on canal construction discussed in Chapter 2, and available information on comparable bulkhead structures allowed for a detailed appraisal of canal integrity.

1. Canal Alignments

The canal can, somewhat arbitrarily, be divided into three types of alignments which have different degrees of integrity:

- ❖ Outshore of Hamilton Avenue, the canal channel extended approximately 1100 feet to a point opposite Percival and 17th streets, and widened from 100 to 300 feet. Although it is difficult to determine the nature and extent of bulkheading in this section by 1870, when the Gowanus Canal Improvement Commission ceased work, historical maps suggest that bulkheads totaling approximately 2,150 linear feet were in place by 1880 (Bromley and Robinson 1880; Sanborn Map and Publishing Company 1886). Except for a 200-foot-long section of shoreline cut back on the east side of the channel *circa* 1980-1995, the outer canal channel configuration remains intact. For the present study, review of bulkhead conditions in this section began at about 16th Street, and included a total of approximately 1,460 linear feet which retains historical alignments.

- ❖ The main section of canal, completed by 1870 from Hamilton Avenue to a point between Douglass and Butler streets, retains all of it original alignment and 100-foot wide channel. The channel is approximately 5,470 feet long and includes 11,200 linear feet of bulkhead.

- ❖ The six private basins, built off the east side of the main canal *circa* 1868-1915, originally had channels totaling approximately 2,800 feet in length with about 6,200 linear feet of bulkhead. The 1st and 5th Street basins were filled in *circa* 1953-

1965, leaving approximately 1,990 feet of channel and 4,365 linear feet of bulkhead, or about 70% of the original basins (see above, Figure 2.10; U.S. Army Corps of Engineers 1953, 1965).

Over 90% of the original Gowanus Canal alignments thus remain open as waterways, although navigability varies considerably within these channels. The 4th Street basin is the least navigable section.

2. Canal Bulkheads

There appear to be three principal types of canal bulkheads, in varying conditions:

- ❖ Timber cribwork, in many places with upper sections deteriorated, replaced with concrete, and/or covered with rip-rap;
- ❖ Concrete bulkheads or relieving platforms, including all five bridge abutments; and
- ❖ Sheet piling of timber or steel.

Although canal history reviewed in Chapter 2 indicates timber sheet piling was common from the earliest period of construction in the 1850s into the early 20th century, it appears that timber cribwork was the preferred and principal type of Gowanus Canal bulkhead beginning in the mid 1860s, and probably replaced most of the early sheetpile construction. All or virtually all of the present timber sheetpile walls appear to be of 20th-century vintage. As summarized below, cribwork comprises over 70% of remaining bulkheads, even where modified or not visible at low water.

a. Timber Cribwork Context

From the colonial period until *circa* 1930, much bulkhead construction throughout the Port of New York involved timber cribwork. When timber was relatively inexpensive, cribwork was a cheap form of bulkhead requiring only hand tools after any dredging phases. Until perhaps the second quarter of the 19th century, timber bulkhead construction was diverse, and remains incompletely documented with no well-defined regional patterns. Fill materials occasionally included wooden vessels (e.g., Louis Berger & Associates, Inc., 1990). By the mid-19th century, there was probably more design standardization. Cribwork construction of the mid-19th century and later involved spiking together logs in alternating perpendicular rows forming square or rectangular cells. Arranged in lines or grids, these cells commonly measured five to eight feet on a side, and from about seven to eight feet in height. Empty cribwork units could be floated into place and sunk as fill was added. Some cells, probably at the bottoms of cell units, had plank flooring to hold enough fill material to sink the structure; builders added more fill once the cells were in place to form a solid bulkhead. Cribwork often reached to between 20 and 25 feet below mean low water, and extended to about 10 feet above this elevation. In section, cribs below mean low water typically extended to widths of 20 to 25 feet, sometimes tapering on the exterior or both faces as they rose. Above mean low water, crib widths in section narrowed to about 15 feet. These dimensions apply to average traffic and harbor bottom conditions; some railroad piers carrying heavier loads included cribwork 55 feet wide at bottom, 40 feet wide at top and over 40 feet high. Fill material in cribwork bulkheads extended behind the timbers to the height of the bulkhead, and aside from dredged sand and silt could include demolition debris and stone. Being very open sided, cribwork construction worked best with coarse fill. Square timbers, spiked or bolted together in a smooth, continuous face and fitted onto notched cribwork logs, formed the outer face of the bulkhead above mean low water in most cases. Stone faces were far less common. The upper horizontal surface of the bulkhead varied from packed earth to timber or stone. Although this study found limited documentation of Gowanus Canal timber bulkheads, the chronol-

KEY TO BULKHEAD TYPES

TC-I	Timber Cribwork with Intact Faces above mean low water	TC-CON	Timber Cribwork with Concrete replacement/infill above mean low water
TC-N	Timber Cribwork with New/Recent sections above mean low water	RIP	Rip-rap slope, probably on timber cribwork collapsed above mean low water
TC-D	Timber Cribwork with Deteriorating but visible sections above mean low water	CONC	Concrete wall or relieving platform
		SSP	Steel Sheet Piling
TC-C	Timber Cribwork with Collapsed sections above mean low water	TSP	Timber Sheet Piling

Figure 3.1. Gowanus Canal Assessment of Eligibility: Aerial Photograph Showing Existing Wall Conditions on the Gowanus Canal. Source: U.S. Army Corps of Engineers, 2003

ogy of canal construction and surface inspection suggest the canal's timber cribwork walls followed the typical designs outlined above. Cribwork installed for some of the private basins were reported as being 20 feet wide at bottom, reaching five feet above mean high water (*Brooklyn Eagle* 1870b; Greene 1917: 52-56; Raber *et al*. 1983: 46-51). Repairs to Gowanus Canal cribwork above mean low water during the last half century have included infill with concrete blocks or poured concrete.

It is usually difficult to date cribwork bulkheads without documentary evidence or archaeological recovery of some types of fill (e.g., demolition debris). For the era prior to more standardized designs, variations in timber joining methods have been identified as sources of potentially significant information (Louis Berger & Associates, Inc., 1990). For all periods, cribwork bottoms should also be regarded as especially important. Cribwork bulkheads were most secure when fitted to bedrock or other very hard bottoms. If not soundly installed—as was often the case with smaller private waterfront development projects—cribwork in bulkheads or in block-and-bridge piers tipped or sank. Building in sand or silt bottoms, where bedrock or clay was more than about 25 feet below mean low water, required dredging and other construction bottom surface preparations to counteract these problems, steps usually characteristic of only larger commercial or industrial ventures. Piles driven below cribwork sometimes sufficed in deep or soft bottoms, as did continuous rows of logs across the bottom of the cribwork. Cribwork bottoms are highly variable, poorly documented, and tend to remain well preserved under water. By contrast, periodic replacement of all components subject to decay above mean low water complicates any identification of extant cribwork bulkheads with particular decades, and minimizes the significance of these upper elements (Greene 1917: 52; Raber *et al*. 1983: 46-51). All available accounts of Gowanus Canal wall construction, including some for concrete bulkheads, indicate that the canal walls rested on piles driven into clay below silty marsh deposits (e.g., *Brooklyn Eagle* 1869a; Stiles 1926). Dredging may have accompanied some of this construction.

b. *Concrete and Steel Bulkheads*

In some places, low-water surface inspection was inconclusive as to whether visible concrete walls were resting on cribwork foundations or were entirely concrete bulkhead resting on piles. In many parts of the Port of New York, concrete bulkheads were relieving platform designs, first developed in this region shortly after 1900 by some of the railroads and perhaps derived from the masonry river walls of the Department of Docks. A major advantage of this form was its fire resistance, since timber elements above mean low water were replaced by concrete and fill material. Typical examples consisted of pile-supported timber and/or concrete sub-decks below mean low water, above which concrete block formed the bulkhead face and supported the outer edge of an upper concrete deck or paving; the space between the two decks was earth fill. In some areas, such as the Brooklyn waterfront south of Fulton Street repaired by the New York Dock Company *circa* 1915-1950, concrete bulkheads were appended to older cribwork in several ways. The new work generally extended beyond the old about 20 feet, and often included riprap in front of the cribwork and among the new piles to preclude cribwork slumping. For cribwork bulkhead repair, there were varied means of actually tying the new work to the old. The new piles could be driven in front of the cribwork, or through it, with some or all of the relieving platform resting on cribwork remains. Later in this period, steel sheet piling driven behind the new piles gave added stability to the interface, with the steel piling tied back to concrete blocks at the rear of the upper deck. Steel piling tended to replace the timber pile supports and the subdecks completely after World War II, in the form of inner and outer sheetpile surfaces tied to each other, or an outer surface tied to a new anchor pile. Repairs over the last half century have also included use of steel H-piles under relieving platforms. Given their extensive documentation in published and unpublished engineering sources, and their very wide distribution in the Port of New York, 20th-century bulkhead structures are usually not eligible for the National Register of Historic Places unless associated with other significant resources (Raber *et al*. 1983: 51-4, 70-2; 1984). The Gowanus Canal was too narrow to allow for appending relieving platforms to the front of older cribwork, but it is possible that relieving platform variations were installed on cribwork sections cut down to mean low water (e.g., Plate 3.1).

c. *Inventory of Bulkhead Conditions*

Table 3.1 summarizes existing bulkhead conditions based on low water inspection. Bulkhead locations are shown in Figure 3.1. Bulkheads with confirmed timber cribwork components total 69% of inspected project areas, with probable cribwork foundations covered with rip-rap comprising another 4% (Plates 3.2 to 3.9).

3. Flushing System

As discussed in Chapter 2, much of the original operating equipment at the Gowanus Canal pumping station was removed or refurbished in the late 1990s, but the two original buildings are otherwise intact. Except for two or three locations in the flushing tunnel repaired with concrete or shotcrete at this time, the original brick tunnel is also intact (Plate 3.10; City of New York 1999; Rakos 2002; personal communication, Lynn Rakos).

4. Bridges

As discussed in Chapter 2, all local road bridges over the main line of the Gowanus Canal have been substantially rebuilt within the last sixty-five years except the restored 1889 retractile crossing at Carroll Street, a New York City Landmark and eligible for the National Register of Historic Places (Plate 3.11). The other four road bridges have recently been determined not eligible for the National Register (Parsons Brinckerhoff Quade & Douglas, Inc. 2003).

The Third Avenue Bridge was heavily rebuilt in 1889 but retained the same navigable width between longer, higher abutments, as described in Chapter 2. This bridge, which once separated the 4th and 5th Street basins and is now the extreme eastern end of Gowanus Canal waters, remained an important component of local navigation until after World War II. Although the roadway and perhaps the deck supports have been altered since 1889, the abutments appear to date from this reconstruction (Plate 3.12).

The dense industrial landscape and marshy substrate of the canal vicinity led to construction of two high-level canal crossings: the 1933 IND steel trestle for the Smith-9th Street Station on the F and G lines, and the Gowanus Expressway built *circa* 1947-1964. The 4,400-foot-long trestle, built over the 9th Street Bridge with much concrete-covered steelwork, reaches over 100 feet high and includes a truss section above the canal. The expressway, built over the Hamilton Avenue Bridge on arched concrete piers, is about the same height (Plates 3.13 to 3.16).

5. Summary of Canal Integrity

As a historical waterway, the Gowanus Canal retains over 90% of its original channel design, locations and widths, including 100% of the original main canal. More than two-thirds of the channel walls are timber

Table 3.1. Gowanus Canal Bulkhead Conditions, 2003.

BULKHEAD TYPES	MAIN CANAL	BASINS	HAMILTON AVE-- 16th STREET	TOTALS
TIMBER CRIBWORK: INTACT OR NEW	4800 ft (42%)	2420 ft (55%)	340 ft (23%)	7560 ft (44%)
TIMBER CRIBWORK: COLLAPSED OR DETERIORATING	1340 ft (12%)	1350 ft (31%)		2690 ft (16%)
TIMBER CRIBWORK: CONCRETE INFILL/ REPLACEMENT ABOVE MEAN LOW WATER	1310 ft (12%)		200 ft (14%)	1510 ft (9%)
RIP-RAP ON PROBABLE DETERIORATED TIMBER CRIBWORK	180 ft (2%)		520 ft (36%)	700 ft (4%)
SUBTOTAL: KNOWN/PROBABLE TIMBER CRIBWORK	7630 ft (68%)	3770 ft (86%)	1060 ft (73%)	12,460 ft (73%)
CONCRETE/BRIDGE ABUTMENTS	1580 ft (14%)	75 ft (2%)		1655 ft (10%)
TIMBER OR STEEL SHEET PILING	1990 ft (18%)	520 ft (12%)	400 ft (27%)	2910 ft (17%)
TOTALS	11,200 ft (100%)	4365 ft (100%)	1460 ft (100%)	17,025 ft (100%)

Plate 3.1. Gowanus Canal Assessment of Eligibility: View south of recent bulkhead at 14th Street, with concrete face above possible cribwork cut off at the mean low water mark (Photographer: Thomas Flagg, November 2003).

Plate 3.2. Gowanus Canal Assessment of Eligibility: View southeast of the 11th Street basin (Photographer: Thomas Flagg, November 2003) [Source: Raber Associates].

Plate 3.3. Gowanus Canal Assessment of Eligibility: View northeast of intact timber cribwork bulkhead near the head of the 7th Street basin (Photographer: Thomas Flagg, November 2003) [Source: Raber Associates].

Plate 3.4. Gowanus Canal Assessment of Eligibility: View east towards the head of the 6th Street basin (right of view) and Bond Street (right background), with concrete bulkhead and gas pipe tunnel crossing (left of view) and intact timber cribwork bulkhead (right of view) (Photographer: Thomas Flagg , November 2003) [Source: Raber Associates].

Plate 3.5. Gowanus Canal Assessment of Eligibility: View southeast of the 6th Street basin. A steel sheetpile bulkhead is seen at the right of the view, with a collapsing timber bulkhead visible beyond (center right of view). An intact timber bulkhead (center left of view) and a steel bulkhead (left) can also be seen (Photographer: Thomas Flagg , November 2003) [Source: Raber Associates].

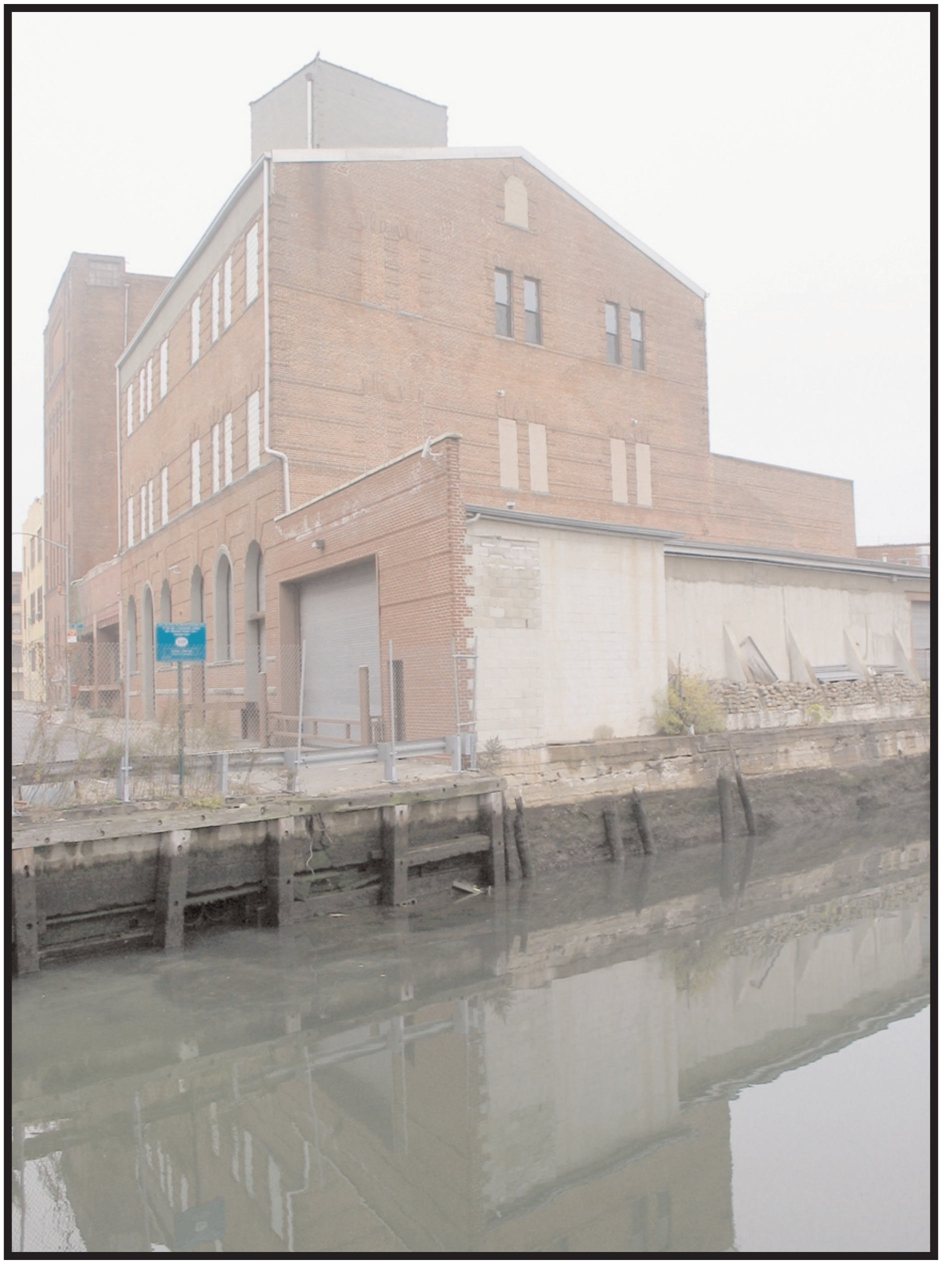


Plate 3.6. Gowanus Canal Assessment of Eligibility: View northeast at Bond Street, showing several types of concrete bulkheads of concrete additions to timber cribwork bulkheads. The circa 1900 building at the center of the view was formerly used by an ice company and a brewery, but probably not serviced by the canal (Photographer: Thomas Flagg November 2003) [Source: Raber Associates].

Plate 3.7. Gowanus Canal Assessment of Eligibility: View east of steel sheetpile bulkhead and crushing plant at the junction of the main canal (left of view) and the 4th Street Basin (Photographer: Thomas Flagg , November 2003) [Source: Raber Associates].

Plate 3.8. Gowanus Canal Assessment of Eligibility: View north of deteriorating timber crib-work bulkheads at the end of 2nd Street, with the surviving component of the circa 1918-21 Foreman Blades Lumber complex visible in background (Photographer: Thomas Flagg , November 2003) [Source: Raber Associates].

Plate 3.9. Gowanus Canal Assessment of Eligibility: View northwest of the intact timber crib-work bulkhead at the end of 1st Street, with a 1916 concrete oil terminal structure (Photographer: Thomas Flagg, November 2003) [Source: Raber Associates].

Plate 3.10. Gowanus Canal Assessment of Eligibility: View northeast towards the end of the canal, with timber sheetpile (right) and steel sheetpile (left center) bulkheads, and concrete bulkhead at the end of the canal (left) (Photographer: Thomas Flagg, November 2003) [Source: Raber Associates].

Plate 3.11. Gowanus Canal Assessment of Eligibility: View north of the Carroll Street Bridge (Photographer: James Lee, November, 2003)[HRI Neg. # 03070 D1-46].

Plate 3.12. Gowanus Canal Assessment of Eligibility: View southeast of Third Avenue Bridge. The filled 5th Street Basin is visible in the background (Photographer: Thomas Flagg, November 2003) [Source: Raber Associates].

Plate 3.13. Gowanus Canal Assessment of Eligibility: View northeast of the Gowanus Canal, 9th Street bridge and the trestle for the F and G Trains. 1952. Taken from the new Gowanus Expressway overpass, this view also includes the Cirillo Bros. Coal & Fuel Co. at left, Cranford Co. concrete & asphalt plant at left just beyond covered lighter in 11th Street Basin and a number of tugboats, covered lighters, and hold barges. Source: Brooklyn Public Library.

Plate 3.14. Gowanus Canal Assessment of Eligibility: View northeast near the 11th Street basin showing concrete additions to the cribwork bulkhead face (left) and new timber face on cribwork bulkhead (right). The New York Transit Authority trestle is visible in the background (Photographer: Thomas Flagg , November 2003) [Source: Raber Associates].

Plate 3.15. Gowanus Canal Assessment of Eligibility: View North of the former S.W. Bowne grain warehouse (Photographer: James Lee, November 2003) [HRI Neg. # 03070 D1-02].

Plate 3.16. Gowanus Canal Assessment of Eligibility: Oblique aerial view looking east of the lower portion of the canal. The New York Transit Authority trestle is at center (Photographer: Thomas Flagg, 1988) [Source: Raber Associates].

cribwork, with portions below mean low water most likely dating to canal construction beginning *circa* 1866 and ending sometime in the early 20th century. The general design, materials, and workmanship of the canal walls through the waterway's industrial history retain much integrity from this era. The substantially intact 1904-1911 flushing system, although not a complete success during the industrial period of canal history, contributed to canal operations and maintenance of local health. Two bridge crossings, at Carroll Street and Third Avenue, retain most or all of their integrity from the period of active canal industrial use. The other four local bridges no longer have this character, and the two high-level crossings have limited direct association with the canal except as part of a more general set of construction obstacles within the former Gowanus Creek drainage.

C. HISTORIC SITES AND STRUCTURES ALONG THE CANAL (FIGURE 3.2)

1. Site of Denton's Mill (Yellow Mill)

Denton's Mill was mapped as late as 1849 (and sketched in 1850) just before it was engulfed by onrushing development. It was about a half-block east of the main stem of the canal, south of Carroll Street.

The site today is occupied by a modern, three-story metal-sided building (Plate 3.17). Fire insurance maps show that by 1886 the site was occupied by the Watson and Pittinger Lumber Yard (whose facility also occupied the opposite bank of the canal, below Carroll Street) and the "Philp" (*sic*) Paper Mill, the latter named in 1889 by the Gowanus Canal Commission as the canal's sixth greatest polluter. By 1904, the paper mill had been replaced by the Loomis lumberyard; in 1915 this company also occupied what had been Watson and Pittinger's. The 1938 map shows what appears to be the present building on the Watson and Pittinger's site, its occupant engaged in the manufacture of printing ink, and the paper mill site held a sand and stone dealer. By 1950 the sand and stone dealer was gone. The 1969, 1977, 1986 and 1996 maps show a plastics company in the ink manufacturer's building.

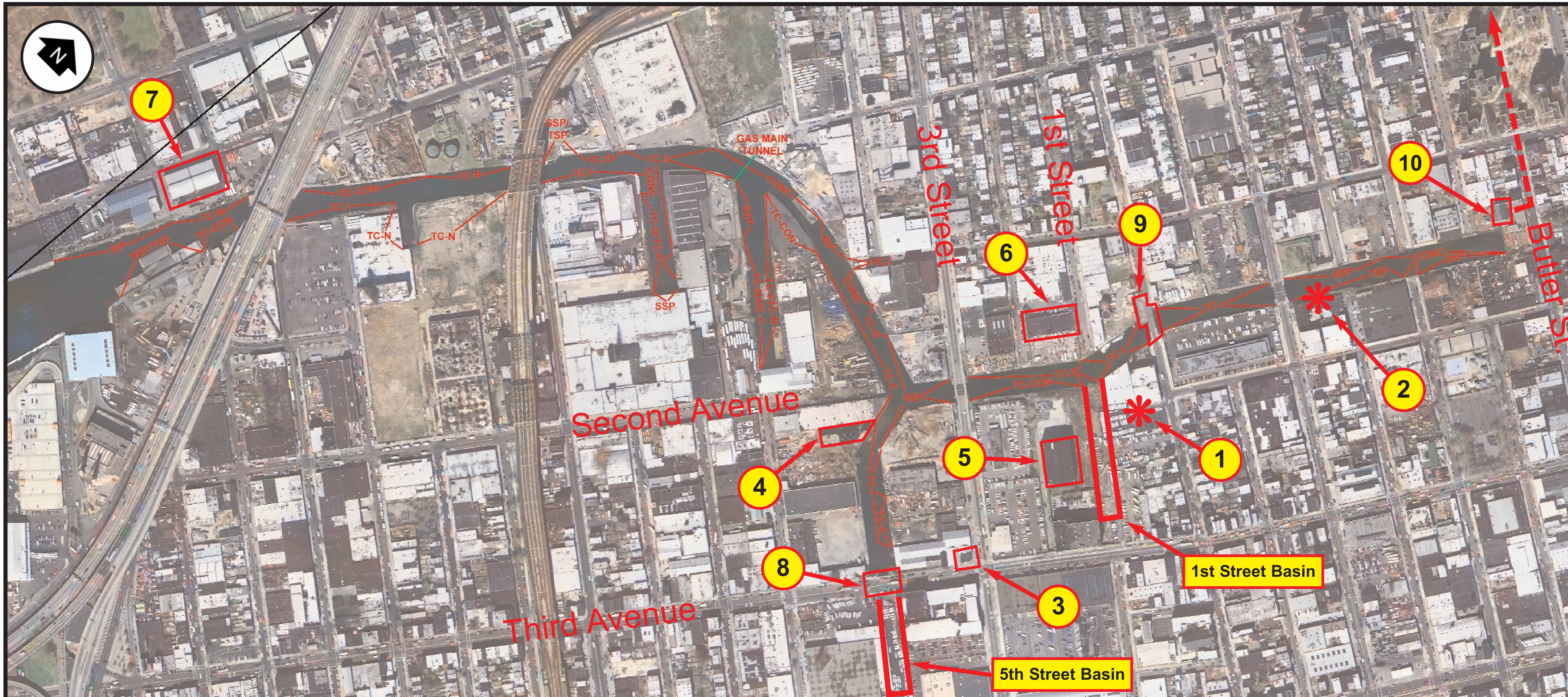
Given the site's history of redevelopment, not surprisingly no surface indications of the mill or dam were noted. The building on the site is architecturally undistinguished.

2. Site of Freeke's Mill (Old Gowanus Mill)

By reference to the maps discussed in the previous chapter, and information provided by 19th century historians, Freeke's Mill is believed to have stood just north of Union Street, probably either where the canal main stem now flows and/or on the east bank. The site is shown in Plate 3.18.

The mill was standing at the time of Lossing's visit in 1850, but he refers to its destruction in the past tense. The site was mapped in 1886 as "Adams' Lime, Brick and Lath Yard," virtually devoid of buildings. By 1904 there were buildings on the site set back from the canal; the immediate bank held "lumber in piles." Additional detail on the 1915 map reveals this to have been a packing case manufacturer. The 1950 fire insurance map shows a "Beverage Warehouse" on the canal bank; this is apparently the structure still on the site.

As is the case at the site of Denton's Mill, no surface indications of the former presence of Freeke's Mill were noted. The structure is an undistinguished brick building, approximately two stories, with a band of steel-framed windows.



1 Approximate Site of Denton's Mill

2 Approximate Site of Freeke's Mill

3 Brooklyn Improvement Company Office Building

4 Burns Bros. Coal Pockets

5 Former Brooklyn Rapid Transit Power House

6 Foreman Blades Lumber

7 S.W. Bowne Grain Storehouse

8 Third Avenue Bridge

9 Carroll Street Bridge

10 Pumping Station

Flushing Tunnel

Figure 3.2. Gowanus Canal Assessment of Eligibility: Aerial Photograph Showing Historic Sites and Structures in the Vicinity of the Gowanus Canal. Note: For clarity only a segment of the alignment of the flushing tunnel is shown. The complete alignment is shown in Figure 2.13. Source: U.S. Army Corps of Engineers, 2003.

Plate 3.17. Gowanus Canal Assessment of Eligibility: View East on Carroll Street approximately at the site of Denton's Mill (Photographer: Charles Ashton, January 2004) [HRI Neg.# 03070 D3-25].

Plate 3.18. Gowanus Canal Assessment of Eligibility: View Northeast approximately at the site of Freeke's Mill (Photographer: James Lee, November 2003) [HRI Neg.# 03070 D1-57].

3. Litchfield Office Building, 360 Third Avenue (corner of 3rd Street)

This small yet noticeable structure is known locally as having been the office of Edwin C. Litchfield, the power behind the Brooklyn Improvement Company (developer of much the land surrounding the Gowanus Canal) (Plate 3.19).

An 1880 atlas is ambiguous as to whether or not there is a building on the site, and Boyd's Directory (1873) includes a listing for the Brooklyn Improvement Company at "3d c. 5th ave." However, an 1897 directory lists the company at "3d c 3d av." It is shown on the 1886 fire insurance map. In 1904 it was labeled "Office," surrounded on two sides by a coal yard that fronted on the Fourth Street Basin (Bromley 1880; Boyd 1873; Lain 1897; Sanborn 1886, 1904).

Architecturally this is one of the most interesting structures in the study area, and is distinctly Renaissance Revival in feeling. It embodies many stylistic features found on the brownstone rowhouses built on Litchfield lands nearby. The building is brick with stone trim, two stories high and three wide. The visual focus of the façade is the arched central entry on Third Avenue, reached by a grand stair and framed by an Ionic portico. The cornice of the entry portico extends across the full width of the façade separating the first floor from the second. Rusticated stone quoins define the bays and the corners of the building. Windows are arched, with the exception of the central window on the second floor, which is rectangular. All are in elaborate stone surrounds. A narrow string-course connects the sills of the second floor windows. The style of the building and the appearance of the top of the building suggest that a major cornice originally capped the facade.

4. Burns Bros. Coal Pockets, Fourth Street Basin

Starkly utilitarian in their straightforward, unornamented design, this group of 18 coal storage silos stands on the south bank of the 4th Street Basin near Second Avenue and the main canal (Plates 3.20 and 3.21).

The original group of eight pockets—those nearest the basin—was built sometime between 1915 and 1924. Between 1932 and 1938, ten more were added behind the original group. All are elevated on concrete legs to provide 15 feet of clearance below. A note on the 1938 (and subsequent) insurance map indicates that there was originally an iron-clad conveyor shed atop the group, and there was an iron-clad boiler and winch house atop the pair nearest the water. The original group is 40 feet tall, the later ones 50 feet.

In 1938 there was a garage on the property between Burns Bros. and Second Avenue, but by 1950 both parcels were listed as Burns Bros. The area between the pockets and the street was occupied by "Coal piles." By 1969 there was no mention of Burns Bros. On the map, the parcel where the pockets stand was labeled "Truck rental," and the adjacent parcel held a Sanitation Department garage built in 1957 (Sanborn 1938, 1950, 1969).

Coal was one of the materials essential to urban life in the 19th and early 20th centuries, and was one of the major commodities that was shipped on the canal. Besides domestic heating and cooking, coal was also used to produce gas and, later, burned to generate electricity. Coal pockets were used to off-load coal from one type of vehicle—barges, in this case— and, using gravity, transfer it to smaller vehicles such as wagons or trucks for local delivery. Elsewhere in the country coal pockets typically were elevated railroad sidings designed to accommodate delivery by hopper cars, but in the case of Burns Bros., equipment pow-

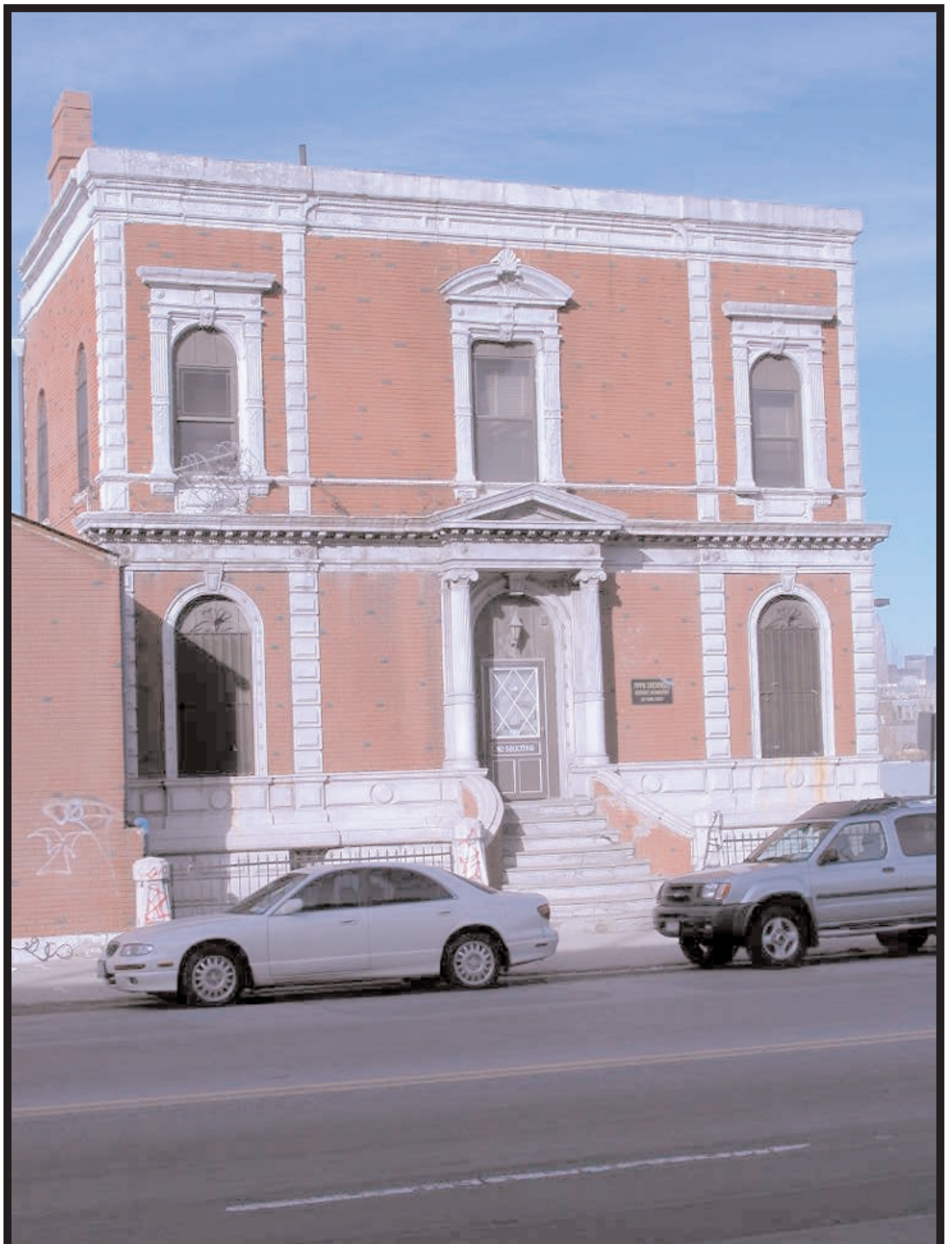


Plate 3.19. Gowanus Canal Assessment of Eligibility: View North of Brooklyn Improvement Company Office Building. (Photographer: Charles Ashton, January 2004) [HRI Neg.# 03070 D3-09].

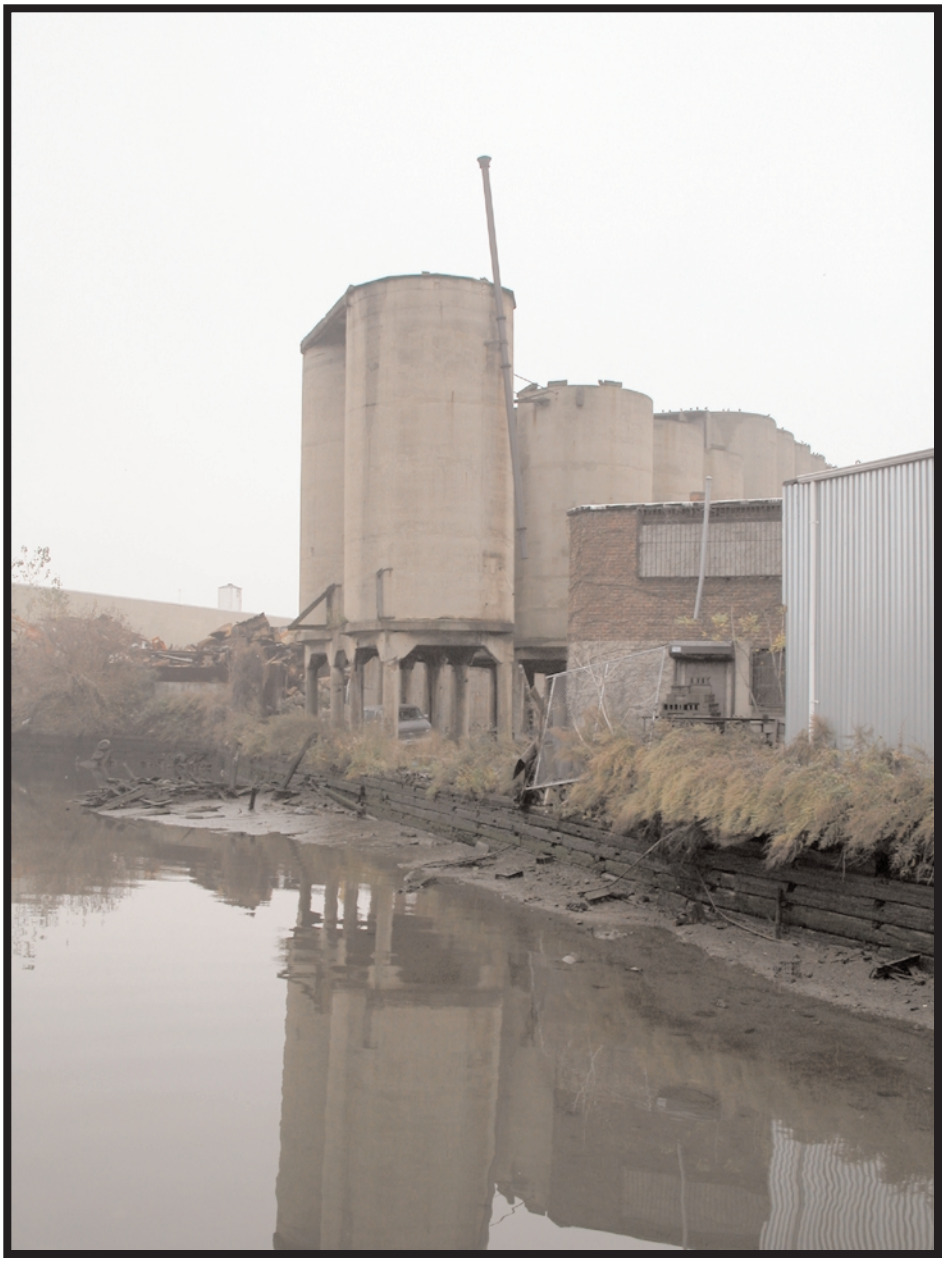


Plate 3.20. Gowanus Canal Assessment of Eligibility: View southeast of Burns Bros. Coal Pockets (Photographer: James Lee, November 2003) [HRI Neg.# 03070 D1-32].

Plate 3.21. Gowanus Canal Assessment of Eligibility: View southwest of Burns Bros. Coal Pockets and timber cribwork bulkhead near the head of the 4th Street Basin (Photographer: Thomas Flagg, November 2003) [Source: Raber Associates].

ered by the boiler presumably elevated coal from barge holds into the concrete pockets, from which trucks below were filled.

5. Former Brooklyn Rapid Transit Power House, east of the canal, north of 3rd Street

This impressive brick Romanesque Revival building is a visual landmark in the canal neighborhood, looming as high as an eight-story building although the elevations reflect the three interior galleries. (Plate 3.22). It is nine bays wide on the Third Street façade, five facing the canal. Each bay is topped by a corbelled round-headed arch; corbelled quoins define the corners of the building. It is apparently unused.

The building is but a remnant of a larger complex built in 1902 and described in some detail on the 1904 Sanborn fire insurance map. This building is labeled as the Dynamo Room, with four galleries. Next to it toward the 1st Street Basin was a two-story boiler building with a coal pocket in the roof. Two more boiler buildings and a smaller dynamo building fronted on Third Avenue, and a 125-foot smokestack dominated. On the canal bank were a coal elevator and a cement coal pit, linked by tracks. A cement tunnel led from the coal pit to the larger boiler building. A note on the map described its operation: " Coal is fed automatically to boilers by chutes from coal pocket in roof of boiler ho[use]. Coal is carried to pocket by endless eye-bar cables and iron buckets through tunnel from coal pit." The entire parcel was labeled "Brooklyn Rapid Transit R. R." By 1915 a water softening plant had been added at the corner of 2nd Street and Third Avenue, but it was not in operation. Additional coal-handling equipment had been added canal-side., and the site was identified as "Brooklyn Rapid Transit R. R. Power Ho." (Sanborn 1904).

By 1938 it had become the "Williamsburg Power Plant Corp. Central Power Sta." The smaller boiler buildings were gone, the water softening plant had become a lumber company, and the smaller dynamo building was vacant. By 1950 only the existing dynamo building and the smokestack remained, although the smaller dynamo house was being used for steel drum renovating and storage by another owner. By 1969 the dynamo building stood alone, surrounded by a voltage switching yard. A new building (1959) stood on Third Avenue containing cable vaults and frequency changers. That building became the Jewish Press by 1977, leaving the massive 1902 brick building as the sole surviving structure on the site related to its power-generating past (Sanborn 1938, 1950, 1969, 1977).

Most of the area between Third Street and 2nd Street was part of the property in 1915; it was labeled "Brooklyn Rapid Transit," and it was completely occupied by a coal pile and a conveyor. It was still a coal pile in 1938, but by 1950 contained scattered buildings.

The Brooklyn Rapid Transit Corporation, or BRT, was the forerunner of the Brooklyn-Manahattan Transit or BMT. It was a holding company, formed in 1896, and by the turn of the century owned every steam railroad, elevated line and streetcar line in Brooklyn except one (which held out until 1906). One of its primary missions was consolidation of the various lines, and this included electrification—hence the need for the large generating plant in Gowanus. The BRT was reorganized in 1923 as the Brooklyn-Manhattan Transit Corporation and was eventually subsumed (with the IRT and the IND) into the city subway system in 1940 (Feinman 2001).

The surviving remnant of the electric generating station is a highly visible landmark highlighting the consolidation of mass transit at the turn of the 20th century, just as New York City absorbed its four neighbors

Plate 3.22. Gowanus Canal Assessment of Eligibility: View East of Former Brooklyn Rapid Transit Power House (Photographer: Charles Ashton, January 2004) [HRI Neg.# 03070 D3-07].

to become the five boroughs. It also is related to the bulk shipment, handling and use of coal, one of the canal's principal freights. It is also, with the Litchfield Office Building, one of the more interesting buildings architecturally in the study area.

6. Foreman Blades Lumber, west side of the canal between First and Second Streets (Plate 3.23)

Although architecturally not as striking as the BRT Power House, Foreman Blades Lumber appears to retain its integrity and is associated with another of the canal's major freights.

Its first appearance on fire insurance maps is in 1938, when the entire block bounded by the canal, 1st, 2nd and Bond Streets was indicated as "Standard Oil Co. of N. Y." A number of buildings were occupied by tenants. Standard Oil had been indicated as the owner of the northern half of the block in 1904 and 1915; the southern half was occupied by a dealer in building materials as early as 1886. By the time the 1938 map was published, Standard had the entire block, and it had been virtually cleared and redeveloped from its 1915 appearance. The Bond Street side of the property had an "Auto Ho.", storage and a garage; Foreman Blades Lumber was the tenant on the canal side. A building no longer extant was directly at the edge of the canal, used for lumber storage (Sanborn 1886, 1904, 1915, 1938).

The building that survives today was identified on the insurance maps as having been built in two sections, the more southerly in 1918, the northern in 1921. Their uses were, respectively, lumber storage and as a lumber warehouse. By 1950 the Foreman Blades parcel was occupied by Phillips Paper products, and the building were being used for paper box manufacturing and a paper warehouse. The canal-side building was gone by 1969, and the two rear buildings were labeled simply "Loft." This label persists up to the 1996 map (Sanborn 1950, 1969).

Like the Burns Bros. coal pockets, the Blades and Foreman building is associated with one of the canal's primary uses, the bulk movement of materials that were directly associated with the growth of Brooklyn. Its utilitarian function is reflected in its design; it is a simple rectilinear concrete frame with brick curtain walls, free of ornament.

7. S. W. Bowne Grain Storehouse, west side of the canal between Bay and Creamer Streets (Plate 3.24)

This massive 4-story, 200-by-80-foot brick building is an end-gabled structure with a central transverse firewall and eight bays on its long side, most of which have round-arched window openings. A monitor runs the full length of the building's roof peak. Although the storehouse's interior was not inspected, it was almost certainly a wood-framed structure, with 12-foot ceiling heights as later reported (e.g, U.S. Army Corps of Engineers 1988). The Bowne storehouse can be dated with some precision to 1886, as the Sanborn insurance map published that year labeled it as "Grain Ware Ho. Being Built." Into the early 20th century, the storehouse was part of a two-block-long complex of hay, feed, and grain processing facilities from Creamer to Sigourney streets, including south of Bay Street a feed mill removed *circa* 1904-1915 and a large 1912 hay and feed storage building (Sanborn Map Company 1904, 1915).

As originally operated, the storehouse was associated with a grain elevator on the bulkhead opposite the storehouse's south end. The elevator, for which limited information is available, was probably equipped with grain legs to transship grain from Erie Canal barges into the storehouse, where a grain elevator at

Plate 3.23. Gowanus Canal Assessment of Eligibility: View North of Forman Blades Lumber building (Photographer: James Lee, November 2003) [HRI Neg.# 03070 D1-34].

Plate 3.24. Gowanus Canal Assessment of Eligibility: View north of the former Bowne Stores (Photographer: Thomas Flagg, November 2003) [Source: Raber Associates].

the southeast corner probably helped move grain to a conveyor in the monitor for distribution to storage bins. The storehouse probably served for local distribution and for on-site milling. Transhipment from the storehouse to ships for export, once an important component of Brooklyn waterfront traffic as discussed below, seems less likely here because of the limited draft available in this section of channel as reviewed in Chapter 2. A horizontal conveyor between the canalside elevator and the storehouse evidently entered the latter at the fourth floor southeast corner above the windows in that bay; the present blocked-in opening at this spot may represent the former conveyor access (Sanborn Map Company 1904, 1915; Plate 3.25).

The waterside elevator stood until *circa* 1950-1969, but by 1938 had been converted to part of a general warehouse facility along with the rest of the complex. Demand for hay and grain had declined significantly, as cars and trucks replaced horses in the city and the port's role in regional grain distribution declined. The two-block Bowne Company was now part of a larger "Bowne-Morton's Stores, Inc.", an "approved public warehouse." The firm had another building on the west side of Smith Street, and the entire north side of Bay Street from Smith Street to Court Street. There was no mention of hay, grain, or milling in any of the building labels on the 1938 fire insurance map; the grain warehouse was no longer in specialized use, it had apparently become a general-use warehouse. By 1950, the southern part of the Bowne complex, below Bay Street, was engulfed in later buildings associated with cargo and stevedoring companies. North of Bay Street, a one-story warehouse was built between the canal and the northern part of the grain warehouse before 1950. Now gone, the eastern façade of the grain warehouse shows signs of its former location, visible from the canal (Sanborn Map Company 1938, 1950, 1969; U.S. Army Corps of Engineers 1932, 1942, 1953, 1965, 1978, 1988).

The Bowne storehouse is an unusual, probably unique example of a 19th-century Brooklyn storehouse adapted for grain handling. Brooklyn dominated the handling of bulk products in the Port of New York from the 1840s until the firm establishment of container traffic by *circa* 1970. For most of this period, bulk products on much of Brooklyn's waterfront were transhipped and stored at small terminals consisting of narrow finger piers with or without piersheds, bulkheads retaining wide marginal wharf space, and masonry storehouses lining the wharves. Evolving from earlier 19th-century storehouses in Manhattan and Brooklyn, most of the classic Brooklyn storehouses were built *circa* 1850-1880 between Main Street and Erie Basin, with a smaller number on Smith Street and the latest examples built at Bush Terminal *circa* 1895-1905. They were especially notable from Atlantic Avenue to Main Street, once forming a nearly unbroken wall except around the Fulton Ferry. Typically, the storehouses were flat-roofed structures four to six stories high, 150 to 200 feet long, and 50 to 80 feet wide with three to five bays of round-arched windows on the short sides facing the water and the streets. Timber-framed with longitudinal arrays of square columns generally 15 to 18 feet apart transversely, the storehouses had timber floors, brick exteriors and party walls often made of rubble stone. The most intact examples include the Empire Stores in the project area, the former Merchants or Governors Stores on Pier 41 at the foot of Van Dyke Street, the Beard Stores (Warehouse Pier) in Erie Basin at Van Brunt Street, a smaller block of stores in Erie Basin at Richard Street, the Bowne Stores, and the brick storehouses at Bush Terminal. Less intact examples include the Tobacco Warehouse west of Empire Stores and parts of the former New York Dock Company Cold Storage Building. The Bowne storehouse, which falls within the size range of other Brooklyn stores and has the familiar round-arched window, is the only gable-roofed example in this class of building, and

Plate 3.25. Gowanus Canal Assessment of Eligibility: View generally north of the pumping station (Photographer: Charles Ashton, January 2004) [HRI Neg.# 03070 D3-05].

also the only one oriented with the long side–and all windows–facing the bulkhead (Raber Associates 1984; Beyer Blinder Belle 1990; Parrott 2002).

The gable roof at the Bowne complex was clearly adapted to grain handling, and was in some ways a retention of a slightly earlier form of warehouse more widespread until the mid-19th century, when the dominant flat-roofed form emerged (Parrott 2002). Unlike large grain elevators built later in the 19th century to accommodate rail and marine traffic, the Brooklyn grain facilities were somewhat idiosyncratic, sometimes combining general warehouse forms with grain handling functions largely intended for export traffic, and sometimes including highly specialized structures with little resemblance to typical storehouses. Until the repeal of the British Corn Laws in 1846, export of unmilled grain remained a relatively minor feature of port activity. There were few if any specialized storage or handling facilities for grain before the Corn Laws repeal immediately quadrupled grain exports through the port, and made grain traffic to Britain a major component of transatlantic trade (Albion 1939:76-94; Anonymous n.d.). All of the port's grain facilities developed between *circa* 1846 and 1922, serving either railroad car or canal boat. The Brooklyn facilities all received grain from canal boats in bulk. Three types of facilities eventually handled grain at the port, in various combinations and sequences: private grain stores (almost all in Brooklyn) with stationary wharfside grain elevators; floating grain elevators which transferred product from canal boats to ships; and grain elevators at railroad terminals. The grain stores and floating elevators appeared as soon as the Corn Laws disappeared, while the railroad elevators did not start to rise above the port's shores until the late 1870s. The grain stores disappeared by *circa* 1915 after the virtual disappearance of the canal grain traffic which supported the grain stores, and the sharp decline in the port's share of export grain traffic. The railroad and floating elevators retained the remaining traffic. The New York State Barge Canal grain elevator completed in 1922 in Gowanus Bay was part of an attempt to re-direct the port's grain traffic, and was something of an anomaly in being a large grain elevator designed for canal traffic. Early 20th-century changes in overseas grain shipping patterns highlighted a fundamental lack of grain handling development that had been a growing problem in the Port of New York for a quarter century. With essentially no improvements in grain facilities after 1922, competition from other ports significantly reduced grain traffic following a relatively brief surge of Canadian grain exports through the Port of New York during and after World War I (Anonymous n.d; see Raber et al. 1984: 95-104 for discussion of Brooklyn export grain facilities).

Located where ship traffic was probably made difficult by limited dredging efforts, the Bowne complex was most likely used only for local distribution, as noted above. This may explain its orientation parallel to the nearest street, to facilitate wagon loading rather then marine transshipment.

Today the building is one of the few distinctly 19th-century structures on the canal banks. It retains its brick exterior with shutters at the few wall openings, and no major additions or alterations are visible from the exterior. The former Bowne Grain Warehouse typifies the canal's role in importing bulk goods into the city, and was built just as the canal was nearing its peak. The company's fortunes followed those of the urban hay and feed trade, but today the warehouse is one of the most visually intact canalside structures linked to the canal's role in the growth of Brooklyn.

8. Third Avenue Bridge

The Third Avenue Bridge crosses the canal between the 4th Street basin and the filled 5th Street basin. Constructed in 18870 and heavily rebuilt in 1889, the bridge was a necessitated by construction of the 5th Street basin. It is discussed above in Section B. 4. of this chapter, and shown in Plate 3.12.

9. Carroll Street Bridge

The Carroll Street Bridge has previously been designated a New York city Landmark and found individually eligible for inclusion in the National Register. It is discussed above in Section B. 4. of this chapter, and shown in Plate 3.11.

10. Pumping Station

Constructed as an element of the 1905-11 flushing system, the Pumping Station is discussed in Section B. 3. of this chapter and is shown in Plate 3.25. Plate 2.14 shows the building nearing completion in 1911.

Chapter 4

RESOURCE INTERPRETATION AND PROJECT EFFECTS

A. GOWANUS CANAL AND ASSOCIATED HISTORIC INDUSTRIAL RESOURCES

1. Waterway Significance under National Register Criteria A and C

The Gowanus Canal retains considerable integrity of location, design, and materials. Based on its importance in the history of Brooklyn, as summarized in Chapter 2, the canal appears to meet National Register Criterion A: it was a transportation system facilitating urban growth in the city and borough, as well as an infamous source of pollution requiring over a century of complaint, study, and engineering. The canal also appears to meet Criteria A and C based on its status as the largest waterway in the Port of New York developed with virtually no federal assistance, as indicated by a summary historic context (below) of this regionally significant canal.

a. The Gowanus Canal and Local Industrial Waterways in the Port of New York

By the 1830s, four basic types of engineered inland navigation designs were evolving in North America:

- ❖ excavated canals, creating artificial overland routes on which boat sizes were limited by channel and lock dimensions;
- ❖ river navigation assisted by channel clearance and dredging, where channel depth was the principal limiting navigation factor;
- ❖ river navigation assisted by locks and excavated bypass canals around rapids, with dams at canal headworks creating limited slackwater navigation sections, and boat sizes limited by canal and lock dimensions; and
- ❖ slackwater navigation systems with locks, dams, and bypass canals, designed to create navigable pools over long river distances for steamboats (Raber *et al*. 1991: 9).

Some transportation canals, however, notably those at rapids, became more important as sources of waterpower, such as those at Lowell in Massachusetts, Windsor Locks in Connecticut, and the Lachine Canal at Montreal.

As developed through the 19th and early 20th centuries, virtually all of these navigation systems were intended to link Atlantic coast, Gulf Coast, or Great Lakes-St. Lawrence River ports with interior waterways or communities to expand regional commerce. The continent's major ports were on bays, along the Great Lakes, or on the banks or estuaries of large navigable rivers. Because most ports were relatively small and had good rail connections, there was little use of short interior waterways to move freight to nearby urban areas.

By contrast, the size, geography, and history of the Port of New York led to the use of about a half dozen interior waterways, which essentially served as extensions of the region's complex coastlines. The port developed in the largest harbor in the United States, sometimes touted as the best natural harbor in the world, and one of the few places where a very large international city developed around a large harbor with deepwater channels to the ocean. The harbor is the drowned Hudson River estuary, which gives the region a sheltered location near the Atlantic Ocean, and water access to the interior via the Hudson and several other rivers. There were deep natural channels into the harbor and through many of its waterways, some significant tidal estuaries like Gowanus and Newtown Creeks and the aboriginal Harlem River, and seven bays with over 100 square miles of safe anchorage including Lower New York Bay, Newark Bay, and Upper New York Bay. The harbor includes the mouths of four rivers (the Hudson, Raritan, Passaic, and Hackensack), and three major tidal straits linking some of the bays with each other or Long Island Sound (the East River, the Arthur Kill between western Staten Island and New Jersey, and the Kill Van Kull between Upper New York and Newark Bays). All these waterways surrounded and separated three large islands (Manhattan, Long Island, and Staten Island) and continental real estate with shorelines totaling over 770 miles, split about 60/40 between New York and New Jersey (Raber 2002).

The port's complex waterways provided easy boat access to much of the region, but generally served as barriers to railroads and highways. Until recent decades, local freight and passenger transport involved harbor craft to a degree not seen in most American ports. Even at the height of rail traffic in the port, lighters and barges delivered much of the freight, and the railroads transferred cargoes from waterfront terminals to navies of tugboats, towed vessels, and steam lighters which made the port's waters a kind of belt line serving the metropolitan region (Flagg 1988, 2000: 5-12). Before highways and trucks reached all parts of the region's cities, tidal creeks provided access to areas otherwise hard to reach. Development of these interior waterways was basically a variant of river navigation assisted by channel clearance and dredging. Unlike most other river navigation projects, however, those in the metropolitan New York region were for very local traffic, and usually dead-ended well downstream of original marshy headwaters.

The Gowanus Canal was one of at least seven developed interior waterways in the port, all of which were on the New York side of the harbor (Figure 4.1). Most, including the original Gowanus Creek, were tidal estuaries feeding salt marshes, with limited navigability. The other estuaries included Newtown Creek, Bronx River, Eastchester Creek (Hutchinson River), Westchester Creek and two separate waterways (Harlem River from the East River, and Spuyten Duyvil from the Hudson) later channelized as the modern Harlem River. With perhaps less than three feet of water available at low tide (*Brooklyn Daily Eagle* 1868b), Gowanus Creek was probably the least navigable of these streams aboriginally. Despite this limitation, Gowanus Creek's proximity to a fast-growing urban area in the early 19th century made it the earliest fully developed interior waterway in the region, and the largest of the port's waterways improved almost entirely without federal assistance. The Gowanus Canal's history, design and construction were also unlike those of the other industrialized estuaries, which generally had some waterside development prior to channel improvements.

Newtown Creek

Newtown Creek, the largest and most aboriginally navigable of the industrialized tidal estuaries, had up to 17 feet available at low tide for perhaps two miles, and was accessible to small ships and steamboats (cf. Randel 1814, U.S. Coast Survey 1844). After a long history as a local highway for small farming communities and as a tidemill power source beginning in the 17th century, parts of the creek were bulkheaded and adjacent marsh areas filled *circa* 1850-1860 for prospective real estate development and for some noxious industries attracted by the creek's relative

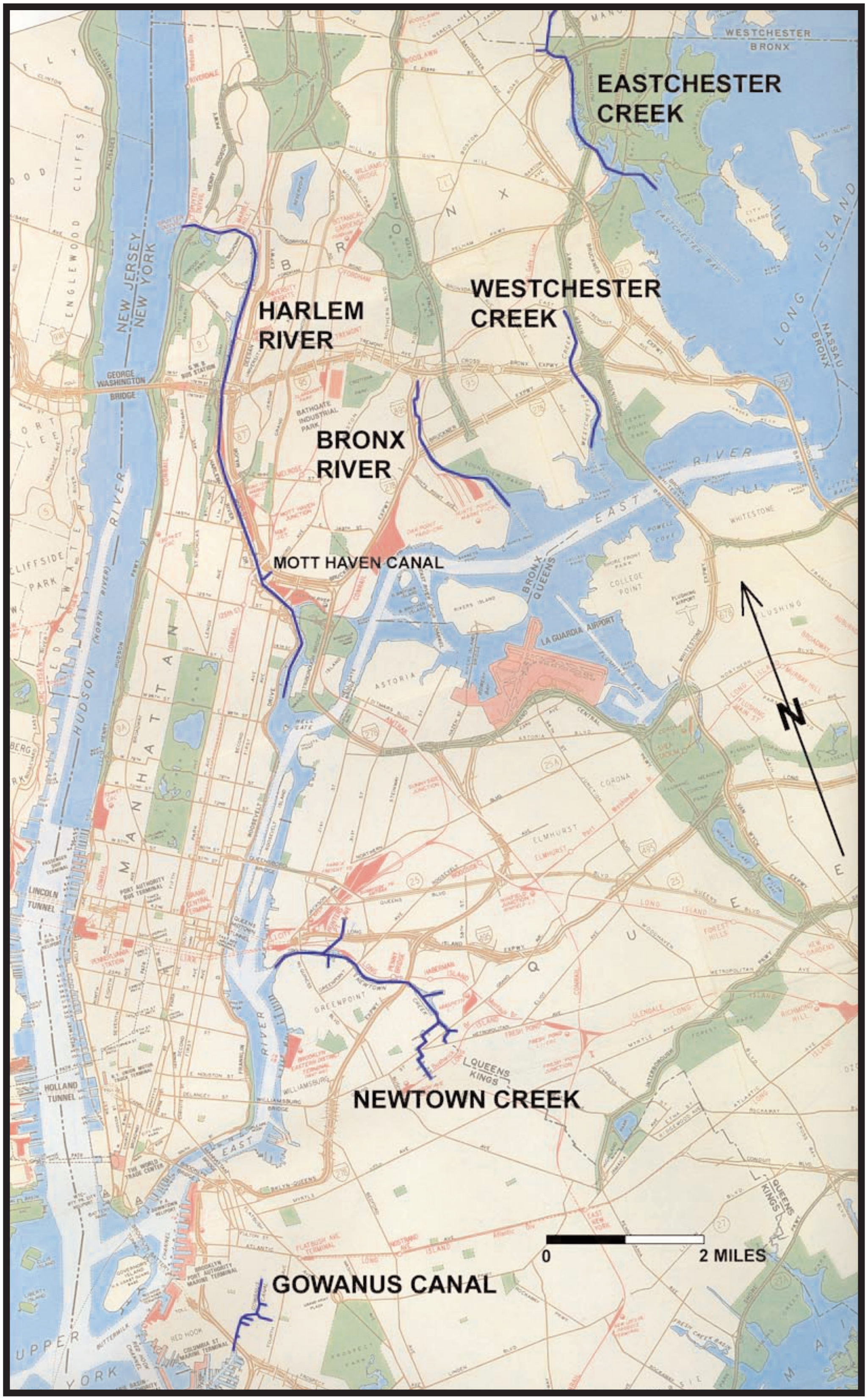


Figure 4.1. Gowanus Canal Assessment of Eligibility: Map of Waterways in the New York Vicinity (Base map source: The Port Authority of New York and New Jersey, n.d.).

remoteness. Between 1860 and 1880, Newtown Creek became a national center of refined petroleum product manufacture, stimulated in part by the 1861 completion of nearby Long Island Railroad facilities. These decades saw more nearby urban growth, construction of two short canals for delivery of building materials, increased shipments of coal and lumber, and the first local demands for federal channel improvements of this creek. U.S. Army Corps of Engineers dredging *circa* 1880-1900 encouraged additional industries requiring sea-going vessels, including major copper refinery and chemical production facilities. The Corps created channels 20 to 23 feet deep at low water and 100 to 150 feet wide, with some work not completed until the Great Depression. With increased industrial growth, most of the creek and its tributaries was bulkheaded by 1900. By 1910, Newtown Creek was one of the busiest waterways in the world of its size, with about 70 manufacturing, fuel and bulk materials firms. Manufacturing and bulk products growth continued until after World War II, peaking at some 85 firms. Probably the most important interior waterway in the port at one time, Newtown Creek was not a canal, but rather a small river that developed with the assistance of federal dredging projects. Shoreline bulkheading was done gradually, to provide stable wharves rather than as part of channel enlargement as was the case with the Gowanus Canal (Stiles 1869, 1884; U.S. Army 1872-1950; W.W. Munsell & Co. 1882; Brown and Ment 1980; Seyfried 1984; Flagg 1991).

Eastchester Creek, Westchester Creek, and Bronx River

Eastchester and Westchester Creeks were minor waterways whose improvement followed demands of nearby urban areas developed late in the 19th century for delivery of fuel and building materials. Extending into Westchester County through the Bronx, marshy Eastchester Creek was navigable for about 1.5 miles above Eastchester Bay, with four to nine feet of water at low tide. U.S. Army Corps of Engineers dredging *circa* 1877-1895 created a channel 75 to 100 feet wide with a nine-foot low-water depth, and extended navigation upstream another 1.5 miles, reaching north of the Boston Post Road. As many as 15 terminals developed for receipt of coal and building materials, most near the northern end of the waterway including some located along an 800-foot-long private canal dredged west of the channel in 1894 just north of the Post Road. Eastchester Creek traffic in oil, sand and gravel remains fairly active.

Westchester Creek into the early 20th century had a 2.5-mile long, 60-to 80-foot-wide navigable channel about 3.5 to 6.5 feet deep at low water. Except for some local sloop and steamboat traffic, there was evidently limited use of this waterway until U.S. Army Corps of Engineers dredging *circa* 1914-1920 created a 60-to 100-foot-wide channel with an eight-foot depth at low water. By 1919, 16 terminals received oil shipments by barge. A later project deepened the channel to 12 feet but marine traffic dropped sharply after *circa* 1970 (U.S. Army 1872-1950; Jenkins 1912; Smith 1919; Hermalyn 1982; U.S. Army Corps of Engineers 1950-1997).

The 30-mile-long Bronx River provided waterpower to some small colonial mills on its upper reaches, but also had little navigation before the 20th century. The tidal, lowermost 2.5 miles was marshy, with no more than five feet of water at low tide and many shoals. Several coloring or dyeing mills operated just north of the tidal limits from the early 19th century until the lower river was urbanized beginning late in that century. Municipal parkland purchases—inspired by the success of Central Park—led to the closure of the mills *circa* 1887-1890. Several U.S. Army Corps of Engineers projects *circa* 1897-1950 dredged channels four to ten feet deep and 50 to 200 feet wide, allowing the development of up to 18 terminals for marine receipt of coal, oil and building materials. Except for a few oil terminals, there is now little commercial use of the waterway (U.S. Army 1872-1950; Jenkins 1912; Hermalyn 1982; U.S. Army Corps of Engineers 1950-1997).

Harlem River and the Mott Haven Canal

As a waterway linking the Hudson and East rivers, the Harlem River is a project completed by the United States at different times between 1888 and 1938. Unlike federal work on other interior waterways in the port, this project was designed as a canal to create a shortcut between the East and Hudson Rivers that would strengthen port commerce and allow for ship traffic. The waterway originally consisted of two tidal estuaries at the north end of Manhattan Island, flowing in opposite directions between north-south ridges, from a tidal divide near Fordham Landing, just north of the present University Heights Bridge. The aboriginal Harlem River was an East River estuary with a channel 300 to 1500 feet wide, with original depths at mean low water diminishing from about 10 feet at the East River to seven feet at the former Fordham Landing. Several tributary streams met the Harlem River, which was bordered by wetlands in places south of Fordham Landing. Small craft could navigate upriver from the landing towards the upper reaches of Spuyten Duyvil. The latter estuary followed a sinuous course around the bedrock of Marble Hill, running southwest from about 230th to 215th streets before turning northwest and west around the Riverdale Ridge along the Hudson. Spuyten Duyvil broadened from about 150 to 1000 feet towards the Hudson, and was generally four feet deep at mean low water below Kingsbridge Avenue into the mid- to late 19th century. The main elements of the canal plan approved in 1886 included dredging a 400-foot-wide channel from the East River to the present Broadway canal crossing with a 15-foot depth at mean low water, and cutting a nearly straight channel from Broadway to the Hudson. Most of this work was accomplished by 1895, with at least a 15-foot depth achieved along the new 7.6-mile waterway, but the Johnson Ironworks (operated *circa* 1853-1920 on the north side of Spuyten Duyvil) obstructed a planned cut that was not completed until 1938. As with the other federal projects in the port, the Harlem River work involved channel clearance and dredging without bulkhead construction (U.S. Army 1872-1950; Whitford 1905-06: 1410-11; Jenkins 1912; Tieck 1968; Smith 1919: 73-6).

The history of marine traffic, rail and industrial use, and the numerous bridge crossings on the Harlem River is complex and need not be detailed here to assess the significance of the Gowanus Canal. Aside from small tide mills operated in the early 19th century, the only significant waterside pre-canal industries were the ironworks on Spuyten Duyvil established by Isaac G. Johnson, and another ironworks opened by Jordan L. Mott in 1841 on the north side of the Harlem River, just upriver from Third Avenue and south of the bridge of the newly-opened New York and Harlem Railroad. Mott established the community of Mott Haven nearby, and created the Mott Haven Canal described below to provide more water access to the ironworks. While Harlem River land use greatly intensified *circa* 1895-1932, with active waterfront sites rising from about 19 to 85, most of this development involved a proliferation of general freight handlers including more rail terminals, some municipal or utility operations, and dealers in coal, building materials including lumber and masons' supplies, and sand and gravel. The opening of the canal and the raising of many bridges facilitated lighter, barge and carfloat traffic associated with these operations. It appears, however, that the principal cause of waterside development was the contemporary urbanization of northern Manhattan and the Bronx, driven by immigration and the growth of automobile and commuter railway infrastructure. Before the canal opened, marine freight was increasing substantially, and landfill to create new piers and wharves narrowed the Harlem

River south of High Bridge. Rail marine operations north of Willis Avenue also expanded significantly on the Bronx side of the waterway between 1898 and 1927. Very few manufacturers other than the ironworks used the waterway, with most of the nearby construction associated with housing and roadways (Robinson and Pidgeon 1884; G.W. Bromley & Co. 1893b, 1910, 1911; E. Belcher Hyde 1900, 1901, 1912; Jenkins 1912; U.S. Army Corps of Engineers 1926-1988; Tieck 1968; Pearce 1989a, 1989b).

Most of the marine traffic accompanying this growth would probably have occurred without the federal project. City and federal data clearly indicate that the vast majority of traffic *circa* 1895-1958 ran up the Harlem River from the East River to at least Macomb's Dam Bridge, and that relatively little of the traffic consisted of vessels large enough to require bridge openings. This pattern is consistent with the waterway land use history, in which terminals handling general freight, coal, sand and gravel, and building materials were most frequently served by tugboats moving carfloats, barges and tankers in tows able to pass under the bridges. The same data also suggest that most waterway traffic was intraport, or involved tows moving up the East River from coastal or interior points. At all the crossings, the percentages of vessels requiring bridge openings also dropped steadily through time. This seems to reflect not only changes in vessel types used to move freight, but the failure of the improved waterway to fulfill its intended purpose as a ship canal. Trips made by sailing ships, probably carrying lumber or coal, dropped from over 5,400 in 1895 to about 2,400 in 1909, thereafter diminishing to almost none by the end of World War I. This trend was part of a regional drop in schooner and schooner barge traffic, caused by the advent of steampowered colliers and diminished coal demand by some Atlantic coast industries during depressed economic conditions. Harlem River steamship trips are harder to enumerate in the federal data, but appear to have dropped sharply in the same period, virtually disappearing by *circa* 1950 except for oil tankers serving local waterway terminals. It appears that the unfinished sections of the canal after 1895 inhibited passage of larger vessels north of the Macomb's Dam Bridge, and that by the time these sections were completed the improvements remained insufficient to warrant passing ten movable bridges. For most through traffic between the East River and the Hudson, it was evidently faster to pass around lower Manhattan than to use the Harlem River. The principal benefactors of the federal project were local businesses, railroads, municipal operations and recreational vessels, for whom the raised bridges created smooth passages. Like all the region's other interior industrialized waterways, the Harlem River saw a significant decline in commercial traffic by World War II, with virtually none today (U.S. Army 1872-1950; City of New York 1898-1958; U.S. Army Corps of Engineers 1950-1997; Whitford 1922).

Jordan Mott's private canal off the Harlem River was apparently one of the closest analogs to the Gowanus Canal in the region, although it is not well documented. Created *circa* 1850 by channelizing a small marshy tributary to the river, it served barge traffic to his ironworks and several other industries. The bulkheaded canal ran approximately a half mile from the river to present 144th Street in the Bronx, and was about 50 feet wide for most of its length north of 135th Street. There was a lock gate or guard lock at 135th Street which made the canal a tidal basin, an idea proposed elsewhere in the port including early plans for Gowanus Creek, but rarely if ever executed. Below the lock, the canal was about 85 feet wide to the river, probably serving as a basin for barges awaiting high tide movement into the canal, and facilitating rail marine transfers at the Harlem Transfer Company's terminal immediately upstream. An 1869 drawbridge carried 138th Street over the canal. New York City began attempts to fill in most of the canal in 1890 from the bridge inland in 1890, and succeeded in doing so *circa* 1901-1903. The short remaining portion was used for coal deliveries until the 1930s, but almost all of the remaining canal was filled *circa* 1935-1965. Portions may remain intact under fill, but it has none of the Gowanus Canal's visual integrity (Mielatz 1891; Jenkins 1912; U.S. Army Corps of Engineers 1926-1988; Bronx County Historical Society 1984).

b. Surviving Industrial Setting and Associated Resources

In addition to the waterway itself, several structures are related directly or indirectly to the canal, and help to illustrate the history of the canal's construction, evolution and operation.

The Pumping Station at the head of the canal (and the associated tunnel under Butler, Hoyt and Degraw Streets) was built as a direct consequence of the canal and the pattern of its use for its first half-century of existence (i.e., as a destination for household and industrial waste). Because it was built specifically to reduce pollution in the canal, it can be considered as an element of the canal itself, as much so as are the bulkheads. Remarkably, it still serves the purpose for which it was designed and built.

Of the several bridges crossing the canal, two have retained integrity and are significant. The Carroll Street bridge, built in 1889 by the New Jersey Iron & Steel Company, is a retractile bridge, a nearly extinct bridge type. It was designated a New York City Landmark in 1987 and has received an opinion of eligibility for inclusion in the National Register from the New York State Historic Preservation Office.

The significance of the Third Avenue bridge derives from its association with the canal rather than from its intrinsic engineering merits. It was the subject of much debate when it was rebuilt in 1889, fueled by citizens' frustration with the numerous movable bridges over the canal that frequently blocked street traffic. To avoid contributing to traffic congestion, it was specifically built as a high-level (for its time and place) fixed span.

The structures at the Burns Bros., Foreman Blades and S.W. Bowne properties are associated with the canal's role as a conveyor of bulk materials (coal, lumber and grain respectively) into Brooklyn. As would be expected of structures built for utilitarian functions, they have virtually no decorative or stylistic characteristics, other than what their uses demanded, but their significance derives from their historical functions rather than from their appearance. Perhaps better than any other surviving structures, they typify the dozens of structures of similar uses which once lined the canal.

The office of the Brooklyn Improvement Company, at the corner of Third Avenue and 3rd Street, is linked to the canal less directly, but the association exists nonetheless. Edwin Litchfield, head of the Brooklyn Improvement Company, was an early purchaser of swampland bordering Gowanus Creek, and as detailed in Chapter 2, built walls and basins to create usable (i.e., marketable) waterfront. He also created real estate where none had existed by filling behind the walls up to the height of the adjacent fast land. The Brooklyn Improvement Company had a major role in the creation of the canal and the neighborhood that surrounds it, and it is extraordinary that this small structure has survived.

Finally, the former Brooklyn Rapid Transit Power House is associated with the canal as a surviving (albeit tenuously) former industrial user of some of the coal arriving via the canal. It also presages the modern era of mass transit; it was built during a time when smaller transit companies were being consolidated into a transit system, all of which was driven by electricity. The location of the power station on the canal was dictated by the need to receive, handle and store vast quantities of coal to power its boilers. It is also a striking architectural landmark in the canal neighborhood.

2. Criterion D and Archaeological Issues

a. Canal Bulkheads

The Gowanus Canal and its surviving basins include over two miles of timber cribwork bulkheads in various states of preservation (Table 4.1), most or all of which probably have timber pile footings driven into silty marsh deposits. Some of these footings may include undocumented dredging operations. Cribwork bottoms could include new information on vernacular adaptations of a well-established bulkhead form to marsh conditions. It is also possible that fill material in cribwork bulkheads might allow for relative dating of bulkhead sections, and for additional information on fill material sources. The only information on this topic uncovered by this study, summarized in Chapter 2, was a newspaper account of basin construction using, in part, sand from hills cut down south of Fifth Avenue. Given the relative distances of the canal from rock or demolition debris sources at the time of most initial construction, there may be significant variations in fill material used here from material used in similar bulkheads elsewhere in the region. The potential for new information on an important regional form of bulkhead construction appear to make Gowanus Canal timber bulkheads eligible for the National Register under Criterion D.

The narrowness of the canal precluded installation of concrete relieving platforms in front of older cribwork during 20th-century repairs, but as discussed in Chapter 3 it is possible that relieving platforms were installed on older cribwork bases. Although the general forms or types of concrete wall construction in the canal appear well-documented, there may be undocumented variations in these forms directly associated with the canal. This possibility, as well as the association of the concrete walls with a waterway which appears eligible for the National Register, make at least some of the concrete wall sections contributing components of the eligible resource under Criterion D.

b. Submerged Resources

As discussed in Chapter 2, a wide variety of vessels used the Gowanus Canal probably until the Great Depression, including schooners, sloops, sail and steam lighters, tugboats, covered barges, barges hauling coal and sand, and canal boats. There are no visible remains of such craft in the canal, or in the Gowanus Bay Channel section of the project area southwest of the canal. There is a wide range of information available on these types of vessels, of varying degrees of completeness, based on study of hundreds of derelict vessels along the shores of the Port of New York (e.g., Raber et al. 1996, 1999; Panamerican Consultants 1999). Given the federal dredging in the Gowanus Bay Channel, and the irregular dredging in the Gowanus Canal, it is not likely that better-preserved examples of these vessels will survive in the project area. In much of the canal, any surviving submerged vessel components may also lie in contaminated sediments which would make any data recovery extremely expensive. We do not believe that any submerged resources in the project area would be eligible for the National Register under Criterion D.

3. Summary of Eligible Resources

In terms of National Register nomenclature, the Gowanus Canal and its associated resources comprise a historic district (defined by the National Park Service as "a geographically definable area, urban or rural, possessing a significant concentration, linkage or continuity of sites, buildings, structures, or objects which are united by past events or aesthetically by plan or physical development"). The boundaries of the district are defined by the bulkheads lining the main stem of the canal and the four extant 11th, 7th, 6th and 4th Street basins, from the terminus of the canal at Butler Street to a line created by extending the alignment of Percival Street across the canal, enlarged where necessary to encompass other contributing resources described in the next two paragraphs.

First, the sites of the filled 1st Street and 5th Street basins (see Figure 3.2) appear to contribute to the Gowanus Canal Historic District, assuming that they were filled rather than entirely removed in the mid 20th century. Because they were intrinsic elements of the canal at the time it achieved significance, and because the 5th Street basin was associated with the urban development plans of Edwin C. Litchfield, the filled basin sites appear to meet Criteria A and B. Given the length of extant canal and basins, the filled basins do not appear to meet Criterion D; any important historical engineering information in the buried basin walls is available in intact canal sections.

Second, the associated resources enumerated above (the pumping station and flushing tunnel, the Carroll Street and Third Avenue bridges, the structures at the former Burns Bros., Foreman Blades and Bowne properties, the Brooklyn Improvement Company office building and the former Brooklyn Rapid Transit Power House) all contribute to the Gowanus Canal Historic District.

B. PROJECT EFFECTS

Among the presently-anticipated project actions outlined in Chapter 1, two have the potential to possible affect eligible resources. The first is “bank softening,” which would remove bulkheads to unknown depths. Given the general integrity of Gowanus Canal bulkheads, their major role in defining the historic visual character of the waterway, and their potential for significant new information, bulkhead removal would in most places be an adverse effect on a resource eligible for the National Register of Historic Places. The relative severity of such an effect will depend on the bulkheads being removed, and the horizontal extent of removal. In some places where the visible bulkhead consists of concrete blocks replacing former upper components of timber bulkheads, less visual character will be lost. Removal of 19th- or early 20th-century fill materials from timber bulkheads may lead to loss of potentially significant industrial archaeological data.

Habitat creation—capping the basins with clean fill and planting vegetation—would adversely affect the canal by filling contributing elements. While other basins have been filled in the past without destroying the canal’s eligibility, the loss of additional historic features would diminish it further. Adding fill to a basin without completely obliterating it (i.e., filling to below the tops of the bulkheads) would be less severe but would still require mitigation.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

The Gowanus Canal from Butler to Percival Streets, along with selected associated bridges and industrial buildings and the sites of two filled basins, is recommended as being eligible for inclusion in the National Register of Historic Places as a historic district.

Possible “bank softening” project actions could have an adverse effect on this resource. For any canal sections subject to such action, the following steps are recommended:

- ❖ detailed photographic documentation at low-water conditions to the standards of the Historic American Engineering Record or other standards acceptable to the New York State Historic Preservation Office and the Army Corps of Engineers;

- ❖ review of project plans to identify the potential for loss of significant information on fill materials or bulkhead components; and

- ❖ archaeological identification and recovery of significant data in bank softening project areas, either by limited pre-construction excavation, or by in-construction monitoring.

Bank softening at locations adjacent to contributing buildings (the pumping station, the three bulk material handlers, and the former power generating station) would diminish their settings and is best avoided if possible. If avoidance is not feasible, mitigation activities should be expanded to include photographic documentation of the contributing building, emphasizing its relationship to the adjacent bulkhead.

Habitat creation (capping the basins with clean fill and planting vegetation) has the potential to adversely affect part of the eligible resource by eliminating or visually compromising basins, depending on the height of the fill with respect to the bulkheads. As above, any such work should be preceded by detailed photographic documentation of the entire basin and its bulkheads at low-water conditions to the standards of the Historic American Engineering Record or other standards acceptable to the New York State Historic Preservation Office and the Army Corps of Engineers.

Provision should be made for a program of historic interpretive signage at public access points along the canal. These signs should be developed in consultation with the New York State Historic Preservation Office, the Army Corps of Engineers and other interested parties.

Finally, it will be recalled that while the approximate locations of Denton’s and Freeke’s mills are known, the presence and/or integrity of any buried remains is not. Any work involving excavation in these areas should be accompanied by archaeological monitoring during construction.

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