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Final Report

RECONNAISSANCE CULTURAL RESOURCE INVESTIGATIONS

ARTHUR KILL NEW YORK REACH

RICHMOND COUNTY, NEW YORK

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NEW YORK HARBOR COLLECTION AND REMOVAL OF DRIFT PROJECT

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ABSTRACT

Documentary, field, and informant investigations at reconnaissance levels were made for 63 waterfront structures and 253 marine resources in the Arthur Kill New York Reach. Results included identification of 44 past or present waterfront structures within project areas. None of these structures or sites appears potentially significant. Fifty-five derelict vessels or floating drydocks, and six vessel clusters, were identified as potentially significant marine resources subject to potential adverse project effects. There may be potentially significant Native American resources subject to undefined project effects in some onshore areas. Offshore effects on such resources appear unlikely, but cannot be fully assessed without some additional data collection. We recommend conducting sufficient additional research on potentially significant marine resources subject to project effects to determine National Register eligibility. For Native American resources, we recommend avoiding effects on onshore sites by specifying onshore project construction methods and/or assessing survival of intact soils, and collecting additional data to identify any possible offshore materials with possible archaeological material. Seventeen additional derelict vessels not studied for this reconnaissance because of project catalog development scheduling should be inspected and assessed.

ACKNOWLEDGEMENTS

This study is one of three conducted along approximately thirty miles of coastline separating Staten Island and New Jersey, along which lie some 500 derelict vessels. We appreciate assistance rendered by New York District personnel in undertaking some of the very difficult fieldwork needed to survey this large array of resources, including archaeologists Nancy Brighton and Lynn Rakos, and the crews of the Corps vessels *Hocking*, *Hudson*, and *Hayward*. We also thank Carlotta DeFillo, Research Librarian at the Staten Island Historical Society, Vincent Sweeney, former curator at the Staten Island Institute of Arts and Sciences, and Dorothy A. D'Eletto, Assistant Curator at the Staten Island Institute of Arts and Sciences for their help in guiding us through their collections and making important research materials available. Norman Berger, former project manager with the Department of Business Services, City of New York, shared some of his accumulated wisdom on Staten Island's waterfront with us.

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I. INTRODUCTION

A. Proposed Project Actions

The New York District, U.S. Army Corps of Engineers, is undertaking the New York Harbor Collection and Removal of Drift Project, in cooperation with state, local, and regional authorities. The project is implemented in stages. A reach designated Arthur Kill New York is now being planned on the Staten Island side of the Arthur Kill from the Staten Island Rapid Transit (SIRT) railroad bridge to a point about 800 feet south of Amboy Road in Tottenville, all in Richmond County, NY (Figure 1). Federal statutes and regulations require identification of significant cultural resources in project areas, and mitigation of any adverse impacts to such resources. Pertinent authorizations for cultural resource planning of this kind include the National Historic Preservation Act of 1966 (PL 89-655), the National Environmental Policy Act of 1969 (PL 91-190), the Archaeological and Historical Preservation Act (PL 93-291), Executive Order 11593, Procedures for the Protection of Historic and Cultural Properties (36 CFR Part 800), and Corps of Engineers Identification and Administration of Cultural Resources (33 CFR 305). Significant cultural resources include any material remains of human activity eligible for inclusion on the National Register of Historic Places, after evaluation against criteria contained in National Register of Historic Places, Nominations by State and Federal Agencies (36 CFR 60.6).

Project actions include: removal of harbor structures, objects, or derelict vessels likely to become sources of drift in the anticipated absence of maintenance; maintenance or repair of such sites likely to become sources of drift if otherwise unattended; and use of adjacent land and water areas for equipment and personnel access to accomplish project objectives. Land and water access requirements remain undefined. Figure 1 shows the shoreline which includes proposed project areas, a distance of some ten miles. Project actions, including the removal of miscellaneous shoreline debris, will occur almost continuously along this coast, as well as around the perimeter of Prall's Island in the Arthur Kill. Figures 3-7 (pp. 34-38) show waterfront structure remains subject to proposed project actions, and approximate locations of derelict vessels or other marine resources.

B. Scope of Investigations

The New York District contracted with Frederic R. Harris, Inc., to update the catalog of proposed actions and prepare studies of potential project effects on environmental and cultural resource effects. Frederic R. Harris, Inc., retained Raber Associates to conduct cultural resource reconnaissance investigations of proposed project areas, and to identify potentially significant or significant resources. Although our investigations considered the entire extent of the Arthur Kill New York Reach and its regional historic context for background purposes, we limited formal assessment of project effects on significant resources to structures, derelict vessels, and unclassified objects with some remains of former recognizable features. Project areas consisting of miscellaneous, disarticulated timber or other loose debris were not studied. Documentary and field investigations, undertaken between May and September 1994, addressed actions outlined in catalogs prepared in March 1991. New catalogs prepared by URS Consultants for Frederic R. Harris, Inc., were not completed until October 1994. We did not investigate seventeen vessels added to the 1991 catalog in 1994, or one vessel with incomplete locational information.

The Corps has no plans showing precise project area locations. The only locational data available at the start of our investigations were pre-1985 aerial photographs, marked by URS Consultants with numbers corresponding to the 1991 catalogs. We transferred these data to paper reproductions of undated aerial photographs provided by the Corps, taken c1985-90. The aerial photographs did not always allow for precise delineation of project structures or vessels. Preparation of detailed maps of project areas was not included in the scope or budget of our investigations. We limited detailed reconnaissance mapping to the use of published base maps, and provide only approximate locations of marine resources in this report.

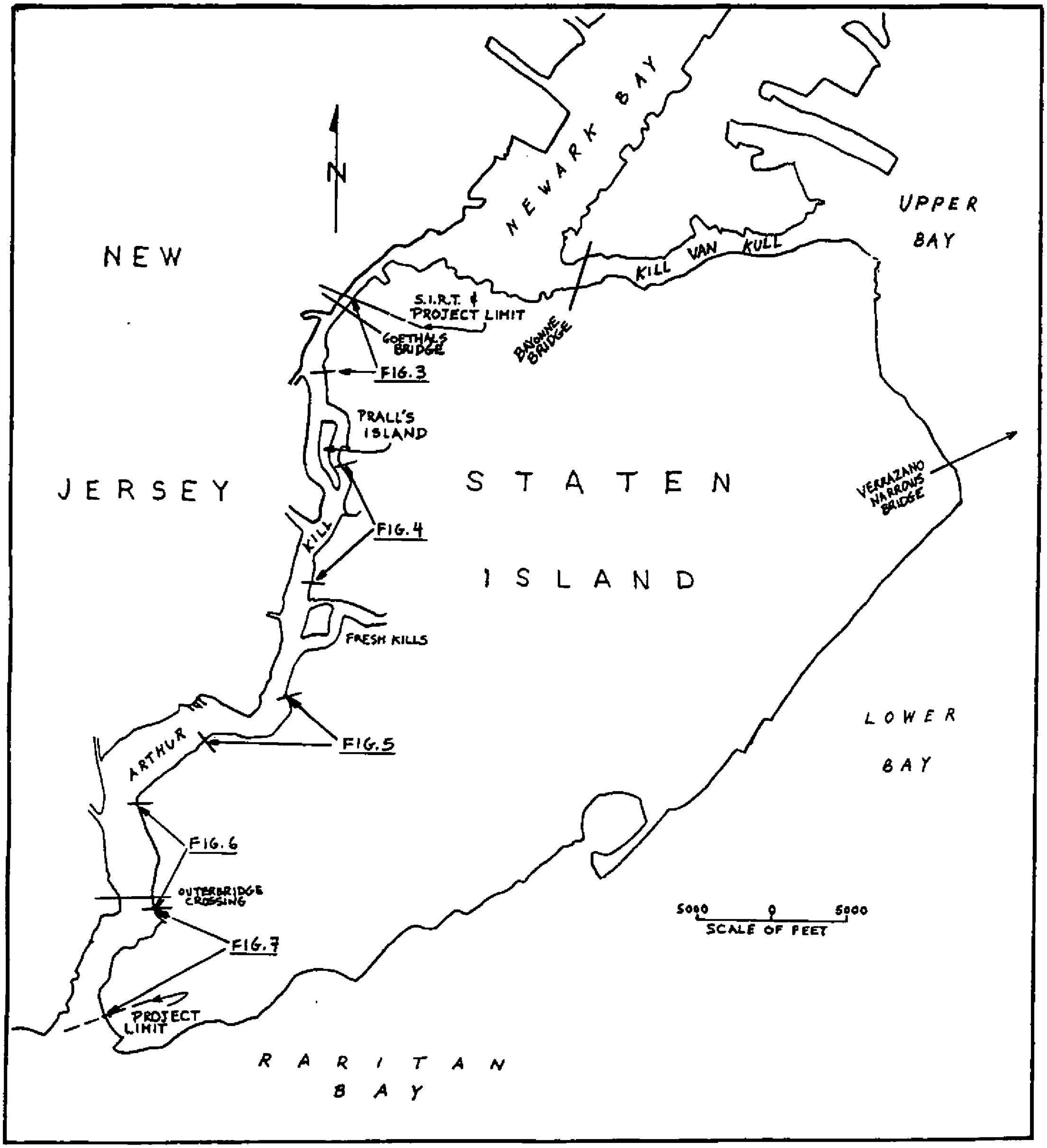


Figure 1. PROJECT AREA LOCATION
with locations of figures 3-7

This study was made in conjunction with similar work on the Arthur Kill New Jersey and Kill Van Kull reaches of the Collection and Removal of Drift Project (Raber, Flagg, Weinstein, Musser, and Wiegand 1995, and Raber, Flagg, Weinstein, Wiegand, and Brouwer 1995). Results from these companion studies are included in assessments of significance made for some resources in the Arthur Kill New York Reach, especially derelict vessels.

C. Organization of Report

Section II of this report discusses our investigation methods. Section III briefly reviews present Arthur Kill New York environments. Section IV discusses the possibility of recovering Amerindian resources in project areas in the context of past and environmental conditions. Section V outlines patterns of Euroamerican waterfront development in the reach. Section VI outlines the historic context of project waterfront structures, inventories such structures, discusses their significance, and assesses anticipated project effects on significant or potentially significant resources. Section VII identifies and inventories marine resources, discusses their significance, and outlines anticipated project effects on significant or potentially significant resources.

Section VIII presents reconnaissance conclusions, and recommendations for additional study or other steps to mitigate adverse project impacts. The report concludes with lists of documentary and informant sources. Because of the large number of historic maps and other graphic materials consulted for these investigations, source lists include two separate categories other than written material: maps, identified in text citations as [maps]; and plans, drawings, and photographs, identified in text citations as [plans]. Appendices include the current catalog of proposed project actions under review, and updates or memoranda submitted as part of these investigations.

D. Report Authors

Michael S. Raber acted as principal investigator for this study, and wrote or edited this report. Thomas R. Flagg acted as transportation historian and project photographer. Flagg compiled much of the site-specific data for the study, assisted in fieldwork by land and water, collected some of the map data used in research, prepared discussions of industrial development used in section V, and analyzed some marine resources. Gerald Weinstein acted as marine historian and project photographer, inspecting, photographing, and assessing the marine resources included in the reach. Weinstein drafted much of the material in Section VII. Ernest A. Wiegand acted as prehistorian, researching and writing the discussion of Amerindian resources and past environments in Section IV. Norman Brouwer assisted in fieldwork, identified ships and other vessels, and prepared some written descriptions incorporated in Section VIII.

E. Summary of Findings

We identified 44 historic structures or site areas within 63 project areas on the current catalog of actions. None of these structures or sites appears potentially significant. Among some 253 marine resources investigated, we identified 55 potentially significant derelict vessels or floating drydocks, all of which would be subject to potential adverse effects. There may be potentially significant Native American resources subject to undefined project effects in some onshore areas. Offshore effects on such resources appear unlikely, but cannot be fully assessed without some additional data collection. We recommend conducting sufficient additional research on potentially significant marine resources subject to project effects to determine National Register eligibility. For Native American resources, we recommend avoiding effects on onshore sites by specifying onshore project construction methods and/or assessing survival of intact soils, and taking further action to determine whether Amerindian resources will be effected by project-related dredging.

II. INVESTIGATION METHODS

We conducted four distinct tasks in our study prior to developing recommendations:

i. documenting the broad context, sequence, and location of land use, landscape changes, and cultural resources in the Arthur Kill New York Reach;

ii. documenting the site histories of project areas;

iii. documenting present conditions in project areas;

iv. assessing the known or potential significance of project areas.

A. Context and Sequence

We used primarily published information for this task, including current literature on local geology, sediment regimes, and paleoenvironments, regional Amerindian archaeology, and various materials on the history of the reach. We also reviewed site files held by the New York State Office of Parks, Recreation, and Historic Preservation and the New York State Museum. There are no detailed treatments of local waterfront history. We adjusted for this problem somewhat with common-scale mapping of about two dozen historic maps dating from 1836 to 1990. The scope of this reconnaissance generally precluded much primary documentary research on local or regional context. In assessing the type and context of derelict vessels in the reach, we used available written descriptions, available drawings in several collections, consultations with knowledgeable researchers, and detailed descriptions of vessel designs based on field inspections in all three reaches investigated for this contract.

B. Site Histories

For most waterfront project areas, we relied for site histories largely on comparative mapping, facilities data collected by the Corps of Engineers since World War I, discussions in local histories, and selected historic photographs including some in author Flagg's private collection. There are no cultural resource management reports which relate specifically to project areas in any useful detail. The production of overlay or single maps summarizing waterfront development (figures 3-9) was especially useful in establishing sequences of construction, when taken with general waterfront construction methods in use at different times (see section VI). For derelict vessels, we reviewed most available historic aerial photographs held by the New Jersey Department of Environmental Protection and Energy. Charges for access to these photographs, introduced after the budget for these investigations was fixed, precluded review of all such images.

C. Present Conditions

We made trips on land and water to photograph and inventory all project areas in the March 1991 catalog. Trips by water for this reach included two in vessels provided by the Corps of Engineers, and several made in a motorized raft for low-tide inspections of resources in areas with very limited available draft.

D. Assessment of Significance

Our principal frame of reference for significance was the regional context of the Port of New York and its history. For waterfront structures, we have argued elsewhere that the particularities of harbor situations and vernacular building traditions may create very different harbor structures and historical waterfront complexes at different ports (Raber, Flagg, Wiegand, and Antici 1984). Without understanding port conditions, comparison of superficially similar structures among ports may be misleading (except perhaps for military projects), especially for pre-20th century structures built by commercial interests other than railroads. For derelict vessels, consisting almost entirely in this reach of harbor craft, there are few available contextual studies other than Brouwer 1990. We developed preliminary statements of context for a number of vessel types during this study, including assembly of scattered materials on vessels used in canals once leading into the port.

III. PRESENT PROJECT AREA ENVIRONMENTS

The coastline of the Arthur Kill New York Reach is today relatively undeveloped, and extends in most places to elevations of 5-20 feet above mean high water. Mud flats and dense vegetation characterize much of the coastline. Most original shore surfaces are level, aside from steeper terminal glacial moraine areas from about the Outerbridge Crossing through much of Tottenville. Holocene saltwater marsh extends almost continuously from Rossville north, covered with mountains of solid waste around the Fresh Kills and lower levels of fill in many other places. Small sections of salt marsh, covered largely with fill or industrial debris, appear at Smoking Point south of Rossville and south of Ellis Lane in Kreischerville. Shelving sand beach fronting level surfaces, probably with limited amounts of historic fill, found south of Bentley Street in Tottenville and in the Chelsea section opposite Prall's Island. At Tottenville north of Bentley Street, and at several commercial/industrial projects to the north such as terminals of the Mobil and Gulf oil companies and a Consolidated Edison generating station in Chelsea, fill extends 80-400 feet beyond the approximate high water lines mapped in the early 19th century prior to most historic development (cf. figures 2-7). Most present shoreline development is limited to these projects, active or abandoned marina and shipyard areas in Tottenville, Chelsea, and Travis, and the SIRT, Goethals, and Outerbridge Crossing bridges.

Offshore surfaces subject to proposed project dredging consist primarily of fine-grained inorganic sediment. Depth and sedimentation rates for this material is not fully documented, but remains of interest for any assessment of prehistoric archaeological potential as discussed in Section IV. Recent sedimentation studies indicate that Raritan River and oceanic sources deposit as much as 75,000 metric tons per year of sediment to the Arthur Kill from the south, and that about 37,000 metric tons of sediment from the Arthur Kill flows into Newark Bay each year. In New York Harbor as a whole, fluvial sources may provide about 60% of the inorganic fine-grained sediments to the system, with the ocean supplying about 30% of these materials. Dredging activities in the Arthur Kill amount to annual removal of some 45,000 metric tons of sediment, and as noted elsewhere in the region plays the major role in sediment removal. Channels and dredged pits are now the prime sinks and pathways for sediment accumulation (Suszkowski 1978; Bokuniewicz and Ellsworth 1986; Coch and Bokuniewicz 1986). Coch and Bokuniewicz noted that

> "Without dredging, the channels and pits would fill relatively quickly and the sediment budget could change substantially. It seems likely that eventually deposition over the entire floor of the [lower Hudson] estuary would be similar to that found today only in undredged areas, and if a sediment balance was redone, the strength of the requisite oceanic source would be greatly reduced" (1986:168).

Dredging in the federally-maintained navigation channels has thus altered earlier sediment accumulation rates. The deepest natural channels, enlarged by federal actions, are relatively close to the New Jersey side of the Arthur Kill, but at Tottenville are about equally close to Staten Island (cf. U.S. Congress 1920: 317). Federal channel dredging may have deposited some material in offshore project areas, as have perhaps undocumented private dredging around past or present wharves and piers in the project area.

The rates of sediment accumulation available from the Army Corps of Engineers for the Arthur Kill and channel was .55 feet per year (Jean Michel [persons consulted]). Although this rate applies only to the maintained channel and does not necessarily reflect conditions along the shore, it appears to underscore the conclusion that there is a rapid buildup of sediment in project areas. Sedimentation in project areas is now probably slower than in dredged channels, but it is likely that fluvial and ocean materials deposited within the last several thousand years comprise offshore project areas within 10 feet of mean sea level.

IV. PALEOENVIRONMENTS AND NATIVE AMERICAN RESOURCE POSSIBILITIES

Millenia of natural events and several centuries of historic settlement resulted in dramatic changes in project area land or water surfaces once open to Amerindians. These changes affected the likelihood that Amerindians settled in project areas at different times, and the possibilities of project actions impacting any remains of such settlement. In this section, we first outline the prehistoric environmental history of the project area and vicinity, and discuss the relationship of past and present landscapes. We then review current understandings of regional Amerindian prehistory and history, in this same vicinity. Finally, we assess the potential for project effects on Native American resources.

A. Regional Overview of Paleoenvironments

The project area falls largely within the Coastal Plain province of the Atlantic slope, with the northern end included within the Piedmont Plateau of the Appalachian province immediately to the north and west. The Coastal Plain slopes gently to the southeast and continues under the Atlantic Ocean as the continental shelf. In and adjacent to the project area, very gentle slopes of under 6 feet/mile characterize the Coastal Plain, although steeper slopes and higher ground are common further inland (Kummel 1940: 15-21). The Triassic period Brunswick formation, consisting of sedimentary red shales and sandstone beds up to 10,000 feet thick, underlies the lower Raritan River and the Arthur Kill along the edge of the Piedmont Plateau, including the northwest corner of Staten Island (Lewis and Kummel 1910-12 [maps], Schuberth 1968). In at least some parts of the Arthur Kill, this bedrock is today about 30 feet below mean sea level (Sargent and Lundy 1976, as interpreted in Kardas and Larrabee 1981b). An igneous diabase intrusion forming the Palisades sill occurs near the eastern edge of this formation and is exposed in west-central Staten Island. The basement rock of Staten Island consists of the early Paleozoic Wissachickon or Manhattan formation, which is made up of the metamorphic rocks schist and gneiss (Anderson 1968, Schuberth 1968). A large area of serpentine covers much of the northeastern and central portions of Staten Island.

Unconsolidated Cretaceous sands and clays of the Raritan and Magothy formations, about 70 million years old, overlie bedrock on both sides of the Arthur Kill (Schuberth 1968). The last major advance of the Wisconsin glacier in the Pleistocene, which reached its maximum extent approximately 16,000-14,000 B.C., evidently removed the Cretaceous deposits from the Arthur Kill, and perhaps from the lower Raritan. The Harbor Hill terminal moraine, created at the point of the glacier's maximum advance by the deposition of glacial till while the ice front was stabilized, covers the northern portion of Long Island and abuts the slightly earlier Ronkonkoma terminal moraine. The Harbor Hill terminal moraine crosses to Staten Island at the Narrows near Fort Wadsworth, continues west towards Todt Hill, and proceeds southwest to the Arthur Kill and from the shore to Ward's Point, where it disappears to re-emerge in New Jersey at Perth Amboy (Lewis and Kummel 1910-12 [maps]; Ogden 1977, Schuberth 1968). Stratified drift occurs south of the terminal moraine and unsorted ground moraine covers those areas north of the terminal moraine, although continued exposure of Cretaceous deposits in the Rossville and Kreischerville portions of the project area encouraged 19th- and 20th-century clay industries discussed below in section V.

The Wisconsin ice sheet was probably 10-13,000 feet thick (Sanders 1974). As atmospheric warming began in late Pleistocene times, the glacier began to retreat to the north, a process that continued until about 3,000 B.C. Coinciding with this warming trend was a rise in sea level, which during maximum glaciation had been about 400 feet below present levels as the ice locked up much of the earth's water (Edwards and Emery 1977). Although this rise continues today, it is relatively minor (about .3 ft./century compared to the most rapid rate of about 3-4 ft./century between 10,000 and 6,000 B.C. (Gross 1974:114; Kardas and Larrabee 1976a). The timing and nature of sea rise is directly relevant to prehistoric Native American cultural resources in project areas, as discussed below.

During late glacial times, there were a number of large glacially-fed lakes throughout the northeastern United States, with water levels well above present land or water surfaces. Lake Hackensack covered much of the valley of the Hackensack River including the western portion of Staten Island) and, as indicated by varve analysis, existed for 2550 years (Schuberth 1968). This lake joined glacial Lake Flushing in the area of Elizabeth, New Jersey. To the north of the project area, glacial Lake Hudson joined lakes Hackensack and Flushing to the south and east. Glacial Lake Albany was a separate body north of present Kingston, New York (Woodworth 1905; Schuberth 1968; Sanders 1974). Impounded glacial meltwaters formed these lakes during two periods: during the early Wisconsin stage from the water held by the Ronkonkoma terminal moraine across southern Long Island; and, after glacial readvance and retreat, behind the Harbor Hill terminal moraine stretching from Staten Island across the northern portion of Long Island (Sanders 1974).

Radiocarbon data suggest that by about 10,500 B.C., Lake Hudson and possibly Lake Albany drained, while brackish water associated with post-glacial sea level rise entered the lower Hudson (Newman *et al.* 1969). At the beginning of this marine transgression, sea level was about 100 feet below the present benchmark, with vast areas of the continental shelf exposed (Fairbridge 1977: 90-91). Subsequent sea rise took place at different rates, with the most rapid rise between 10,000 and 6,000 B.C. when the sea rose to within 70-80 feet of present levels. By about 600 B.C., sea level was approximately 10 feet below present (Kardas and Larrabee 1976a: 11-12).

Stream rejuvenation, associated with post-glacial rebound of land relieved of compression caused by glacier weight, deposited stratified gravel, sand and silt over glacial lake varve deposits. West of the project area, the shoreline of glacial Lake Passaic was upwarped some 77 feet (Schuberth 1968). In project areas, these stratified deposits pre-date silts and clays associated with the marine transgression which continues today. In much of the Arthur Kill New York Reach, stratified deposits are well below present surfaces, and are covered by marsh associated with rising seas discussed below. These deposits are important benchmarks for possible early human settlement on presently submerged surfaces. Estimating the location and timing of such settlement requires local dating of sea rise, along with biotic and climatic reconstructions noted below.

Geological phenomena associated with glacial retreat complicate measurement and/or identification of changing coastlines. The earth's crust did not react to the diminishing weight of the glacial ice in a linear manner. Following an early period of post-glacial crustal rebound, the lower reaches of the Hudson estuary subsided while the more northerly areas continued to rise (Woodworth 1905), a theory apparently borne out by radiocarbon dating of basal layers of peat formed by marine transgression. Basal peat, usually a good indicator of approximate shoreline locations, provides datable suggestions of dramatic elevational differences developing over short areas: peat dated to about 10,000 B.C. appears some 92 feet below present sea level in western Long Island Sound, 22 feet lower than comparable material at Iona Island upriver from Manhattan (Newman *et al.* 1969). Closer to the project area, construction of the New York Telephone building in lower West Side Manhattan revealed a peat bog with remains of several juniper (*Juniperis communis*) treetrunks 45 feet below sea level. This bog, underlaid within stratified sand deposits, provides compelling local evidence of coastal subsidence (Schuberth 1968). Regional data such as these underscore the need for local empirical data in reconstructing local shoreline history. Organic silt deposits found consistently above peat strata in controlled borings and cores reflect actual marine transgressions (Woodworth 1905; Emery and Milliman 1970; Newman 1977).

Such data have been obtained for one locale along the Arthur Kill, on Staten Island near the confluence of Fresh Kills. Prior to detailed field investigations, Kardas and Larrabee estimated that during Paleoindian times (c8000 B.C.) the Arthur Kill

> "would have been a stream valley with the ocean shore far to the east near the present continental shelf. Gradual rise of sea level was such that about 5,000 years ago (3000 B.C.)... sea levels were about 25 to 30 feet lower than at present. Under the circumstances of this gradual rise, today's apparently inhospitable salt marshes within the Study Area were probably highly desirable locations for [Native American] camp sites throughout most of the Holocene. This is particularly true along the edges of the Arthur Kill and the Fresh Kills, and where other stream confluences occurred" (1981a:4-5).

Subsequent field investigations including pollen sample probes provided detailed local paleoenvironmental information (Kardas and Larrabee 1981b). Data from a pollen sample core (VB-2) indicated that between c3,000-1 B.C. a rise in sea level turned the former freshwater stream into an estuary with brackish marshes forming peat deposits along the estuary edges. A peat sample taken from a depth of 14 feet below present sea level was radiocarbon dated at 2010 +/- 75 years before present (c60 B.C. - Dicarb Sample #2169). Accumulations of grey fibrous peat and grey clay associated with gradual sea level rise continued to c1880 A.D., a period during which shoreline position remained fairly stable but the edge of dry, upland areas continued to move eastward to present positions. Modern landfill operations compressed the underlying strata to about five feet below sea level. These results suggested that early habitation sites have not existed along this section of the Arthur Kill shore for at least 2000 years and probably longer, and that some earlier sites could be submerged beneath Arthur Kill waters.

Analysis of pollen samples indicates that following glacial retreat, there was early plant colonization of a park-tundra environment between approximately 13,000 and 10,000 B.C. (Sirkin 1967). A spruce forest with associated pine, oak and fir succeeded this episode, and lasted until about 8,000 B.C. (Eisenberg 1978; Connally and Sirkin 1971; Snow 1980). In a review of current climatic interpretations for this period, which has been traditionally viewed as a boreal forest in vegetational composition, Eisenberg (1978) argued convincingly that a more continental climate actually prevailed, based upon knowledge of late glacial drainage conditions and the nature of spruce as a colonizer species in open areas. His contended that previous paleoenvironmental interpretations were too dependent upon comparison with existing boreal forest conditions in more northerly latitudes, and that local conditions must be taken into consideration in arriving at more accurate interpretations. Newman reached similar conclusions (1977), discovering in northwestern Long Island types of diatoms, Foraminifera and mollusks which presently exist in the area within samples dating to this early period. He also argued that climatic conditions at this time were more similar to those of the present than those in more northerly areas.

Faunal species available as food to early human settlers during late glacial and early post-glacial times included such extinct forms as mammoth, mastodon, bison, and giant beaver, as well as species that have not been present in the area for several millenia: caribou, elk, horse, and musk ox (Ritchie 1980). Near the project area, a mastodon was found in clay deposits of glacial Lake Hackensack, and the remains of two mammoths have been found in the Times Square area of Manhattan (Schuberth 1968: 196-97). Modern-day species, notably white-tailed deer and moose, were also present (Eisenberg 1978; Ritchie 1980). The earliest evidence for the presence of man in the region dates to this era (Eisenberg 1978; Funk 1976; Moeller 1980).

Between about 8,000 and 5,500 B.C., continued climatic warming favored the establishment of a mixed deciduous/coniferous forest in the project area region. During this period, the Pleistocene fauna became extinct or moved north with migrating vegetation zones. More or less modern fauna replaced them, although populations of mast-eaters such as deer and turkey were probably significantly lower than in later millenia. Predominantly deciduous conditions prevailed after about 5,500 B.C., with some important climatic variations. The climate was warm and moist between about 5,500 and 2,500 B.C., and encouraged mast-eating populations as oak increased in vegetational importance, along with hemlock and varied deciduous species. As noted below, shellfish populations which attracted human settlers were also in place by this time. Warmer and drier conditions pertained between about 2,500 to 1 B.C., with possible effects on human populations. Overall, the two periods after about 5,500 B.C. probably featured mean annual temperatures somewhat above present ones. Cooler and moister climate has been the general rule during the last 2000 years, during which time sea level has been relatively stable and project area landscapes assumed the forms seen in early historic times (Salwen 1975; Newman 1977; Funk and Rippeteau 1977; Eisenberg 1978; Snow 1980).

B. Regional Native American Prehistory and History

We consulted a variety of sources to assess the potential for Native American archaeological resources, including early twentieth century archaeological reports, recent (after c1960) research reports, cultural resource management reports (after c1970) and archaeological site inventory forms and records on file at the New York State Museum, and the New York State Department of Parks, Recreation Historic Preservation. We assess the likelihood of encountering such sites in project areas after reviewing the context of information about different periods of Native American occupation.

The project area and vicinity has been the focus of both professional and avocational archaeologists, as well as collectors, since the late 19th century. Unfortunately, much of the earlier work lacks the detail necessary site-specific and regional comparison, analysis and interpretation. In many cases, field notes appear not to have been taken or contextual information relied heavily on memory or hearsay. Artifact collections were not summarized or presented in detail. While later reports certainly have more detailed information, some of the more important sites in this vicinity are known only or chiefly from surface collections -- often on disturbed areas -- and inadequately-reported excavations. None-the-less, were it not for the pioneering work Skinner, Pepper, Schrabisch, Harrington and others, much of what is known of the Archaic, Woodland, and Contact periods in the area would have been totally lost.

1. Paleoindian Period (c. 10,000-8,000 B.C.)

Research at the Meadowcroft Rockshelter in western Pennsylvania shows human populations present in the Northeast at least 19,000 years ago (Adovasio et al. 1977; Carlisle and Adovasio 1982). It is significant that this site was located close to the point of maximal advance of the glacier, implying that other sites of comparable antiquity may exist fairly close to similar points of maximal advance elsewhere in the Northeast. In the project area vicinity, however, we would not expect very early Paleoindian sites, as the waters of glacial Lake Hudson were approximately 100 feet above the present level of the Hudson River (Schuberth 1968: 195). Project area habitation was impossible before Lake Hudson drained sometime prior to 10,500 B.C.

Between about 10,500-8,000 B.C. the region was first occupied by the Native Americans we call Paleoindians. These were probably small groups of people, distinguished archaeologically by medially-fluted projectile points and a presumed lifeway based, in part, on hunting of large Pleistocene fauna. Although Paleoindian sites occur throughout the Northeast, they are few in total number, with even fewer subject to controlled excavations, so that the period is not well understood despite a dramatic increase in the discovery of sites and findspots in recent years.

Paleoindian sites exhibit diversity in both environmental settings and artifact assemblages. Site locations include the tops of hills and ridges, watercourse margins, caves and rockshelters, and lakesides (Funk 1972, 1976; Ritchie 1980; Kraft 1977; Moeller 1980; Robbins and Agogino 1964, Wiegand n.d.). Loring, noting the association of Paleoindian fluted points with beaches along the late Pleistocene Champlain Sea in New York, proposed the possibility of coastal Paleoindian sites, some of which could be submerged today (1980). Sites range from those having a limited number of artifacts in a few tool classes -- such as those at Dutchess Quarry Caves Nos. 1 and 8, Twin Fields, Davis, and Potts -- to those having large assemblages representing many functional tool classes such as the Debert site in Nova Scotia, the Bull Brook site in Massachusetts, and the Plenge site in New Jersey (Funk 1977; MacDonald 1968; Byers 1954, 1956; Kraft 1973, 1977). Defined site types include base camps, hunting camps, quarry-workshops, emergency shelters, and kill sites (Funk 1972; Gramly 1982,). Gramly proposed the latter site type based on site setting and artifact assemblage at the Vail Site in Maine, where fluted points were found in a location thought to have served as a ford for caribou migrations. The co-fitting of fragments of some of these points with fragments from an associated habitation locus with eight artifact concentrations provides a unique example of functionally separate but demonstrably coeval Paleoindian sites (1982). Unfortunately, no faunal remains at either locus were recovered to lend additional support to this interpretation. Recently, Pfeiffer (1994) reported the discovery of the Leib Site, a small Paleoindian site in eastern Connecticut at what may have been a caribou fording place. At the Hiscock site in western New York, a large number of Pleistocene fauna have been recovered including mastodon, caribou, and wapiti. Several Paleoindian tools, including a fluted point, have been recovered from the site although not in demonstrable association with any particular faunal species (Laub *et al.* 1988).

Greater amounts of better-controlled data acquired in recent years have shifted the interpretation of settlement/subsistance patterns from the traditional emphasis on nomadic hunting of Pleistocene megafauna to variations of a mixed hunting-and-gathering economy. Gardner's research in the Shenandoah Valley (1977) suggested that Paleoindians followed a more settled life and exploited more restricted territories than formerly believed. Faunal and floral recoveries from several sites point to relatively complex subsistence economies and varied diets. These remains include caribou at the Holcombe Beach site in Michigan (Fitting *et al.* 1966), the Whipple site in New Hampshire (Curran 1984), and the Bull Brook site in Massachusetts (Speiss, Curran, and Grimes n.d.). Researchers have suggested that caribou may have been associated with Paleoindian projectile points recovered from Dutchess Quarry Caves #1 and #8 (Funk 1972; Funk *et al.* 1970; Kopper *et al.* 1980), but this hypothesis has failed given the lack of demonstrated stratigraphic associations, evidence of human modification of the recovered bones of caribou and other species (giant beaver and flat-headed peccary), and a recent series of 11 accelerator mass-spectrometer radiocarbon dates which are all older than any other reported dates for demonstrated associations (Steadman, Funk and Stafford 1994).

Other faunal remains include beaver bones at the Bull Brook site (Speiss, Curran and Grimes n.d.). The Shawnee-Minisink site in eastern Pennsylvania yielded many floral remains, including large quantities of hawthorn plum seeds, blackberries, and chenopodium and physalis seeds, plus unidentified fish bones (McNett and McMillan 1974; Kauffman and Dent 1982). Moeller discounted a possible association of humans and mastodon in southwestern Massachusetts (1983, 1984), but Sneider found such association possible for a site in central New York State (1985). Loring's work along the Champlain Sea suggested that Paleoindians may have utilized marine resources (1980), a view shared by Brennan, who suggested oyster use by Paleoindians in the Lower Hudson (1974). This latter possibility found support in the work of Newman *et al.* (1969).

Several limited finds in the greater metropolitan New York region confirm the presence of Paleoindians, including the recovery of several diagnostic artifacts at the Piping Rock site on the lower Hudson River (Brennan 1977), the discovery of artifacts at a site in White Plains (personal communication, Jay McMahon), and two fluted points and several other artifacts of probable Paleoindian age found during construction in Pound Ridge (Wiegand n.d.). The project area includes several Paleoindian sites with far more recovered material, but with significant problems of artifact integrity.

The best known Paleoindian find on Staten Island is the Port Mobil site along the Arthur Kill, consisting of three contiguous areas of Paleoindian occupation which may represent separate sites. The Port Mobil site proper is located within the Mobil Oil tank farm on a hill about 1500 feet northeast of the Arthur Kill and 25-50 feet above the waterway. Port Mobil finds include 144 tools, among which are 18 small fluted points and over 100 other scrapers, drills, knives, gravers, spokeshaves, cores and other tools. Approximately 30-40 of these tools were collected from the Charleston Beach site nearby. Unfortunately, these materials were all obtained from disturbed contexts when exposed by construction activity at the tank farm (Kraft 1977). Kraft suggests that Port Mobil may have been occupied recurrently.

The Charleston Beach site is immediately southwest of the Port Mobil site along the Arthur Kill. Salwen (1968) reported 2 fluted points along with many other artifacts dating to more recent Early or Middle Woodland times. Ritchie (1969) provides a list of some of the collected artifacts: six fluted points, three side scrapers, and single specimens of flake knives, utilized flakes, single and double spokeshave scrapers. Unfortunately, the other remaining Paleoindian artifacts from the site are not specified here or in the other reports, making an interpretation of site function difficult. This site was also surface collected. Although Salwen felt the beach was too disturbed to yield intact archaeological deposits, he suggested deep excavations through the peat layer behind the beach in hopes of finding in situ materials (1967a). Test excavations in 1968 discovered Paleoindian materials beneath a peat layer at the beach edge (Salwen 1968, cited in Pickman 1988a and Pickman and Yamin 1978).

The North Beach site is located on an outwash beach near the Arthur Kill, north of the Port Mobil site. Surface collection here yielded a broken fluted point, a fluted point preform, two large unifacial knives, an end scraper with graving spurs and a side scraper (Kraft 1977). Several other areas in Staten Island have yielded small amounts of Paleoindian materials. At the Cutting site, close to the Arthur Kill, a single fluted point was found in the early 20th century (Sainz 1962). Surface finds have also been found along the Arthur Kill at the Smoking Point Site (Pickman and Yamin 1978).

2. The Early Archaic Period (c8,000-6,000 B.C.)

The Archaic era generally featured development of a mixed, diffuse economy based on hunting, fishing, and the gathering of plant foods. Although the Early Archaic period is not well documented, it emerged directly from Paleoindian lifeways. Cavallo's discovery of the Turkey Swamp site in the Mantasquan River Basin of northeastern New Jersey, with Paleoindian style tools and Early Archaic radiocarbon dates (7660 +/- 660 to 8739 +/- 165 B.P. [before present - c5710-6789 B.C.]) suggests a gradual local cultural development comparable to that known for the Southeast (1981).

Early Archaic materials are often hard to distinguish, frequently appearing intermixed with later artifacts or features. Their paucity has prompted some to propose a period of low human population, but recovered evidence may simply reflect archaeological sampling procedures, site destruction, and possible drowning of sites by risen seas. The inferred importance of hunting may be more apparent than real, given the lack of preserved organic remains. Most known sites are small, with the few recovered artifacts suggesting short-term camps, although large concentrations of Early Archaic materials such as those from the Taunton River basin in southeastern Massachusetts suggest possible base camps (Funk 1972; Dincauze and Mulholland 1977).

There are Early Archaic materials reported for several sites in the project area vicinity on Staten Island. Avocational archaeologists Albert Anderson and Donald Hollowell found Early Archaic materials from several sites, the most impressive of which is at Ward's Point, a large multi- component site south of the project area dating from Early Archaic to the historic period. Excavations by several avocational archaeologists resulted in the recovery of over 30 points as well as scrapers, knives drills, utilized flakes, "choppers," hammerstones, anvil stones, abrading stones and celts. The variety of point types is both impressive and puzzling. Most are bifurcated types such as LeCroy (4) and Kanawha Stemmed (14), with three untyped bifurcates as well. Also found were 3 Kirk Stemmed, 1 Kessell side-notched and 12 other untyped points. Charcoal samples from two hearths were dated at 5310 +/- 125 B.C. (I-4512) and 6300 +/-140 B.C. (I-5331). Ritchie and Funk (1971) noted that while the 6300 B.C. date would correspond well to the dates of between c6200-6300 B.C. for LeCroy and Kanawha Stemmed points from the St. Albans site in West Virginia (Broyles 1966), the 5310 date is far too young for these types and was considered questionable.

At the Hollowell site, about 30 points were recovered, most of which were Kanawha Stemmed. Other tools included scrapers, knives, an adze, choppers and celts (Ritchie and Funk 1971). At the Old Place site near the northwestern corner of Staten Island, Kirk Stemmed, Kirk Corner-notched, Stanley and Morrow Mountain points were found by Anderson and Joseph Bodnar. They also excavated a hearth which was radiocarbon dated to 5310 +/-125 B.C. (I-4070) (Funk 1976). The Richmond Hill site excavated by Hollowell produced a date of 7410 +/- 120 B.C. (I-4929) for a level containing Palmer points, Kirk Corner-notched points, a single Hardaway-like point and a variety of other tools, including scrapers and choppers (Ritchie and Funk 1973).

Early Archaic materials have been found elsewhere on Staten Island, but definitive descriptions are lacking. At the Travis or Long Neck Site, at the former site of the Richmond County Airport near the confluence of Neck Creek and the Arthur Kill, a single bifurcated-base point appears in Burgher's 1941 report. As over 3000 points were found, as well as hundreds of other artifacts at this major multi-component site, it is quite possible that additional Early Archaic materials exist within the collection. This is the only site in or very close to the project area with Early Archaic materials.

The somewhat latter dates for the Ward's Point and Old Place sites point to the possible later diffusion of point types known for the Early Archaic in West Virginia (Broyles1966) into the Northeast, where they may be of Middle Archaic age (c6000-4000 B.C.). Ritchie and Funk (1973) point to ameliorating environmental conditions to explain the greater presence of Early Archaic sites in the region at this time. Other sites in the vicinity yielding Early Archaic materials include the Ryders Pond site on Long Island and, along the Hudson River in Westchester County, the Piping Rock, Montrose Island and Dogan Point sites (Ritchie and Funk 1971; Funk 1976).

3. The Middle Archaic Period (c6,000-4,000 B.C.)

During the Middle Archaic period a period of continued climatic warming encouraged the establishment of essentially modern deciduous forest. A more diverse resource base may account for the greater number of known archaeological sites for the period. Available data suggest a well-established pattern of seasonal food capture, with site types apparently including spring fishing camps, hunting camps, rockshelters, and -- at least in the lower Hudson estuary -- shellfishing stations (Dincauze 1976; Barber 1980; Starbuck 1980; Wiegand 1983; Brennan 1977). The North Bowdoin Rockshelter along the Hudson in Putnam County contained oyster shells radiocarbon dated to 7170 +/-225 B.P.[c5220 B.C.] (GX-11448) and Neville points (Funk 1991). Although better represented in the archaeological record than the preceding period, there are few documented stratified sites with good organic preservation. Recovery of such sites is essential for fuller descriptions of settlement patterns and Amerindian use of available natural resources. As mentioned above, some of the Early Archaic Staten Island sites, Old Place and Ward's Point, appear to have been occupied during the early portion of the Middle Archaic period based on both radiocarbon dating and -- at the Old Place Site -- some of the projectile point types recovered. The Stanley and Morrow Mountain points from Old Place are comparable to the Neville and Stark types, respectively, defined by Dincauze (1976) for the Middle Archaic in southern New England.

The Middle Archaic seems to be the most poorly-represented prehistoric period on Staten Island. However, if Late Archaic Poplar Island points actually are earlier, as suggested by Dincauze (1976:140), then Staten Island's Middle Archaic may indeed be somewhat better represented than previously thought. Poplar Island points have been found stratigraphically lower than Late Archaic Laurentian materials at Duncan's Island in the lower Susquehanna River (Witthoft 1955). Unfortunately, clear stratigraphic relationships and radiocarbon dates to support this possibility remain elusive. Poplar Island points are found at several sites on Staten Island. At the Wort Farm Site south of the project area, a single specimen was found along with three points which bear traits of both Late Archaic Bare Island and Poplar Island types (Williams 1968). One is shown is Plate 1 of Williams' report and closely resembles a Stark point. Poplar Island points were also found at the Smoking Point Site in or near the project area (Rubertone 1974), and unspecified Middle Archaic points are known from the Gericke Farm Site (Yamin and Pickman 1986). At the Old Place Site, Poplar Island and Bare Island points were found stratigraphically below a concentration of Bare Island points (Ritchie 1969:147). At the Bowman's Brook A Site near the Kill van Kull in northwestern Staten Island, avocational archaeologists Albert Anderson and Donald Sainz recovered seven Poplar Island points, one of which was associated with a hearth (Ritchie 1969:146). Poplar Island points were also found at the Arlington Place Site, a half mile south of the Bowman's Brook Site (Ritchie 1969: 147).

4. The Late Archaic Period (c4,000-1,700 B.C.)

In the Northeast, there are hundreds of known sites attributed to the Late Archaic period in extremely diverse environmental settings: coastal, riverine, lacustrine, marsh margin, upland, and at sources of lithic raw materials for tool manufacture. Data from Late Archaic sites not only suggest the kind of diversified use of resources for earlier periods, but raise questions of changed population levels and possible ethnic or cultural distinctions (Salwen 1975; Funk 1976; Brennan 1977). At present, such distinctions are entirely functions of differences in artifact styles, and may not reflect any sociological realities. Along or near the lower Hudson River, which during this period was within 10 feet of its present level and probably near its present width, discovered sites include shellfishing stations (Brennan 1974), fall hunting camps (Wiegand n.d.), quarry-workshops (Wiegand n.d.), and rockshelters (Shoumatoff and Hobbs 1975; Wingerson and Wingerson 1976; Wiegand 1980, 1982). Other sites in the Northeast include large, possibly permanent camps, some with mortuary features (Ritchie 1980; Pfeiffer 1983).

Despite the greater body of data evidently available for this period, relative to earlier and some later ones, details of specific adaptations in various areas remain unknown due to both previous research inadequacies and to general problems encountered in Northeast archaeology (Ritchie 1969; Funk 1976). The latter include poorly-defined stratigraphic separation of components, post-contact disturbance or land alteration, and poor organic preservation in some acidic soils (Jordan 1975). For example, Skinner (1909) believed the absence of ceramics in the lower levels of rockshelters excavated by Harrington (1909) and Schrabisch (1909) represented functional differences rather than a pre-ceramic period. The work of these and other late-19th- and early-20th-century excavators initially suggested only Woodland sites survived on Manhattan, but it is now clear that Archaic components were simply not recognized as such.

The Late Archaic period is well represented on Staten Island, where numerous sites have been discovered. While most of these sites appear to have been of small size and probably short-term occupations, a few may represent either major occupations or areas where recurrent occupations have resulted in the deposition of large amounts of materials. As is unfortunately the case for many Staten Island sites, many of the sites are known from disturbed contexts and surface collections, or from the notes or recollections of avocational excavators.

One such site is the aforementioned Travis (Long Neck) site. Now largely destroyed by the construction of an airport, it was actively surface-collected and excavated for over forty years. Although Burgher's 1941 report does not identify the types of the over 3000 points found, large numbers of other temporally diagnostic artifacts are identified. For the Late Archaic, 40 bannerstones are known, including perforated types of probable Vosburg phase affiliation and notched types similar to those reported for the Sylvan Lake phase (Funk 1976). It should be noted that perforated "wing" bannerstones associated with Middle Archaic Stanley/Neville points have been recently recovered from a cremation burial radiocarbon dated at 7880 C-14 years B.C. at the Annasnappet Pond Archaeological District in southeastern Massachusetts (Cross and Doucette 1994). Therefore, at least some of these items from Travis could be of Middle Archaic age. Other items which are probably of Vosburg affiliation include at least 12 semilunar knives and a single plummet. Given the large number of grooved axes (107) and adzes (21) recovered, it is probable that at least some of these date to the Late Archaic.

Late Archaic materials are also present in large numbers at the Ward's Point site, where 302 (35%) of the 860 points summarized by Jacobson (1980) are attributed to this period. These points indicate occupations by peoples associated with the Vosburg, Sylvan Lake and later artifact traditions of the period. Other distinctly Late Archaic artifacts are limited to two bannerstone fragments, one of which was found in a pit feature and is the only demonstrable association of a Late Archaic artifact with one of the several dozen such features known for the site.

Late Archaic artifacts have been recovered in smaller numbers at many of the other sites on Staten Island on or near the Arthur Kill, including several in or near the project area: Wort Farm (Williams 1968), Smoking Point, Chemical Lane (Salwen 1967b), Pottery Farm and Cutting (Roberts *et al.* 1988), to name a few. Along the Kill Van Kull, the Arlington Place and Bowman's Brook sites included Late Archaic Bare Island points. A Late Archaic occupation is also known for the Goodrich site (Greenhouse Consultants 1990).

5. The Terminal Archaic Period (c1,700-1,000 B.C.)

The Terminal Archaic period is best known for the appearance of broad-bladed projectile points and, during the latter half of the period, the use of steatite cooking vessels. Whether these traditions represent actual ethnic differences or simply diffusion of technology from points west and south is anyone's guess. The broad-blade tradition is sometimes associated with burial practices reflecting origins in the Midwest, and is frequently found in more estuarine and coastal locations than Late Archaic sites regionally.

On Staten Island, traces of Terminal Archaic occupations have been found at a number of sites. Snook Kill points were found at the Old Place Site. "Pennsylvania Broad" (Susquehanna Broad?) points were found in the northern locus of the Chemical Lane site near the project area by Sainz, and Anderson reports a "Vinette I vessel in situ with Perkiomen points lying in carbon" (letter to G.O. Pratt, Jr.)(Salwen 1967b). At the adjacent Pottery Farm Site were found Orient phase materials (Rubertone 1974). Orient artifacts were also found at the Smoking Point Site (Pickman and Yamin 1978). Further south, Jacobson reports that 31 points of the period exist for a series of collections made in Tottenville. This represents but 4% of the sample of 860 points examined, and prompted him to suggest that Staten Island may not have been as heavily occupied during the Terminal Archaic as it had been during the Late Archaic and Woodland periods (1980: 55-57). Jacobson also noted several pieces of steatite bowls. Near the Kill Van Kull, the Arlington Place Site yielded Orient Fishtail points and steatite bowl sherds (Salwen 1967c).

6. The Early Woodland Period (c1,000 B.C.-1 A.D.)

The appearance of fired clay ceramics at about 1000 B.C. marks the somewhat ambiguous beginnings of the Woodland era, which is divided arbitrarily into three periods: Early (c1000 B.C. - 1 A.D.), Middle (c1-1000 A.D.), and Late (1000 A.D. to European contact). Most of the Woodland apparently featured a continuation of Archaic economy, although the increase in known shell middens dated to the Early Woodland may indicate an increase in somewhat more sedentary lifestyles. The middens may simply reflect the changing coastlines, which only stabilized around this time: earlier coastal sites are in many cases probably under water. For the lower Hudson Valley, there are few reported Early Woodland sites, most of which are on major waterways (Funk 1976). These data may reflect a settlement shift related to a diminished saline content in the river -- perhaps derived from sedimentation -- which lowered oyster populations (Brennan 1974).

Deteriorating climatic conditions in Early Woodland times may have diminished populations of other biotic resources (Funk and Rippeteau 1977). Although Early Woodland shellfishing stations appear along the lower Hudson River, they are few relative to those known for earlier times (Brennan 1962a). This period included some elaborately-furnished burial sites, but so far has yielded few well- preserved habitation sites (Ritchie and Dragoo 1960). The low site density of the period also appears to apply to the project area vicinity. In his survey of archaeological investigations in the Tottenville area, Jacobson reports that only 20 (2%) of the 860 points surveyed are of this period, which is lower than all other periods represented, including the Early Archaic (1980).

A shell midden at the Smoking Point Site, which yielded both Orient Fishtail points and sherds of a flat-bottomed ceramic vessel (Ware Plain or Marcey Creek?) may represent the very beginning of the Early Woodland on Staten Island (Salwen 1967d). Located at the very north end of Chemical Lane and adjacent to the Arthur Kill, much of the midden has been covered by sand from channel dredging. Inland from the Arthur Kill, Williams' work at Area B of the Wort Farm Site produced Vinette I, Windsor Cord Marked and Matinecock Point Incised sherds of the Early Woodland North Beach phase of the Windsor Tradition (Williams 1968; Smith 1950; Ritchie 1969). Early Woodland materials were also found along the northern edge of Clay Pit Road (Yamin and Pickman 1986).

Although two of the six sites in New Jersey reported by Skinner and Schrabisch (1913) are reported as containing potsherds, the descriptions are not sufficiently detailed to allow a more specific temporal placement than Woodland period.

7. The Middle Woodland Period (c. 1-1,000 A.D.)

The Middle Woodland period is also poorly known for the lower Hudson vicinity (Funk 1976). Settlements may have become more permanent, at least in the middle Hudson Valley, based on the presence of large, possible storage pits and on the larger size of ceramic vessels. Limited materials from this period in the lower Hudson appeared at the Parham Ridge, Crawbuckie Nos. 1-7, Hanotak Rockshelter, and Van Cortlandt sites (Brennan 1962b; Funk1976). The Seaman Avenue burial sites in Manhattan included Middle Woodland ceramics (Bolton 1909; Cohn 1976b).

Williams (1968) reports a single early Middle Woodland Fox Creek point (formerly Steubenville Stemmed) from Area A of the Wort Farm site. A single probable Jack's Reef Corner-notched point is depicted on Plate 13 of Burgher's report on the Travis site (1941). Pottery of Early or Middle Woodland age was also found on the surface at the Charleston Beach Site (Salwen 1967a).

The largest concentration of Middle Woodland materials on Staten Island occurs in the Tottenville area. Jacobson's collection survey lists 155 points (18% of his total sample of 860) as being of this period. Of the 127 pit features (a minimum number, given the lack of detailed documentation for much of the work carried out over the decades in this area), only one contained "archaic Algonkian"(Early to Middle Woodland?) sherds. Of the at least 77 burials known from the Tottenville study, most cannot be accurately dated. However, a child burial here is one of the most richly furnished graves in the region. Discovered in Pepper's 1895 investigations, the deceased was accompanied by lavish grave goods including 2 Jack's Reef Corner-notched points, cache blades, a shell necklace, a stone pendant, a platform pipe, a cut mica ornament and a probable copper gorget. The Jack's Reef points and platform pipe are clearly indicative of a Middle Woodland age, although the cultural affiliations are not entirely clear (Jacobson 1980).

8. The Late Woodland Period (c. 1,000-1600 A.D.)

By Late Woodland times, which ended with the 17th century settlement of Europeans, horticulture was evidently present (Ritchie 1980). Until recently, maize horticulture and somewhat increased sedentarism were a given in reconstructions of Late Woodland prehistoric life for the coastal New York region, along with possible increases in warfare and fortification (Smith 1950; Solecki 1950; Salwen 1975; Ritchie 1980). There is evidence, however, that the Delaware or Lenni Lenape people who lived in the Late Woodland lower Hudson Valley were not engaged in intense conflict; similar people in the upper Delaware Valley occupied small, unfortified, dispersed hamlets along river bottoms (Kraft 1970, 1974). Ceci argued that both maize horticulture and sedentary village life were products of European contact in at least this area, and that prehistoric maize production was not productive here (1977, 1979). Silver reviewed evidence supporting the traditional view (1981), and it is clear that this issue will require much more work. At stake are fundamental differences in understanding what happened to local Native Americans in early historic or Contact times.

Many of the sites found on Staten Island have contained a Late Woodland component. At the Wort Farm Site, Williams recovered Late Woodland Madison and Levanna points and a small amount of ceramics (1968). At the Smoking Point Site, recovered ceramics included a Middle or Late Woodland pipe with incised decoration (Rubertone 1974). Two Madison points were recovered from the Junkyard Site at Clay Pit Ponds State Park Preserve (Yamin and Pickman 1986). Given the large number of artifacts found at the Travis Site, it is quite possible that Late Woodland materials were plentiful here. Although only one probable Levanna point is depicted in the report, a total of 16 hoes and a number of stone mortars were recovered, which along with several Contact period trade items indicates occupation from the Late Woodland into the historic period (Burgher 1941).

Smaller amounts of Late Woodland materials were also recovered near the south end of the project area from the Woodvale-by-the-Sea development, where they were found in fill thought to have derived from a nearby site (Pickman 1988b). Recent work has included the recovery of Late Woodland Bowman's Brook phase materials from the site of a New York City Correctional Facility immediately adjacent to the Arthur Kill (Pickman 1993). Although there was evidence that much of the area had been disturbed during historic times, some evidence of shell features appeared below the plow zone.

Of the several Woodland period sites along the Kill Van Kull, only the Bowmans Brook site (the type site of the Bowmans Brook phase of the East River tradition can be attributed specifically to the Late Woodland, although it is likely that some of the others, which are described as village sites (some with burials) or shell middens, are also Late Woodland (Ritchie 1969, Smith 1950).

By far the largest amount of Late Woodland materials recovered so far from Staten Island come from the Burial Ridge site and other nearby sites in Tottenville. Late Woodland Madison and Levanna type points totaled 232, 27% of the 860 points studied by Jacobson (1980), and many of the 667 sherds he summarized are of Late Woodland age. So too were those found during Jacobson's 1960 excavations, where most of the ceramics were of the Clasons Point phase (Jacobson 1980). Although 55 pit features and 77 burials are known from the numerous collections and all-too-few controlled excavations that have been conducted at the Tottenville sites, few contained ceramics or other artifacts whose age and/or cultural affiliations have been determined. Regarding the burials, Jacobson notes that their pattern of orientation "lends some support to the thesis of a Munsee-speaking cultural presence in southern Staten Island, with the sizable proportion of skulls heading southwest from associated postcranial remains" (1980:69).

9. The Contact Period (c1600-1700 A.D.)

Giovanni da Verrazano led the first European exploration of the region in 1524, but despite probable continued visits by Dutch whalers during the sixteenth century there was no sustained contact before Hudson's 1609 explorations (Brasser 1978). At this time, present metropolitan New York was part of a wide area occupied by the Delaware, who probably evolved directly from Late Woodland cultures given evidence of artifact assemblages and settlement patterns (Kraft 1974). Kraft (1970) contends that the Pahaquarra-Minisink continuance is distinct from that of the Owasco-Iroquois defined by Ritchie (1980), although the northern Munsee Delaware probably were in active contact with the Mohawk Valley Iroquois. The Munsee-speaking Delaware were probably not a defined political unit, in contrast to the Iroquois, but rather a loosely-organized, Algonquian set of culturally- and linguistically-related groups in New Jersey and adjoining portions of Delaware, Pennsylvania, southeastern New York, and southwestern Connecticut (Goddard 1978a, 1978b; Salwen 1978).

In New Jersey, the Raritan Delaware occupied the lower Raritan River area north to the Kill Van Kull. They also occupied the southern part of Staten Island, with the Hackensack occupying the island (Bolton 1975). Most Native Americans on Staten Island left in 1675, following their last land sale of 1670 (the first being in 1630). Some Canarsies from Long Island, who had moved to Staten Island after selling their own land in 1652, were still present at Fort Hamilton, possibly retaining some rights of use on Staten Island (Skinner 1903; Goddard (1978b). To the north, the Reckgawawanc Delaware occupied northern Manhattan, with the southern part of the island possibly held by the Mareckawicks, who lived chiefly in parts of Brooklyn (Bolton 1975). These and other local groups in this region practiced a seasonal round of activities including hunting, fishing, shellfishing, gathering, and farming (Van der Donck 1868; Lindestrom 1925).

Remains of European trade goods and Native American wampum at numerous sites in the lower Hudson/Long Island region and the Delaware Valley reflect extensive Dutch-Delaware commercial relations centered on the fur trade. Higher fur prices at New Amsterdam than along the Swedish-controlled Delaware brought many Delaware to the city from western New Jersey and eastern Pennsylvania (Zimmerman 1974). Beaver remains at Contact-era sites are particularly telling. Limited recovery of trade items at Delaware sites could reflect insufficiently intensive survey for often tiny items (Skinner 1915; Kraft 1974). Northern Manhattan has yielded an unusual amount of Contact period materials at Dyckman Street Site burials and at Inwood Park, although questions remain as to the ethnic identity of the burials (Finch 1909: 68; Bolton 1909; Ceci 1977). The Delaware occupied the northern island through most of the 17th century, as indicated by a 1676 document granting a group called the Weckquaesgeek the right to use old planting fields at Inwood (Bolton 1975; Ceci 1977). Immediately north across Spuyten Duyvil, the Reckgawawanc maintained a fortified site called Nipnichsen from which they attacked Henry Hudson on his return downriver in 1609 (Bolton 1975; Finch 1909).

The intensity of the fur trade decimated beaver populations in this area by about 1640 (Underhill 1838; Van der Donck 1968). Wampum production, which required access to the coast for the shell raw material, continued as an important native commercial activity since the Dutch used wampum as a medium of exchange for trade with inland groups to whom beaver remained accessible (Salwen 1978). Beginning c1640, however, Old World diseases and the Governor Kieft War with the Dutch lowered local Delaware populations substantially, and land sales reduced the number of native settlements. By the early 18th century, most remaining Delaware moved to the Ohio River Valley (Weslager 1978).

The availability of historic documents for the Contact era does not solve a number of uncertainties about Amerindian life in this period. Ceci argued that European trade led to permanent village settlement by encouraging the production of wampum, since she believed maize cultivation would have been insufficient in this area for such settlement (1977). Van der Donck's reference to corn planting in burned-over fields in the early 1600s may contradict this argument, although it is unclear if he was referring to the coast or to areas further up the Hudson (1968). Temporary seasonal camps, used especially for winter hunting, do emerge in early historic accounts, but actual recovery of deer bones indicating winter kills at village sites suggests only some villagers were doing the hunting. There are also temporary camp sites which appear to have been used in both warm and cold seasons. Ceci argued these multi-season camps reflect attempts by the Delaware groups to remain close to areas of European trade, and that they preceded the establishment of permanent villages devoted to fur trade or wampum production (1977). Only additional empirical work at Contact era sites can begin to resolve these and similar problems, such as the dramatic issue of whether Native American political and military activities were indigenous or induced.

Archaeologically, the Contact period is very poorly represented on Staten Island. At Burial Ridge in Tottenville, only two pit features contained trade materials: an iron knife and a Spanish Medio Real minted between 1685-1700 (Jacobson 1980). A single burial containing a sherd of Dutch pottery and bottle glass is the only definite Contact period grave known, although one other burial contained an (intrusive?) iron knife blade. Other artifacts from the Tottenville area attributable to the Contact period include 12 gun flints, 6 kaolin pipe fragments, an iron nail, and 5 metal projectile points. Skinner's report that one of the burials at Tottenville contained 96 whelk columella, the stock from which white wampum beads were manufactured, may mean that this burial was also of the Contact period, when wampum production was a widespread and important economic activity (1912). Several items found at the Travis site have been considered trade items. However, at least some of those cited in the text or depicted in Plate 15 of Burgher (1941) are of late 18th or 19th century origin, including the clay tobacco pipes marked "R. Tippet" and "Peter Dorne" as well as #1 and 3 in Plate 15, and at least one of the gunflints (Plate 15:9), which is of the blade type commonly available after 1740 and which replaced the earlier wedge type (Whitthoft 1966). Skinner (1909) and Parker (1922) report two Contact sites: Bloomfield (a.k.a. Watchoque) and New Springville. No Contact period sites are known for the west side of the Arthur Kill or from the New York side of the Kill Van Kull.

C. Assessment of Native American Site Potential in the Project Area

The summary above clearly indicates there was human occupation in or near project areas through all periods of Native American settlement in the Northeast. As we noted in our companion study of the Arthur Kill New Jersey Reach (Raber *et al.* 1995a: 20-21), earlier researchers have remarked on the abundance of archaeological sites on Staten Island's west side -- as well in the South Amboy vicinity of Raritan Bay and along the south side of the Raritan River -- relative to the dearth of sites on the Arthur Kill's New Jersey shore (cf. Skinner 1912: 90-1, Skinner and Schrabisch 1913: 43). As noted above, recent research indicates that sites were located elsewhere on Staten Island (Pickman 1988), but these often appear to be short-term camps or resource acquisition sites. Many of the sites along the western and northern portions of Staten Island are, in contrast, much larger and contain higher densities of both artifacts and features. Given the nature of most of the archaeological investigations conducted overmore than a century, it is difficult to determine with confidence whether these differences reflect multiple short-term occupations of a particular site over a long period or seasonal, semi-permanent or permanent (year-round) occupations as well. The density of archaeological materials in the Tottenville/Burial Ridge area, particularly from the Woodland period, would argue that longer term settlements were present along the shore.

Several characteristics of the Arthur Kill New York Reach and immediate vicinity may have made this area very desirable for Native American settlement, especially the proximity of well-drained uplands or beaches to freshwater streams, mudflats, and marshes. While rich in bird life and other natural resources, the marshes probably inhibited habitation except for very small seasonal camps on isolated high spots. Deeper water in historic times has run close to the New Jersey coast of the Arthur Kill, with the most extensive mudflats located adjacent to Staten Island (cf. U.S. Congress 1920: 317). Mudflat environments of some mollusks and shellfish (mussells, clams, and crabs) made these areas attractive to native harvesters. The Tottenville or Ward's Point vicinity, a terminal moraine area with high ground adjacent to marsh and bay resources -- including the oysters once found in huge middens at sites around South Amboy -- would have likely been an unusually attractive area in a largely wetland environment. These characteristics pertained for at least the last 2000 years of prehistoric life in this area, as the sea rose to levels high enough to allow for marsh development. In earlier periods, settlement could have occurred not only under the present Arthur Kill and Raritan River, but under historic marsh areas as well.

Although many sites reviewed above can be assigned to specific periods, it must be emphasized that recovery of datable information from intact cultural deposits in well-controlled excavations has been relatively rare in the project area and vicinity. There are also many sites for which information is far more limited. One such site is the Chelsea site, first reported as Skinner's Site 6 (1909) and later as Site 7(1909)(Salwen 1967e), at which "graves" and "lodges" were found as well as grooved axes but no pottery. It was located about a quarter of a mile east of Pralls Creek along Bloomfield Road. Many other sites appeared in reviewing published sources (Parker 1922, Bolton 1975, Skinner 1903) and site inventory records at both the New York State Museum and the New York State Department of Parks, Recreation and Historic Preservation. Cultural resource management-generated investigations have many located sites, but most of these are Stage 1 investigations of insufficient intensity to recover detailed information or, in many cases, even an age and/or cultural affiliation (i.e. Greenhouse Consultants 1987, 1988; Williams 1967). Of the eleven prehistoric sites discovered during the Stage 1B survey of the Clay Pit Ponds State Park Preserve, only two sites had temporally-diagnostic artifacts (Yamin and Pickman 1986). **Despite the plethora of prehistoric material from this important area, then, any intact new finds in the project area could contribute to better understanding of regional culture history, and perhaps meet National Register eligibility Criterion D on this basis. It is important to note that most Native American finds in disturbed contexts within this area would probably not meet this criterion, given the relative abundance of similar information already collected for all prehistoric periods. Well-preserved isolated features and additional Contact-era artifacts might meet this criterion even in disturbed contexts.**

Even allowing for marine transgression, erosion, and, in places, heavy disturbance due to historic development, there is a good possibility that some sites exist within project limits beneath existing landfill as is the case for the Smoking Point site (Salwen 1967d), under near-shore peat deposits as at Charleston Beach (Salwen 1968), or under offshore marine deposits overlying late glacial sands. Proposed project actions with possible effects on Native American resources include offshore dredging and onshore creation of equipment access roads or staging areas. In addition to the possibility of existing prehistoric sites being located in the areas to be dredged, it is clear from the preceding sections that a large number of sites have been found within a short distance from the present shore, particularly in well-drained locations.

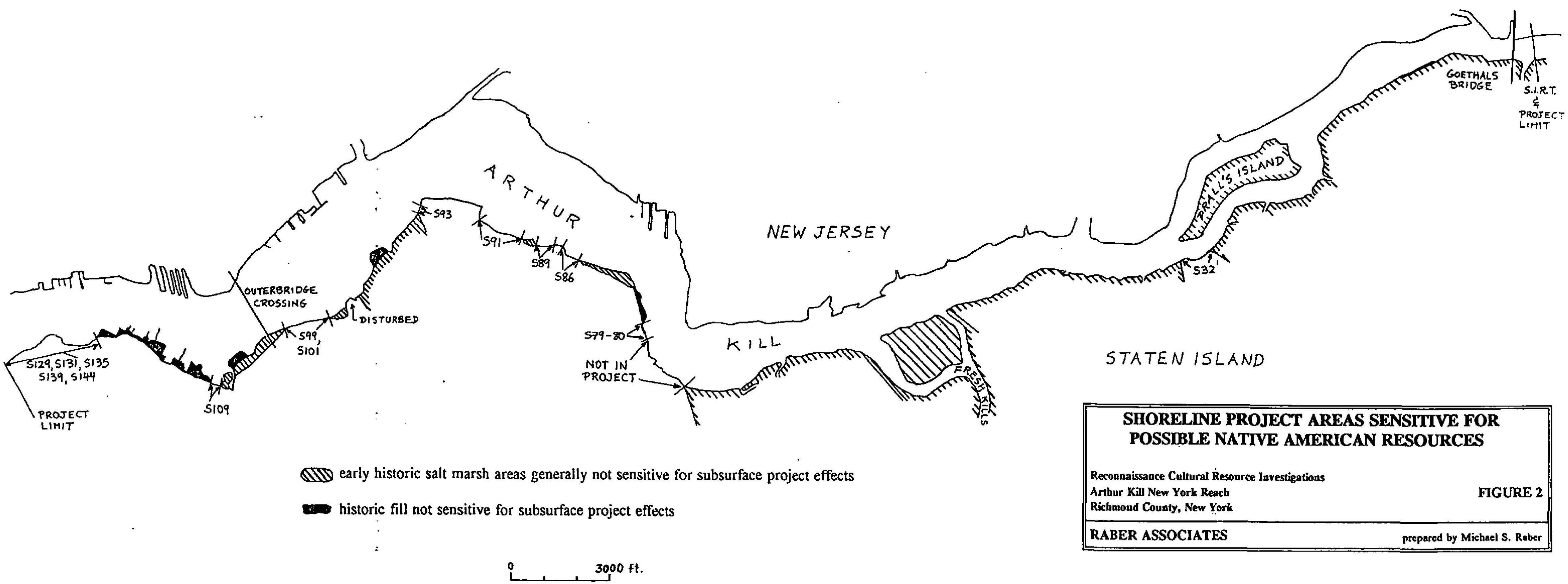
At present, it is not possible to define possible project effects with any precision. Dredging or onshore access limits remain unspecified. We also have little detailed information on the extent of subsurface disturbance along project areas, or on the depth or extent of landfill placed on marshes or other original historic surfaces. We can, however, distinguish onshore project areas in terms of potential for buried Native American sites and assess potential project effects in general terms. As shown in Figure 2, detailed comparison of about twenty historic maps indicates three major types of onshore surfaces with different archaeological potential:

- **Historic fill placed 50-300 feet outshore of marshy or dry-land historic coastlines would not have intact Native American archaeological materials.**

- **Marsh surfaces beneath historic fill would probably not contain intact, potentially significant Native American resources.** Although fill depths are not well documented and earlier dry-land surfaces beneath marsh deposits have demonstrated potential for such resources, proposed actions are unlikely to penetrate marsh deposits because of construction cost factors, such as the need to reintroduce fill for stable surfaces. **Small well-drained elevations within marsh areas and/or near streams are an exception to this generalization, however. The Travis Site appears to have been located in such a context.**

- **Well-drained, sandy beach or upland areas documented prior to historic filling should be regarded as very sensitive for intact, potentially significant Native American resources, unless subsurface disturbance can be documented.** There is a strong cartographic correlation of these areas with reported archaeological sites. All or parts of the following project catalog items, consisting of miscellaneous debris to be removed along the shore, appear to include such areas: S32, S79, S80, S86, S89, S91, S93, S99, 101, S109, S129, S131, S135, S139, and S144. Some of these items include areas of outshore fill or historic marsh. At least one, S99, includes an area almost certainly disturbed or covered by activities at the demolished Kreisher brick works discussed in section V.

Project actions call for dredging to as much as 10 feet below mean sea level in small selected areas. The partially-documented siltation and channel dredging regimes discussed above in Section III suggest that **it is unlikely project dredging would penetrate Holocene marine and river silts, in which no intact Native American resources are expected. Outwash deposits beneath these more recent sediments could include such resources. Only borings made in or near proposed project dredging sites can confirm the depths of the more archaeologically sensitive deposits. Available information from Staten Island indicated that these deposits were more than 10 feet below mean sea level** (Sargent and Lundy 1976, as interpreted in Kardas and Larrabee 1981b).


S.I.R.T. & PROJECT LIMIT
GOETHALS BRIDGE
PRALL'S ISLAND
S32
NEW JERSEY
ARTHUR
KILL
STATEN ISLAND
FRESH KILLS
NOT IN PROJECT
S79-80
S86
S89
S91
S93
DISTURBED
S99, S101
OUTERBRIDGE CROSSING
S109
S129, S131, S135
S139, S144
PROJECT LIMIT
early historic salt marsh areas generally not sensitive for subsurface project effects
historic fill not sensitive for subsurface project effects
0
3000 ft.
SHORELINE PROJECT AREAS SENSITIVE FOR POSSIBLE NATIVE AMERICAN RESOURCES
Reconnaissance Cultural Resource Investigations
Arthur Kill New York Reach
Richmond County, New York
FIGURE 2
RABER ASSOCIATES
prepared by Michael S. Raber

V. OVERVIEW OF EUROAMERICAN DEVELOPMENT

This section outlines the major patterns of Euroamerican development in project areas, and briefly describes how these patterns relate to present project area conditions. The emphasis here is on patterns of development; sections VI-VIII describe the nature, variation, and relative significance of waterfront structures and marine resources. Figures 3-7 (pp. 34-38) summarize project area shoreline changes.

A. Initial Settlement Patterns, c1675-1800

There was no Euroamerican settlement on Staten Island's west side under the Dutch West India Company, whose representatives and settlers became embroiled in conflicts with local Native Americans in the 1640s and 1650s which severely restricted any Dutch presence on the island prior to a 1660 peace treaty. The first permanent settlement was a small village of French Waldenses and Huguenots at South Beach in 1661 (Steinmeyer 1950: 1-11). Under English rule, more or less continuous from 1664 to the American Revolution, the project area developed very slowly. The most important factors in coastal underdevelopment were the extensive salt marshes north of later Rossville, inauspicious location relative to the ports and markets of New York City and Philadelphia, and large land grants in the Tottenville area which restricted settlement until after the Revolution.

English rule began with a 1664 grant by Charles II to his brother James, the Duke of York, of land between the Connecticut and Delaware rivers. As Lord High Admiral, the duke quickly brushed aside the Dutch at New Amsterdam with a small fleet and installed his own governor, Richard Nicolls. James recognized the very limited Dutch claims to Staten Island, leaving his governors to secure new title to other lands from the Indians and to make land grants. Nicolls made Staten Island part of the shire of Yorkshire, along with Long Island and Westchester, but evidently made no Staten Island land grants. His successor, Francis Lovelace, purchased Native American land rights to Staten Island in 1670 and laid out lots on the island's north, east, and south sides granted to various individuals. The island became a separate jurisdiction in 1675, and a separate county -- Richmond -- in 1683. By the late 1670s about 100 grant patents had been issued under Lovelace and Gov. Edmund Andros, one of the largest of which included part of the project area. For services to the Duke of York, Christopher Billopp was granted some 1300 acres on the southwest corner of the island in 1675, all of which was above mean high water in keeping with most such grants. In 1687, Billopp secured about another 300 acres between mean high and mean low water, including several coves for landing boats (Bayles 1887: 104-6; Mershon 1918: 36-98; Leng and Davis 1930: 680; Steinmeyer 1950: 7-14).

The Billopp grant, occupying an especially favorable location for farming and for oyster harvesting from Raritan Bay and the Arthur Kill, is the only one noted for the project area in local histories. Smaller grants to the north, and some subdivision of the Billopp grant led to the creation of scattered farms near the Arthur Kill south of Fresh Kills by the end of the colonial period. Billopp's grant, held by a series of genealogically-linked successors until the Revolution, included the earliest ferry across the Arthur Kill, opened c1709-16 between Perth Amboy and the end of Amboy Road. Primarily a local link made by skiffs or scow barges, the Billopp ferry may sometimes have served as part of a route between New York City and Philadelphia when weather inhibited sloop or packet traffic from Perth Amboy. The ferry to Perth Amboy operated at least intermittently from Amboy Road until c1860, when the landing was moved a half mile north. The Amboy Road site is within project limits, but today includes only limited remains of a 20th-century shipyard mooring pier; it is not clear if the ferry landing included built structures or simply utilized the shelving shore at this location. North of the Billopp grant, two small communities or neighborhoods emerged around later colonial ferries established as competition for the New York-Philadelphia route increased. The first of these was franchised by c1722 at (Old) Blazing Star (later Rossville), just south of the extensive marshes running along the island's northwest side. In the midst of the marshes, on the sandy rise of Long Neck (later Linoleumville or Travis) south of Prall's Island, the New Blazing Star ferry opened c1757, and by c1764 linked a stagecoach and ferry route between the two cities. The Blazing Star name originated with a tavern at each ferry site (Clute 1877: 233-4; Bayles 1887: 104-8; Leng and Davis 1930: 344-51, 679-84; Reed 1962; Adams 1983).

Old Blazing Star was the principal settlement in the project area until after the Revolution, occupied by farmers, a few gentry, and perhaps fishermen. A mill on nearby Great Fresh Kills served this community. The village's small waterfront, now obscured by Witte's marine graveyard, served boats engaged in oystering, clamming, and the fisheries. It is likely that many farmers engaged in seasonal fishing activities. Blessed with rolling farmlands and fine views out over the Kill that included marshlands on the Jersey side, Old Blazing Star/Rossville remained a very pleasant place to live for well over a century (Figure 5; Sleight 1967).

Staten Island was occupied by British forces throughout the Revolution, and was home to a number of prominent Tories including the owners of the Billopp grant. After the war, the remaining 850 acres of the grant were confiscated and subdivided, leading to a the emergence of another farming and fishing community in what became Tottenville. By 1800, a saw and grist mill, with a large millpond at the mouth of a creek about a third of a mile south of the present Outerbridge Crossing, opened to serve this village. The site, later known as Dissosway's or Weir's Mill, was demolished and the pond drained or filled in by c1910, leaving no visible remains (Bayles 1887: 110; Robinson 1907 [maps]; Leng and Davis 1930: 209, 611; Figure 7).

Homes of farmers and fishermen were scattered along roads near the Arthur Kill south of Old Blazing Star into the late-19th and early-20th centuries (e.g., Beers 1874 [maps]). Few remain standing. Based on close comparison of historic maps and available information on project area limits, none of these residential sites appear subject to proposed actions.

B. Geography, Transportation, and Underdevelopment on Staten Island's West Side in the 19th and 20th Centuries

1. Patterns of Underdevelopment

The Arthur Kill's Dutch etymology varies in different sources, but clearly refers to a somewhat remote body of water. Arthur is an Anglicized *Achter*, or back; *Kill* here probably is the common Dutch term for creek or stream used elsewhere around Staten Island, but may be a corrupted version of *Achter Cul* or back bay, a term once applied to Newark Bay and later used for what could have once been seen as the bay's smaller arm (cf. Bayles 1887: 3; Leng and Davis 1930: 3). Remoteness was relative to New York Harbor's traditional center, Upper New York Bay and the lower East and Hudson rivers. As the Port of New York expanded in developed size and commercial importance c1815-60, the Arthur Kill's location and often marshy shores tended to restrict development on both sides of the waterway. Even as the channel itself became an increasingly important avenue of commerce -- for Pennsylvania coal via the Delaware and Raritan Canal and coastal traffic with Middle Atlantic states -- communities along the Arthur Kill remained largely agrarian backwaters, with the only significant new developments being the mines and small factories of the clay products industries in Woodbridge and Perth Amboy (Raber, Flagg, Weinstein, Musser, and Wiegand 1995: 24-8).

Beginning after 1870, development along the two sides of the Arthur Kill diverged markedly, with the New Jersey shore becoming heavily industrialized, and the Staten Island side remaining largely open space outside of the small villages established before 1800. By 1905, the channel's west side saw large copper refineries, agricultural chemical works, new or expanded clay products plants, building materials manufactories, metallurgical industries, the beginnings of today's extensive petroleum handling facilities, and vessel construction yards emerging on dry land as well as filled marsh (Raber, Flagg, Weinstein, Musser, and Wiegand 1995: 29-38). In this same period, only a few important plants appeared on the Staten Island side, all of relatively modest size, including the Kreischer brick works, the American Linoleum Manufacturing Company, the Atlantic Terra Cotta Company, and Tottenville Copper. We review the histories of these firms below (figures 4, 6, and 7).

Explaining why things did not happen is sometimes more difficult than explaining why they did. The principal factors in the relatively slow growth of commerce and industry on Staten Island, particularly on its west side, were probably the island's relative isolation within the larger port and the limited transportation links with the mainland via rail or road. In the New York metropolitan region, antebellum manufacturing generally developed first along the frontage of the harbor and connecting waters. In the next stage, especially c1865-90, new railroads provided better access to some of these same areas and stimulated additional manufacturing along the rail network. After World War I, and especially after c1950, publicly-financed highway construction allowed industrial operations to diffuse beyond rail and port facilities. On Staten Island, some industrial development occurred in the first two stages, but mainland rail service came late and effective highway access post-dated most industrial growth. For the west side, many transportation improvements also treated the coast and the channel as something to cross rather than as a destination for development.

Both light and heavy industry has flourished around the Port of New York. The region's large and lucrative urban market have long attracted "light industry" and small firms, but Staten Island lacked ready access to this market. Despite a rail link to New Jersey in 1889 and the 1928-31 completion of three Port Authority bridges to New Jersey, the island's real market access remained almost entirely by water until after 1964, when the Verrazano and other bridges were actually linked to a highway system. In the era when almost all freight moved by water, the distance was greater from the island's west side than from almost any other section of the region, and the deeper Arthur Kill channel near New Jersey clearly favored facilities on that side. The channel and the direct links to mainland rail networks after 1870 help explain why heavy industries -- requiring large tracts, tidewater locations, and remote neighborhoods with few complaints about pollution -- concentrated on the New Jersey shore, even though Staten Island shared these same other advantages.

As discussed below in sections V.C-D, most development in the Arthur Kill New York Reach c1850-1920 emerged from use of local resources like clay and oysters, or from demands of nearby off-island markets for items like coal barges. Decades later, long after the main period of industrialization in the region, large facilities did make use of much of the waterfront - but the chief attraction to them was the vast extent of unwanted land still available even to very undesirable users (see section V.E).

2. Transportation Developments after c1800

Water and road transportation around or through the project area remained rather limited well into the 20th century. The two Blazing Star ferries, primarily serving New York-Philadelphia traffic, apparently went out of service during the Revolution. Irregular or short-lived ferries for this traffic revived at New Blazing Star c1786-1836, but were replaced by new steamboat-stagecoach routes via the Arthur Kill and the Raritan River to New Brunswick. In one of the last attempts to shorten the older route across Staten Island, the Richmond Turnpike was completed in 1819 from New Blazing Star to Tompkinsville at the island's northeast corner. Steamboat service through the Arthur Kill began as early as c1807, with John L. Steven's *Phoenix*, but was probably interrupted at times by the prolonged battle over New York's steamboat monopoly charter, ultimately overturned in 1824 by the U.S. Supreme Court (*Gibbons v. Ogden*). Thomas Gibbons' *Bellona*, the boat operated by Cornelius Vanderbilt which sparked the final legal confrontation, ran to Perth Amboy for a time and could have stopped on the Staten Island side. By 1838, there was regular New York-New Brunswick steamboat service stopping at Rossville, with landings documented for Tottenville and Chelsea by the 1850s. Rossville and Tottenville had hotels at their landings, frequented by fishermen and travellers, during the late 19th century. The history of steamboat traffic through the Arthur Kill remains incomplete, but landings evidently continued at Rossville and Tottenville into the 1890s (Leng and Davis 1930: 349, 704; Steinmeyer 1950: 44; Reed 1961-62; Cudahy 1990: 31-8).

Later industrial activity at New Blazing Star, by then called Travis, led to new local ferry service beginning with rowboats and gasoline launches operated by or for employees of the American Linoleum Manufacturing Company c1873-1916. The Carteret Ferry Company initiated steam ferryboat service in 1916, by which time there was significant industrial activity on both sides of the Arthur Kill at Carteret, New Jersey and Travis. At Travis, the ferry company first used an American Linoleum pier, building its own slip nearby by 1918. Carteret Ferry also entered the World War I wooden shipbuilding boom at its adjacent repair, as noted below (section V.C.3). The company ran the ferry until 1929. Kirchner Brothers, which ran a launch service during seasons or hours not served by the ferry company, maintained launches as the sole means of crossing until 1960. Very limited remains of Carteret Ferry operations remain in project areas (Figure 4; Robinson 1917 [maps]; Army Corps of Engineers 1918-1953 [maps]; Van Name 1919; Red 1961-62; Noble 1974; Cudahy 1990: 286).

Ferry service between Tottenville and Perth Amboy, linking two towns, proved more durable than that seen at the two Blazing Stars. A series of individuals operated scow ferries from the end of Amboy Road until at least 1828. Undocumented operations may have continued at this location until 1860, by which time service consisted of a rowboat. The anticipated arrival of the Staten Island Railway Company stimulated the appearance of a private steam ferry service, which ran sporadically until the railroad took over the ferry route in 1867. A pier on Main Street served the route from the 1860s until the 1890s, when the railroad -- now owned by the Baltimore & Ohio -- was extended south several blocks to Bentley Street and a new terminal pier constructed. From this location, the railroad's ferry operated until 1948, long after automobile traffic over the Arthur Kill's bridges had made it unprofitable. Diesel ferries continued service until 1963 under Sunrise Ferries (Figure 7; Leng and Davis 1930: 706; Beers 1887 [maps]; Robinson 1898 [maps]; Army Corps of Engineers 1918-53 [maps], 1926-53; Reed 1960; Cudahy 1990: 99).

The Staten Island Railway Company's line, built 1851-60, ran from its main Manhattan ferry terminal at Clifton to Tottenville, and was chiefly of use to passengers. Rail freight service was delayed by the high cost of bridging the Arthur Kill and the limited industrial traffic offered by Staten Island. By the early 1880s, however, the Baltimore & Ohio was seeking a harborside freight terminal and found that Staten Island's north shore was one of the few places available in the port if the Arthur Kill was crossed. The Baltimore & Ohio bought the Staten Island Railway in 1886 and extended it north to St. George, where a new terminal was built consolidating all ferry service from the northeast corner of the island. While building a freight terminal west of the St. George ferry to Manhattan in 1888, the Baltimore & Ohio built a new line called the Staten Island Rapid Transit (SIRT) from Cranford Junction, New Jersey, across the Arthur Kill to Staten Island and on to St. George. The SIRT in this way joined the Central Railroad of New Jersey's main line for freight connections on the mainland. The 1889 Arthur Kill bridge's 500-foot draw span was the longest in the world at the time; it was replaced in 1959 with a vertical lift bridge, also the world's longest when built (*Engineering News-Record* 1959; Reier 1977: 110; Harwood 1990).

The railroad's presence made little impact on Staten Island's industrial development, especially on the west side where freight services remained limited. The Baltimore and Ohio was interested in extending a line along the shore, though the extensive marshes north of Rossville made this an expensive project to contemplate without an existing industrial market. From the north, at Arlington Yard, the SIRT extended a spur to the Gulfport oil terminal south of the rail bridge c1924-32, lengthening it to reach a Consolidated Edison power plant at Travis in the 1950s. At Tottenville, Atlantic Terra Cotta Company and Tottenville Copper Company shipped by rail. During the 1926-28 construction of the Outerbridge Crossing, SIRT built a branch a short distance north of Tottenville near the waterfront, apparently to bring in bridge materials. This line could easily have been extended further north, and appears to have been left intact after completion of the bridge in hopes that it would stimulate location of industry there. No industry located there, and the line was eventually taken up (Army Corps of Engineers 1924-53 [maps]; Reed 1964b).

Significant road construction projects came too late to reverse the island's industrial isolation. The Port Authority's Goethals Bridge and Outerbridge Crossing, completed simultaneously, were major engineering achievements but did perhaps less for west shore development than the earlier ferries. By the time the island was linked to regional highways after 1964, the entire New York City region was in the process of de-industrialization: although highway connections did stimulate residential and commercial development, Staten Island lost 24% of its manufacturing employment between 1958 and 1967 (Leng and Davis 1930: 380-82; Works Progress Administration 1939: 608; Staten Island Chamber of Commerce 1971: 23).

C. Industries Based on Local Natural Resources and Maritime Trades

1. Agriculture

New York's urban center provided a market for Staten Island fruit and dairy products from initial Euroamerican settlement into the early 20th century; in 1900 there were more than 80 milk dealers on the island, many of whom operated small farms as well as delivery (Sachs 1988: 110). Undocumented farming activity just inland of project areas probably involved these markets, although we have no evidence of shoreline development related to agriculture other than Weir's Mill. The Isaacsen preserving house, which probably shipped products by water, operated just south of Neck Creek in Travis near the Arthur Kill in the 1860s and 1870s (Beers 1874 [maps]; Sachs 1988: cover, 110).

2. Oystering and Fishing

European settlers in the Arthur Kill-Raritan Bay vicinity quickly learned, as local Native Americans had long known, the value of oysters and other fruits of the sea. Well into the 18th century, inter-Indian trade involved harvested oysters sold to interior groups. Oysters became a major item of commerce among European settlers in the Port of New York from the beginning of European settlement, sold not only locally but as pickled products for the West Indies trade into the early 19th century. In the 18th century they were so common as to be a staple food for the poor. Until decimated by pollution c1890-1910, Staten Island's oyster business shipped large quantities within the port and to other cities (Sachs 1987: 14-15), and was regarded as the island's premier industry into the late 1870s:

> "The vessels employed in this trade, hailing from Staten Island, may be counted in the hundreds, while the individuals subsisting thereby may be enumerated by thousands" (Clute 1877: 329-30).

Oysters thrive on moderately firm sandy bottoms in areas not routinely exposed by tides. Major oyster beds were located in the deeper waters of the Arthur Kill, Prince's Bay on Staten Island's ocean side, the mouth of the Raritan River, and the Kill van Kull. Before c1850, an oysterman would work from characteristic skiffs or small sloops using long-handled tongs and rakes. The same vessels could deliver the oysters to a central processing point, or to a market on Manhattan. Although some oyster houses in Tottenville and Perth Amboy prepared oysters for marketing, most of the processing took place on several floating barge-factories on Manhattan's waterfront. It is likely that many of those engaged in the trade lived along the Arthur Kill, especially in the Tottenville and Rossville areas, near the oyster beds. With most of the processing done elsewhere, only tie-up piers were usually needed on the west shore of the island (Walling 1859 [maps]; Bayles 1887: 705; Sachs and Waters 1988: 27; Frank Bohlen [persons consulted]).

By the 1810s local oyster beds had begun to shows signs of exhaustion due to over-fishing. Rivalry for access to the oyster beds became increasingly intense; "oyster wars" over poorly defined submarine boundaries, in which fishermen battled one another and were often imprisoned, still erupted between Jerseymen and Staten Islanders in the 1890s. A more practical solution to the problem of the exhaustion of the beds was planting and cultivation of seed oysters. By the mid-1820s this form of underwater farming turned the oyster fishery into a major business. Sixty years later, Bayles claimed that "...all the inhabitants of the southern half of Staten Island may be called oystermen, since many of them have invested a little in the beds in some shape, or work more or less on hire for the regular growers" (1887: 710). Oyster cultivation led to larger commercial operations, with a few firms dominating the business by the 1850s. The scale of operations by this time involved sloops and schooners, replacing the smaller skiffs. Seed oysters from Virginia and Long Island were planted in well-defined beds, and were cultivated and guarded until they were mature and ready for market. Many growers lived near the Arthur Kill at Pleasant Plains (a short distance northeast of Tottenville), Tottenville, Rossville, and Chelsea. The work-force became increasingly specialized: no longer was it sufficient to say you were an oysterman. The 1875 state census schedule for the Staten Island town of Northfield distinguished four primary occupational categories within the oystering group (Bayles 1887: 707-10; Leng and Davis 1939: 57; Works Progress Administration 1939: 613; Sachs 1987: 16-17).

The northern United States oyster industry peaked c1880-1910, with New York as its capital. In 1900, 200,000 bushels of oysters were harvested from the waters around Staten Island. By this time, however, water pollution -- notably from oil refineries and chemical plants on nearby New Jersey shores -- was decreasing oyster yields. The pollution had other effects: about this time local newspapers gave much play to stories of typhoid and other diseases brought about by eating oysters, and the market for them declined dramatically. The U.S. Dept. of Agriculture took steps to regulate conditions in the industry, and while these steps eventually preserved much of the trade, the oysters no longer came from Staten Island beds. The Arthur Kill beds were ordered shut down in 1917 and by 1927 there was a permanent ban on all oyster beds in the New York harbor area (Sachs 1987: 18-19; Sachs and Waters 1988: 29; Hurley 1992).

Although less well documented, fishing for shad, herring, and menhaden occupied some people along the Arthur Kill, notably at Rossville. Water pollution took its toll on these species as well. There appear to no intact remains of documented oyster- or fishing-related sites in the project area.

3. Vessel Construction and Repair

The oyster and fishing trades probably provided the most important initial stimulus to shipyards and boatyards along Staten Island's Arthur Kill waterfront. Most of the documented yards were in Tottenville, beginning by c1850 as demand for larger oyster vessels increased. As Staten Island timber disappeared c1860, repair work became more important but waterborne lumber traffic from upstate New York and the southeast United States evidently allowed for continued new construction. There was also a growing market for repair and construction of coal barges and tugs with the appearance of New Jersey railroad coal terminals in Elizabethport, Perth Amboy, South Amboy, Woodbridge, and Bayonne c1855-90. By 1880, there were eight Tottenville shipyards, all using horsepowered marine railways, which repaired 400-500 fishing smacks, tugs, and coal barges but built only thirteen vessels in that census year. Some yards, notably that of A.C. Brown (operated c1850-1932) and J.S. Ellis (operated c1861-1920) were prominent among builders of oyster boats. The Brown yard also built tugs, barges and scows; Ellis's, once the largest local yard, specialized in pilot boats, tugs, and schooners. The demise of wooden shipbuilding by the Great Depression eliminated most of the Tottenville operations, although several yards handling coal barge repairs or construction of small tugs and floating drydocks persisted in the 1950s. None of the Tottenville yards survive today, and their remains in project areas are generally in very deteriorated condition (Hall 1880: 119; Bayles 1887: 702; Kochiss 1974: 115; Robinson 1917 [maps]; Army Corps of Engineers 1926-1953; Staten Island Historical Society n.d.).

There were small yards for vessel construction or repair in Rossville (c1880) and in Chelsea (c1890-1930) about which little is yet reported (Bayles 1887: 702; Army Corps of Engineers 1918 [maps], 1926, 1932). At Linoleumville, the Carteret Ferry Company participated in the World War I demand for wooden cargo ships by building three four-masted schooners at its repair yard between 1918 and 1920, including the last large sailing ship constructed in the Port of New York. This operation ceased in the early 1920s. Only limited remains of these operations survive in project areas (Noble 1974).

4. Clay Industries

The largest, most commercially-valuable Cretaceous clay deposits near the project area were confined primarily to Woodbridge and Perth Amboy, New Jersey, where mining of clay for sale to brickmakers or for firebrick production began in the second quarter of the 19th century (Raber, Flagg, Weinstein, Musser, and Wiegand 1995: 25-9). The accessible Staten Island clay deposits, requiring little stripping, were concentrated along the south side of Great Fresh Kills and along the Arthur Kill between Fresh Kill and Kreischerville. These included Raritan Formation clays suitable for firebrick, and kaolin deposits used to manufacture ceramic housewares and to coat papers. Manufacturers did not begin to mine these materials until the 1850s, a generation after the rise of New Jersey's clay industry. The most important early Staten Island clay user was Balthazar Kreischer, a German immigrant who established a brickworks in Manhattan in 1845. He is credited with starting the International Ultramarine Works on the Arthur Kill south of Smoking Point in 1852. This chemical works, using minerals and local kaolin, operated under several owners into the 1960s, when it was replaced by the Vigliarulo Brothers sand, gravel, and cement plant. Kreischer's principal manufacturing effort, however, was establishment in 1854 of a clay mine and firebrick works which continued at several locations until c1927. The works remained inland from the Arthur Kill, and an auxiliary component of his Manhattan operations, for two decades during which Kreischer began making clay gas retorts at the Staten Island plant. He purchased additional clay beds in Woodbridge, NJ and Chester City, PA in 1865. In 1873-74 he moved the entire manufacturing operation to a three-acre site on the Arthur Kill a half mile north of the present Outerbridge Crossing. In the 1880s, the firm -- now run by his sons -- employed over 100 men making about 3.5 million firebricks annually. Kreischerville emerged as a rural industrial community around the plant, dominated by mansions built for the owners. All products were shipped by water; the firm had a steam lighter built in 1880. The plant ceased production c1927 and was demolished in the 1930s, leaving only timber bulkhead remains in project areas (Clute 1877; Bayles 1887: 732-34; Leng and Davis 1930: 626; Steinmeyer 1950: 124; Jones 1991; Staten Island Historical Society n.d.).

Several other smaller brickworks operated south of Great Fresh Kills and north of Rossville c1870-1940, away from project areas. Tottenville became involved in a later major clay industry development, the manufacture of terra cotta for architectural ornament. American terra cotta manufacture began in Chicago in 1869, and was first established on the East Coast at Perth Amboy in the late 1870s under Alfred Hall, providing an important use for imperfect fire clay previously mined and discarded. In 1897, former craftsmen and officers of Hall's firm, Perth Amboy Terra Cotta Company, moved to the north end of Tottenville's waterfront to establish the Atlantic Terra Cotta Company. Unlike other Staten Island clay industries, Atlantic did not use local clays -- generally not of appropriate quality -- but brought in clays from New Jersey by barge. The firm also used the nearby Staten Island Railroad, unusual among industries in this reach. Atlantic Terra Cotta by 1906 employed 450 to 500 men and was producing tile for early New York City subway stations, the Flatiron Building, the West Street Building, and the Plaza Hotel. Responding to unsettled economic conditions, four large firms combined in 1907 to form a new Atlantic Terra Cotta Company, including the Tottenville and Perth Amboy companies. Business continued to contract under the combined company, and after several years in which only firebrick was made the Tottenville plant closed in 1933. Terra cotta manufacturing proved to be more durable in New Jersey, lasting well into the 1950s. The Tottenville plant's waterfront project areas include fragmentary remains of several piers, including one made of barges; the upland buildings have been demolished in the last two decades (Robinson 1898, 1907 [maps]; Sanborn Map Company 1898-1911 [maps]; Baltimore and Ohio Railroad 1912; Robinson 1917 [maps] Safford 1974; Sachs and Waters 1988: 82; Raber, Flagg, Weinstein, Musser, and Wiegand 1995: 33-4; Staten Island Historical Society n.d.).

D. Other Manufacturing Industries

The most historically significant industry in this reach may have been the American Linoleum Manufacturing Company plant in Travis, the first American linoleum factory. Its location here, just inland of the New Blazing Star ferry site far from any rail link, was possible because it received all its raw materials and shipped all its product by barge and lighter. Established in the early 1870s as one of the pioneer industries on the northern Arthur Kill, American Linoleum's use of this marshy backwater seems reasonable for a heavy industry using very flammable materials. Major raw materials or ingredients were available locally. All similar industries established later along the Arthur Kill chose the New Jersey side instead, however, taking advantage of the deeper channel and the access to Central Railroad of New Jersey freight service (Raber, Flagg, Weinstein, Musser, and Wiegand 1995).

Reed (1964) provided a detailed account of this enterprise. Frederick Walton developed linoleum in England after kneading some dried paint which had oxidized on a neglected paint can. He patented it in 1863, naming linoleum from "linum" (flax), and "oleum" (oil). His linoleum was made from oxidized linseed oil, ground cork, wood pulp, Kauri gum, rosin and coloring pigments, all thoroughly mixed and rolled on a burlap backing under pressure, allowing it to be made in any desired length. The material was shipped to America from the English factory and sold well. One of its importers was Joseph Wild & Company, a floor covering distributor, which purchased Walton's rights in 1872 and brought him to New York to supervise the building of a new plant for a new firm, the American Linoleum Manufacturing Company, formed in 1873 largely with English capital. The 200-acre Long Neck or Travisville site consisted mainly of swamp land, with access only by water or the Richmond Turnpike, then a dirt road. Manufacturing began in 1874, on a plant covering about 7 acres with many British workers. The material was dried and aged sufficiently by 1875 to be sold (Clute 1877: 327; Sachs and Waters 1988: 90, 94).

Barge-delivered coal was readily available from nearby New Jersey rail terminals. The Jewett Oil Works of Port Richmond delivered linseed oil by steamboat, and finished linoleum was shipped by steam lighter to New York. Linoleum proved to be a far more durable floor covering than oil cloth, which it rapidly displaced. The initial year's shipment of about 94,000 square yards quadrupled by 1880, and nearly tripled again by 1890. By the late 1870s, success spurred significant plant improvements, including a narrow-gauge industrial railroad built from the company's pier to the plant, and replacement of the early wooden structures with a brick plant in 1881-1882. During this period, the firm covered marsh and old stage road areas with ashes. The popularity of the product soon led to day and night shifts, with the new buildings lit with electric arc-lamps in 1882 -- one of the first plants in the region to use them, because of the flammability of the materials used. The plant employed 200 persons by c1882 (Reed 1964).

World War I interrupted supply of materials such as burlap and Kauri gum, and the plant closed for a time. After the war business resumed on a larger scale, and as many as 1000 employees were on the payroll at times. The plant then had 46 buildings. Additional types of linoleum were made, such as desktop linoleum, but by the mid-1920s the company suffered from competition with cheaper grades of linoleum made without burlap backing. In 1928 the firm was taken over by the Sandura-Wild Corporation which moved manufacture to its newer Philadelphia plant and closed the Staten Island plant in 1930. The plant was kept intact. In 1935 fire destroyed the Philadelphia plant. Sandura-Wild considered re-opening the Staten Island plant, but facing the cost of replacing all the machinery the firm instead sold all the machinery at auction and kept the doors shut. After passing through several owners the property was conveyed in 1952 to Consolidated Edison, which demolished the plant. There are today some limited remains of waterfront structures probably associated with the linoleum plant (Reed 1964; Sachs and Waters 1988: 90, 94).

Few other manufacturers located in the project area vicinity. South of Smoking Point, the Oakland Chemical Company manufactured dioxogen and other materials c1898-1950, using a small pier to ship and receive by lighter until c1940. All shipments were by truck during the operations last years; fragmentary remains of the pier survive in project areas (Sanborn Map Company 1898-1911 [maps]; Robinson 1907, 1917 [maps]; U.S. Congress 1913, 1920; Army Corps of Engineers 1926, 1932, 1942, 1953). There were also two small metallurgical firms for which there is little documentation. In Chelsea, Mathison and Company smelted and refined antimony c1873-1920; none of this firm's small waterfront remains in any project area (Sanborn Map Company 1898-1911 [maps]; Robinson 1907, 1917 [maps]; United States Congress 1913; Leng and Davis 1930: 637; Staten Island Historical Society n.d.). Benjamin Lowenstein moved a scrap copper reprocessing operation from Manhattan to Tottenville in 1900, naming it Tottenville Copper. The firm relied on rail shipments, and while near the former Weir's mill pond had no waterfront presence. In 1931, Western Electric purchased and renamed the company Nassau Smelting & Refining, using it as the Bell Telephone system's salvage unit to reclaim non-ferrous metals from obsolete telephone equipment. It operated until relatively recently. Finally, historic maps indicate the small Bernard silk mill in Tottenville c1907 on the north side of the former Weir's mill pond (Baltimore and Ohio Railroad 1914; Robinson 1901, 1917 [maps]; Robie 1920; Staten Island Historical Society n.d.).

E. The 20th Century Attractions of An Unused Coastline

North of Tottenville, Staten Island's Arthur Kill waterfront remained largely unused until well into the 20th century. The generally sparse 18th- and 19th-century development diminished further in the face of depressed economic conditions for some local industries after World War I, continued land transportation limits, and increasing pollution. Water pollution depleted oyster and fishing businesses by the early 20th century, as noted, and local communities suffered further from air pollution. Since prevailing wind directions were from the west, the rise of the chemical and copper refining industries on the opposite shore of the Arthur Kill gave Staten Island strong doses of unhealthy clouds, which ruined agricultural products and made the west side of the island a less desirable place to live and work (e.g., Anonymous 1984).

A perception of isolation has always been a factor in Staten Island's relative lack of historical development. On the island's west side, the perception may have moved beyond isolation to a feeling of desolation, encouraging the location of facilities that made it still more desolated. The decline of much of this coastline by c1930, with attendant low land values, attracted new and sometimes even less desirable uses:

a very large municipal landfill site;
petroleum and other bulk materials terminals;
a large marine scrapyard;
a Consolidated Edison power plant
a municipal correction facility;
abandonment of hundreds of vessels.

The earliest and most notorious of these developments was the processing or dumping of New York City solid waste at the marshes around the Fresh Kills. The city began eyeing this perceived wasteland during World War I, and signed a contract with a private company to establish a garbage processing facility on the Island of Meadows in 1916. This operation, fiercely opposed by Staten Island's borough government and many citizens, opened in 1917 but proved commercially unsuccessful and failed the next year. An attempt to revive it under receivership was quickly stopped by the island's board of health. The city owned 1200 acres by this time, and a generation later began the present landfill operation. Dumping commenced in 1946, with construction of bulkheads and mooring racks for garbage barges in 1947. The landfill grew quickly. Another Staten Island dump was closed in 1948 and more garbage was transferred to Fresh Kills. In 1953 the city acquired 1700 adjoining acres by condemnation. Robert Moses was coordinator for the Fresh Kills project, and proclaimed that the marshy wastes would be filled in to become the site for parks, houses and factories, none of which have materialized. The Fresh Kills Landfill is now the destination of some 10,000 tons of domestic garbage produced daily in New York City. Garbage arrives here in barges from dumping stations around the city, is removed by clamshell- bucket cranes and taken by bulldozers hauling steel-treaded wagons across the plains of garbage to the current dumping spot (Leng and Davis 1930: 368-72; Campbell 1981; Department of Business Services n.d.: vol. 4).

Bulk materials terminals began in this reach about the time of the first garbage plant, and were generally established by World War II, mirroring somewhat faintly the more extensive growth of such facilities on the New Jersey side of the ARthur Kill. Brooklyn Edison developed a waterside coal storage plant in Rossville c1918, converted to a private terminal by World War II and rebuilt as a proposed liquified natural gas terminal in the late 1970s. Environmental permitting issues have kept the new terminal closed. Two petroleum terminals with tank farms appeared in the 1920s and 1930s, the Socony-Vacuum (Port Mobil) facility north of Kreischerville, and the Gulf Refining (Gulfport, now Petro-Port) terminal south of the Goethals Bridge which by the mid-1970s became a GATX terminal for temporary storage of petroleum products of all kinds and various owners (Army Corps of Engineers 1918 [maps], 1926-1988).

Although the Fresh Kills Landfill is perhaps the ultimate sign of this area's low status, the abandonment and/or scrapping of vessels along much of the shore perceived by some as a more widespread visual blight. Section VIII discusses some of these abandonment patterns. Rossville endured the most intense concentration of scrapping activity, the graveyard of the Witte Marine Equipment Company begun in 1931. The Witte family managed to obtain the entire waterfront of Rossville and there carries on a large marine scrapping operation. Vessels of all sort are brought in and allowed to settle on the mudflats. Eventually their more valuable parts are stripped, and the rest of the hulk may be left for an indeterminate period. This firm, most of whose vessels are not included in the present project catalog, operated on a small scale in 1940 and 1951, and was in full cry by 1961 (New Jersey Department of Environmental Protection and Energy 1940, 1951, 1961 [plans]; Army Corps of Engineers 1953, 1965).

Edgar Sleight summarized the effects of the Witte graveyard and other developments on Rossville:

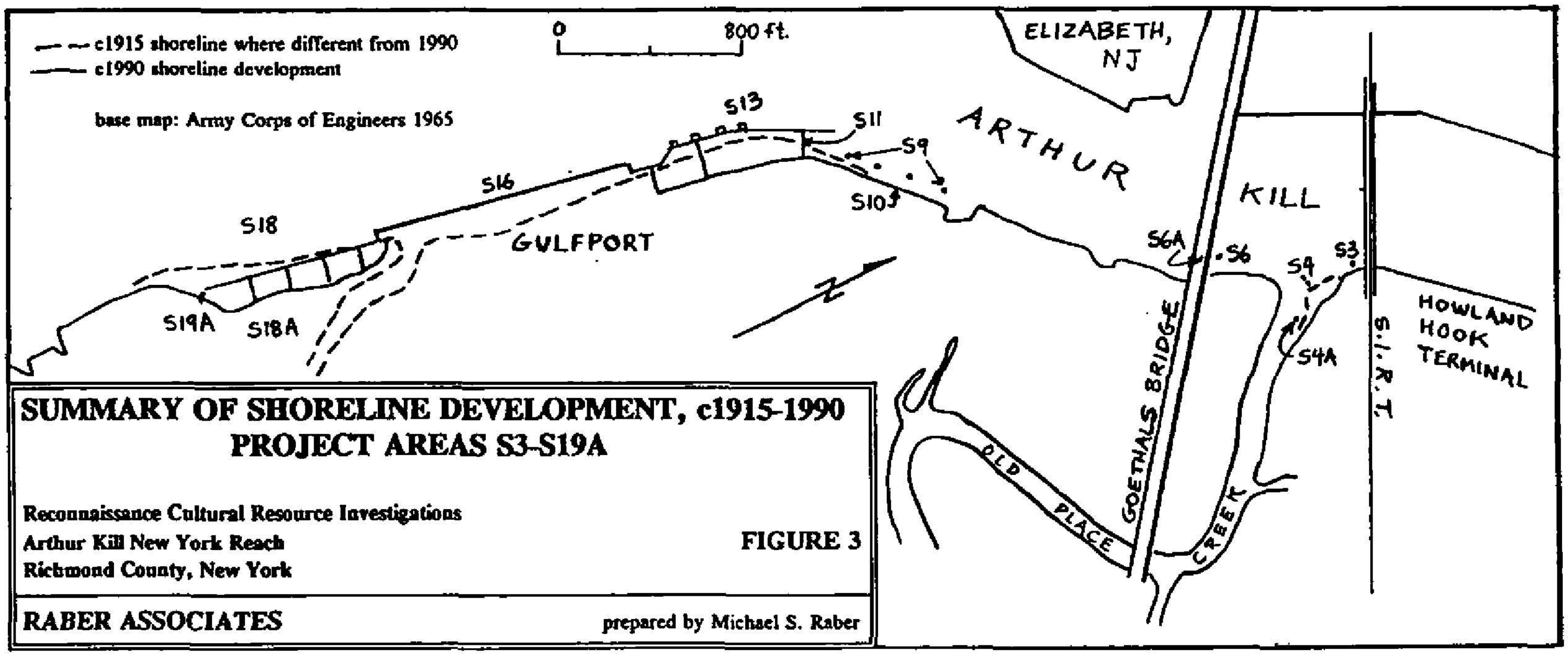
> Rossville is quite different today. With the expansion of industry on the New Jersey side of the Sound, not only was the fine view destroyed, but, more important, fumes from the factories forced people to move away. The boats that had made trips from the Rossville dock each morning and returned in the late afternoon have long since quit. The waters are heavily polluted and that ended all shell fishing. But by far the most important reason for the demise of Rossville is the waterfront junk yard, an eyesore to civilized man. A great many people have left; those who reside here today are by and large not descendants of the old Blazing Star families. Houses and stores are closed and vacant... (1967: 3).

Later uses of undeveloped space on or near the Arthur Kill included the Consolidated Edison Arthur Kill Generating Station outside Travis, begun shortly after World War II, and the city's Arthur Kill Correctional Facility built at Smoking Point c1970. The power plant, begun as a coal-fired operation with rail- and water-based coal-handling facilities, has been expanded and converted to oil fuel. The rail spur, extended to the plant in the 1950s, is no longer in use but each of the two generating units is served by a bulkhead for receipt of oil (Cunningham 1959; Army Corps of Engineers 1953-88; Staten Island Institute of Arts and Sciences 1947-48 [plans]).

The opening of the Verrazano Bridge (1964) and the West Shore Expressway (1976) have stimulated new housing and light-industrial/warehousing development on roads near the Arthur Kill, and encouraged some recreational uses such as the Tottenville Marina's conversion of one of that town's shipyards beginning c1979. The island's west shore still retains much of its desolate character (Bozman 1987; McPolin 1994).

Note to figures 3-7

These figures are based on common-scale comparisons of all maps consulted for this study. For clarity, shoreline development is summarized without showing every structure ever built. All waterfront structures (S) corresponding to the remains of piers, wharves, dolphins, or ferry racks listed in the October 1994 catalog of proposed actions are shown; miscellaneous debris project areas are not shown. Clustered groupings of derelict vessels or other marine resources are shown, with cluster numbers corresponding to those in Table 5 on p. *100* (e.g., C1 = Cluster 1). Except for V254, an isolated marine resource, all such resources are shown only as clusters.



SUMMARY OF SHORELINE DEVELOPMENT, c1915-1990
PROJECT AREAS S3-S19A

Reconnaissance Cultural Resource Investigations
Arthur Kill New York Reach
Richmond County, New York

FIGURE 3

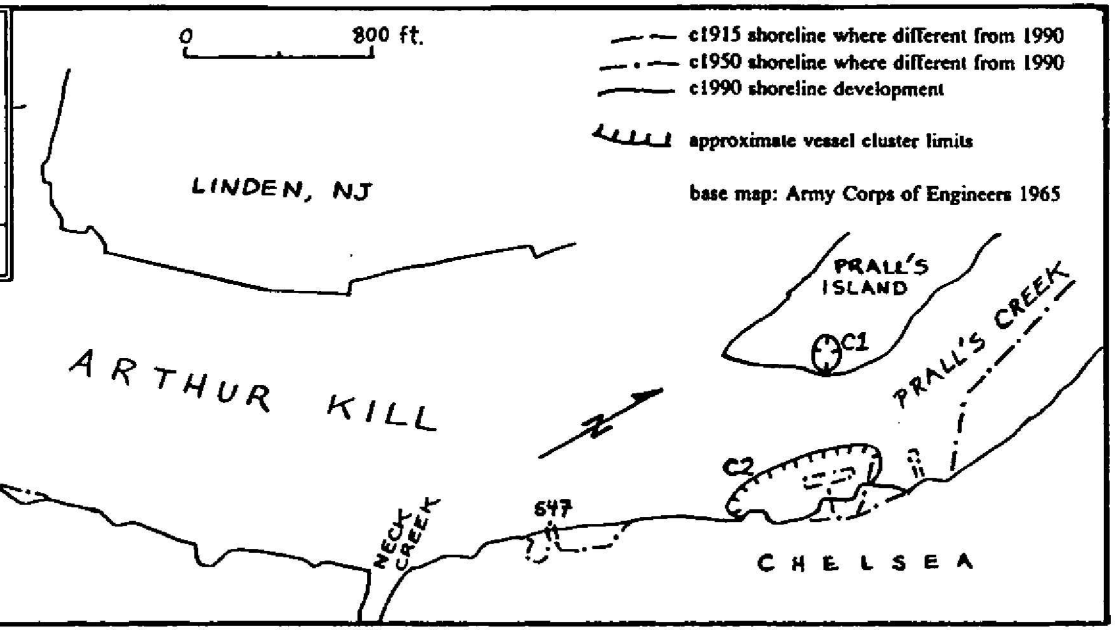
RABER ASSOCIATES — prepared by Michael S. Raber

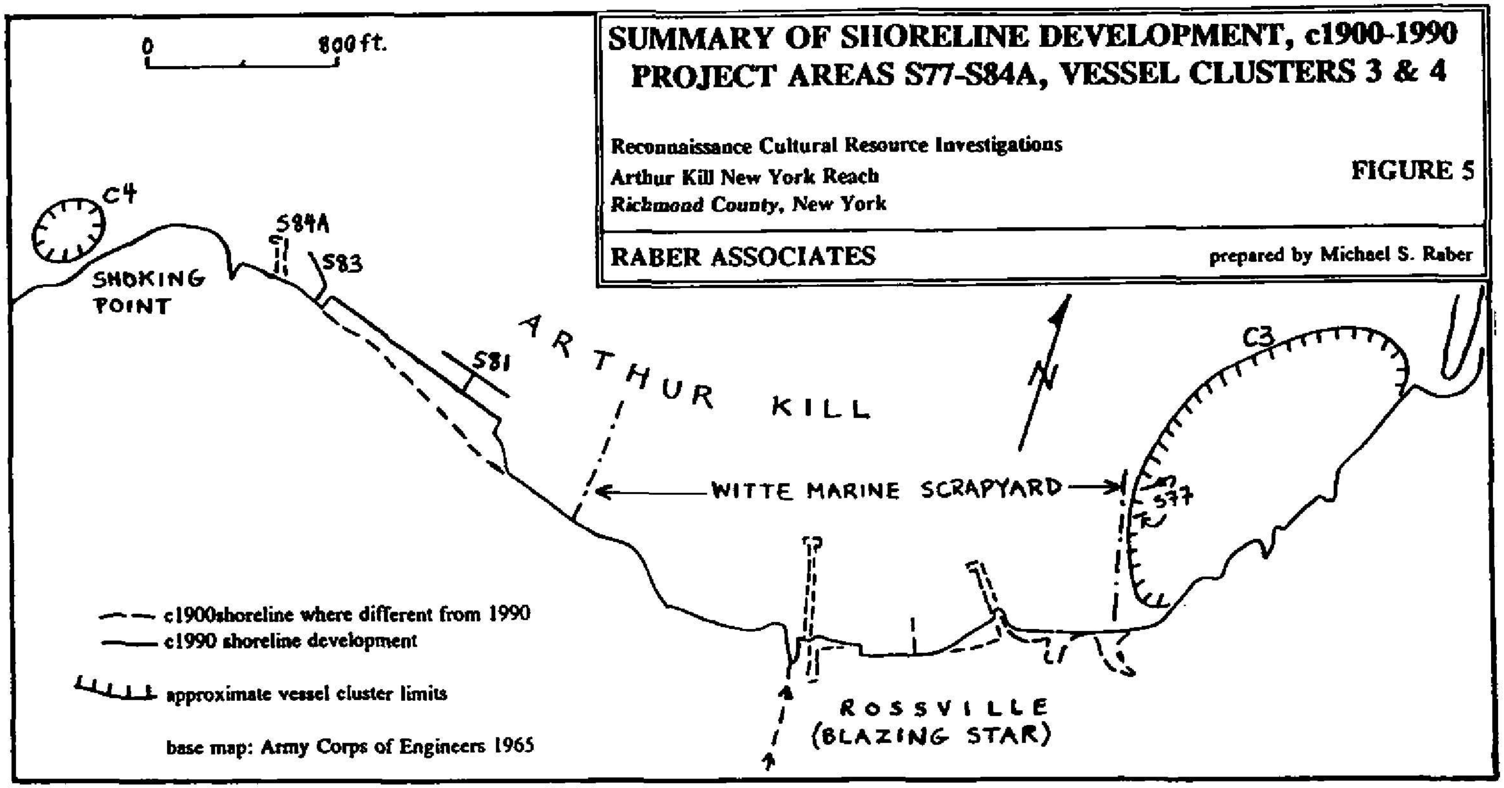
SUMMARY OF SHORELINE DEVELOPMENT, c1915-1990
PROJECT AREAS S47-S69, VESSEL CLUSTERS 1 & 2

Reconnaissance Cultural Resource Investigations
Arthur Kill New York Reach
Richmond County, New York

FIGURE 4

RABER ASSOCIATES prepared by Michael S. Raber





SUMMARY OF SHORELINE DEVELOPMENT, c1900-1990
PROJECT AREAS S77-S84A, VESSEL CLUSTERS 3 & 4

Reconnaissance Cultural Resource Investigations
Arthur Kill New York Reach
Richmond County, New York

FIGURE 5

RABER ASSOCIATES

prepared by Michael S. Raber

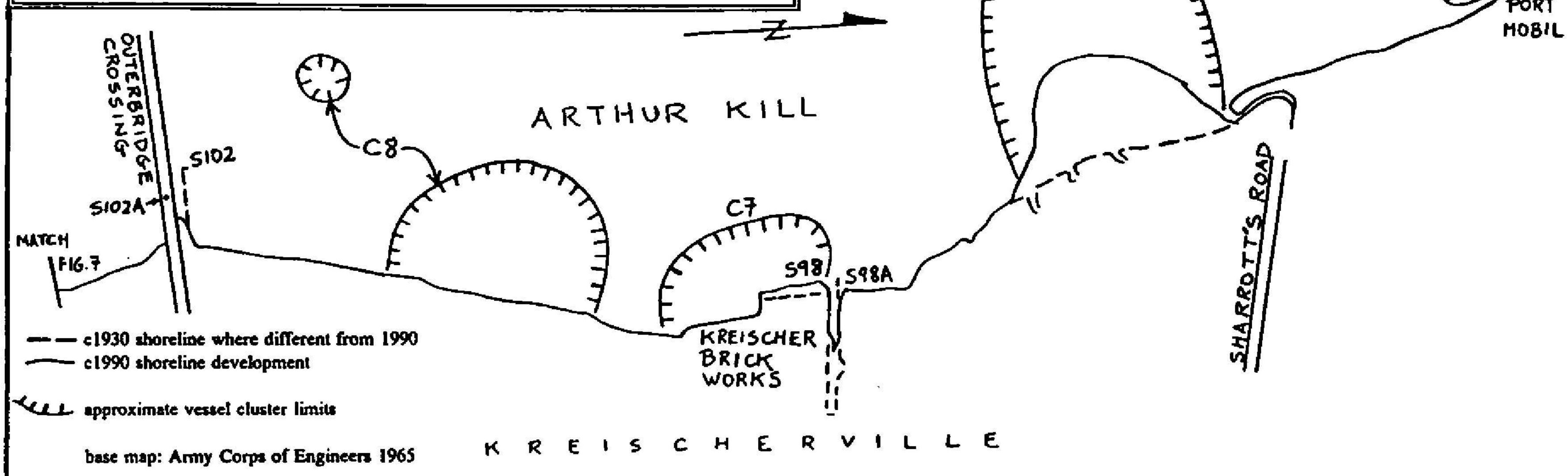
SUMMARY OF SHORELINE DEVELOPMENT, c1930-1990
PROJECT AREAS S98-S102A, VESSEL CLUSTERS 5-8

Reconnaissance Cultural Resource Investigations
Arthur Kill New York Reach
Richmond County, New York

FIGURE 6

RABER ASSOCIATES

prepared by Michael S. Raber



base map: Army Corps of Engineers 1965

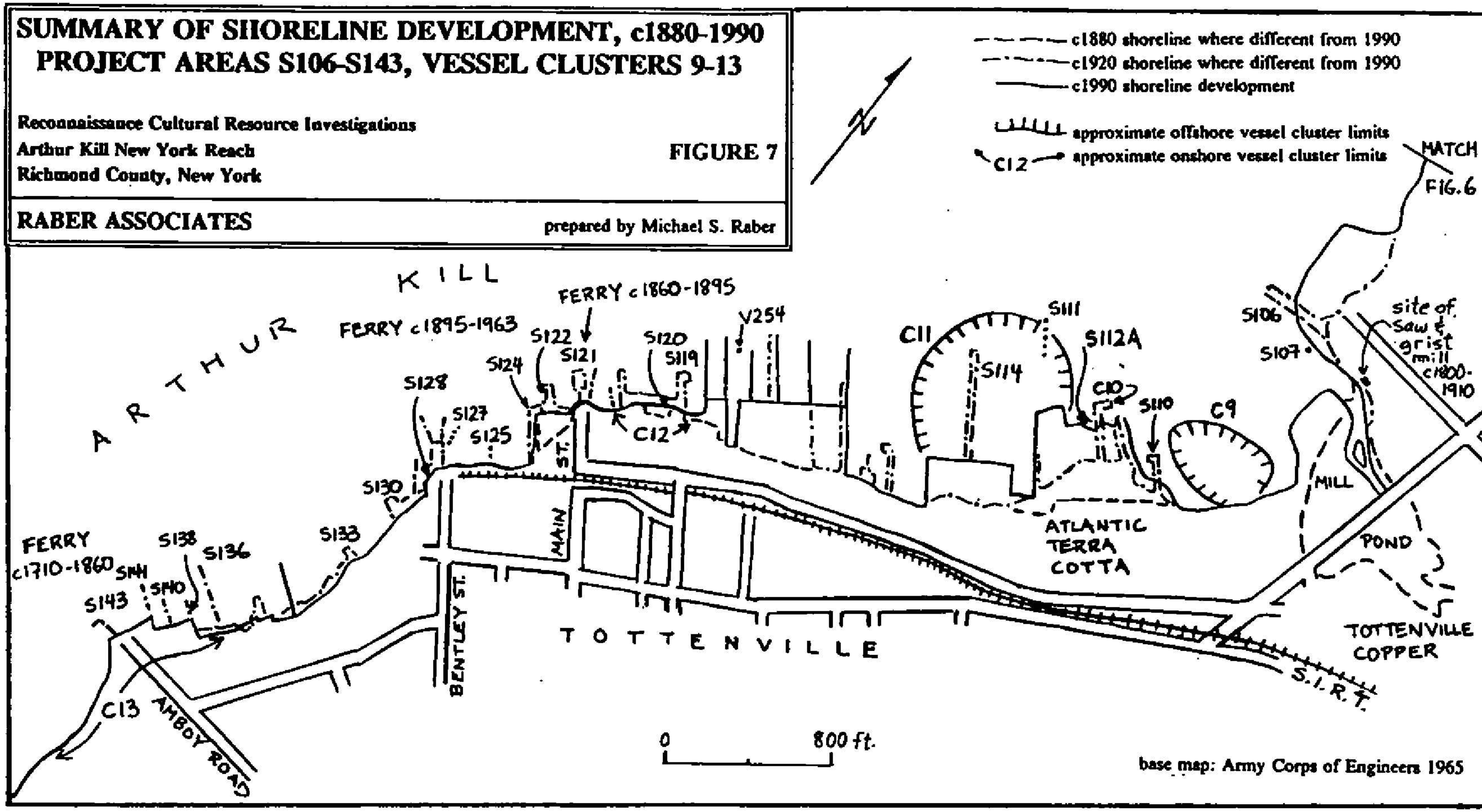
SUMMARY OF SHORELINE DEVELOPMENT, c1880-1990
PROJECT AREAS S106-S143, VESSEL CLUSTERS 9-13

Reconnaissance Cultural Resource Investigations
Arthur Kill New York Reach
Richmond County, New York

FIGURE 7

RABER ASSOCIATES

prepared by Michael S. Raber



VI. WATERFRONT STRUCTURES INVENTORY, SIGNIFICANCE, AND PROJECT IMPACTS

General development patterns reviewed in section V, and analysis of approximately two dozen historic cartographic sources, indicate that all waterfront areas, structures, or surfaces subject to potential project effects are artificial, post-dating 1895 in nearly all cases. We identified at least some historic background for 44 separate sites within 61 catalog project areas including waterfront structures. Three of these project areas were actually vessels discussed in Section VII (S33, S74A, S96); S33 is also inventoried with waterfront structures because it served as a pier, as did V258 (Table 1). Plates following this section illustrate most structures retaining more integrity than standing or disarticulated piles.

Analysis of waterfront structures involved placing placing project area structures within the context of Port of New York historical development, and within the context of associated industrial complexes. The context outlined below is based on previous reviews of waterfront structure history in the Port of New York by Raber Associates (e.g., Raber, Flagg, Wiegand, and Antici 1984; Raber, Flagg, Weinstein, Antici, and Wiegand 1986). In most places, present project surfaces are either 20th-century rebuildings of late-19th-century features, or are of original 20th-century construction. Except for some pipelines used to transport liquid fuel products, all historic waterfront resources subject to potential project effects are substructures (bulkheads and piers). There are also items of less note such as disarticulated timber debris which are not evaluated as historic resources. Section VII reviews the locations, spatial relationships, histories, and present conditions of all known waterfront resources in areas subject to project effects, and assesses resource significance based on present conditions and the regional or national importance of these resources as discussed immediately below.

A. Historic Context

Project areas under review here include two somewhat overlapping types of substructures: fill-retaining bulkheads, and piers. The line between these types becomes fuzzy in the case of solid-fill piers, one of which may have once been present in project areas, but in construction the solid fill pier components are more like bulkheads.

1. Bulkheads

By the time filling and bulkheading began in the Arthur Kill New York Reach in the 1870s and 1880s, there was a distinctive style of timber cribwork bulkhead construction in the Port of New York. Evolving from more diverse and incompletely documented colonial bulkheading practices, 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. 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. 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 (Mordecai 1885a, 1985b; Snow 1901; Greene 1917: 52-56; Raber, Flagg, Wiegand, and Antici 1984: 46-51).

Relative to many other sections of the Port of New York developed before c1930, both sides of the Arthur Kill are unusual in having very little cribwork bulkhead construction (cf. Raber, Flagg, Weinstein, Musser, and Wiegand 1995: 50). In the Arthur Kill New York Reach, part of one project area bulkhead at the Kreischer brick works included reported cribwork (S98). The remaining three timber bulkheads in the reach subject to potential project action, built c1910-50, consist of piles, vertical sheet piling, or sheathing, sometimes with tie-backs into fill (S10, S57-S59, S98A). These forms, less expensive than cribwork, have persisted throughout the history of the port, especially in small landfill projects. A combination of natural conditions, the foundation requirements of cribwork, and the scale of many construction projects in these areas probably explains the absence of cribwork, which is usually more durable than other timber bulkhead forms.

Cribwork bulkheads were most secure when fitted to bedrock or other very hard bottoms. If not soundly installed, cribwork in bulkheads or in the block-and-bridge piers described below 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 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 the least documented and probably most varied elements in timber bulkheads throughout the port, and tend to remain well preserved under water.

Historical waterfront development in the project area often confronted a set of difficult bulkhead engineering constraints. Bedrock along the original shorelines was about 30 feet below mean sea level in many places, and much of the shore was wetland or shallow silt and sand (Staten Island Chamber of Commerce 1901: 21; Kardas and Larrabee 1981b: Figure 8). For even the largest projects, dredging of wetlands or other cirbwork bottom preparation procedures was probably prohibitively costly and time-consuming. As was also the case for timber piers and wharves, the pollution-induced disappearance of marine borers from the harbor beginning about 1850 made most bulkhead components permanent, other than components subject to decay above mean low water. The onset of serious petrochemical water pollution by the mid-1880s in the Kill Van Kull and – perhaps slightly later – the Arthur Kill helped sustain the use of inexpensive timber construction, and made less durable bulkhead designs more viable (Hurley 1992). Bulkhead neglect at inactive sites, and cleaner waters encouraging the resurgence of borers in the 1980s, have now decimated many of these structures. Insufficient integrity of any vernacular construction traditions make most older timber bulkheads non-significant. For those timber bulkheads in this reach with any physical integrity, relatively recent construction and/or replacement of some older components appear to preclude these structures being significant resources.

One c1965 concrete bulkhead (S49) is probably an example of a relieving platform, first developed in this port shortly after 1900 by some of the railroads. Pile-supported, usually timber sub-decks below mean low water support concrete blocks forming the bulkhead face. The blocks also support the outer edge of an upper concrete deck or paving, as well as timber fender systems, with solid fill in the space between the lower and upper deck. Fire resistancy is a major advantage of this type of bulkhead, since all timber elements are below mean low water (see Raber, Flagg, Wiegand, and Antici 1984: 51-51, 70-72). Ubiquity, relative youth, and extensive documentation make most Port of New York relieving platform bulkheads non-significant resources. Permit files and other municipal records contain many hundreds of examples with detailed engineering drawings (e.g., Department of Business Services, City of New York n.d.).

The fill behind timber bulkheads or placed on wetlands is generally not documented, but in most places is probably dredged material and demolition debris. Oyster shells may have been used in at least some areas, as reported for Perth Amboy (e.g., Environmental Assessment Council, Inc., 1979: II-31). The relatively recent age of any demolition debris (virtually all after 1870) probably precludes the presence of significant undocumented historic archaeological materials.

2. Piers and Wharves

In regional waterfront areas developed before c1850, response to marine borers tended to incorporate cribwork construction into piers, which were often solid-fill or narrow block and bridge piers. The latter consisted of discontinuous sections of cribwork linked by plank bridges. Outer pier ends were blocks of cribwork, often forming a T- or L-shape across the rest of the structure. These components served several functions. The inter-crib spaces allowed for passage of strong tides, while the outer blocks protected the piers from damage by ice blocks or errant vessels (van Buren 1874: 174; Raber, Flagg, Wiegand, and Antici 1984: 41-43). By contrast, the natural conditions which probably restrained cribwork construction in the Arthur Kill also tended to encourage extensive use of pile-supported piers and wharves throughout project area history. Although in plan some pre-1870 piers in the Arthur Kill New York Reach resemble those with crib block outer ends, it is possible that that crib blocks were deployed rarely, if at all. For visible pier remains of this vintage in the reach, documented by overlay of historic cartographic features, limited surviving evidence suggests all-pile foundations in most cases. One possible solid-fill pier in Tottenville, built c1850 and later converted to a bulkhead by filling along one of its sides, was evidently built like the timber-sheet-pile-retained bulkheads noted above (S124). Similar solid-fill piers, and any crib block structures, are either buried in landfill inshore from project areas or have probably not survived site redevelopment. Piers appear on maps of the project area as early as the 1830s (U.S. Coast Survey 1835-36). If these structures had all-pile foundations, they would be much earlier examples of this form than pertained in most other sections of the port. Pile-driving expenses typically inhibited pile foundation structures in the port before c1870.

No pile piers built before the 1950s survive in project areas with much integrity, by which time the form had long been a relatively standardized and well-documented feature of regional port development. The great majority of identifiable project waterfront structures were pile piers, concentrated at former small shipyards in Tottenville. A timber pile pier consists essentially of piles driven into yielding harbor bottom in rows transverse to the long axis of the pier, with each row capped by heavy timbers, and with the entire array of piles and caps supporting a wooden plank deck. Pile spacing within and between rows is usually rather variable, depending on the loads anticipated for the pier and the acuity of the builder. Timber bracing within and between pile rows -- known together with the caps as bents -- also varies with circumstance, becoming common only in the present century after some well publicized pier failures. Double rows of piles at pier edges, together with fender piles with horizontal bracing, eventually replaced all vestiges of cribwork protection. The timber pile pier as outlined above became the principal staple of waterfront construction in the Port of New York, where such structures became common after about 1850 and very widespread in new construction after the Civil War. As waterfront substructure forms, they are too well documented and remain too common to warrant much cultural resource management concern unless associated with important commercial or industrial waterfront complexes. There are many detailed descriptions of the form and its all-wood variations, with specific reference to the Port of New York (Snow 1901; Hoag 1905b; Green 1917; see Raber, Flagg, Wiegand, and Antici 1983: 55-58 for a review and summary).

The Arthur Kill New York Reach also includes several examples of vessels re-used as piers, including two wooden car floats (S33 and V258) at marine repair yards, and three canal boats sunk and filled with concrete at the former site of the Atlantic Terra Cotta Company (V205-V207). While not very typical of regional pier construction practices, similar forms of vessel re-use sometimes served to retain landfill from colonial times to c1900, and was seen at several other demolished or filled-over Tottenville facilities (e.g., Army Corps of Engineers 1924). Given the deterioration of on-shore facilities or pier features associated with these vessels, their potential significance rests primarily with their status as vessels and is discussed in Section VII.

In regional usage, wharves are waterfront structures paralleling shorelines, while piers project away from the shore, usually at right angles. In the Port of New York before World War II, piers were the most important waterfront substructures along nearly all developed coasts in the City of New York, on the New Jersey sides of the Hudson River, Upper New York Bay, and Kill Van Kull, and at Elizabethport. The distinctive arrays of piers, usually narrow or "finger" forms, in these areas emerged from high land values at buildable sites near navigable channels, the need in many areas to reach these channels in a cost-effective manner, and increasing ship lengths. Piers built at Tottenville, Rossville, Travis, and Chelsea for shipyards, ferry or steamboat landings, and fishing operations generally followed this pattern. Along the New Jersey side of the Arthur Kill and on the lower Raritan River, there was far greater use of wharves: lower land values away from settlements such as Perth Amboy, relative proximity of the best natural navigation channels, and the small size of vessels serving most industrial sites, all tended to encourage wharf forms. Wharves on the New Jersey side had the advantage of minimizing near-shore dredging by construction close to deep water channels, where vessel propeller action or federal dredging maintained navigable depths (Raber, Flagg, Weinstein, Musser, and Wiegand 1995). In the Arthur Kill New York Reach, the Kreischer brick works and most of the 20th-century waterfront users handling extensive barge traffic also chose wharf development.

Some wharves like those at the brick works (S98, S98A) were bulkheaded solid-fill structures, but most were adaptations of timber pier construction. The two most common wharf forms were wide pile-supported timber or concrete decks extending from bulkheaded shores (e.g., S67, S107, S128, S137), or a variety of distinctive offshore forms. Historic maps suggest that, beginning with L- or T-shaped structures, offshore wharves first evolved locally into long forms adjacent to shipping channels on the New Jersey side of the Arthur Kill in the late 19th century, with the offshore section linked to the shore by one or more piers of equal or less width. Staten Island examples in project areas include the Gulfport wharves designated S9 and S11-S13, the latter an array of cribwork cells linked by timber-pile-supported walkways and shore approaches. As a local adaptation, offshore wharves remain well-represented on both sides of the Arthur Kill by some of the better-maintained structures not no action or minor repairs.

A few pile-supported wharves in project areas have concrete decks on steel concrete-filled piles (S16, S81, S83). Concrete decks appeared in the Port of New York beginning in 1909, in response to rapid deck deterioration due to moisture. This is a common and well-documented development. After World War II, rising timber costs gradually pushed regional waterfront builders to use other materials for pier supports such as concrete pile caps and steel H-piles. Concrete casing often protects steel piles from the deck to 2 feet below mean low water. Steel piles are stronger than timber piles, can be made in longer lengths, and bond well to concrete. These recent innovations are well documented, and are part of a national or international engineering context which is not significant under any current preservation standards (Quinn 1961; Raber, Flagg, Wiegand, and Antici 1983: 62-78).

3. Miscellaneous Substructures

Other substructures reviewed included undocumented timber pilings possibly associated with construction platforms for the Goethals and Outerbridge Crossing bridges, recent pile supports for a sanitary sewer outfalls, timber dolphins or mooring structures in various states of decay, and timber ferry racks at the former, latest Perth Amboy-Tottenville ferry landing. As individual resources, these structures are too common or well-documented in form, and/or too deteriorated, to be significant. As noted in section VI, however, several are associated with significant sites.

B. Waterfront Complexes or Facilities Associated with Structures

Of the 19th-century industrial or marine complexes associated with project areas, all are demolished to at least ground level. Some sites, such as the Atlantic Terra Cotta Company, have been redeveloped with recent new structures. At other sites like the Tottenville shipyards, Kreischer brick works, or American Linoleum Manufacturing Company, most or all of the onshore structures probably had shallow foundations and did not include processes or equipment with below-ground features except perhaps for steam engine houses. Archaeological remains at these sites are probably limited to demolition debris and remains of unfinished or spoiled products which are generally well-documented or readily available (e.g., Gurcke 1987). These demolished complexes thus appear unlikely to retain significant new information, and do not appear potentially significant.

Surviving facilities associated with project structures include the oil terminal begun by Gulf Refining Company south of the Goethals Bridge c1930 and the Consolidated Edison generating complex in Travis opened in the 1940s. These facilities, partially modified or rebuilt, appear typical of many similar surviving contemporary complexes, and are not potentially significant.

C. Inventory

Table 1 summarizes the nature, distribution, known history, and present condition of all waterfront resources located or documented within limits of areas subject to anticipated project actions. Plates illustrating resources other than pile fields follow this section. Descriptive terms in Table 1 refer to the types of structures reviewed above. Inventory sources appear at the end of the table, referenced to sources listed in full at the end of this report.

Table 1. **INVENTORY OF HISTORIC WATERFRONT RESOURCES IN RECONNAISSANCE PROJECT AREAS**

KEY

Column 1: CAT =	**PROJECT AREA NUMBER(S) AND PROPOSED ACTIONS** (REM = Remove, REP = Repair)
Column 2: SN =	**HISTORIC SITE NUMBER WITHIN PROJECT AREA** (ordered north to south, and earliest to latest)
Column 3:	**SITE NAME(S)** (historic name or locational description)
Column 4:	**DATES USED** -1903 = beginning before 1903 +1903 = beginning after 1903 1942- = ending before 1942 1942+ = ending after 1942
Column 5:	**DESCRIPTION, FUNCTION, SOURCES** (sources referenced at end of table)
Column 6:	**DIMENSIONS** (ft)
Column 7:	**1994 CONDITION** (summary of present condition; plate references)

D. Assessment and Project Effects

Based on the historic context outlined above and the inventory of structure types and conditions, none of the project areas reviewed here appear to be potentially significant due to their poor condition, well-documented form, and/or lack of association with potentially significant larger complexes.

Proposed project actions will therefore have no effects on potentially significant waterfront structures.

Table 1. INVENTORY OF HISTORIC WATERFRONT RESOURCES IN RECONNAISSANCE PROJECT AREAS

CAT	SN	Site Name(s)	Dates used	Description, Function, Sources	Dimensions (ft)	1994 Condition
S3 REM	1	NO DATA	NO DATA	NO DATA	NO DATA	15 piles & steel sheeting
S4 REM	1	Charles F. Vachris pier	-1965+	Timber pile/deck pier. Limited information. Source 5.	115x30	very deteriorated Plate 1
S4A REM	1	dolphin, possibly associated with S4	NO DATA	NO DATA	-----	5 piles Plate 1
S6 REM	1	NO DATA	NO DATA	Timber pier or platform, possibly associated with Goethals Bridge construction	NO DATA	17 piles
S6A REM	1	possible temporary Goethals Bridge supports	-1928+?	Undocumented timber structure under Goethals Bridge	NO DATA	40 piles
S9 REM	1	probable remains, Gulfport offshore wharf	-1942-1953+	Timber pile/deck wharf with 2 timber pile/deck catwalks to shore, used for barge shipment of petroleum; replaced by S11/S13. Sources 7-10.	820x10	4 pile clusters
S10 REP	1	Gulfport Bulkhead	-1942-present	Timber sheet piling and rubble bulkhead behind S9. Sources 1,3,5,7,9.	780 long	partly intact Plate 2
S11 S13 REP	1	Part of Gulfport offshore wharf	-1932-present	Open-pile cribs with timber pile/deck connecting walkways, rebuilt or extended by 1953 with 4 30x30' concrete-capped rock-filled timber cribs connected by walkways, one timber pile/deck approach from shore, & walkway connecting south end of wharf with next wharf to south; pipelines on wharf allowed shipment of petroleum products on barges; steel sheet piling replaced timber crib walls by 1878. Sources 1-12.	originally 560x10, now 800x10, with 165x25 approach from shore	largely intact, some deterioration Plate 2
S16 REP	1	Gulfport concrete wharf	-1932-present	Timber pile wharf with concrete deck, used by Gulf Refining for receipt & shipment of petroleum products; piles replaced with concrete-filled steel tubes by 1942; 300x30-foot transit shed added by 1953, removed by 1965; owned by Petroport Terminal Corp. by 1988. Sources 1-12.	originally 860x50; extended to 1190x50 by 1942	intact; fender repair Plate 3

Table 1. INVENTORY OF HISTORIC WATERFRONT RESOURCES IN RECONNAISSANCE PROJECT AREAS

CAT	SN	Site Name(s)	Dates used	Description, Function, Sources	Dimensions (ft)	1994 Condition
S18 S18A S19A REM	1	Gulfport barge mooring rack	-1953-1965+	Timber pile/deck structure connected to south end of concrete dock (S16), used by Gulf Oil Corp. for mooring barges. Sources 1-8.	800x15 with 5 90x5 catwalks to shore	partially intact Plate 4
S33	1	Probable William Spencer & Sons pier or drydock.	-1942+	Wooden carfloat possibly used for marine work. See section VII.2.n.	180x40	partially intact
S46A REM	1	NO DATA	NO DATA	NO DATA	NO DATA	14 piles
S47 REM	1	Staten Island Oil Co. pier	-1965+	Sunken wooden barge with concrete deck and timber mooring piles at *face and south side*, connected to shore by solid-fill causeway with crushed-stone surface, used by Staten Is. Oil Co. for barge receipt of petroleum products by barge. Sources 5-6.	60x30	concrete deck Plate 5
S49 REP	1	Con Edison bulkhead	c1965-present	Probable timber-pile-supported concrete relieving platform bulkhead, used by Con Edison for receipt of fuel oil. Sources 1-5.	500 long	intact; fender damage Plate 6
S57 S58 REP/ S59 REM	1	Con Edison bulkhead	-1953-1965+	Solid-fill timber bulkhead with concrete surface, with catwalks extending from each end of the face, used for receipt of coal and fuel oil by Con Edison; slightly rebuilt by 1965; used by Con Edison for receipt of fuel oil. Sources 5-8,37	originally 265 long; rebuilt as 255x100, with 2 145-long catwalks	largely intact Plate 7
S61	1	Possible remnant of Carteret Ferry Shipyard wharf	c1916-20	Possible north side of timber pile/deck wharf. Sources 32-3.	about 460 long	135 piles
S63 S64 REM	1	Carteret Ferry Shipyard structures	c1917-20	Possible timber pile/deck ways or small piers. Sources 11,13,15,32-3.	each about 100 long	pile fields
S66 REP	1	Sanitary outfall	-1988+	Timber pile sewer outfall support	180 long	largely intact Plate 8

Table 1. INVENTORY OF HISTORIC WATERFRONT RESOURCES IN RECONNAISSANCE PROJECT AREAS

CAT	SN	Site Name(s)	Dates used	Description, Function, Sources	Dimensions (ft)	1994 Condition
S67 REM	1	Possible American Linoleum Manufacturing Company pier remains	-1898-1931	Timber pile/deck wharf with coal elevator, used to transfer coal from barge to narrow gauge cars and for shipping linoleum products; stiff-leg derrick and narrow gauge tracks installed by 1924 to receive linseed oil and coal from lighters, rosin from coastwise steamers. Sources 11,15-22,34.	originally326x 111	timber sheet piling
	2	Con Edison wharf attached to ruins of S66-1	c1952-1965+	Timber pile/deck wharf. Sources 5,7,34.	225x50	
S68 S69 REM	1	NO DATA	NO DATA	Two timber-pile-supported concrete platforms, north & south of former small creek mouth.	15x15, 15x5	concrete slabs on piles
S70 REM	1	NO DATA	NO DATA	NO DATA	NO DATA	2 piles, pile cluster
S74A REM	1	Unidentified, untyped moulded wooden vessel	NO DATA	Untyped moulded wooden vessel; not a bulkhead	70 long, 6 high	poor
S75 REM	1	NO DATA	NO DATA	NO DATA	NO DATA	13 piles
S77 REM	1	NO DATA	NO DATA	NO DATA	NO DATA	140 piles
S81 REP	1	Offshore bulk materials wharf	built -1978 never used	Concrete-filled, steel-pipe-pile, concrete-decked offshore wharf, with pier to older Brooklyn Edison concrete bulkhead built c1918 for coal receipt & storage; wharf built by Public Service Gas & Electric Co. for receipt of liquefied natural gas but never used due to environmental legal issues; later proposed for other bulk materials handling by Rossville Marine Terminals, Inc. Sources 1-4,10-15.	380 long with 100x40 shore approach	intact; timber fender damage Plate 9
S83 REP	1	Bulk materials pier	see S81	Concrete-filled, steel-pipe-pile, concrete-decked pier, part of project noted for S81. Sources 1-4.	210 long	largely intact

Table 1. INVENTORY OF HISTORIC WATERFRONT RESOURCES IN RECONNAISSANCE PROJECT AREAS

CAT	SN	Site Name(s)	Dates used	Description, Function, Sources	Dimensions (ft)	1994 Condition
S84A REM	1	Oakland Chemical Company pier	c1898-1932+	Timber pile/deck pier used for receipt of raw chemicals and coal, and shipment of chemical products by lighter; replaced by 1942 with truck shipping. Sources 9-22.	originally 302x107x72, L-shaped	35 piles
S96 REM	1	remains of hoisting engine on work barge	NO DATA	Part of a vessel; see Section VII.2.x	10x10	platform with machinery
S98 REM	1	Kreischer Brick Manufacturing Co. bulkhead	-1907-1924-	Combination pile, masonry and crib wharf with clay fill for loading brick onto scows; part of slip. Sources 15-19.	525 long	timber sheeting Plate 10
S98A REM	1	Kreischer Brick Manufacturing Co. bulkhead	-1917-1924-	Timber sheeting-retained solid fill structure, probably with clay fill; part of slip. Sources 11,13,15,17,35.	40 long	timber sheeting
S102 REM	1	Unidentified pier possibly for Outerbridge Crossing construction	c1926-1928	Timber pile/deck structure. Source 12.	originally 320 long	pile field
S102A REM	1	NO DATA	NO DATA	NO DATA	NO DATA	25 piles
S106 REM	1	Moran Towing & Transportation Company repair pier	-1918-1932+	Timber pile/deck pier used for tie-up and repair of coal barges and floating equipment. Sources 11-16.	originally 328x64	70 piles
S107 REM	1	Possible Southern Ship Yard Ways or Moran Towing & Transportation Company wharf	-1898-1932+	Probably timber pile/deck structure, timber sheathed if Moran wharf associated with S106. Sources 11-17,19,21.	originally, approximately 650x20	44 piles
S110 REM	1	A. Kreusler stonecutting works pier/Atlantic Terra Cotta Company pier	-1898-1932	Timber pile/deck pier, probably used for receipt of clay and shipment of terra cotta products c1907-20. Sources 12,14,15,17,19,21,35.	originally 200x25 with T-shaped end	80 piles

Table 1. INVENTORY OF HISTORIC WATERFRONT RESOURCES IN RECONNAISSANCE PROJECT AREAS

CAT	SN	Site Name(s)	Dates used	Description, Function, Sources	Dimensions (ft)	1994 Condition
S111 REM	1	Possible Atlantic Terra Cotta Company offshore mooring rack	-1932+	Probably timber pile/deck structure. Source 11.	260 long	pile field
S112A REM	1	Possible Atlantic Terra Cotta Company pier	-1932+	Probably timber pile/deck structure. Source 11.	NO DATA	pile field
S114 REM	1	Staten Island Shipbuilding Co./ M&J Tracy Co./ Tottenville Shipyard Co. pier/James O'Boyle Shipyard/Townsend Transportation Co. pier	-1921-1965+	Timber pile/deck pier, used by M&J Tracy for repairing coal barges; by 1932 owned by Tottenville Shipyard Co. & used for boat repairs; by 1942, north side leased as excursion boat tie-up for Sound Steamship Lines; by 1953, used by James O'Boyle Shipyard for mooring floating drydocks and mooring small craft for engine repairs; by 1965, used by Townsend Transportation Co. for mooring company-owned floating equipment. Sources 5-14,16.	590x30'	pile field
S119 REM	1	H.R. Yetman/Transatlantic Shipyard Corp./Stephen H. Cossey Pier	-1898-1918+	Timber pile/deck pier, not used by c1920 though part of shipyards in operation to 1924+. Includes part of wooden screw-propelled vessel. Sources 13-17,19,21.	originally 122x200x50	75 piles
S120 REM	1	NO DATA	NO DATA	NO DATA	NO DATA	26 piles
V258	1	Tottenville Marine Basin pier	-1953+	Timber carfloat resting on mud flat with timber approach extending from shore, used for mooring and repair of small craft, with marine railway adjacent to north side of carfloat and marine repair plant in rear. Sources 7-8. See Section VII.2.n.	115x35	partly intact; see Section VII.2.n
S121 REM	1	Main Street Pier	-1855-1932+	Timber pile/deck pier, rebuilt several times with different sizes & forms, used by ferry to Perth Amboy -1855-1898-, also by Totten's Wharf & Repair Yard c1859, Cole Bros. c1917, Arthur Kill Towing Co. for mooring c1920, by Warren Pierce for receipt of coal for local delivery by 1924, by Amboy Towboats Inc. as tie-up for tugs awaiting orders by 1932. Sources 11-17,19,21,25,27-9.	approximately 225x25	25 piles
S122 REM	1	Tottenville Holding Co./Seguine, Runyon & Stiles Co. lumber pier	-1898-1942+	Timber pile/deck pier, rebuilt by 1942. Sources 10,12,15,17,19,21.	originally about 130x30, rebuilt 110x10	28 piles

Table 1. INVENTORY OF HISTORIC WATERFRONT RESOURCES IN RECONNAISSANCE PROJECT AREAS

CAT	SN	Site Name(s)	Dates used	Description, Function, Sources	Dimensions (ft)	1994 Condition
S124 REM	1	Tottenville Holding Co./Seguine, Runyon & Stiles Co. pier and/or bulkhead	-1855-1942+	Possible solid-fill pier -1855-1887+, converted to bulkhead by 1898, for undocumented uses. Sources 9,11,13,15,17,19-21,23-9.	pier originally 280x30; bulkhead 150 on south side	15 piles & timber sheeting
S125 REM	1	Unidentified pier, probably associated with Staten Island Rapid Transit trestle	-1898-1907+	Timber pile/deck pier, function unknown. Sources 19,21.	about 80 long	pile field
S127 REM	1	Perth Amboy Ferry rack	-1918-1963	Timber ferry racks for Tottenville - Perth Amboy ferry, owned by Staten Island Rapid Transit RR to 1948, by Sunrise Ferries to 1963. Sources 7-16,32.	2 racks, originally 110 & 160 long	355 piles
S128 REM	1	Perth Amboy Ferry wharf	-1932-1953+	Timber pile/deck wharf for second ferry slip, same history as S127; only ferry slip in use by 1953. Sources 7-16,32.	NO DATA	pile field
S130 REM	1	Namee family pier	-1898-1942+	Timber pile/deck private wharf -1898-1918; rebuilt -1942+. Sources 9,11,13,15,17,19-21.	originally 100x80, later 80x20	35 piles
S133 REM	1	DeHart family pier	-1898-1924+	Timber pile/deck pier. Sources 13,15,17,19-21.	about 35x20	pile field & timber sheeting
S136 REM	1	D.A. Joline/A.C. Brown & Sons Shipyard mooring pier and bulkhead	-1917-1932+	Timber pile/deck mooring pier, lengthened c1918. Sources 11-17.	originally 110x15, rebuilt to 375x15	pile field
S137 REM	1	A.C. Brown & Sons Shipyard pier or wharf	-1917-1932+	Timber pile/deck pier or wharf. Sources 11-17.	NO DATA	pile field
S138 REM	1	A.C. Brown & Sons Shipyard pier or railway dry dock	-1898-1932+	Timber pile structure. Sources 11,13,15,17,19-21.	60x20	pile field
S140 REM	1	A.C. Brown & Sons Shipyard pier and/or ways	-1898-1932+	Timber pile/deck mooring pier. Sources 11,13,15,17,19-21.	100x16	pile field

Table 1. INVENTORY OF HISTORIC WATERFRONT RESOURCES IN RECONNAISSANCE PROJECT AREAS

CAT	SN	Site Name(s)	Dates used	Description, Function, Sources	Dimensions (ft)	1994 Condition
S141 S142 REM	1	A.C. Brown & Sons Shipyard ways	-1918-1932+	Two of up to ten timber shipways built on natural bank for construction of lighters and barges. Sources 11-16.	NO DATA	piles and timber on beach Plate 11
S143 REM	1	Perth Amboy ferry/ Manahata Club/A.C. Brown Shipyard pier	c1684-1918+	Timber pile/deck structure(s), probably rebuilt many times in undocumented forms, used for ferry c1710-1860; boating (?) club c1874, and mooring pier for shipyard. 1921: pile pier for mooring, 125'x20', fair condition; not shown thereafter	various dimensions; originally about 80 long, later 125x20	pile field Plate 11

Sources

1 Army Corps of Engineers 1988 [maps]
2 Army Corps of Engineers 1988
3 Army Corps of Engineers 1978 [maps]
4 Army Corps of Engineers 1978
5 Army Corps of Engineers 1965 [maps]
6 Army Corps of Engineers 1965
7 Army Corps of Engineers 1953 [maps]
8 Army Corps of Engineers 1953
9 Army Corps of Engineers 1942 [maps]
10 Army Corps of Engineers 1942
11 Army Corps of Engineers 1932 [maps]
12 Army Corps of Engineers 1932
13 Army Corps of Engineers 1924 [maps]
14 Army Corps of Engineers 1926
15 Army Corps of Engineers 1918 [maps]
16 U.S. Congress 1920
17 Robinson 1917 [maps]
18 Staten Island Sound Deep Waterways Association 1916 [maps]
19 Robinson 1907 [maps]
20 U.S. Coast Survey 1899 [maps]
21 Robinson 1898 [maps]
22 Sanborn Map Company 1898/1911 [maps]
23 U.S. Geological Survey 1897
24 U.S. Coast Survey 1889 [maps]
25 Beers 1887 [maps]
26 U.S. Coast Survey 1874 [maps]
27 Beers 1874 [maps]
28 Walling 1859 [maps]
29 U.S. Coast Survey 1855a, 1855b [maps]
30 U.S. Coast Survey 1844 [maps]
31 U.S. Coast Survey 1835-36 [maps]
32 Cudahy 1990: 285-6
33 Noble 1974
34 Reed 1964b
35 Bayles 1887: 732
36 New Jersey Department of Environmental Protection and Energy [plans]
37 Staten Island Institute of Arts and Sciences 1947-48

Plate 1. Waterfront Structures S4 (center) and S4A (right) to east

Plate 2. Waterfront Structures S10 (left), S11 (center rear), and S13 (center & right) to south

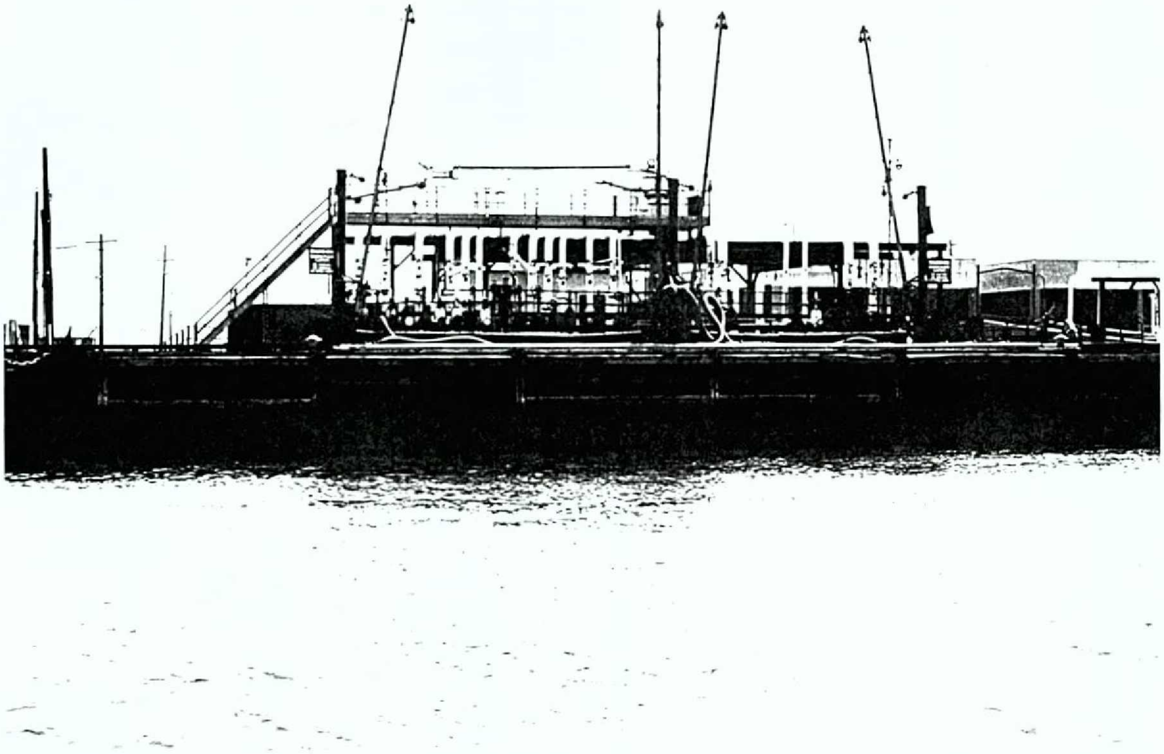


Plate 3. Waterfront Structure S16 to east

Plate 4. Waterfront Structures S18 (center-left) & S18A (center-right, rear) to northwest

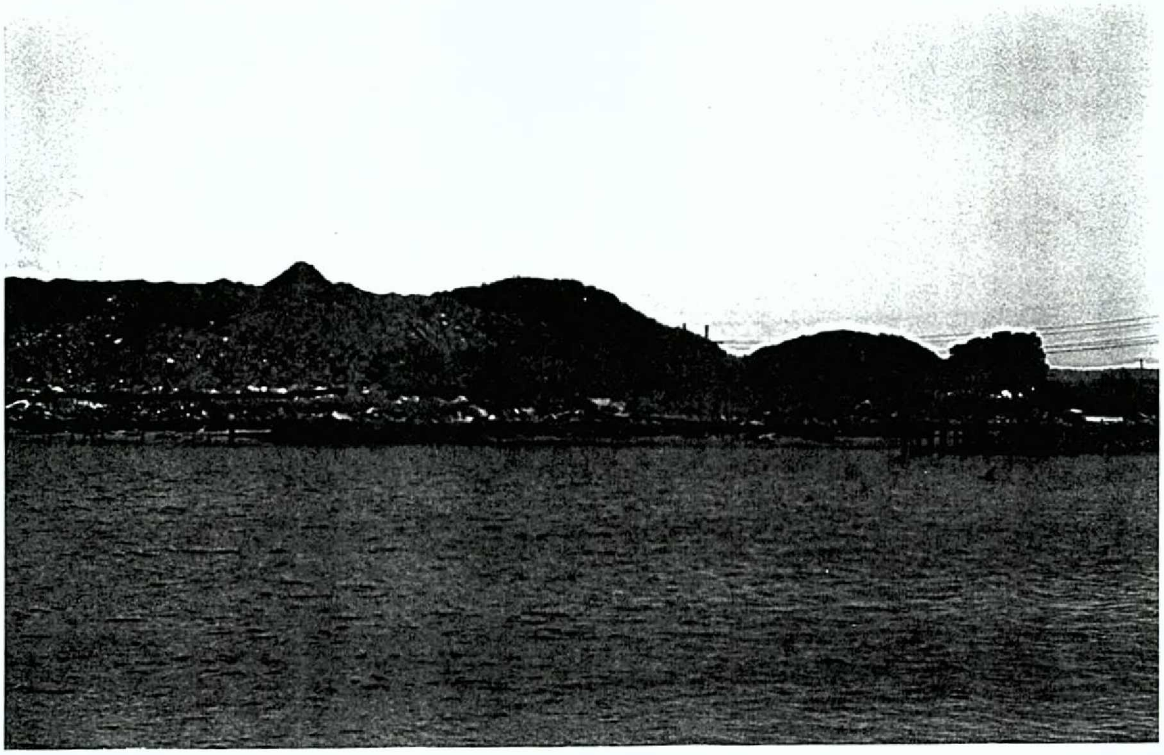


Plate 5. Waterfront Structures S46A (left) & S47 (right) to east

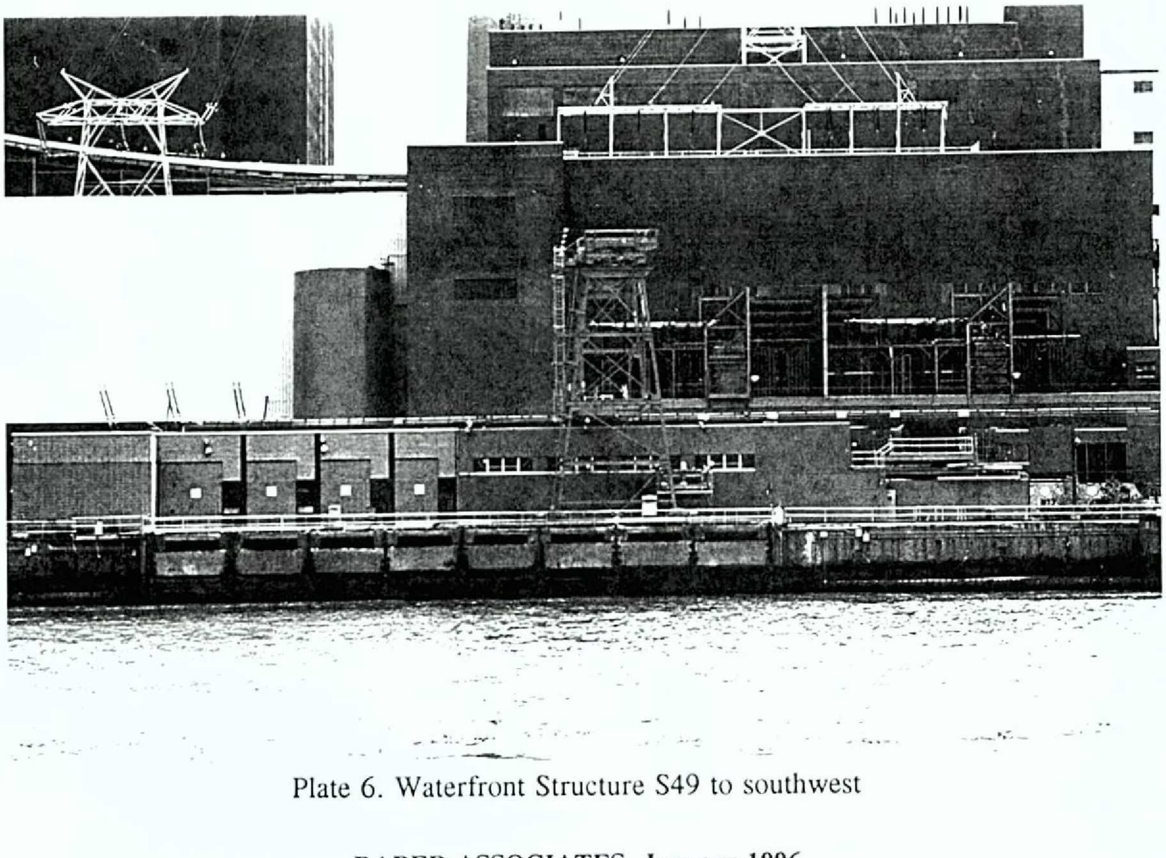


Plate 6. Waterfront Structure S49 to southwest

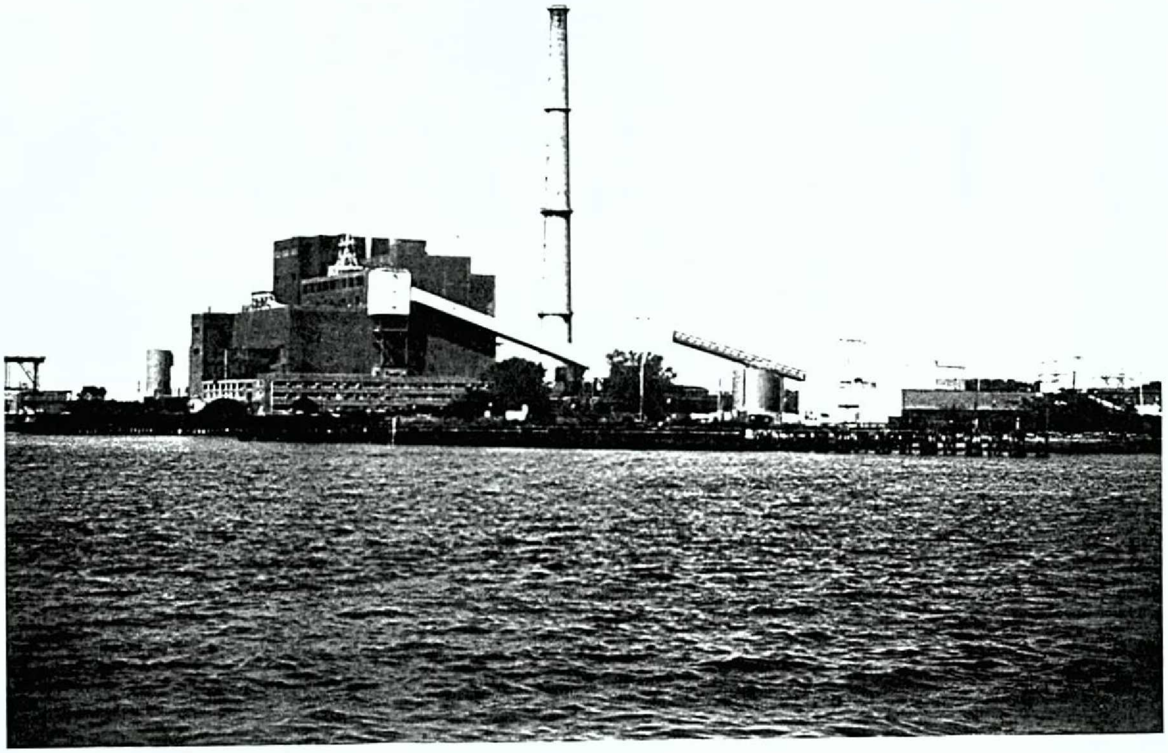


Plate 7. Waterfront Structures S57 (center) and S58 (right) to northeast

Plate 8. Waterfront Structure S66 to northeast

Plate 9. Waterfront Structure S81 to south

Plate 10. Waterfront Structure S98 to east

Plate 11. Waterfront Structures S141 (center-left) and S143 (right) to north

VII. MARINE RESOURCE INVENTORY, SIGNIFICANCE, AND PROJECT IMPACTS

We investigated over 250 derelict vessels and other possible marine resources included in the 1991 project catalog. One vessel (V212) in the 1991 catalog could not be located; separate sets of annotated aerial photographs prepared by Raber Associates and URS Consultants, Inc., suggest this vessel may be the same as V224. One other 1991 catalog item (V259) could not be distinguished from deteriorated pier remains at S121. Three catalog structures (S33, S74A, S96) proved to be vessels or equipment associated with a vessel, and two others (S119 and S143) included, or were associated with, uncatalogued derelict vessel remains. The latter two vessels are designated here with brackets, e.g. [S119]. Of the 269 vessels now included in the 1994 catalog, seventeen vessels added to this catalog after our investigations were not viewed or analyzed (see Table 2, no. 40 and Table 3). Plates following this section illustrate better-preserved examples of investigated marine resources, and some of the more fragmentary remains.

Analysis of marine resources involved two types of context:

> the history and significance of individual vessels or vessel types, in the regional framework of the Port of New York and contiguous waterways;
>
> the possible collective significance of any vessel clusters, as groupings representing important patterns of vessel abandonment in the port, or as groupings with unusual concentrations of potentially significant or significant vessels.

A. Individual Vessels

1. Identification and Inventory

We classified 197 marine resources among thirty-eight known or possible resource types, by comparing surviving size, structural or design characteristics with many available drawings, descriptions, and studies of vessels used in the Port of New York. Fifty-five investigated resources were too deteriorated to allow for any reasonably firm identifications. For most of the identified types, there are no detailed structural descriptions in available written sources, requiring collation of field data from this reconnaissance, the companion studies being completed by Raber Associates in the Kill Van Kull and Arthur Kill New Jersey reaches (Raber, Flagg, Weinstein, Wiegand, and Brouwer 1995; Raber, Flagg, Weinstein, Musser, and Wiegand 1995), previous documentations (Brouwer 1985; Kardas and Larrabee 1985b; Flagg *et al.* 1992), and other recent investigations (Flagg n.d.b). Table 2 inventories project resources by type, with summaries of our findings on the most important known physical characteristics for resources with much physical integrity, based on field observations and graphic or written sources. Tables 3 and 4 summarize these findings by catalog number, resource type, and location.

Typological identifications of most harbor craft with better-preserved examples were relatively straightforward, based on previous studies, although as discussed below distinctions between hold barges used for coastwise vs. canal or harbor service remain somewhat unclear (sources for Table 3, nos. 6, 7, and 8). Several types are much less well-documented, or have not previously been identified or classified as done here. As discussed below, assessments of significance must address some of these ambiguities in identification. The principal identification issues in the Arthur Kill New York Reach involve wooden vessels suitable for use on the New York State Barge Canal system as well as in the Port of New York.

a. Identification Issues: Canal Boats/Barges

Boats used on regional canals or contiguous waterways pose several identification problems. Functionally, boats with general canal service designs were used in non-canal traffic, sometimes following periods of canal service but sometimes with no canal service at all (Clouette 1978a, 1978b; Robert Hager [persons consulted]). Examples of non-canal service involving "canal boats" include intra-harbor freight transfers to or from creeks and small rivers with insufficient clearance for larger barges, extensive transport of materials up and down the Hudson River, and shipment of clay products from Woodbridge and Perth Amboy (U.S. Congress 1928: 12). For boats built for and used on canals, distinguishing the canal(s) of primary use and, often, the specific type of boat among those used on particular canal systems is also an identification issue -- especially where only boat bottoms survive with little if any side or end remains.

Our principal criteria in identifying project resources as canal-type boats were width and form. While these boats may be as long as vessels used only for harbor or offshore/coastal work, they are narrower (generally 20-25 feet vs. 30-35 feet) and have rounded or pointed bows and occasionally rounded sterns. These boats are transitional forms, between traditional moulded hulls with curved floors and frames requiring bent or curved fabricated members, and barge forms with few if any such members. The use of bilge logs in at least some canal boats eliminated most curved members, except for rounded bows and sterns.

We assigned all vessels identified as canal boats to those suitable for use on the New York State Barge Canal, built 1905-18 and still open. Although reconnaissance investigations did not involve measurement of vessel remains, dimensions collected for preparation of the 1991 project catalog strongly suggest this era of vessel origins. Even if available 20-to-25-foot width measurements -- apparently made to the nearest foot -- prove to be imprecise, they clearly show that these examples exceed the 17.5-foot widths of boats used on the 19th-century New York State canals, and the narrower 10.5-to-14-foot widths seen on boats entering New York Harbor or its tributary waters via the Delaware and Hudson, Morris, or Delaware and Raritan canals (e.g., Whitford 1905: 1467; Canal Museum 1981; Brouwer 1990: 112-17).

Among the project area canal boats, we have distinguished two major classes (Table 3, nos. 5-6). The Large Wooden Barge Canal or Harbor Hold Barges seem to correspond structurally to undated 20th-century drawings of vessels generally 22-to-34 feet wide and about 108 feet long, labeled Barge, Barge Canal Boats, Canal Box, Barge for Lake Work, Canal Box O'Donnely Type, Big Grain Boat, Big Grain Box, Deep Barge (cf. Table 3, no. 7 and Feeney Shipbuilding Company n.d.). Although derived from earlier generations of boats used on the New York State canals, these vessels are substantially wider and retain pre-Barge Canal boat features in a somewhat vestigial manner, such as low inset cabins. We believe these boats represent a thorough re-working of earlier forms for use on the Barge Canal after c1915-20. In contrast, the Probable Transitional/Smaller Barge Canal Boats appear to be slightly larger versions of the 19th-century forms, lacking bowstables quarters for towing animals, built c1905-15 while boatbuilders worked out the designs typified by the Feeney drawings (Garrity 1977: 23, 159; Canal Museum 1981; Richard Hager [persons consulted]).

2. History and Significance

Of the identified marine resources, 107 (54%) were unpowered wooden boats or barges (Table 4, nos. 1-4, 6-8, 17, 18, 33, 35), most of which are examples of vessel types once extremely important in the commerce of the Arthur Kill and Raritan River, and in the Port of New York generally, involving extensive towing of freight. Another 35 project vessels (18%) were types of harbor tugs whose service once included the towing of such barges (Table 4, nos. 9, 11). Towing in or near project area waters began by no later than the 1830s with Delaware and Raritan Canal traffic and early clay product shipments, and accelerated by c1850-55 as canal boats and other barges moved greater volumes of clay products and rail-to-tidewater coal shipments. By World War I, over 55,000 different barges or boats were used in the extensive towing traffic through the Arthur Kill, probably in the large tows of up to 70 vessels documented for the late 1880s when towing accounted for 90% of the freight in this waterway (Army Corps of Engineers 1887: 2633; U.S. Congress 1920: 316). Beginning c1935 with declines in clay product or coal shipments, and in all remaining canal shipping generally, towed traffic in the improved channel of the Arthur Kill gradually disappeared by the 1960s in favor of larger coastal and oceangoing ships. Towing requirements were by then met with steel barges, with the last wooden barges and scows in the harbor probably built in the 1950s. Steel-barge lighterage in the Port of New York finally succumbed to container transport in 1983 (Brouwer 1985b: 49; Brouwer 1990: 127). We identified nineteen unpowered steel vessels, relics of this traffic which include a number of car floats used to move railroad cars across the harbor (Table 4, nos. 5, 19, 20, 34). Car floating began to decline in the 1950s, and since the Penn Central and Conrail consolidations of 1968-76 this service remains extremely limited.

Other project vessels once involved in sail- or steam-powered freight handling include three lighters used for small intra-harbor cargo transfer, and eleven ships built or converted for coastwise transfers of coal on routes including the Arthur Kill. We found, then, that 178 (90%) of the identified marine resources were remains of now-vanished freight handling in or near project area waters. There is little direct evidence at present on direct associations of project marine resources with Arthur Kill commerce, although comparison of abandonment dates and locations with vessel types suggests the possibility of such associations (section VIII.B below). Most of these particular examples probably date to the 20th century, as noted above for canal boats and suggested below for other types. As individual resources, questions of significance must focus primarily on whether these resources

> retain physical evidence of undocumented structural, mechanical, or living quarter features which distinguish different vessel types, including important variations within types which reflect different functions or diverse building traditions (National Register Significance Criterion D); or
>
> represent well-preserved examples of important vessel types which are incompletely documented and/or extremely rare as surviving artifacts (National Register Significance Criteria C and D).

Despite several documentations of harbor craft in the Port of New York, construction details for most types remain unrecorded. Even very incomplete vessel examples can be significant under Criterion D if they add new information about structural details. Surviving superstructure features may be significant under Criterion D for information on cargo handling and living conditions (Brouwer 1985b: 50).

Table 3 lists our findings on potential vessel significance by catalog number, type, location, and approximate abandonment dates. We review these findings below by vessel types, with pertinent examples from the two companion reaches we investigated abbreviated KVK and AKNJ.

a. Wooden Covered Harbor Barges (Refrigerator Barge, Covered Cement Barge)

Used to carry boxed, barreled and bagged cargoes from shore to ship and ship to ship, covered harbor barges probably originated with various types of early-mid-19th century towed harbor vessels with lightly-built moulded or curved hulls, such as immigrant barges and safety barges. Regional boat builders developed scow-type wooden hulls, requiring very few members with lines, by the late 19th or very early 20th century (Brouwer 1990: 127-37). Few covered barges survive in good condition with original deck houses within the Port of New York. One example is preserved as the floating home of the Hudson River Waterfront Museum at changing harbor locations, and several less accessible but intact examples remain at the Witte marine scrapyard in Rossville. Two now-removed covered barges, in Edgewater, New Jersey and at Shooters Island, received written, large-format photographic, and (at Shooters Island) drawn documentation, with detailed information on the superstructures but very limited coverage on the hull (Brouwer 1985a, 1985b; Flagg n.d.b).

All of the eight covered barges identified in the Arthur Kill New York Reach are deteriorated. Of the two best-preserved, V189 retains its hull and deck but only traces of its house, and V252 has been severely burned but has hull, house post, and house roof stringers remains. KVK V162 and V167 are better-preserved examples and have received some prior documentation (Flagg *et al.* 1992), but they are far from shore making close observation of lower hull construction difficult. **V189 and V252 are high and dry at low tide, making hull observation easy. In conjunction with previous documentation and the Kill Van Kull examples, V189 and V252 should be regarded as potentially significant under Criterion D for potential to provide undocumented construction and woodworking details** (plates 46, 61).

b. Probable Wooden Harbor Open Deck Scows (Flat Scows)

Deck scows were commonly used to move metal construction material and boxed, barreled, or crated goods from shore to ship, ship to shore and ship to ship. Their hull evolution probably resembled that of covered barges, emerging as scows by the late 19th or very early 20th century (Brouwer 1990: 127-37). Although by this period there was evidently a relatively narrow range of design form for newly-built deck scows, variations in functional equipment and conversion of other vessel types to deck scow service have complicated understanding more standard deck scow types. As a type standard, open deck scows are not well documented. We know of no original drawings of such vessels. Neither of the previous formal barge documentations in this port included deck scows, which in some surveys have not been distinguished from trap rock carriers and garbage scows; one brick scow was included in a documentation at Edgewater, New Jersey (Brouwer 1981, 1983, 1985a; Kardas and Larrabee 1985). Conversion of stick lighters to deck scows was common practice for at least one railroad (Taber 1981: 448), and research for this reconnaissance and its companion studies suggests that at least some covered barges were similarly converted (Raber, Flagg, Weinstein, Musser and Wiegand 1995: 101).

We identified five vessels in the Arthur Kill New York Reach as probable deck scows, four of which are too deteriorated to provide much new information. Older aerial photographs indicated that better-preserved V104, initially identified as a derrick barge, consisted instead of a crawler crane set down on a probable deck scow abandoned c1961-71, with the vessel in place before crane was added for possible scrapping operations (New Jersey Department of Environmental Protection and Energy 1971 [plans]; Port Authority of New York and New Jersey 1974 [plans]; cf. Raber *et al.* 1994). We found AKNJ vessels 16 and 92 potentially significant as probable examples of "standard" deck scows, with five other comparably-preserved deck scows or converted covered barges in the Kill Van Kull Reach. Further investigation may allow for definitive typological assignments of all these vessels, and provide a relative body of vessels to which V104 may be compared. **V104 should be regarded as potentially significant**

for information on an incompletely documented barge type, and perhaps for information on conversions among barge types under Criteria C and D (Plate 37).

c. Wooden Derrick Lighters (Stick lighters)

Towed derrick or stick lighters commonly hoisted and carried deck cargoes from ship to shore and ship to ship. Probably originating from post-Civil-War lighters built with schooner hulls, these vessels were converted to scow-type construction by c1900 (Brouwer 1990: 133). As a type, there is good information on some 20th-century derrick lighters, but many construction and woodworking details remain unrecorded or at least unreported. At least one historic drawing of a derrick lighter survives, with good specifications and some details (Feeney Shipbuilding Company n.d.: 4 [plans]). One derrick lighter has been documented in Edgewater, New Jersey, with detailed information on rig, fittings and hoist/cabin, but less detail on hull construction; additional hull detail notes on this same vessel were subsequently collected prior to vessel removal (Brouwer 1985a; Flagg n.d.b). Other examples include a similar vessel in excellent condition, also in Edgewater, which recently sank and will shortly be in poor condition, and an unrecorded example in very poor condition at Shooters Island (Brouwer 1983: V49).

Three of the five vessels identified as derrick lighters in the Arthur Kill New York Reach are generally poorly preserved. V155, probably abandoned c1961-71, is in relatively poor condition but retains partially collapsed house remains house remains, and sheathing on the solid bulkheads suggesting in-hull cargo carrying. We identified this vessel as a derrick lighter from a 1977 aerial photograph taken by author Flagg (New Jersey Department of Environmental Protection and Energy [plans]). V182, similarly identified, retains only its hull. AKNJ V14 retains a partly-preserved hull but lacks any house, hoist gear, or rig remains. Among known surviving derrick lighters, V155 and AKNJ V14 are among the best last examples of the typical wooden form, and could yield additional information on hull structure and deck fittings. Relatively well-preserved V120 appears to be an updated version of this type with a wooden hull, and modern cross-treed steel mast and superstructure. V120 may be a local conversion for scrapping operations similar to that suggested above for V104, but could also represent a later, undocumented derrick lighter type. Historic views indicate a similar vessel once intact in the Kill Van Kull (Staten Island Institute of Arts and Sciences 1947-48 [plans]). In conjunction with AKNJ V14 and other information on derrick lighters, **V155 and V120 should be regarded as potentially significant under Criterion D for its potential to provide undocumented construction and woodworking details** (Plate 42).

d. Wooden and Steel Trap Rock Scows (Sand Barges, Flat Scows, Bulkhead Scows)

Wooden trap rock scows carried trap rock, crushed stone and sand from Hudson River quarries to harbor vicinity building sites, occasionally also transporting coal, regular deck scow cargoes, and municipal garbage. Most of the river quarries opened in the 1870s, and the trap rock scows probably evolved quickly from smaller deck scow designs or contemporary brick scows. High end bulkheads was the most distinctive cargo-handling feature of the trap rock scows, but they also had stronger hull construction than most other barge forms (cf. Table 3, nos. 1-4). Several good drawings of this vessel type survive, although as noted above for derrick lighters many construction and woodworking details remain undocumented (Feeney Shipbuilding Company n.d.: 1, 3; New York Trap Rock Corporation 1951 [plans]). This type of craft was not noted as distinct from standard open deck scows in previous work at Shooters Island or Edgewater, though numerous examples were described in survey reports (Brouwer 1981, 1983, 1984). Partial descriptions appear in surveys of Manhattan's Upper West Side and part of Newark Bay (Raber *et al.* 1986; Flagg *et al.* 1992), the latter study including what is also listed as KVK V173.

We identified three wooden trap rock scows as potentially significant in our management summary (Raber *et al.* 1994). Additional analysis of older aerial photographs and comparison with examples in the two companion reaches has convinced us that two of the three (V55, V192) cannot be confirmed as being of this type, and that none of the examples of in the Arthur Kill New York Reach are as well preserved as AKNJ V54 and V55 AKNJ or KVK V173 KVK, which are intact or nearly intact examples.

Steel trap rock scows, developed after World War II from the wooden types, are still used by Lone Star Industries/NY Trap Rock for carrying their products from upriver quarries. While we do not know if these types are still built, there are good plans available (Staten Island Shipbuilding Company, Hull Department n.d.). Neither the wooden nor steel examples in the Arthur Kill New York Reach appear to have potential for additional information, and should not be regarded as potentially significant.

e. Probable Transitional/Smaller Barge Canal Boats

We have interpreted six marine resources as being one or more variants of this vessel class, which appears to have emerged directly from earlier forms used on the 19th-century New York State canals (Table 2, no. 6). There has been considerable information collected on some thirteen types of the 19th-century boats, much of it by researchers associated with the Chittenango Landing Canal Boat Museum, but very little detailed information has been published or reported (Canal Museum 1981; Brouwer 1990: 112-17; Chittenango Landing Canal Boat Museum 1993 [plans]; Richard Hager [persons consulted]). For boats built early in the Barge Canal era, there is apparently little collected data. We know of few comparable examples. One vessel (V83) of this general class was surveyed but never recorded in Shooters Island Area 1 (Brouwer 1981). Three 20th-century canal boats sunk at Bridgeport, CT have been placed on the National Register, but have never been fully documented and may now be lost (Clouette 1978a, 1978b).

We found seven potentially significant examples in the Arthur Kill New Jersey Reach (V30, V32, V43, V59, V98, V99, V103), among which we distinguished four variations in construction (Raber, Flagg, Weinstein, Musser and Wiegand 1995: Table 3, no. 5). Of three relatively well-preserved examples in the Arthur Kill New York Reach, V214 in similar in type to AKNJ V30, V32, V43, and V59, but probably has more intact and accessible lower timbers. V214 is partly buried in stone fill, while the AKNJ vessels are far out from shore and either largely under water at low tide, or well surrounded by mud flats. The vessel we currently identify as [S143] is also buried in rocky fill and probably has surviving lower timbers at least an equal in preservation to those of AKNJ V103, which [S143] resembles. V219, identified as the *Marion Melvin* by author Brouwer, was abandoned c1961-71 (at least 30 years later than V214 and [S143]). It is a well-preserved example of another style, identified as Barrel Bow in one surviving drawing, and retains standing sides and some stanchions (Table 2, no. 6; Feeney Shipbuilding Company n.d.: no. 15). **In conjunction with the AKNJ examples, V214, V219, and [S143] should be regarded as potentially significant under Criterion D for their potential new information on possible modifications of older boat styles for early Barge Canal use.** Other examples, identified largely on the basis of dimensions, are too deteriorated to provide such information (plates 52, 54, 65).

f. Large Wooden Barge Canal or Harbor Hold Barges (Canal Boxes, Deep Boxes, Grain Boxes, Deep Boat, Cement Boat)

As discussed above, these was apparently a larger and slightly later class of boat suitable for Barge Canal use, primarily to carry coal or grain to and within the Port of New York, but probably not used for coastwise or offshore service. There was apparently much construction detail variety within this class, and some ambiguity remains about the distinctions between canal/harbor and offshore barges hold barges. We identified ten vessels in the canal/harbor class (Table 2, no. 7), a type for which some drawings appear to exist without complete construction details (Du Bosque 1915, Feeney Shipbuilding Company n.d. [plans]). Although several examples were surveyed at Shooters Island, none were documented (Brouwer 1981, 1983). A survey near Port Ivory on the Kill Van Kull located several other poorly preserved examples, to be noted in our study of this reach (Flagg *et al.* 1992; (Raber, Flagg, Weinstein, Wiegand, and Brouwer 1995). Two hold barges recently identified in Bayonne, New Jersey include one well-preserved example (V11, in Raber, Flagg, Weinstein, and Brouwer 1995).

Relative to AKNJ V57 and V58, the examples in the Arthur Kill New York Reach appear too deteriorated to provide additional information and are not considered potentially significant.

g. Wooden Coastwise Hold Barges (Coal Barges/Boxes, New Haven Boxes, Grain Boxes, Box Barges)

These larger versions of the hold barges used in the Barge Canal carried coal between railroad-owned coal piers and customers such as power stations and local distribution companies, in New York harbor and within coastwise towing distance. They were also used for grain cargoes. Although probably of early 20th-century origin, the coastwise hold barges have little documented history to date. Some available drawings appear to correspond to this type, but as noted above full distinctions between the canal/harbor and offshore hold barges remain undefined (Du Bosque 1915, Feeney Shipbuilding Company n.d. [plans]). The largest hold barges, to 150 feet in length, were probably truly rectangular, some with heavier cross keelson floors not seen in smaller examples. Elsewhere in the Port of New York, some of the examples noted for Harbor Hold Barges may be coastwise examples.

In the Arthur Kill New York Reach, we identified thirty-nine vessels as likely members of the coastwise class (Table 2, no. 8). Although none are as well preserved as AKNJ V41, five retain enough fabric to provide more information on construction techniques. V106 has an intact outer hull and stanchions, but no deck and house. V134 and V135 have standing hull portions, and along with V106 are accessible at low tide on foot. V160 and V169 are far out on a mud flat and difficult to access at low tide, but retain standing sides, ends, stanchions with decks which appear to have collapsed. **These five examples should be regarded as potentially significant under Criterion D for their potential new information on construction details, and on distinctions between canal/harbor and offshore hold barges** (plates 38, 40, 41, 43).

h. Wooden and Steel Screw Harbor Tugs; Steel Shifting Tug

Steam-powered wooden screw- or propeller-type vessels developed by c1870 from sidewheel towboats, and served to dock ships, tow sailing ships into the harbor, and tow barges. Once extremely common and important in regional commerce, the wooden type has not been well documented in area surveys and recordations. Several nearly intact examples were noted but not recorded at Liberty State Park; nine others were found at Shooters Island but also never documented (Brouwer 1977a-c, 1981, 1983). A project by the Maine Maritime Museum to restore the well-preserved *Seguin* failed; we do know if this vessel was documented or conserved. There are other generally well-preserved examples at the Witte marine scrapyard with surviving superstructures. In addition to surviving artifacts, there is incomplete documentation of wooden screw harbor tugs in drawings made by the Feeney Shipbuilding Company (n.d.: nos 16-17 [plans]), the Staten Island Shipbuilding Company (n.d. [plans]), and other collections we have not reviewed, as well as in popular and professional maritime history literature which remains largely uncollated.

We identified thirty-four wooden screw harbor tugs in the Arthur Kill New York Reach, all of which are deteriorated to hulls only (Table 2, no. 9; Table 3). Eight relatively intact hulls – V9, V41, V75, V76, V84, V97, V100, and V102 – should be regarded as potentially significant under Criterion D for potential new information on hull construction apparently not noted in contemporary drawings (plates 17, 29, 30, 35, 36).

After c1930, welded steel designs replaced the wood and iron tugs developed in the late 19th century. Although not yet formally documented, the welded steel tugs are still in use in the Port of New York, and appear well represented in at least the drawings available from the Staten Island Shipbuilding Company (n.d. [plans]). The single, fairly deteriorated and stripped example in the Arthur Kill New York Reach, V46, does not appear to be potentially significant.

Steel shifting tugs are smaller versions of harbor tugs used to tow or shift construction barges, cranes, or inoperable self-propelled vessels, with similar technological and design pedigrees. They also remain in common use, but, unlike the larger tugs, shifting tugs can be built in a wide variety of small shipyards with little standardization of design. Wooden examples are more rare, but South Street Seaport Museum has preserved an operating example, the *W.O. Decker*. Given this variety and continued use, it is at present difficult to define the type fully or evaluate the significance of the single example, V121, identified in the Arthur Kill New York Reach. At present, V121 does not appear potentially significant. The significance of steel shifting tugs may warrant review in several decades.

i. Steel Army Steam Tug *Bloxom*

Built on the Ohio River in 1944 for U.S. Army use, the *Bloxom* (V43) was a Maritime Administration LT type wartime tug design. The tug was later used by the Pennsylvania Railroad to move carfloats in Chesapeake Bay before being purchased for scrap by the Witte operation. Arriving at its present location in the 1970s, just north of what is now considered the Witte armada of derelict vessels, the *Bloxom* retains all its original power plant in a lagoon of its own oil (Witmer 1992; New Jersey Department of Environmental Protection and Energy [plans]).

This is perhaps the most intact tug reviewed in any of the Corps reaches in the Port of New York, but it is not a design with local antecedents or later influence. It is an example of a class of federally-built steam tug which was at once extremely advanced and immediately obsolete, although it served the railroad well. The steam technology was state of the art, but of limited commercial appeal after World War II, when its large engine room staff ("black gang") compared unfavorably with the one or two engineers needed to run a diesel tug. The LT design is significant primarily as an example of emergency building programs and designs during the two world wars, with widely variable design success, military effectiveness, and commercial utility. For example, federally-mandated steam locomotives design during World War I, forced on the railroads, proved to be sound types that were copied for years afterward. The Defense Plant Corporation ordered many standardized harbor tugs to be built during World War II, many of which subsequently served for fifty years in civilian service with new engines. The Liberty ships were similarly adaptable though generally in foreign hands. Unsuccessful programs included wooden, concrete, and mass- produced steel ships built in World War I with little commercial adaptability.

The survival or documentation of LT-type tugs remains unknown to us. Some were converted to diesel power by private owners, and by the U.S. Navy as the ATA class used until c1970. One LT class example may still be in service with the Turkish navy. **As a largely unaltered example of the original LT design, V43 should be regarded as potentially significant under Criterion C and D pending identification of other examples or any surviving design documentation** (Plate 18; *Jane's Fighting Ships* 1967: 439; 1991: 578).

j. Possible Wooden Sailing Lighter

Sailing lighters, developed from smaller Hudson River sloops by the mid-19th century, carried freight from ship to ship or ship to shore into the early 20th century. They were an important transition to the steam-powered lighters used until after World War II (Brouwer 1990: 84). Documentation on sailing lighters, long gone from the Port of New York, appears limited to one article with published drawings (Douglas 1904) and some historic photographs (e.g., Johnson and Lightfoot 1980: 44; South Street Seaport Museum n.d. [plans]). We identified V77 as a possible rare example, although the dimensions of 110x25 feet given in the 1991 catalog do not match those taken as typical from Douglas 1904. The relatively well-preserved hull is far from shore in a gradually shoaling area and may not be dry at low tide. Closer examination would be required to make a firm typological identification. Historic views indicate that KVK V9, V10, V15, and V83 are badly deteriorated possible examples of the same class, with surviving diagnostic features more readily accessible. **In conjunction with information from the Kill Van Kull examples, V77 should be regarded as potentially significant under Criterion C and D, as a possible rare example of an under-documented, important class of harbor craft** (Plate 31).

k. Probable Wooden Steam Lighter

Functional descendants of the sailing lighter, wooden steam lighters had lighter, beamier hulls than wooden tugs. They probably appeared c1900-1905 and were replaced by similarly-modeled steel versions beginning c1912. Few if any wooden steam lighters survive intact. One engine from a steel lighter survives at South Street Seaport Museum. Available documentation appears limited to some historic photographs and several drawings including some detail sheets (New York Central Railroad 1908 [plans]; Staten Island Shipbuilding Company n.d. [plans]; Crater 1963; Taber 1981).

We identified V179 and V260 as likely examples of wooden steam lighters, in part from historic aerial photographs (New Jersey Department of Environmental Protection and Energy [plans]). Although both are deteriorated, V179 -- abandoned by 1932 and beached fairly far out from shore -- retains its single cylinder steam engine in remarkably good condition. V260, abandoned c1940-51, is on shore and in better condition, with engine bearers visible. **V179 and V260 appear to retain some information on construction or power plant arrangements which would help distinguish steam lighter from tug designs, and should be regarded as potentially significant under Criterion D** (plates 44, 64).

l. Large and Medium Size A-Frame Crane Barges

Probably adapted from shoreside sheer legs and other lifting equipment by the mid-to-late 19th century, towed A-frame crane barges were used for cargo transfers, dock construction, and ship salvage. We have identified at least two sizes and capacities (Table 2, nos. 15-16), neither of which is well documented aside from historic photographs (South Street Seaport Museum n.d. [plans]; Smith, ed. 1919: 265; Army Corps of Engineers 1965). No working, intact examples or drawings of the large wooden heavy-lift type appear to remain in the Port of New York. The last, modified examples of these vessels in the port, the Merritt Chapman & Scott barges *Monarch* and *Constitution*, were scrapped in the 1980s. Some limited private documentation, and salvage of a hoisting engine, accompanied this scrapping. Smaller or medium-size steel A-frame crane barges, with poorly-documented history or design, also appear to have gone out of service. There may be drawings of steel crane barges which we have not seen (e.g., Staten Island Shipbuilding Company n.d. [plans]).

V69, V111, and V193 appear to be examples of the wooden heavy-lift type, all of which were clearly scraped for their iron. **V111 (abandoned c1951-61) and V193 (abandoned c1932-40) have relatively well-preserved hulls with some surviving decking. These two hulls could provide new information on construction details, A-frame foundations, and undocumented options such as possible ballast tanks. They should be regarded as potentially significant under Criterion D** (plates 39, 47; New Jersey Department of Environmental Protection and Energy [plans]).

V4 is an extremely well-preserved, recently-abandoned example of a medium-size steel A-frame crane barge, with an intact crane and engine house. We have not made any close inspection of possible surviving operating equipment or power plant. In conjunction with any available drawings of this type, V4 could help assemble a full picture of construction and design. Given the present absence of such information, V4 should be regarded as potentially significant under Criterion D (plate 14).

m. Wooden Hopper Barges (Dump Scows)

By the early 20th century, there were several types of barges used to carry garbage, municipal ash, and semi-liquified material from harbor dredging operations to land filling and ocean dumping sites (Brouwer 1990: 140-42). The origins or early history of these designs remain undocumented. State and federal restrictions on dredging and use of offshore dumping sites have largely removed these vessels from use. The most common type was the hopper barge, described in Table 2, no. 17. Although there has been no survey or documentation of hopper barges in the Port of New York, several sets of drawings exist and there is at least one very well-preserved example at the north end of the Witte marine scrapyard. There has not been sufficient comparison of available drawings with any surviving examples to determine if the drawings document all significant features (Staten Island Shipbuilding Company n.d. [plans]).

We identified five hopper barges (V50, V238, V242, V216, V237), all but one of which was abandoned c1951-61. Two are too deteriorated to provide additional information. Of the remaining three, V50 was abandoned c1932-40, and while deteriorated may be an older example which -- as revealed in older aerial views -- lacks the common watertight hull section between the hoppers (New Jersey Department of Environmental Protection and Energy [plans]; Flagg n.d. [plans]). There are probably no drawings of this variety. V238 is largely intact but partly buried in fill and burned. V242 is an intact example of the largest, eight-hopper type but is currently buried under timber debris making details inaccessible. None of the examples located in the Kill Van Kull Reach are in better condition. **When used with historic plans and some Kill Van Kull examples, V50, V238, and V242 should be regarded as potentially significant under Criteria C and D** (plates 19, 21, 58, 59).

n. Wooden and Steel Car Floats (Station Floats, Transfer Floats)

As part of the response to the proliferation of marine rail terminals around the Port of New York, especially along the Hudson River, car floats appeared shortly after the Civil War to move railroad cars across port waters, either between rail terminals or from a terminal to a waterside warehouse destination. Essentially long scows equipped with tracks, car floats quickly evolved into two types. Transfer floats carried railroad cars between railroad marine floatbridge terminals. Station or terminal floats served as floating transfer stations on which shipments were transferred between cars or from cars to warehouses. Table 3, no. 18 summarizes the two major track and structural arrangements. Wood transfer floats were replaced early in the 20th century by steel transfer floats, although wood station floats continued in service for several additional decades. Since 1976, all carfloat operations have ceased other than those run across the Upper Bay by Cross Harbor Railroad between Greenville and Brooklyn (*Nautical Gazette* 1871; Brouwer 1990: 142-45; Flagg 1994).

Wooden car floats of either variety are not documented aside from miscellaneous historic photographs and perhaps a few drawings with incomplete details. None have been surveyed in detail or recorded in the port. We identified six examples in the Arthur Kill New York Reach, along with four in the Kill Van Kull Reach (KVK V78, V92, V93, and V155). The Arthur Kill examples, abandoned at various dates before 1961, are most likely station floats. V204 retains too little fabric to contribute new information on this type, **but S33, V3, V196, V208, and V258 are better preserved or relatively intact and can provide much detail on construction and design. Largely intact S33, shortened to serve as a pier or drydock, may prove especially valuable as a sectioned, accessible example. These five examples should be regarded as potentially significant under Criteria C and D** (plates 12, 13, 50, 51, 63).

Although many have been scrapped, abandoned, cut into smaller deck scows, or adapted for other uses such as floating cement plants, steel car floats remain in some use and are well documented in numerous available drawings (Staten Island Shipbuilding Company n.d. [plans]). The thirteen steel car floats we identified do not at present appear potentially significant, as long as carfloating continues and intact examples are reasonably numerous.

o. Steel Oil and Gas Barges

By the early 20th century, the growth of waterside oil terminals or refineries in the port led to the appearance of steel barges used to carry liquid fuels to shoreside distributors and vessels being refueled. We identified one welded steel oil barge, V44, abandoned or scrapped c1961-71 (New Jersey Department of Environmental Protection and Energy [plans]). The joining system suggests post-1930 construction. Direct descendants of this style of craft are still in use, and detailed drawings are probably abundant (e.g., (Staten Island Shipbuilding Company n.d. [plans]). V44 would probably not contribute any additional information on the type, and should not be regarded as potentially significant.

We identified V40 as a possible self-propelled gasoline barge built for the U.S. Navy in 1943-44, probably to supply small vessels or aircraft. This barge is similar in size and form to YO class oil Barge Self Propelled. Although the number YOG 64 is written on the bow, in a rather casual fashion, the project catalog size does not match the various YOG classes 6 through 73. A set-back pilot house and the size difference suggest this vessel was possibly rebuilt and lengthened for civilian service. Several higher numbered, less altered examples are probably still in use with navies of the United States, the Philippines, and other nations. It is not likely that V40 represents a good example of any class of Navy vessel, and it should not be regarded as potentially significant (*Jane's Fighting Ships* 1967: 449, 776).

p. Probable Pusher

We identified 15-foot-long V131 as a pusher, a small powered steel vessel used for shifting other vessels in yards and confined waters. The only other example we have seen is currently laid up on Rondout Creek in the Hudson River Drainage. V131 was probably abandoned c1971-78. This appears to be a very specialized vessel type that is not well documented, and may never have played a role of any significance in the Port of New York. Steel construction suggests that plans of similar vessels may prove available. At present, we do not regard V131 as potentially significant (New Jersey Department of Environmental Protection and Energy [plans]).

q. Wooden Steam Double-Ended Ferries

Robert Fulton introduced this general vessel type in 1812 with the *Jersey*, designed to load at either end. Fulton's double-hull or catamaran ferries, with single paddlewheels between the hulls, were vulnerable to ice jamming and were replaced by single-hull double-ended sidewheelers as the Fulton-Livingston monopoly ended in 1824. About 200 wooden ferries of this type were built or purchased for service in the Port of New York c1824-1922, with iron- and steel-hulled models introduced in the 1870s and 1880s. The wooden ferries, most of which were built c1845-75, played an important role in the expansion of the port's commerce and population, especially after the Civil War. About twenty were purchased by the federal government for naval service in that conflict, including combat assignments. Many remained in service well into the 20th century. The most common wooden double-ended ferries were probably those powered by vertical- or walking-beam single-cylinder steam engines, followed by those with inclined single-cylinder steam engines (Cudahy 1990: 94-9, Table IV-1, Appendix C; Brouwer 1990: 185-88). Despite their popularity as subjects of contemporary drawings and photographs, there is very little documentation on their design and construction. We are not aware of any survey-level or formal documentations, or of any detail drawings other than perhaps some of engines which may be in the South Street Seaport Museum's Fletcher Collection. One silt-buried example with parts of an inclined engine lies in the Hudson River at Garrison, NY.

In the Arthur Kill New York Reach, we identified V12, V13, and V81 as remains of inclined-engine varieties, and V58 as a vertical-beam-engined example known to author Brouwer as the *Westfield*, built in 1862 for the Staten Island Railroad ferry. Although deteriorated, all four retain substantial lower hull elements which could provide new information on construction and design, as well as wood-and-iron supports for the inclined-engine shafts and the walking beam of V58. The walking beam supports on V58 appear rare among surviving East Coast marine resources. We have also identified KVK V5 as a vertical-beam-engined ferry, with similar surviving features. **These features make V12, V13, V58, and V81, along with KVK V5, potentially significant under Criteria C and D. The *Westfield* suffered the worst regional ferry disaster when a boiler explosion in 1871 killed 66 people, which could also make V58 potentially significant under Criterion A (association with important historical events).** Rebuilt, the *Westfield* continued in service until c1912 (plates 15, 16, 26, 33; Cudahy 1990: 140-43).

r. Steel Screw Double-Ended Municipal Ferries

Beginning in 1888, steam-powered screw- or propeller-type ferries replaced the sidewheelers. By the time the City of New York launched direct management of ferries in the East River and Upper Bay in 1905, steel-hulled models, powered by double compound steam engines with two high- pressure and two low-pressure cylinders, were a standard characterizing most of the municipal ferries built before 1950 in a variety of classes or sizes (Hilton 1984: 6, 29, 38; Brouwer 1990: 188-89). Builders' drawings of all classes are available at South Street Seaport Museum, but have not been analyzed to assess the completeness of documentation for hull or power plant arrangements. Few fully intact or original examples of ferries of this vintage -- including similar models built by private companies in the port -- survive today. In addition to the examples noted below for the Arthur Kill New York Reach or similarly-classed ferries located elsewhere, the 1905 *Binghamton* built for the Hoboken Ferry Company is now a restaurant in Edgewater, NJ, the 1938 *Miss New York* sank in the Hudson, and what is probably the 1937 *Mary Murray* is grounded in the Hackensack Meadows. Two 1950 *Merrill*-class ferries with 6-cylinder unaflow steam engines are now serving as jails at Rikers Island.

Ferry aficionados have known for some time that catalog items V62 and V234 are the ferries *Astoria* ex *William C. Collins* and *Dongan Hills*, respectively. The Staten Island Shipbuilding Company built the 151-foot-class *Astoria* in 1925 as one of sixteen similar craft used for East River service, and the 251-foot *Dongan Hills* in 1929 as one eight new Staten Island ferries (Roberts and Gillespie 1974: 13, 51; Cudahy 1990: 234-41, 406-10). One of *Astoria*'s sisters, *Major General William H. Hart* ex *Harlem* ex *John Lynch*, was sold to the federal government in 1941 and is now partially grounded at Bridgeport, CT. Both project vessels are partially scrapped, and we have not determined the condition of their power plants. The Dongan Hills is missing the wooden interior finishes which made it most distinct from the subsequent Mary Murray-class of municipal ferries, and the Astoria is stripped down to the main deck. **It is possible that V62 and V234 could yield new information ton on hull, superstructure, and perhaps power plant construction, when compared with available drawings and other partly intact ferries. They should be regarded as potentially significant under Criteria D** (plates 27, 57).

s. Possible Four-Masted Barkentine

World War I stimulated enormous demands for all varieties of American freight ships, including what became the last large wooden sail- or steam-powered ocean-going ships. V49 is possibly a relatively rare example of this period. Author Brouwer has previously identified V49 as the four-masted barkentine *Herdis*, based on informant data and photographs in the John A. Noble Collection on Staten Island. Built at Chelsea, MA in 1917, *Herdis* was converted to a four-masted schooner in 1922 for operation by the Maryland Transportation Company in coastwise coal traffic, and abandoned at Smoking Point in the 1930s while still rigged as a schooner (U.S. Department of Commerce 1923: 327; Brouwer 1990: 89-90; New Jersey Department of Environmental Protection and Energy [plans]).

This vessel is a rather rare variation of traditional New England early-20th-century multi-masted schooner construction, the only four-masted barkentine left in the Port of New York, and apparently the only surviving ship of this type converted to schooner rig. Hull construction probably resembles that of contemporary as-built East Coast schooners with three to five masts, some of which survive in better condition including KVK V37 (*Paul Thurlow*, 1918), and two beached at Wiscasset, ME (*Luther Little*, 1917, and *Hesper*, 1918). There is little resemblance to contemporary five-masted Gulf Coast barkentines. Earlier four-masted schooner hulls, slightly better preserved than the *Herdis*, survive in the Bayonne II Reach on the north side of the Kill Van Kull (V54 *Matowoc* 1890 and V60 *Estelle Krieger* 1899). Wooden shipbuilding techniques contemporary with the World War I boom are generally well understand (e.g., Desmond 1919), but not all details of hull construction or variations among different vessel classes have been documented. **Although now very deteriorated, V49 retains enough hull bottom fabric for potential new information on construction, especially if compared to the few remaining contemporary examples. As one of a very few surviving remnants of the last period of New England wooden sailing shipbuilding, V49 should be regarded as potentially significant under Criterion D** (plates 19, 20; Morris 2975, 1984; Raber, Flagg, Weinstein, and Brouwer 1995).

t. Schooner Barges and Conversions from 19th-Century Ships

Demand for coal in New England's industrial ports, not readily accessible by rail from mid-Atlantic coal fields, stimulated marine shipping from coal terminals between Norfolk and New York by the 1870s. Towing of coal in canal-size barges sufficed in relatively sheltered coastal waters, but could not handle the rigors of ocean travel beyond Narragansett Bay. Large multi-masted schooners, built mostly in Maine, dominated the long-distance coal trade until the late 1880s, when several types of schooner barges appeared. A schooner barge was a towed cargo ship, usually with two to four short masts rigged fore-and-aft for steadying in heavy seas, towed by a large tug. One tug could tow four to six schooner barges, each of which required a crew of three to four men. Despite dangerous seagoing towing conditions, the economy of this shipping mode, compared with more traditional individual sailing ships, quickly ended most new schooner construction until World War I. Older ships were converted to schooner barges c1890-1925 by lowering masts, removing bowsprits and jibbooms, and adding nearly-continuous main deck hatches, large towing bitts, and small steam engines for sail hoisting. Over 100 new schooner barges were also built c1890-1900, with distinctive hull features (Table 2, no. 29). Most as-built or converted schooner barges were wooden; a few were steel. The advent of steam-powered colliers and the demise New England's textile industry in the 1920s sharply reduced demand for schooner barges, a number of which were abandoned in the Kill Van Kull and the Arthur Kill (Parker 1948; Morris 1984; Brouwer 1990: 151-53).

There are three wooden schooner barges at Smoking Point (V52, V53, V54), along with the *Herdis* which was not converted to a barge. The three barges, abandoned before 1932, include what we have identified as one as-built schooner barge (V52), one schooner barge converted from a steam-powered sidewheeler (V53), and one schooner barge converted from a schooner (V54). Author Brouwer or informants to him have identified V52 as the *Devon* (1895, Bath, ME), V53 as the *Hatteras* (1865, Brooklyn, NY), and V54 as the *Camden* (1872, Cleveland, OH). All were probably owned by the Morecraft Transportation Company when abandoned at Smoking Point c1927-32. Two other as-built schooner barges were identified south of Sharrott's Road (V82, V83), and one more north of Outerbridge Crossing (V194); no confirmed identifications have been made for these three vessels, abandoned c1932-40. Our preliminary identification of V194 as schooner-barge conversion *Atlantic Queen* was not confirmed in any published vessel listings, and analysis of 1951 and 1961 aerial photographs -- taken when V194 had much more fabric -- showed hatch arrangements similar to typical as-built schooner-barge designs (New Jersey Department of Environmental Protection and Energy [plans]; cf. Raber *et al.* 1994).

Section VIII.B discusses the significance of the Smoking Point vessels as a group or cluster. The individual significance of these and the other schooner barges, all of which are very deteriorated but have considerable hull fabric, varies with their origins. *Hatteras*, the oldest, was converted from a sidewheeler run between New York and New Orleans to a single-masted sloop barge in 1882, and to a three-masted schooner barge in 1894. While of no real importance as a conversion, a process completed on a variety of vessel types, *Hatteras* **may be the only accessible surviving Civil-War-era ocean-going steamship hull in the region. The remaining lower timbers probably would not have been altered and thus could provide new information on this period of shipbuilding. As an individual resource, V53 should be regarded as potentially significant under Criterion D** (plates 19, 23; U.S. Department of the Treasury 1892, 1898; U.S. Department of Commerce 1923, 1932; *Nautical Gazette* 1894; Heyl 1953).

Camden was built as a three-masted Great Lakes Schooner for grain and lumber transport. She was moved to the Atlantic coast in 1893, unrigged in 1904, and rebuilt as a schooner barge in 1916. There is some documentation of Great Lakes schooners, not all of which we have reviewed in detail. The two-masted *Alvin Clark* (1846), a generation older than *Camden*, was raised intact in 1969, revealing among other features a large centerboard. *Camden*'s contemporary, the three-masted *Lucia P. Simpson* (1875) was documented with limited hull construction data other than a cross section and some jointing techniques. **The remaining lower timbers of V54 may include new information on the last generation of 19th-century Great Lakes style shipbuilding, such as whether later vessels had centerboards, making it potentially significant under Criterion D** (plates 19, 23, 24; Great Lake Maritime Institute 1978; Jackson, ed. 1983; Morris 1984; Brouwer 1990: 80-82).

Construction of wooden as-built schooner barge hulls may be covered in existing documentation of late-19th- and early-20th-century shipbuilding, but existing construction documentation for this distinct class of American vessel is thus far very limited. The only other apparent as-built hull of this type in the port is KVK V76, in equally deteriorated condition. **Remaining lower timbers of V52, V82, V83, and V194**

may provide data on fastenings, jointing, and scantlings which could include features distinctive to this class of vessel. These four vessels should be regarded as potentially significant under Criterion D (plates 19, 21, 22, 34, 48; Desmond 1919: 59, 61, 62, 99, 195; Parker 1948: 41; Morris 1984).

u. Ferris Ocean Freighters and Conversions

One response to the great demand for World War I freighters was a series of government contracts issued by the Emergency Fleet Corporation for over 1000 wooden steamers, most of which were adaptations of a design of their namesake, Theodore Ferris (Table 2, no. 30). There were considerable construction contract problems, and, as with many contemporary federal projects, the Armistice left the Ferris steamers incomplete or unneeded. Some were converted to schooner barges on the East Coast, a few became West Coast sailing vessels, and most were scrapped for their iron and burned on the Potomac River (McKellar 1959; Brouwer 1990: 202).

We identified four hulls as originally built to Ferris designs, based on analysis of historic aerial photographs, information previously provided to author Brouwer by Charles Lufbarry, and review of published vessel listings. V184, possibly the *Neal O'Boyle* ex *Weequaic* (Brunswick, GA), and V195, possibly the *Corone* (1920, Portland, ME) appear to have been unmodified Ferris steamers, both abandoned north of Outerbridge Crossing c1932-40. V72 and V78, the latter possibly the *Winapie* (1919, Newington, NH), were converted to schooner barges and probably converted to unrigged barges before their abandonment south of Sharrott's Road, V72 c1951-61 and V78 before 1932. These identifications differ somewhat from those made for these vessels in our 1994 management summary (U.S. Department of Commerce 1923:353; American Bureau of Shipping 1926: 255, 1940: 404, 909; New Jersey Department of Environmental Protection and Energy [plans]; Raber *et al.* 1994).

The Ferris steamers represent an unusual chapter in American shipbuilding history. These vessels, a smaller number of Hough-type wooden steamers begun under the same program, and the Hog Islander-type cargo steamers also begun under World War I government contracts, were early examples of federal-private industry mass production shipbuilding efforts more successfully accomplished in World War II in the Liberty ship program. There is some contemporary documentation of the Ferris vessels in contemporary trade publications of the era, but we have found little thus far of much detail. **Although deteriorated, V72, V78, V184, and V195 all retain much hull fabric and could yield new data on original Ferris construction up the tween deck level. V72 and V78 could also reveal methods used to convert as-designed screw vessels into schooner barges. These four vessels should be regarded as potentially significant under Criterion D.** In the Bayonne II Reach, V73 (*James Howard*) is another Ferris steamer converted to a schooner barge or unrigged barge, in similar condition (plates 28, 31, 32, 45, 49; Desmond 1919: 181-2; Raber, Flagg, Weinstein, and Brouwer 1995).

v. Unidentified Sailing Vessel

A surviving bobstay recess and centerboard trunk indicated that V57 was a very deteriorated sailing vessel of undetermined age or type, abandoned at Port Mobil at an undetermined date. More detailed examination of fastenings, jointing, and scantlings might indicate age or type. **As some mid-19th-century wooden vessels have survived in derelict condition in the port (e.g., V53), and as some important regional types of sailing vessels such as Hudson River sloops remain under-documented, V57 should be regarded as potentially significant under Criterion D pending further investigation** (plate 25; Mark Peckham [persons consulted]).

w. Wooden Float

These small, relatively lightly-framed wooden structures, framed and decked over, serve as stages for gangways between piers and vessels. Probably of great antiquity, they appear to remain in common use. They are not well documented, but at present do not appear rare enough to warrant more attention to the lone example, V184A, identified in the Arthur Kill New York Reach. V184A will not provide new information not readily available elsewhere, and should not be regarded as potentially significant.

x. Wooden and Steel Work Barges (Pile Drivers, Winch Scows)

Still used to transport construction materials to harbor sites, or as permanent platform for small pile drivers, whirly cranes, cement plants, hoists, and steam plants, wooden work barges have little historical documentation but have remained almost unchanged for perhaps a century in the Port of New York (Brouwer 1990: 159). We are aware of no plans or previous studies of this type. An abundant supply of wood vessels of this type probably delayed the arrival of modern welded steel examples, still in use.

We identified V2 as a possible wooden work barge, V45 as a probable steel work barge, and S96 as remains of a hoisting engine once on a wood or steel work barge. V2 is badly deteriorated, and appears unlikely to provide more or different information than AKNJ V15 and V91, identified as potentially significant. V45 and S96 are examples of very common forms which, if undocumented, will probably remain available for study for a number of decades. These marine resources do appear potentially significant.

y. Pleasure Craft and T-Boat

Five vessels were identified as small wood frame pleasure craft: V117, V117A, V120A, V122A, and V218. All but V122A, abandoned c1951-61, were abandoned after 1961. Although perhaps rarely documented in any formal sense, vessels of this type have appeared in a number of popular magazines for some years. Those built forty to sixty years ago have "classic" features valued by enthusiasts or collectors, and are often lovingly preserved. These deteriorated examples do not appear to have such features. While it is presently difficult to evaluate the significance of such craft, we do not believe these five vessels will provide new information about pleasure craft, and should not be regarded as potentially significant.

V245, identified as T-Boat Mary M. in the catalog, is a 65-foot-long wooden vessel probably used as a for-hire fishing boat, abandoned at Tottenville c1978-85. A T-Boat refers to a federally-regulated class of commercial excursion vessel under 100 gross tons with a carrying capacity of less than 50 people. The lack of towing bitts or side wearing strakes tends to confirm the use of V245 for excursion rather than utility purposes. This vessel is probably of relatively recent origin, and at present does not appear to be of a type with significant historical associations or context. We do not believe V245 should be regarded as potentially significant (Plate 60; Charles Deroko [persons consulted]).

z. Wooden Floating Drydock (Balance Dry Dock, Through Dock)

These structures, used to lift ships for bottom repairs, evidently originated in England and Russia in the early 18th century with converted ships' hulls. First patented in the United States c1816, the present form of a flat-bottomed pontoon with high side walls first appeared at the Port of New York in sectional and non-sectional balance form c1840. Some shipyards in the port, including those on the Kill Van Kull and at Perth Amboy, continue to use wooden and/or steel floating drydocks, but generally of the sectional type. There are at least some surviving drawings of the balance dry dock form, described in Table 2, no. 38, but we are at present uncertain as to the completeness of documentation on this form (Stuart 1852: 29; Benjamin, ed. 1880: 464; Construction Management, Inc. 1941 [plans]; Bushey Shipyard n.d., 1944 [plans]; Cook 1957: 302; Brouwer 1990: 160-62).

We identified V215 and V254 as non-sectional types. V215 is missing its wing walls but has a well-preserved pontoon high out of the water. V254 retains its wing walls but is filled with demolished pier timbers and is partially sunk. We also identified KVK V68 and V79 as non-sectional drydocks, the former in somewhat better condition than the Arthur Kill New York Reach examples. KVK V79 is far more deteriorated. These are probably the only stand-alone floating wooden dry docks we have observed in abandoned condition in this port. **Unless there are still active docks of this type in the port, V215 and V254 could provide some new information on dry dock construction in conjunction with available drawings and KVK V68. Pending review of regional shipyards and available drawings, these structures should be regarded as potentially significant under Criteria C and D** (plates 53, 62).

aa. Other Individual Marine Resource Questions

We were unable to make positive identifications of other vessels or marine resources. One very deteriorated metal vessel, V225, was said to be the remains of a yacht once owned by American aviator Amelia Earhart (John Garner [persons consulted]). This vessel has been completely scrapped to just above the bilge line (Plate 56). Review of published yacht listings has not produced any evidence of a boat owned by Earhart or her husband. Given the deteriorated state of the vessel and lack of any confirmed association with Earhart, we do not believe V225 should be regarded as potentially significant. This alters the preliminary conclusion on this vessel made in our management summary (Raber *et al.* 1994).

B. Vessel Clusters and Abandonment Patterns

1. Identification and Discussion

Based on analysis of approximate abandonment dates, likely historical events or patterns associated with abandonments, and the potential significance of vessels, we grouped the marine resources discussed above into thirteen relatively discrete clusters (Table 5). These clusters include all marine resources except V254, a lone wooden dry dock at the Tottenville Marina. Cluster identification and dating emerged from use of historic aerial photographs, and comparison of vessel types with patterns of pre-abandonment marine activity in cluster areas (Table 1 and Table 1 sources). Lighting and tidal conditions at times of relatively high-altitude aerial photograph flights complicate vessel abandonment dating, making our dates conservatively recent (New Jersey Department of Environmental Protection and Energy [plans]).

There were more vessels abandoned on the west shore of Staten Island than along any other coastline in the Port of New York. As demand for towed vessels and other harbor craft declined, beginning with the drop in coal traffic of the late 1920s, the relatively undeveloped character of this shore its often shallow waters proved an attractive location for abandoning commercially-worthless craft. This pattern probably explains the appearance of most marine resources in the Arthur Kill New York Reach, including 159 resources in clusters 1, 4, 5, and 7-9, and about thirty of the items in clusters 3, 6, and 11-13. The proximity of marine terminals and repair yards handling coal-trade vessels along the New Jersey sides of the Arthur Kill and Kill Van Kull, and to a lesser extent at Tottenville, probably explains the concentration of coastwise hold barges and coal-carrying ships in clusters 4 and 8. In a few cases, abandonment occurred at piers or wharves no longer in active use (clusters 7 and 11-13), but the availability of undeveloped and under-policed stretches of shore appears to have been a more important factor in selecting abandonment sites.

Other apparent patterns of abandonment include vessel scrapping (most of clusters 3 and 6), the accumulation of vessels at marine repair yards during years of active operation (many of the items in clusters 11 and 13), and the re-use of vessels as tie-up piers (seen in clusters 2, 10, and 12). There are clear associations of vessels obtained by Witte's Marine Scrapyard with items now in clusters 3 and 6, including the Army tug *Bloxom* (cluster 3) obtained with a Pennsylvania Railroad carfloat still within the Witte yard proper, and the ferry *Astoria* in Cluster 6 (Roberts and Gillespie 1974: 13). Some of the abandoned vessel types seen in clusters 11 and 13 are consistent with former repair and marine transportation activities, including repair of coal barges and the use of floating drydocks for engine repair at Cluster 11.

2. Potential Significance

Clusters 1, 5, 7, 9, 10, 12, and 13 each include at least one potentially significant vessel, but appear either unrelated to important former events or patterns at their abandonment sites, or unlikely to contribute new information to such patterns. These clusters do not appear to be potentially significant. The Atlantic Terra Cotta Company site which once included Cluster 10 has been too thoroughly demolished to retain potential significance as a historic industrial complex. The small pier made of the Cluster 10 vessels is an interesting example of barge re-use, but lacks remaining associated site resources, likely informant/documentary data on pier use, or useful material evidence. The Cluster 10 barges appear too deteriorated to reveal much about their adaptation for pier use, which once included installation of concrete decks (Army Corps of Engineers 1924). The marine yards associated with clusters 12 and 13 have been out of operation too long to obtain likely informant data on yard operations.

Clusters 2 and 11 include vessels associated with repair yards which operated into the 1960s or 1970s, a period of decline for many small undocumented marine contractors in the Port of New York. These clusters are of sufficiently recent origin that additional documentary and informant research could yield potentially significant information on marine activities and vessel re-use patterns in this period (Criteria A and D). The fact that some of the events in question may be less than fifty years old, making the cluster nominally ineligible for the National Register under the usual application of eligibility criteria, must be tempered by two considerations. First, cluster history may <u>start</u> over fifty years ago, especially at CLuster 11. Second, and more significantly, informant data is usually critical for documenting resources of this type. Unless such data is gathered in the near future, it may not be available when the resource as a cluster becomes old enough to readily satisfy the usual eligibility criteria.

Clusters 3 and 6 seem associated largely Witte Marine Scrapyard activities c1932-90. Although the present scrapyard proper is not within project limits, documentary or informant data on these clusters may be available from past or present scrapyard personnel which could add new information on 20th-century port history. These clusters appear potentially significant under Criteria A and D. In particular, understanding patterns of acquisition at the Witte yard may allow for more precise chronologies on the abandonment or replacement of specific vessel types once common in the port, and on the shifting fortunes of specific public or private marine operations. Such information can expand on existing historical vessel typologies (e.g., Brouwer 1990).

Clusters 4 and 8 are directly associated with the systematic abandonment of coal trade vessels c1925-40, at the beginning of a long decline in what were once major components of port transhipment and traffic patterns. Many of the vessels at Port Johnson in the Kill Van Kull arrived for the same reasons. Complex patterns of vessel ownership and arrangements for mooring vessels, during periods prior to outright abandonment, accompanied the evolution of at least some of these clusters, to judge from available information on ownership of abandoned ships. Information developed on the Port Johnson cluster suggests such arrangements were critical in generating some of the largest marine graveyards in the port (Raber, Flagg, Weinstein, and Brouwer 1995). **Documentary and material evidence associated with vessels in clusters 4 and 8 could provide important new information on coal handling firms and Port of New York vessel graveyards, making these clusters potentially significant under Criteria A and D. Cluster 8 is also potentially significant under Criterion D as an important source of information on undocumented hull construction practices for several types of wooden ships,** as discussed above (section VIII.A.2.t).

C. Project Effects

Currently-proposed catalog actions call for removal of all marine resources discussed above. These actions could have adverse effects on those resources identified as potentially significant.

Table 2. TYPOLOGICAL INVENTORY OF MARINE RESOURCES IN RECONNAISSANCE PROJECT AREAS

Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
1. Wooden Covered Harbor Barges (Refrigerator Barge, Covered Cement Barge) Sources: 6,7,10-12,14, 17,20,28,30, 38,48,53	80-115x24-30 200-500 tons	Rectangular hull plan with slightly rounded corners on deck, vertical sides, sharply raking ends. Option of well rounded ends. Moderate sheer and camber, flat bottom. House on deck with battered sides, vertical ends & roof with sheer & camber set back from ends 6' to 7' & 1' from sides; option of full width house. House Structure: sliding doors on one or both ends, 4 or 6 (possible option of 8) sliding side doors with top hatch covers resting over low coamings. Partial width roof beam mortised through centerline house post tops supporting 3 roof stringers. Top corners & stanchions braced with vertical hanging knees and horizontal lodge knees. End & side stanchions side-bolted or top- mortised into lower sill. House typically sheathed outside with edge-butted horizontal planks, inside with spaced battens. Longitudinal roof planking nailed to beams lying on stringers. Captain's cabin options: inside house butted to stern wall, butted outside of house end with main house set slightly off center to opposite end of hull, partially sunken into hull, partially inset into main house, placed on roof center or offset slightly to one end. Hull access hatches with ladders each end with wooden coamings, gratings and covers. Deck Gear: Corner single post bits &/or cleats, or optional center double bit. Various small cleat arrangements bow & stern. 1 or 2 hand windlasses for warping movements. Bilge pump. Cargo handling: Option of roof-mounted, hand- or power-operated double-boom cargo mast with slings or nets.	Hull can be viewed as planes of lower longitudinal partial-hull-height girders intersected by higher lightly braced transverse partial-hull-height girders, a system favoring longitudinal over transverse strength. 3 main interior longitudinal girders in varying arrangements of alternating solid bulkhead, trussed girder, and unbraced stanchions resting on longitudinal scarfed keelsons. Known examples include centerline girder of unbraced stanchions with bulkheads at both quarter lines, or centerline bulkhead & trussed girders at the quarter lines. Main girders & optional intermediate keelsons terminate in end rake timbers bow & stern. Side trusses each comprised of scarfed bilge or chine log, top clamp timbers, raked corner poles, short vertical stanchions & intermediate king posts running from bilge log to clamp. 8 to 16 cross keelsons lay on the keelsons & pierce solid bulkheads. Numerous closely-spaced cambered deck beams lie on the tops of interior & side longitudinal girders. Deck beams landing directly over cross keelsons are attached to them by stanchions connected with hanging (upper vertical) & standard (lower vertical) natural or cut knees forming transverse trusses which may have X or angle bracing. Whole hull generously united with spikes, screw bolts, headed bolts, clinch bolts, & tie rods. Longitudinal deck planks spiked onto the deck beams. Deck house supports: centerline house posts footed through hull around optional center solid bulkhead to center keelson; in hulls with wing solid bulkheads, the house posts run through to the center keelson making the top stringer intercostal. Atypical hull style: Covered Cement Barge on Bulkhead Scow (Sand Barge) type hull with 8 interior main longitudinal girders. Covered (possible) Cement Barge on hull having Crane Barge, Covered Barge, & Sand Barge features including solid full hull height longitudinal bulkhead with flanking truss or unbraced stanchion girders, all running from bottom planking to deck planking pierced by suppressed deck beams on top and cross keelsons.	V189, V252	V122, V124, V187, V188, V217, V243

Table 2. TYPOLOGICAL INVENTORY OF MARINE RESOURCES IN RECONNAISSANCE PROJECT AREAS

Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
2. Wooden Harbor Open Deck Scows (Flat Scows) Sources: 6,8,11,17,18, 30,43,44,46, 53,68	80-90x28-30 approximately 200-300 tons	Rectangular hull plan with slightly rounded corners on deck, vertical sides, sharply raking ends. Moderate sheer & camber, flat bottom. Cabin at stern inset from end.	Hull can be viewed as planes of lower longitudinal partial-hull-height girders intersected by higher lightly-braced partial-hull-height transverse girders, a system favoring longitudinal over transverse strength. 3 main interior longitudinal girders in varying arrangements of alternating solid bulkhead, trussed girder, & unbraced stanchions resting on longitudinal keelsons. Known examples include centerline girder of unbraced stanchions with bulkheads at both quarter lines, or centerline bulkhead & trussed girders at the quarter lines. Option of scarfed intermediate keelsons between main girders. Main girders & optional intermediate keelsons terminate in end rake timbers bow & stern. Side trusses each comprised of a scarfed bilge or chine log, top clamp timbers, raked corner poles, short vertical stanchions & intermediate king posts running from the bilge log to the clamps. 8 to 16 cross keelsons lay on the keelsons & piercing the solid bulkheads. Numerous closely-spaced cambered deck beams lie on the tops of the interior & side longitudinal girders. Deck beams landing directly over the cross keelsons are attached to them by a stanchion connected with hanging (upper vertical) & standard (lower vertical) natural or cut knees forming transverse truss which may have X or angle bracing. Whole hull generously united with spikes, screw bolts, headed bolts, clinch bolts, & tie rods. Longitudinal deck planks spiked onto the deck beams. (Atypical): trap-rock-carrier type side rails, end bulkheads & midship bits for gravel or garbage service.	V104	V107, V108, V127, V119

Table 2. TYPOLOGICAL INVENTORY OF MARINE RESOURCES IN RECONNAISSANCE PROJECT AREAS

Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
3. Wooden Derrick Lighter (Stick lighter) Sources: 6,8,11,12,17, 25,28,30,36, 40,43,48,53	100x32x9 200-850 tons	Rectangular hull plan with slightly rounded corners on deck, vertical sides, sharply raking ends. Moderate sheer & camber, flat bottom, captains cabin & hoist room aft, mast & boom stepped in front. Cargo handling: Wooden pole mast footed on wooden platform resting on the cross keelsons, stayed to sides & stern with wire rope shrouds running from mast head to chain plates bolted to the side & end planking. Hand- or gas- engine-powered multi- function friction hoist,5-10 ton capacity. Option of center-mounted mast with fore & aft booms & awning stanchions fore & aft, with cabin aft and hatch opening forward of mast. Option of guyed or braced wooden or metal A-frame. Option of elliptical hull plan called "Watermelon Lighter"	Hull can be viewed as planes of lower longitudinal partial-hull-height girders intersected by higher partial-hull-height transverse trusses, similar to hulls of covered barges & deck scows but with increased transverse X bracing & thus more transverse strength. 3 main interior longitudinal girders generally consisting of a center line of stanchions with 2 solid bulkhead girders on the quarter lines. Main girders & optional intermediate keelsons terminate in end rake timbers bow & stern. Side trusses each comprised of a scarfed bilge or chine log, top clamp timbers, raked corner poles, & king posts running from bilge log to top clamps. King posts are generally / or K braced to wing bulkheads. 8 to 10 cross keelsons lay on the keelsons & pierce the solid bulkheads. Numerous closely-spaced cambered deck beams lie on the tops of interior & side longitudinal girders. Deck beams landing directly over cross keelsons are attached at the ends by stanchions connected with hanging (upper vertical) & standard (lower vertical) natural or cut knees forming a transverse truss which may have X or angle bracing. Whole hull generously united with spikes, screw bolts, headed bolts, clinch bolts, & tie rods. Longitudinal deck planks spiked onto the deck beams.	V120, V155	V182, V190, V235

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Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
4. Wooden Trap Rock Scows (Sand Barges, Flat Scows, Bulkhead Scows) Sources: 1,8,10-12,18, 25,28,32,41-43,48	105-120x27-35x 9-10 500 to 1500 tons	Rectangular hull plan with straight vertical sides & sharply raking ends. Moderate sheer & camber, flat bottom. Deck cargo area bounded at sides by high deck rails & at ends by high bulkheads with cabin at stern.	Hull can be viewed as planes of full-hull-height longitudinal trusses centrally intersected by planes of partial-hull-height transverse trusses giving equal strength in either direction. 6 or 7 main interior longitudinal trussed girders each consisting of a scarfed lower keelson, X bracing, & scarfed deck stringer all terminating in end rake timbers fore & aft. 10 to 13 athwartship trusses each consisting of a cross keelson lying on the keelsons, vertical single or paired stanchions at the longitudinal truss intersection points & at truss ends, X bracing, & cross deck log/deck beam supporting the deck stringers. At intersections of athwart & longitudinal trusses, tie rods run top to bottom to enabling trusses to work together. Each side girder consists of a scarfed bilge or chine log, scarfed top log, raked corner poles, single or paired king posts. Whole hull generously united with spikes, screw bolts, headed bolts, clinch bolts, & tie rods. Athwartship deck planking spiked to longitudinal main deck stringers & optional intermediate stringers (only under the cargo area). Stringers reduce in height from center line out to give camber to the deck.		V11, V35, V42, V55, V115, V128, V150, V164, V191, V213, V220, V221, V222, V223, V226, V227, V230, V232, V233, V236, V240, V244
5. Steel Trap Rock Barges (Sand Barges) Sources: 53	110-180 x 35-40	Rectangular hull plan with sharply raking straight or curved ends, slight or no sheer, slight camber.	Welded steel plates over angle or channel frames. Hull divided by athwartship watertight compartments. Low rail around deck with high bulkheads at ends. Option of edge rails around ends.		V14, V63, V64, V65

Table 2. TYPOLOGICAL INVENTORY OF MARINE RESOURCES IN RECONNAISSANCE PROJECT AREAS

Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
6. Probable Transitional/ Smaller Barge Canal Boats Sources: 8,15,16,22, 25,33,43,49, 51	108-110x20-23 approximately 600 tons	Generally rectangular deck plan with straight vertical or slightly flared sides, round or curved bows and round, slightly curved or square stern. Moderate sheer and camber. Rounded forefoot and option of rounded lower stern. Flat bottom. Square or slightly rounded bilge. Hatch opening in bulk carriers over most of deck allows interior stowage of cargo. Cabin aft sunk into hull. Barn door rudder and tiller. Options of cabin forward or midship.	Three variations seen in AKNY Reach: (1) Floor of parallel longitudinal keelsons with enlarged center keel, joined to generally square or slightly elliptical raking ends & curved lower forefoot and stern (V214) (2) Athwartship floor beams mortised into side bilge logs. Side frames notched into outer edge of bilge log. Sharply rounded bow & bluff-rounded stern, vertical bow frames, probable horizontal planking (probable Laker Style). ([S143]) (3) (Barrel Bow Boat) Round bow of horizontal sawn and scarfed breast timbers supported inboard by widely- spaced vertical side stanchions. Center line stanchions attached to deck beams with metal straps. Closely-spaced vertical stern timbers support horizontal planking. Vertical planking on rounded bow section spiked into breast timbers. Horizontal planks on parallel sides are edge-bolted with metal rods & are spiked to side stanchions. Framing undetermined. From historic aerial photos, possibly decked over with 4 hatch openings, indicating possible non-bulk cargo service (V219 - Marion Melvin)	V214, V219, [S143]	V205, V207, V229
7. Large Wooden Barge Canal or Harbor Hold Barges (Canal Boxes, Deep Boxes, Grain Boxes, Deep Boat, Cement Boat) Sources: 7-8,13,18,25, 28,35,43,44, 49.	approximately 108-110x22-30x14	Rectangular plan but with slightly curved sides and/or radiused bow as an option. Moderate sheer and camber. Vertical or slightly flared sides. Curved lower forefoot and stern. Flat bottom. Hatch opening over most of deck allows cargo to be carried internally. Cabin on or inset into after deck.	A center keelson & 6 or more longitudinal intermediate keelsons. Vertical, raked, or compound-angled end rake timbers bow and stern. With no interior full-height longitudinals, structural strength lies mainly with the outer hull. Each side frame consists of bottom scarfed bilge or chine log, top clamp timbers, & vertical, raked or compound angled corner rake timbers united by stanchions mortised or notched into the bilge log. Line of stanchions runs down the centerline supporting 5 to 7 deck beams spanning the hatch opening. Athwart ceiling planking on top of keelsons to ease cargo cleanup. Coaming all around hatch is supported inside the opening with either standard knees, wood brackets or angle iron to the deck beams. Option of wooden hatch covers and strongbacks or tarpaulins for cargo protection.		V47, V137, V139, V163, V167, V176, V180, V181, V206

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Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
8. Wooden Coastwise Hold Barges (Coal Barges, Coal Boxes, New Haven Boxes, Grain Boxes, Box Barges) Sources: 7-8,13,18,25, 28,35,44,50.	105-150x26-36x 11-15 300-1200 tons	Rectangular hull plan with vertical or slightly raking ends and rounded forefoot or options of sharply raking ends or vertical end above load line with raking lower portion. Slightly flared or vertical sides. Moderate sheer and camber. Flat bottom. Hatch opening over most of deck allows cargo to be carried internally. Captains cabin aft. Option of life boat on cabin and ground tackle on bow	A center keelson and 6 or more longitudinal intermediate keelsons. Vertical, raked, or compound angled end rake timbers bow and stern. With no interior full height longitudinals, structural strength lies mainly with the outer hull. Each side frame consists of scarfed bottom bilge or chine log, optional scarfed top clamp timbers and vertical, raked or angled corner rake timbers united by stanchions mortised or notched into the bilge log & notched into the top clamp. Line of stanchions runs down the centerline supporting 6 to 9 deck beams spanning the hatch opening. Athwartship ceiling planking laid over floors to ease cargo removal. Longitudinal deck side walkway and end platform planking around hatch supported by intermediate cross beams of small section. Coaming/deck rail all around hatch supported inside the opening with either standard knees, wood brackets or angle iron to the deck beams. Coaming may have peaked ends. Option of wooden hatch covers and strongbacks or tarpaulins for cargo protection.	V106, V134, V135, V160, V169	V136, V136, V138, V140, V141, V142, V143, V144, V145, V146, V148, V149, V151, V152, V153, V154, V156, V159, V161, V162, V165, V166, V168, V170, V172, V173, V174, V177, V178, V185, V186, V197, V210, V211, V224

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Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
9. Wooden Screw Harbor Tugs Sources: 8,14,25,28, 43,75	70-90 x 20-25	High sheer and moderate camber. Bluff bows and overhanging stern protecting rudder. Round bilge. Long superstructure with sheer. Raised pilot house forward. Option of raking or vertical funnel and after mast. Grating on fantail protects rudder post & quadrant turned by chains from pilot house. Power plant: 1 coal (later oil-burning) scotch boiler & single expansion or compound engine exhausting to atmosphere. 300-700 hp. Large water tanks in hull. Deck gear: For-&-aft double towing bit on fore deck, double athwart bit just aft of house, multiple single bits on sides. Low bulwark all round with freeing ports aft. Long single-story deck house with cabins, galley forward or aft with engine room midship. Options of stairs or ladder forward & aft. Narrow pilot house mounted forward but set back on deck house with option of captains cabin incorporated in aft section. Running light shields, name boards and search light mounted on top. Option of fire monitor on roof. Option of raised clerestory over engine and boiler room pierced for cowling and stack. High natural draft stack with whistle pipe forward, escape pipe aft. 2 or more cowl type trimable ventilators. Pulling boat aft on house with radial davits. After mast stepped against rear of house for towing lights.	Heavy (often doubled) athwart frames laid over sistered keel topped with single or multiple keelsons. Heavy structural longitudinal ceiling (planking) inside. Shelves & clamps under deck/side connection with option of natural or cut lodge knees. Up to 5 athwart ship bulkheads. Longitudinal butt jointed side planking with scarfed upper strakes fastened to frames with treenails and spikes. 2 or 3 upper full-length & partial-length lower rubbing strakes. Longitudinal deck planking laid on deck beams.	V9, V41, V75, V76, V84, V97, V100, V102	V10, V15, V17, V19, V51, V79, V80, V85, V86, V87, V88, V90, V91, V92, V95, V96, V98, V99, V101, V103, V255, V256, V257, V261, V263, V265

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Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
10. Steel Army Steam Tug Sources: 28,65,66,71	142.2 x 33.1 x 14. 573 gross tons.	Vertical stem, moderate sheer, long deck house set forward with pilot house cabin. Foremast between cabin and stack. Boiler and engine room casing, low forced draft type stack and 4 cowls on deck. Fore & Aft towing bit forward, athwart bits aft.	Powerplant: 2 Babson & Wilcox watertube boilers steaming 1200 hp 3 cylinder Skinner Unaflow Engine.	V43 (BLOXOM)	
11. Welded Steel Harbor Tug Sources: 28,51	90-110 x 20-25	Full lines, vertical bow, marked sheer. Overhanging fantail type stern. Deck house set well forward with raised pilot house on top with cabin butted aft. Single stack (rare option of twin fore and aft stacks). Single mast butted to aft end of house. Twin fore and aft towing bits on foredeck. 2 or 4 single or double bits along sides. Twin athwartship towing bits next to back of house.	Steel angle section frames with welded steel plates. Power plant: 900-1600hp, 6-16 cylinder, 2 or 4 cycle diesel engine with direct drive, electric drive, or air clutch drive. Side plating protected with half round or square section wearing strakes. Steel plate deck surrounded by steel bulwark pierced by freeing ports.		V46
12. Steel Shifting Tug Sources: 28,51	45-65 x 12-15	Full lines, vertical bow, marked sheer. Overhanging fantail type stern. Deck house set well forward with raised pilot house on top with cabin butted aft. Single stack (rare option of twin fore and aft stacks). Single mast butted to aft end of house. Twin fore and aft towing bits on foredeck. 2 or 4 single or double bits along sides. Twin athwartship towing bits next to back of house.	Steel angle section frames with welded steel plates. Power plant: Small bore diesel engine and air clutch drive. Side plating protected with half round or square section wearing strakes. Steel plate deck surrounded by steel bulwark pierced by freeing ports.		V121
13. Possible Wooden Sailing Lighter Sources: 8,26,43	96 x 40	Full bows, slight sheer, nearly vertical stem, square slightly-raked stern. Rig: Single mast far forward. Short bowsprit with forestaysail, mainsail with standing gaff & no boom. Low rail around deck with side freeing ports. Two center line hatches.	Limited information	V77	

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Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
14. Probable Wooden Steam Lighter (self propelled) Sources: 8,17,44,51, 52,68	100-110 x 25-35. 400-600 tons	Bluff bow, rounded vertical stem, slight sheer, overhanging stern, moderate drag, deck house far aft with raised pilot house. Cargo mast fore and sometimes aft of house. Single vertical stack. Cargo handling: Options of single mast, boom and hatch forward. Double ender with similar mast, boom, and hatch aft of superstructure. Small auxiliary hoist aft. Hoisting engine in forward hold. Slings and nets from main hook. Deck gear: Double towing bits forward. Optional style Covered Steam lighter: Full width Deck house inset slightly from bow and running clear to stern. Pilot house on top set back from front with cabin running clear to vertical stack set slightly aft. Option of full length cabin pierced by stack. 2 large cargo doors each side with optional top hatches, option of cargo mast and boom.	Generally lighter, beamier construction than similar sized tugs. Keel projects below hull planking. Center keelson flanked by sistered side keelsons rests on floor beams. Large inside bilge strake timber. Full interior ceiling. Power Plant: 1 coal (later oil-burning) Scotch boiler and single cylinder steam engine exhausting to atmosphere. c300hp. Hull planking attached to frames with treenails & spikes, butt jointed up to sheer strake which is scarfed.	V179, V260	
15. Large Size Wooden Hull A-Frame Heavy Lift Crane Barge Sources: 40,42,76	110-150 x 30- 50. 50-250 tons	Rectangular scow hull with sharply raking ends, slight sheer, little or no camber. A-frame & boom mounted forward of aft-mounted boiler and engine house. Engine house holds steam plant of 2 vertical firetube boilers & multi-drum hoists for main & auxiliary hooks & boom movement. A-frame is footed on pads at hull sides braced down to bilge logs & adjacent keelsons. A frame guyed by wire rope shrouds running to chain plates aft at the sides & stern. Later examples had single lattice girder brace leg in place of backstays. Option of auxiliary mast boom aft. Option of hatch in deck forward. Deck gear: cleats and fairleads on bow, side towing bits forward &aft.	3 or 4 solid bulkhead longitudinals resting on bottom keelsons. Optional intermediate keelsons terminate in end rake timbers fore & aft. Intermediate multiple cross keelsons rest on keelsons &pierce the solid bulkheads. Upper member is longitudinal deck stringer. Multiple cross deck logs pierce solid bulkheads just below stringers. Intermediate longitudinal deck stringers rest on cross deck logs. Side trusses consist of scarfed top logs joined by vertical king posts to scarfed bilge logs terminating in raked corner poles. Ends of cross deck logs &cross keelsons joined with stanchions which assist in forming side truss. Athwartship bottom planking spiked to keelsons & optional intermediate keelsons. Scarfed jointed side planks are vertical staggered, edge bolted &spiked to side king posts & stanchions. Horizontal bow &stern planking spiked onto solid bulkhead ends & intermediate rake timbers & corner poles. Athwartship deck planking spiked to bulkhead & intermediate deck stringers.	V111, V193	V69

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Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
16. Medium size wood hull A-frame Crane Barge Sources: 4,19-20,28, 52	100x30 15-50 tons	Rectangular hull plan with sharply raking bow, raked or vertical stern. Flat bottom. A-frame, boom, & hoist house mounted aft with steam- or gas-driven multi-drum hoist.	Possibly similar to wooden derrick lighter or large crane barge (nos. 3 & 15 above)	V5	
17. Hopper Barges (dump scows) Sources: 8,32,40,48	110-150 x 30-35 x 12-15	Rectangular scow hull, raked ends (option of ends also rounded in plan), vertical sides (option curved rake timbers); moderate sheer and camber? Deck gear: Hand-windlass powered shaft runs length of hoppers on top of coaming, raises & lowers doors by chains. Double or single towing bits at all corners. Side cleats.	4, 6, or 8 watertight trunked compartments inset from sides running clear through hull bottom and deck planking. Hoppers offset to either side of athwart centerline to provide center buoyant compartment. Longitudinal girders consist solely of side stanchions and wing bulkheads running along hoppers. Athwartship bulkheads forming ends of hoppers run to side trusses. Hopper doors move athwartship; form V-shape when closed and hang vertically when open. Longitudinal side planking with options of unscarfed shifted butts or scarfed joints. Longitudinal deck planking with option of scarfed margin planks. Low continuous coaming around hoppers.	V50, V238, V242	V216, V237
18. Wooden Car Floats (Station Floats, Transfer Floats) Sources: 8,20,57,67	180-315 x 35-36 8 to 20 cars 400-1450 tons	Rectangular scow-style hull plan, sharply raking ends with a top-to-bottom curve, vertical sides, longitudinal camber, very slight or no athwartship camber. Center platform and canopy on station floats. Transfer floats have 3 tracks converging to 2 at loading end. Bumper blocks on each track at opposite end. Station floats have 2 tracks separated by a car floor level platform and canopy with bumper blocks one end. Thick side bulwarks inset from ends. Float loading end has fittings for locking toggles mounted on bridge ends.	5 or 6 longitudinal solid bulkheads (depending on type of float) of piled-up scarfed timbers, stagger-bolted through in layers resting on enlarged keelsons; variant of Howe truss bulkheads. Upper stringer is enlarged. Station floats have center bulkhead with two side bulkheads close together under the track centers; transfer floats have 3 paired bulkheads under the 3 tracks. Bulkheads have vertical side stanchions or diagonal side braces. Topmost structural members are closely-spaced deck beams lying on top of the bulkheads. Option of occasional \ bracing from deck beam bulkhead junctions down to adjacent bulkhead. Athwartship bottom planking spiked to keelsons. Scarfed side planking spiked onto side stanchions &/or kingposts. Multiple wearing strakes along sides. Horizontal bow and stern planking spiked onto ends of bulkheads and sides. Longitudinal deck planking.	V3, S33, V196, V208, V258	V204

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Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
19. Welded Steel Station or Transfer Car Floats Sources: 6,8,51,74	125-327 x 36-39 x 6-9 16-20 cars 750 to 1450 tons	Rectangular hull plan with sharply raking or curved ends. Tapered loading end, option both ends tapered. No sheer and very little camber. Track arrangements & locking mechanisms as for wooden car floats.	Welded angle iron frame. Steel bottom, side and deck plates welded to frames.		V8, V39, V59, V60, V61, V67, V68, V68A? V70, V130, V158, V231
20. Steel Oil Barge Source: 51	100-250 long; up to 90,000 barrels in older vessels	Flush deck with no sheer.	Welded steel plates supported by angle or channel iron framing. Hull divided into tanks with individual piping to main filling and discharge manifolds.		V44
21. Probable US Naval type Self-Propelled Steel Gasoline Barge Source: 69	160-174 x 30-32 x 8-13 1400 tons full load; 6,573 barrels	Similar in size and form to YOG class oil Barge Self Propelled. May have special tank and piping arrangements to handle highly volatile gasoline.	Information not collected.		V40
22. Probable Pusher	Not documented	Boxlike shape. Power Plant: generally heavy marine type inboard/outboard unit.	Steel angle or channel iron frame supporting welded steel plates.		V131
23. Wooden Inclined Engine Double-Ended Ferry Sources: 8,26,31,50, 54	140-160 x 30-33 x 12 500-600 gross tons	Elliptical deck plan with overhanging main deck supported by struts to hull serving as paddle wheel guard. No shear (possible reverse sheer or chronic hogging observed) Inclined single cylinder steam engine exhausting to atmosphere in early boats, later to jet or surface condenser. Coal burning multiple large-flue tank boilers, later gunboat boilers. Radial paddle wheels.	Not well documented.	V12, V13, V81	
24. Wooden Beam Engined Double-Ended Ferry Sources: 8,26,31,50, 54	202 x 33 x 13 609 gross tons	Elliptical deck plan with overhanging main deck supported by struts to hull serving as paddle wheel guard. No shear (possible reverse sheer or chronic hogging observed) Vertical beam type single-cylinder steam engine exhausting to atmosphere in early boats, later to jet or surface condenser. Coal burning multiple large-flue tank boilers, later gunboat boilers. Radial paddle wheels.	Not well documented.	V58 (WESTFIELD)	

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Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
25. Steel Screw Double-Ended Municipal Ferry Sources: 8,50,56	84-269 x 26-69 x 10-19 179-2285 tons	Hull plan with strut-braced or sponsoned elliptical overhanging main deck similar to the overhanging guards on paddle wheel boats. No sheer, slight camber. 2- or 3-deck superstructure, with main deck and 2nd deck (on 3 deckers) cabin inset from ends & flush to edge of side overhang. Narrow upper deck house inset & topped with pilot houses fore and aft. Single or Double stacks generally forward of centerline. Power plant: 2-4 coal (later Oil) burning watertube boilers. 200-4000 hp, double compound, or unaflow steam engine. Engine connected to shafting fore & aft.	Steel transversely framed hull divided into water tight compartments by athwartship bulkheads. Hull plating riveted later welded to angle iron frames.	V62 (ASTORIA), V234 (DONGAN HILLS)	
26. Possible 4 Masted Barkentine Sources: 8,31,43,48, 64,65,68	200 x 42.3 x 19.6 1220 gross tons	Probable multi-masted schooner hull plan with marked sheer, sharply raking stem, counter stern. Long poop deck with cabin, raised forecastle & cabin. Square sail plan on foremast, schooner rig on aftermasts. Rig details (original): Bowsprit, jibboom with 4 staysails, foremast with main course, upper and lower topsails, upper & lower topgallants, Royal. Mainmast, Mizzenmast, & Spankermast rigged with standard schooner lower booms & standing gaffs. Option of Topsails and topmast staysails. Rig details (as modified 1922 in conversion to 4-masted schooner): fore and aft sail on foremast.	Probable World War I-era wooden construction technology. 3 hatch openings.	V49 (HERDIS?)	

Table 2. TYPOLOGICAL INVENTORY OF MARINE RESOURCES IN RECONNAISSANCE PROJECT AREAS

Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
27. Possible Schooner Barge Conversion from Sail Sources: 8,31,60,61, 65,68	(original) 190.2 X 33.5 X 14.5, 694 gross tons; (converted) 190 x 33.5 x 14.5 696 gross tons	(original) Fairly bluff bow, flush deck, straight sides, slight tumblehome, cabin aft. Option of centerboard keel. Rig: 3 fore-&-aft rigged masts with topmasts. Boom & gaff supported lower sails. Option of top sails and topmast staysails. Bow sprit &jibboom with multiple fore-staysails. Cargo Handling: 3 small hatches. Lower sail booms probably could double as cargo booms. Probable hand operated windlasses & capstans. (converted) Rig: 2 or 3 lower masts with fore-&-aft sails supported by booms & gaffs. Cargo Handling: enlarged hatches. Loading by pier chutes, unloading by endless bucket hoist or clam-shell bucket.	Continuous frames with lower keel and upper keelson. Single deck with clamp connections between deck beams and frames.	V54 (CAMDEN?)	
28. Schooner Barge Conversion from Steam Sources: 31,58,62,68	(original) 171.6 x 33.6 x 19.4 868 gross tons (converted) 171.5 x 42.3 x 18.8 788 gross tons	(original) Eliptical hull plan with slight sheer, vertical stem, counter stern, Foremast, funnel, beam engine, main mast. Long house running from aft of foremast to poop. Paddle wheel boxed and guarded aft of midships. Rig: Bow sprit without jibboom, forestaystails, fore and main sails without booms or gaffs. (converted) Same basic plan as above minus paddle boxes, guards and bowsprit. Deck house removed and 3 long hatches cut in deck. Rig: 2 or 3 short masts with fore-&-aft sails supported by booms & gaffs. Cargo Handling: None on board. Loaded from coal pier chutes, unloaded by endless bucket hoists, clamshells buckets etc.	Irregular framed spacing, inner ceiling planking; otherwise limited documentation	V53 (HATTERAS)	

Table 2. TYPOLOGICAL INVENTORY OF MARINE RESOURCES IN RECONNAISSANCE PROJECT AREAS

Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
29. As-built Schooner Barge Sources: 8,18,65,66, 68	170-270 x 35-46 x 14-23 700-2,300 gross tons	Full bow, vertical slightly rounded stem, option of raised monkey forecastle, parallel sides with optional tumble home, moderate sheer, overhanging stern, two deck house aft. 2, 3 or 4 masts. After house has lower cabins & galley with 2 life boats mounted on either side, upper inset house has steering wheel, day cabin. Rig: Lower masts only. Fore-&-aft sails with booms & gaffs. Cargo Handling: 2, 3, or 4 hatches covered with hatch boards & canvas. Loaded by chutes unloaded by endless bucket hoists and clamshell buckets. Deck gear steam capstan, anchor windlass, & steam winches supplied by donkey boiler mounted in optional raised forecastle or on tween deck forward.	Generally built with standard wooden sail/ steam materials & techniques. Sawn pieced-together frames resting on lower keel projecting below bottom & covered by upper center keelson and side sister keelsons. Line of stanchions, resting on center keelson, supports deck beams. Option of tween deck beams generally not decked over. Heavy edge-bolted interior ceiling running from sister keelsons to underside of deck. Option of hanging knee or shelf & clamp connections between deck beams & frames. Main hull planking butt-jointed over frames, fastened with treenails & spikes. Option of scarfed sheer strake. In vessels over 200 feet with ABS 16 year ratings, diagonal steel strapping is worked into the hull side & bilge between frames & side planking. High rail or (low bulwark) all round deck supported by frame tops with missing plank strake forming freeing ports.	V52 (DEVON?)	
30. Ferris Ocean Freighter Sources: 8,18,31,43, 59,63,75	267-268 x 46-49 x 23-28 2200-2916 gross tons	Bluff bow & short run, vertical stem, counter stern, moderate sheer. 3 Island layout with raised forecastle, center island, raised poop. 2 cargo masts each with hatches fore and aft. 2 deck superstructure with pilot house on top deck. Vertical stack. Steam Plant: probable multiple Scotch or watertube boiler steaming 3-cylinder triple-expansion engine. Cargo Handling: Fore-&-aft booms on each mast with steam winches. Steam anchor windlass forward. Up to 8 lifeboats mounted before, on and aft of superstructure.	Probably follow typical wooden shipbuilding style of period, with sawn & pieced-together frames resting on center projecting keel, & topped with center keelson & side sister keelsons. Interior ceiling from sister keelsons to deck. Vertical stanchions resting on center keelson support deck beams. Tween deck beams and optional deck between hatch areas. Option of hanging knee or clamp/shelf connections between deck beams & frames. Crossed diagonal steel strapping from below turn of bilge to sheer strakes. End-butted planking with scarfed sheer strakes attached to frames with treenails and spikes.	V184 (NEAL O'BOYLE ex WEEQUAIC?), V195 (CORONE?)	
31. Ferris Freighter Conversion to Schooner Barge Sources: 31,65,68,75	approximately as above (No. 30)	(original) see above (No. 30) (converted) Center island removed and new house probably set on afterdeck. New hatches added. 3 lower masts with sails attached to lower booms and gaffs. Cargo handling: loaded by pier chutes, unloaded by endless bucket hoists or clamshell buckets.	As above (No. 30).	V72, V78 (WINAPIE?)	

Table 2. TYPOLOGICAL INVENTORY OF MARINE RESOURCES IN RECONNAISSANCE PROJECT AREAS

Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
32. Unidentified Sailing Vessel	Unknown	Unknown	Not well documented; remains of bobstay recess and centerboard trunk survive.	V57	
33. Wood Float Sources: 8,75	10 x 3 x 30	Rectangular forms, framed and decked over.	Large timbers bolted and spiked together.		V184A
34. Probable Steel Work Barge Source: 51	50x25x8	Rectangular hull plan with vertical and/or raked bow straight, vertical sides &stern. No sheer or camber.	Steel angle or channel iron frames. Steel plates welded together and welded to the frames forming sides bottom and deck.		V45, S96?
35. Possible Wooden Work Barge Sources: 8,23,43	50x25x8	Rectangular hull plan with vertical and/or raked bow straight, vertical sides &stern. No sheer or camber.	Option of 2 solid bulkheads resting on keelsons & strongly braced with vertical stanchions terminating in vertical or rake end timbers. Lower hull structure not observed. Option of standard &hanging knee connections to athwart deck beams. Horizontal side &end planking. Option of vertical sheathing over side &end planking. Longtitudinal Deck Planking.		V34A
36. Pleasure Craft	10-35 long	Power plant: Inboard diesel, gas. Inboard/outboard gas, outboard gas.	Plank on frame, fiberglass.		V117, V117A, V120A, V122A, V218
37. Wooden T-Boat Sources: 79	under 100 gross tons	Various forms; small central superstructure	Various; not documented.		V245 (MARY M.)

Table 2. TYPOLOGICAL INVENTORY OF MARINE RESOURCES IN RECONNAISSANCE PROJECT AREAS

Type and Sources	Typical Size(ft)&Capacity	Typical Major Form, Superstructure & Equipment Features	Major Hull Construction Features	---Project Vessel Numbers---- Potentially Significant	Not Significant
38. Wooden Floating Drydock (Balance Dry Dock, Through Dock) Sources: 5,8,55,72-74 77,78	150-250 x 65-85 1400-3500 tons	Rectangular pontoon with athwart camber, high side wing walls, option of V-shaped non-buoyant apron extending out from pontoon at one or both ends. Pontoon deck has centerline keel support blocks & tracks for sliding side bilge blocks. Wing walls wider at base, tapering inside dock & vertical outside. Outerwall frame timbers joined to floors at laminated bilge logs. Wing walls vertical stanchions braced with horizontal & angle braces between outer & inner sides. Wing walls divided as 16 water tight compartments (tanks). Boiler house for steam pumps/later control house for electric pumps on wing wall walkway. Hand/powered ratchet & pawl shaft runs along walkway & operates sliding bilge blocks via chains. Electric motors on walkway operate drowned horizontal centrifugal pumps via long shafts. Sliding gates in each side tank admit water to flood dock.	(Typical) Center longitudinal solid water tight bulkheads laid up of edge-bolted scarfed timbers & 2 wing non-watertight solid bulkheads all resting on closely-spaced cross keelsons. Optional sistered cross keelsons under bulkheads faired into single members near sides. Approximately 11 watertight athwartship bulkheads divide the pontoon. Center bulkhead supports keel of lifted ship and is /I\ braced, as are wing & longitudinal bulkheads. Athwart bulkheads braced with stanchions. Option of arched athwartship laminated trusses. Deck beams are cambered top and bottom. Each athwartship upper & lower member joined with multiple notched vertical stanchions. Junctions of deck beams, bulkheads and cross keelsons united with tie rods. Attached to one or both ends of center & wing longitudinals are apron frame timbers. Longitudinal bottom planking spiked to cross keelsons. Horizontal side planking spiked to wing wall stanchions. Horizontal bow and stern planking spiked to center & wing longitudinal ends and intermediate stanchions. Longitudinal deck planking spiked to deck beams.	V215, V254	
39. Not Typed - Insufficient Resource Integrity for Identification					V1,V7,V16,V18, V28,S74A,V55, V56,V66,V71,V73 V74,V89,V93,V94 V105,V109,V110, V112,V113,V114, V116,V123,V125, V126,V129,V130A V132,V133,V135A V147,V157,V171, V175,V183,V192, V198,V199,V200, V201,V202,V203, V209,V225,V228, V239,V241,V246, V247,V249,V250, V251,[S119], V262,V264

Table 2. TYPOLOGICAL INVENTORY OF MARINE RESOURCES IN RECONNAISSANCE PROJECT AREAS

SOURCES CONSULTED

1 Adams 1983: 256
2 Anonymous n.d.
3 Ansted 1933
4 Army Corps of Engineers 1965: 102-3
5 Benjamin, ed., 1880: 557
6 Baltimore & Ohio Railroad 1958
7 Du Bosque, F.L. 1915 [plans]
8 Brouwer 1990: 50-80, 112-17, 126-7, 133-9, 142-3, 159-60
9 Brouwer 1985
10 Brouwer 1984
11 Brouwer 1983: V7
12 Brouwer 1981
13 Bushey Shipyards 1950 [plans]
14 Chapelle 1960
15 Canal Museum 1981: 12, 13, 25, 30
16 Chittenango Landing Canal Museum 1993 [plans]
17 Crater 1963: 60
18 Desmond 1919
19 Flagg et al. 1992
20 Flagg n.d.b
21 Fuerst 1978
22 Garrity 1977: vi, 159-62
23 George W. Rogers Construction Co. 1944
24 Hall 1884
25 Feeney Shipbuilding Company n.d. [plans]
26 Johnson and Lightfoot 1980
27 Kardas and Larrabee 1985
28 Lang and Spectre 1980: 337, 341, 355, 373, 379-80, 385-86
29 Lederer 1945
30 Lehigh Valley Railroad 1920
31 U.S. Depts. of Commerce/Treasury 1892,1898,1923,1932
32 Morse 1908: 62
33 Clouette 1978a, 1978b
34 Nautical Gazette 1873
35 Nautical Gazette 1902
36 New York Produce Exchange 1873-74: 509
37 Pennsylvania Railroad Company 1903
38 Raber et al. 1986
39 Scientific American 1879, 1897
40 Smith 1919: 31, 284
41 New York City Department of Street Cleaning 1921 [plans]
42 New York Trap Rock Corporation 1951 [plans]
43 South Street Seaport Museum Library n.d.
44 Taber 1981: 448
45 Udasco 1992
46 Delaware, Lackawanna and Western Railroad Company 1959
47 Webster 1920
48 Flagg n.d. [plans]
49 McKelvey 1978: 24, 36, 42, 50-1
50 Dod 1889
51 Staten Island Shipbuilding Company, Hull Department n.d. [plans]
52 New York Central Railroad c1908 [plans]
53 Port Authority of New York and New Jersey 1974 [plans]
54 Union Ferry Company 1879
55 Construction Management, Inc. 1941 [plans]
56 Hilton 1984
57 Nautical Gazette 1871
58 Nautical Gazette 1894
59 American Bureau of Shipping 1926, 1940
60 Jackson, ed. 1983
61 Great Lakes Maritime Institute 1978
62 Heyl 1953
63 McKellar 1959
64 Morris 1975
65 Morris 1984
66 Parker 1948
67 Union Dry Dock Company Collection n.d. [plans]
68 New Jersey Department of Environmental Protection and Energy 1932-78 [plans]
69 Jane's Fighting Ships 1967
70 Jane's Fighting Ships 1991
71 Witmer 1992
72 Stuart 1852
73 Cook 1957
74 Interstate Commerce Commission 1916-1918
75 Raber, Flagg, Weinstein, and Brouwer 1995b
76 Army Corps of Engineers 1965
77 Bushey Shipyards 1944
78 Bushey Shipyards n.d.
79 Charles Deroko [persons consulted]

Table 3. MARINE RESOURCE INVENTORY BY CATALOG NUMBERS

Cat. #	Location/Cluster	Type*	Potentially Significant	Earliest Confirmed Date of Abandonment#
V1	Prall's Island	NT		1978
V2	Prall's Island	PWB		1978
S33	Chelsea	WCF	X	1961
V3	Chelsea	WCF	X	1961
V5	Chelsea	MCB		1985
V7	North of Witte's Scrapyard	NT		1932
V8	North of Witte's Scrapyard	SCF		1978
V9	North of Witte's Scrapyard	WTUG	X	1978
V10	North of Witte's Scrapyard	WTUG		1951
V11	North of Witte's Scrapyard	WTR		1978
V12	North of Witte's Scrapyard	WIEF	X	1932
V13	North of Witte's Scrapyard	WIEF	X	1932
V14	North of Witte's Scrapyard	STR		1985
V15	North of Witte's Scrapyard	WTUG		1951
V16	North of Witte's Scrapyard	NT		1951
V17	North of Witte's Scrapyard	WTUG		1951
V18	North of Witte's Scrapyard	NT		1951
V19	North of Witte's Scrapyard	WTUG		1961
V28	North of Witte's Scrapyard	NT		1978
S74A	North of Witte's Scrapyard	NT		1978
V34	North of Witte's Scrapyard	SCF		1978
V35	North of Witte's Scrapyard	WTR		1971
V39	North of Witte's Scrapyard	SCF		1978
V40	North of Witte's Scrapyard	NGB		1978
V40A	North of Witte's Scrapyard	NOT INVESTIGATED		----
V41	North of Witte's Scrapyard	WTUG	X	1978
V42	North of Witte's Scrapyard	WTR		1978
V43	North of Witte's Scrapyard	ATUG	X	1978
V44	North of Witte's Scrapyard	OB		1971
V45	North of Witte's Scrapyard	SWB		1971
V46	North of Witte's Scrapyard	STUG		1971
V47	North of Witte's Scrapyard	LBC		1951
V49	Smoking Point	P4B	X	1940
V50	Smoking Point	HOP	X	1940
V51	Smoking Point	WTUG		1940
V52	Smoking Point	SB	X	1932
V53	Smoking Point	PSBC	X	1932
V54	Smoking Point	PSBC	X	1932
V55	Smoking Point	NT		1940
V56	Smoking Point	NT		1940
V57	Port Mobil	SV	X	----
V58	Port Mobil	WBEF	X	----
V59	South of Sharrott's Road	SCF		1985
V60	South of Sharrott's Road	SCF		1985
V61	South of Sharrott's Road	SCF		1985
V62	South of Sharrott's Road	SSF	X	1985
S96	South of Sharrott's Road	SWB?		1985
V63	South of Sharrott's Road	STR		1961
V64	South of Sharrott's Road	STR		1971
V65	South of Sharrott's Road	STR		1971
V66	South of Sharrott's Road	NT		1961
V67	South of Sharrott's Road	SCF		1985
V68	South of Sharrott's Road	SCF		1985
V68A	South of Sharrott's Road	SCF?		----
V69	South of Sharrott's Road	LCB		1971
V70	South of Sharrott's Road	SCF		1971
V71	South of Sharrott's Road	NT		1978
V72	South of Sharrott's Road	FSB	X	1961
V73	South of Sharrott's Road	NT		1961
V74	South of Sharrott's Road	NT		1985
V75	South of Sharrott's Road	WTUG	X	1961
V76	South of Sharrott's Road	WTUG	X	1961
V77	South of Sharrott's Road	PSAL	X	1961
V78	South of Sharrott's Road	FSB	X	1932
V79	South of Sharrott's Road	WTUG		1961
V80	South of Sharrott's Road	WTUG		1961
V81	South of Sharrott's Road	WIEF	X	1940
V82	South of Sharrott's Road	SB	X	1940
V83	South of Sharrott's Road	SB	X	1940
V84	South of Sharrott's Road	WTUG	X	1961
V85	South of Sharrott's Road	WTUG		1961
V86	South of Sharrott's Road	WTUG		1971
V87	South of Sharrott's Road	WTUG		1961
V88	South of Sharrott's Road	WTUG		1961
V89	South of Sharrott's Road	NT		1961
V90	South of Sharrott's Road	WTUG		1961
V91	South of Sharrott's Road	WTUG		1961
V92	South of Sharrott's Road	WTUG		1961
V93	South of Sharrott's Road	NT		1961
V94	South of Sharrott's Road	NT		1961
V95	South of Sharrott's Road	WTUG		1961
V96	South of Sharrott's Road	WTUG		1961
V97	South of Sharrott's Road	WTUG	X	1961
V98	South of Sharrott's Road	WTUG		1961
V99	South of Sharrott's Road	WTUG		1961
V100	South of Sharrott's Road	WTUG	X	1961
V101	South of Sharrott's Road	WTUG		1961
V102	South of Sharrott's Road	WTUG	X	1961
V103	South of Sharrott's Road	WTUG		1961
V104	Kreischer Brick Works	DS	X	1971
V104A	Kreischer Brick Works	NOT INVESTIGATED		----
V105	Kreischer Brick Works	NT		1985

*see Vessel Type Abbreviations at end of table
#New Jersey Department of Environmental Protection and Energy 1932-78 [plans]; Robinson 1917 [maps]; Port Authority of New York and New Jersey 1974 [plans]

Table 3. MARINE RESOURCE INVENTORY BY CATALOG NUMBERS (cont.)

Cat. #	Location/Cluster	Type*	Potentially Significant	Earliest Confirmed Date of Abandonment#
V106	Kreischer Brick Works	HB	X	1961
V107	Kreischer Brick Works	DS		1961
V107A	Kreischer Brick Works	NOT INVESTIGATED		----
V108	Kreischer Brick Works	DS		1961
V109	Kreischer Brick Works	NT		1961
V110	Kreischer Brick Works	NT		1961
V111	Kreischer Brick Works	LACB	X	1961
V112	Kreischer Brick Works	NT		1961
V113	Kreischer Brick Works	NT		1961
V114	Kreischer Brick Works	NT		1961
V114A	Kreischer Brick Works	NOT INVESTIGATED		----
V115	Kreischer Brick Works	WTR		1971
V116	Kreischer Brick Works	NT		1978
V117	Kreischer Brick Works	PC		1971
V117A	Kreischer Brick Works	PC		1985
V119	Kreischer Brick Works	DS		1971
V120	Kreischer Brick Works	DL	X	1971
V120A	Kreischer Brick Works	PC		1985
V121	Kreischer Brick Works	SHTG		1961
V122	Kreischer Brick Works	WCB		1961
V122A	Kreischer Brick Works	PC		1961
V123	Kreischer Brick Works	NT		1961
V124	Kreischer Brick Works	WCB		1961
V125	Kreischer Brick Works	NT		1985
V126	Kreischer Brick Works	NT		1971
V127	Kreischer Brick Works	DS		1971
V128	Kreischer Brick Works	WTR		1971
V129	Kreischer Brick Works	NT		1971
V130	Kreischer Brick Works	SCF		1985
V130A	North of Outerbridge	NT		1985
V131	North of Outerbridge	PP		1978?
V132	Kreischer Brick Works	NT		1985
V133	Kreischer Brick Works	NT		1971
V134	North of Outerbridge	HB	X	1961
V135	North of Outerbridge	HB	X	1951
V135A	North of Outerbridge	NT		1961?
V136	North of Outerbridge	HB		1932?
V137	North of Outerbridge	LBC		1932?
V138	North of Outerbridge	HB		1932?
V139	North of Outerbridge	LBC		1932?
V140	North of Outerbridge	HB		1932?
V141	North of Outerbridge	HB		1932?
V142	North of Outerbridge	HB		1932?
V143	North of Outerbridge	HB		1932?
V144	North of Outerbridge	HB		1932?
V145	North of Outerbridge	HB		1932?
V146	North of Outerbridge	HB		1932?
V147	North of Outerbridge	NT		1932?
V148	North of Outerbridge	HB		1932?
V149	North of Outerbridge	HB		1961?
V150	North of Outerbridge	WTR		1940
V151	North of Outerbridge	HB		1940
V152	North of Outerbridge	HB		1932?
V153	North of Outerbridge	HB		1932?
V154	North of Outerbridge	HB		1932?
V155	North of Outerbridge	DL	X	1961
V156	North of Outerbridge	HB		1961
V157	North of Outerbridge	NT		1961
V158	North of Outerbridge	SCF		1951
V159	North of Outerbridge	HB		1932?
V160	North of Outerbridge	HB	X	1932?
V161	North of Outerbridge	HB		1932?
V162	North of Outerbridge	HB		1932?
V163	North of Outerbridge	LBC		1932?
V164	North of Outerbridge	WTR		1932?
V165	North of Outerbridge	HB		1932?
V166	North of Outerbridge	HB		1932?
V167	North of Outerbridge	LBC		1932?
V168	North of Outerbridge	HB		1932?
V169	North of Outerbridge	HB	X	1932?
V170	North of Outerbridge	HB		1932?
V171	North of Outerbridge	NT		1974?
V172	North of Outerbridge	HB		1932
V173	North of Outerbridge	HB		1932
V174	North of Outerbridge	HB		1932
V175	North of Outerbridge	NT		1940?
V176	North of Outerbridge	LBC		----
V177	North of Outerbridge	HB		1932?
V178	North of Outerbridge	HB		1932?
V179	North of Outerbridge	PSTL	X	1932?
V180	North of Outerbridge	LBC		1932?
V181	North of Outerbridge	LBC		----
V182	North of Outerbridge	DL		1951
V183	North of Outerbridge	NT		1940
V184	North of Outerbridge	FER	X	1932
V184A	North of Outerbridge	FLT		1985
V184B	North of Outerbridge	NOT INVESTIGATED		----
V185	North of Outerbridge	HB		1940
V186	North of Outerbridge	HB		1940

*see Vessel Type Abbreviations at end of table
#New Jersey Department of Environmental Protection and Energy 1932-78 [plans]; Robinson 1917 [maps]; Port Authority of New York and New Jersey 1974 [plans]

Table 3. MARINE RESOURCE INVENTORY BY CATALOG NUMBERS (cont.)

Cat. #	Location/Cluster	Type*	Potentially Significant	Earliest Confirmed Date of Abandonment#
V187	North of Outerbridge	WCB		1961
V188	North of Outerbridge	WCB		1961
V189	North of Outerbridge	WCB	X	1961
V190	North of Outerbridge	DL		1932
V191	North of Outerbridge	WTR		1951
V192	North of Outerbridge	NT		1951
V193	North of Outerbridge	LACB	X	1940
V194	North of Outerbridge	SB	X	1932?
V195	North of Outerbridge	FER	X	1932?
V196	North of Atlantic Terra Cotta	WCF	X	1951
V197	North of Atlantic Terra Cotta	HB		1971
V197A	North of Atlantic Terra Cotta	NOT INVESTIGATED		----
V198	North of Atlantic Terra Cotta	NT		1978?
V199	North of Atlantic Terra Cotta	NT		1961?
V200	North of Atlantic Terra Cotta	NT		1961
V200A	North of Atlantic Terra Cotta	NOT INVESTIGATED		----
V201	North of Atlantic Terra Cotta	NT		1961?
V202	North of Atlantic Terra Cotta	NT		1932
V202A	North of Atlantic Terra Cotta	NOT INVESTIGATED		----
V203	North of Atlantic Terra Cotta	NT		1932
V203A	North of Atlantic Terra Cotta	NOT INVESTIGATED		----
V204	North of Atlantic Terra Cotta	WCF		1932
V205	Atlantic Terra Cotta Pier	SBC		1917
V206	Atlantic Terra Cotta Pier	LBC		1917
V207	Atlantic Terra Cotta Pier	SBC		1917
V208	O'Boyle/Townsend Shipyard	WCF	X	1932
V209	O'Boyle/Townsend Shipyard	NT		1985
V210	O'Boyle/Townsend Shipyard	HB		1932?
V211	O'Boyle/Townsend Shipyard	HB		1971
V212	O'Boyle/Townsend Shipyard	NOT FOUND		1985
V213	O'Boyle/Townsend Shipyard	WTR		1978
V214	O'Boyle/Townsend Shipyard	SBC	X	1940
V215	O'Boyle/Townsend Shipyard	DOCK	X	1971
V216	O'Boyle/Townsend Shipyard	HOP		1961
V217	O'Boyle/Townsend Shipyard	WCB		1978
V218	O'Boyle/Townsend Shipyard	PC		1985
V219	O'Boyle/Townsend Shipyard	SBC	X	1971
V220	O'Boyle/Townsend Shipyard	WTR		1971
V221	O'Boyle/Townsend Shipyard	WTR		1971
V222	O'Boyle/Townsend Shipyard	WTR		1951
V223	O'Boyle/Townsend Shipyard	WTR		1951
V224	O'Boyle/Townsend Shipyard	HB		1951
V225	O'Boyle/Townsend Shipyard	NT		1978
V226	O'Boyle/Townsend Shipyard	WTR		1971
V227	O'Boyle/Townsend Shipyard	WTR		1971
V228	O'Boyle/Townsend Shipyard	NT		1971
V229	O'Boyle/Townsend Shipyard	SBC		1971
V230	O'Boyle/Townsend Shipyard	WTR		1978
V231	O'Boyle/Townsend Shipyard	SCF		1978
V232	O'Boyle/Townsend Shipyard	WTR		1978
V233	O'Boyle/Townsend Shipyard	WTR		1978
V234	O'Boyle/Townsend Shipyard	SSF	X	1978
V235	O'Boyle/Townsend Shipyard	DL		1971
V235A	O'Boyle/Townsend Shipyard	NOT INVESTIGATED		----
V236	O'Boyle/Townsend Shipyard	WTR		1985
V237	O'Boyle/Townsend Shipyard	HOP		1961
V238	O'Boyle/Townsend Shipyard	HOP	X	1961
V239	O'Boyle/Townsend Shipyard	NT		1978
V240	O'Boyle/Townsend Shipyard	WTR		1978
V241	O'Boyle/Townsend Shipyard	NT		1961
V242	O'Boyle/Townsend Shipyard	HOP	X	1961
V243	O'Boyle/Townsend Shipyard	WCB		1978
V244	O'Boyle/Townsend Shipyard	WTR		1985
V244A	O'Boyle/Townsend Shipyard	NOT INVESTIGATED		----
V244B	O'Boyle/Townsend Shipyard	NOT INVESTIGATED		----
V245	O'Boyle/Townsend Shipyard	TB		1985
V245A	O'Boyle/Townsend Shipyard	NOT INVESTIGATED		----
V246	O'Boyle/Townsend Shipyard	NT		1951?
V247	O'Boyle/Townsend Shipyard	NT		1985
V249	O'Boyle/Townsend Shipyard	NT		1985
V249A	O'Boyle/Townsend Shipyard	NOT INVESTIGATED		----
V249B	O'Boyle/Townsend Shipyard	NOT INVESTIGATED		----
V249C	O'Boyle/Townsend Shipyard	NOT INVESTIGATED		----
V249D	O'Boyle/Townsend Shipyard	NOT INVESTIGATED		----
V250	O'Boyle/Townsend Shipyard	NT		1951?
V251	O'Boyle/Townsend Shipyard	NT		1961
V252	O'Boyle/Townsend Shipyard	WCB	X	1961
V254	Tottenville Marina	DOCK	X	1971
V255	Tottenville Marine Basin	WTUG		1971
[S119]	Tottenville Marine Basin	NT		----
V256	Tottenville Marine Basin	WTUG		1961
V257	Tottenville Marine Basin	WTUG		1971
V258	Tottenville Marine Basin	WCF	X	1951
V259	Tottenville Marine Basin	NO VESSEL FOUND - S121 PIER ONLY		
V260	A.C Brown Shipyard	PTSL	X	1951
V261	A.C Brown Shipyard	WTUG		1951
V262	A.C Brown Shipyard	NT		----
[S143]	A.C Brown Shipyard	SBC	X	1932
V263	A.C Brown Shipyard	WTUG		1932
V264	A.C Brown Shipyard	NT		1932
V265	A.C Brown Shipyard	WTUG		1932

*see Vessel Type Abbreviations at end of table
#New Jersey Department of Environmental Protection and Energy 1932-78 [plans]; Robinson 1917 [maps]; Port Authority of New York and New Jersey 1974 [plans]

Table 3. MARINE RESOURCE INVENTORY BY CATALOG NUMBERS (cont.)

Vessel Type Abbreviations

ATUG	Army Steam Tug
DS	Wooden Harbor Open Deck Scows
DL	Wooden Derrick Lighter
DOCK	Wooden Floating Dry Dock
FER	Ferris Ocean Freighter
FLT	Wooden Float
FSB	Ferris conversion to Schooner Barge
HB	Wooden Coastwise Hold Barges
HOP	Hopper Barge
LACB	Large size wooden heavy-lift A-frame Crane Barge
LBC	Large Wooden Barge Canal/Harbor Hold Barges
MCB	Medium size wooden A-frame Crane Barge
NGB	Probable U.S. Navy Gasoline Barge
NT	Not Typed - Unidentified
OB	Steel Oil Barge
P4B	Possible 4-masted Barkentine
PC	Pleasure Craft
PP	Probable Pusher
PSAL	Possible Wooden Sailing Lighter
PSBC	Possible Schooner Barge Conversion from sail (V54) & steam (V53)
PWB	Possible Wooden Work Barge
PSTL	Probable Wooden Steam Lighter
SB	As Built Schooner Barge
SBC	Probable Transitional/Smaller Barge Canal Boat
SCF	Steel Car Float
SHTG	Steel Shifting Tug
SSF	Steel screw double-ended Municipal Ferry
STR	Steel Trap Rock Scow
STUG	Welded Steel Harbor Tug
SV	Unidentified Sailing Vessel
SWB	Probable Steel Work Barge
TB	T-Boat
WBEF	Wooden Beam Engine Doubled-ended Ferry
WCB	Wooden Covered Barge
WCF	Wooden Car Float
WIEF	Wooden Inclined Engine Doubled-ended Ferry
WTR	Wooden Trap Rock Scow
WTUG	Wooden Screw Harbor Tug

Table 4. DISTRIBUTION OF MARINE RESOURCES BY TYPE, LOCATION, AND POTENTIAL SIGNIFICANCE

Resource Type	Prall's Island/ Chelsea	North of Witte's Scrapyard	Smoking Point	Port Mobil	South of Sharrott's Road	Kreischer Brick Works	North of Outer-Bridge	North of Atlantic TerraCotta	Atlantic T.C. Pier	O'Boyle Townsend Shipyard	Tottenville Marina/ Marine Basin	A.C. Brown Shipyard	Total Counts	Poten. Signif.
1. Wooden Covered Harbor Barge						2	3			3			8	2
2. Wooden Harbor Deck Scows						5							5	1
3. Wooden Derrick Lighter						1	3			1			5	2
4. Wooden Trap Rock Scow		3				2	3			13			21	
5. Steel Trap Rock Scow		1			3								4	
6. Probable Transitional/ Smaller Barge Canal Boat									2	3		1	6	3
7. Large Wooden Barge Canal/ Harbor Hold Barges		1			1		7		1				10	
8. Wooden Coastwise Hold Barges						1	34	1		3			39	5
9. Wooden Screw Harbor Tugs		6	1		21						3	3	34	8
10. Steel Army Steam Tug		1											1	1
11. Welded Steel Harbor Tug		1											1	1
12. Steel Shifting Tug						1							1	1
13. Possible Wooden Sailing Lighter					1							1	2	2
14. Probable Wooden Steam Lighter							1						1	1
15. Large size wooden heavy-lift A-frame Crane Barge						1	1						2	2
16. Medium size steel A-frame Crane Barges	1												1	1
17. Hopper Barges			1							4			5	3
18. Wooden Car Floats	2							2		1	1		6	5
19. Steel Car Floats		3			7	1	1			1			13	
20. Steel Oil Barge		1											1	
21. Probable Navy Gas Barge		1											1	

Table 4. DISTRIBUTION OF MARINE RESOURCES BY TYPE, LOCATION, AND POTENTIAL SIGNIFICANCE														
Resource Type	Prall's Island/ Chelsea	North of Witte's Scrapyard	Smoking Point	Port Mobil	South of Sharrott's Road	Kreischer Brick Works	North of Outer-Bridge	North of Atlantic TerraCotta	Atlantic T.C. Pier	O'Boyle Townsend Shipyard	Tottenville Marina/ Marine Basin	A.C. Brown Shipyard	Total Counts	Poten. Signif.
22. Probable Pusher							1						1	
23. Wooden Inclined Engine Double-ended Ferry		2			1								3	3
24. Wooden Beam Engine Double-ended Ferry				1									1	1
25. Steel screw double-ended Municipal Ferry					1					1			2	2
26. Possible 4-masted Barkentine			1										1	1
27. Possible Schooner Barge Conversion from Sail			1										1	1
28. Schooner Barge Conversion from Steam			1										1	1
29. As-built Schooner Barge			1		2		1						4	4
30. Ferris Ocean Freighter							2						2	2
31. Ferris conversion to Schooner Barge					2								2	2
32. Unidentified Sailing Vessel				1									1	1
33. Wood Float							1						1	
34. Probable Steel Work Barge		1											2	
35. Possible Wooden Work Barge	1												1	
36. Pleasure Craft						4				1			5	
37. Wooden T-Boat										1			1	
38. Wooden Floating Drydock										1	1		2	2
Unidentified/Not Investigated	1	6	2		7	16	9	10		19	2	2	74	
Total Counts	5	27	8	2	47	34	67	13	3	52	7	7	272	X
Potentially Significant	2	5	5	2	13	4	11	1		8	2	2	X	55

Table 5. MARINE RESOURCE CLUSTERS

Cluster	Location & Catalog Numbers	Description and History
1	Prall's Island V1-V2	One probably wooden work barge, and fragments of at least one other unidentified wooden vessel, abandoned in the 1970s.
2	Chelsea S33, V3, V4	Two wooden car floats and one medium-size wooden A-frame crane barge, all potentially significant. The car floats were brought to these locations in the 1950s, probably as tie-up piers for small under-documented marine repair yards. The crane barge was abandoned after 1978, probably after repair activity ceased.
3	North of Witte's Scrapyard V7-V19, V28, S74A, V34, V35, V40-V47	Twenty-seven varied steel and wooden vessels, many probably associated with Witte scrapping. Most of the twelve steel vessels, including one potentially significant Army tug, were left here c1961-78. Two potentially significant wooden inclined-engine doubled-ended ferries were abandoned here before 1932, probably pre-dating the Witte operation. The other thirteen wooden vessels, including two potentially significant screw harbor tugs, were left here c1940-78 and may be associated with the Witte yard.
4	Smoking Point V49-V55	Seven wooden vessels abandoned before 1940, including three schooner barges owned by the Durham Navigation Company, a schooner owned by the Maryland Transportation Company, a hopper barge, and a wooden screw harbor tug. Five are potentially significant.
5	Port Mobil V57, V58	Possible wooden sailing vessel and wooden beam engine double-ended ferry, both potentially significant; unknown abandonment date(s)
6	South of Sharrott's Road V59-V103, S96	Forty-seven steel and wooden vessels abandoned in several periods, at least some by the Witte operation. Three wooden schooner barges and a wooden inclined-engine double-ended ferry -- all potentially significant-- appeared before 1940, probably pre-dating much Witte activity. More than half the vessels appeared c1951-71 during Witte operations, including twenty-one wooden harbor screw tugs, a possible wooden sailing lighter, a large wooden Barge Canal-type boat, a schooner barge, and three steel trap rock scows. Seven from this second period are potentially significant. The last eight vessels, all known or likely Witte discards, include seven steel car floats and the steel ferry ASTORIA, all abandoned after 1978.
7	Kreischer Brick Works V104-V117A, V119-V130, V132, V133	Thirty-four vessels, mostly wooden towed boats and barges, deposited c1951-85, many years after brick work activity ceased. Only four are potentially significant.
8	North of Outerbridge V130A, V131, V134-V195	Sixty-seven predominantly wooden vessels, more than half being coal trade craft parked in a carefully-packed array by 1932. Most of the remainder appeared c1932-61. Cluster includes thirty-four coastwise hold barges, a schooner barge, two as-built Ferris freighters, seven large wooden Barge Canal-type boats, three wooden covered lighters, a probable wooden steam lighter, and a large-size wooden heavy-lift A-frame crane barge. Eleven are potentially significant.
9	North of Atlantic Terra Cotta V196-V204	Thirteen wooden vessels, most unidentifiable, including two wooden car floats -- one potentially significant -- and one coastwise hold barge. A few vessels abandoned before 1932, most c1951-78.
10	Atlantic Terra Cotta pier V205-V207	Three Barge Canal-type boats sunk c1907-17 as L-shaped pier, probably for barge tie-up. None potentially significant.

Table 5. MARINE RESOURCE CLUSTERS (cont.)

Cluster	Location & Catalog Numbers	Description and History
11	marine repair yard of M.J. Tracy, Tottenville Shipyard Co., James O'Boyle Shipyard, Townsend Transportation Co. V208-V247, V249-V252	Fifty-two wooden or steel vessels and a wooden floating drydock, at least half abandoned gradually c1920-70 during repair yard operations, the remainder after the yard closed. Wooden vessels include covered harbor barges, a derrick lighter, trap rock scows, smaller Barge Canal-type boats, coastwise hold barges, hopper barges, and a car float. Eight potentially significant resources, including steel ferry DONGAN HILLS.
12	Tottenville Marine Basin V255-258, [S119]	One potentially significant wooden car float used as tie-up/repair pier during operations c1942-55, plus three wooden screw harbor tugs and one other vessel abandoned c1955-71 after yard closed.
13	A.C. Brown & Sons Shipyard V260-V265, [S143]	Four wooden vessels abandoned before 1932 in last days of yard operations, including a potentially significant small Canal Barge-type boat and three screw harbor tugs. Three other wooden vessels, including a potentially significant sailing lighter and a screw harbor tug, abandoned c1940-51 after yard closed.

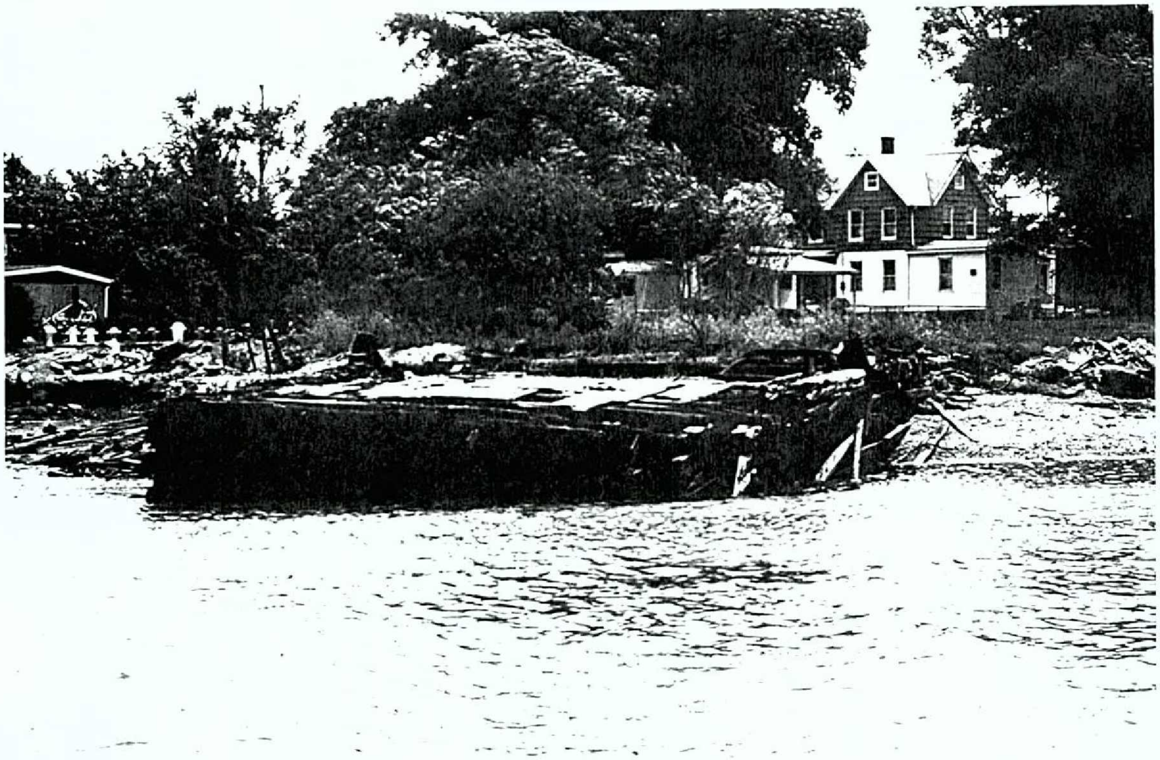

Plate 12. Derelict Vessel V3 to southeast

Plate 13. Derelict Vessel S33 to east

Plate 14. Derelict Vessel V4 to southeast

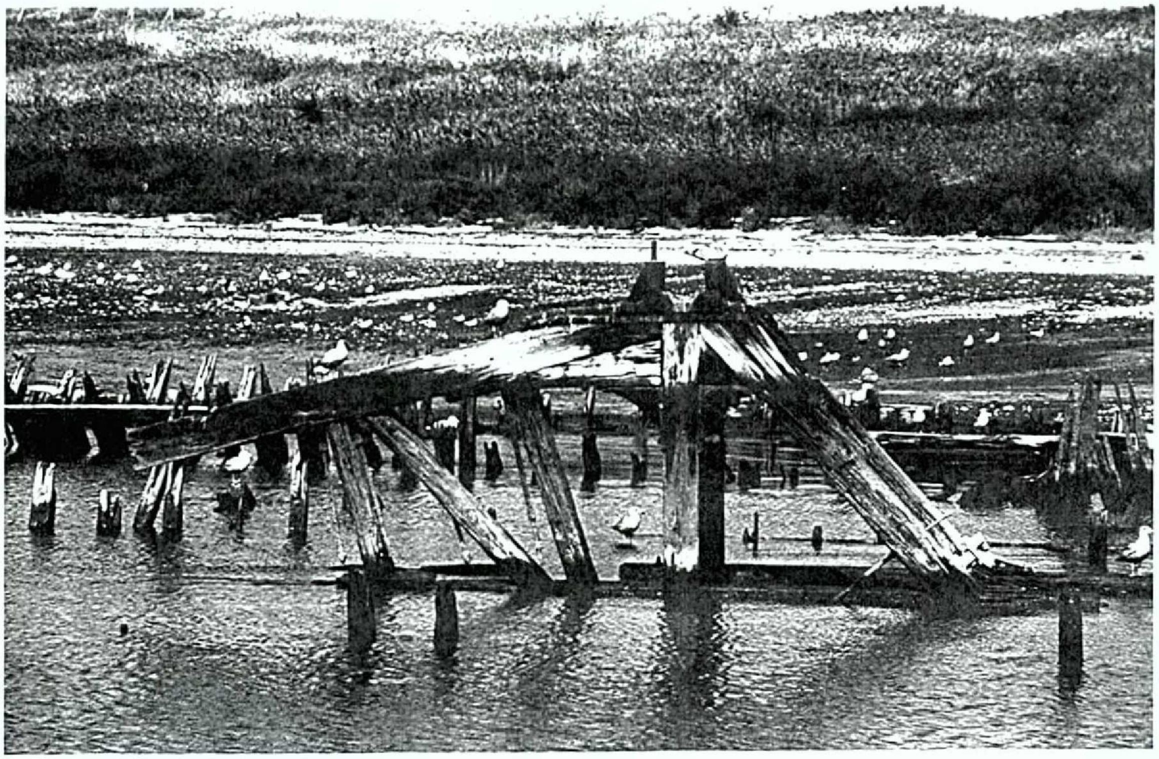

Plate 15. Derelict Vessel V12, detail of angle frame, to northeast

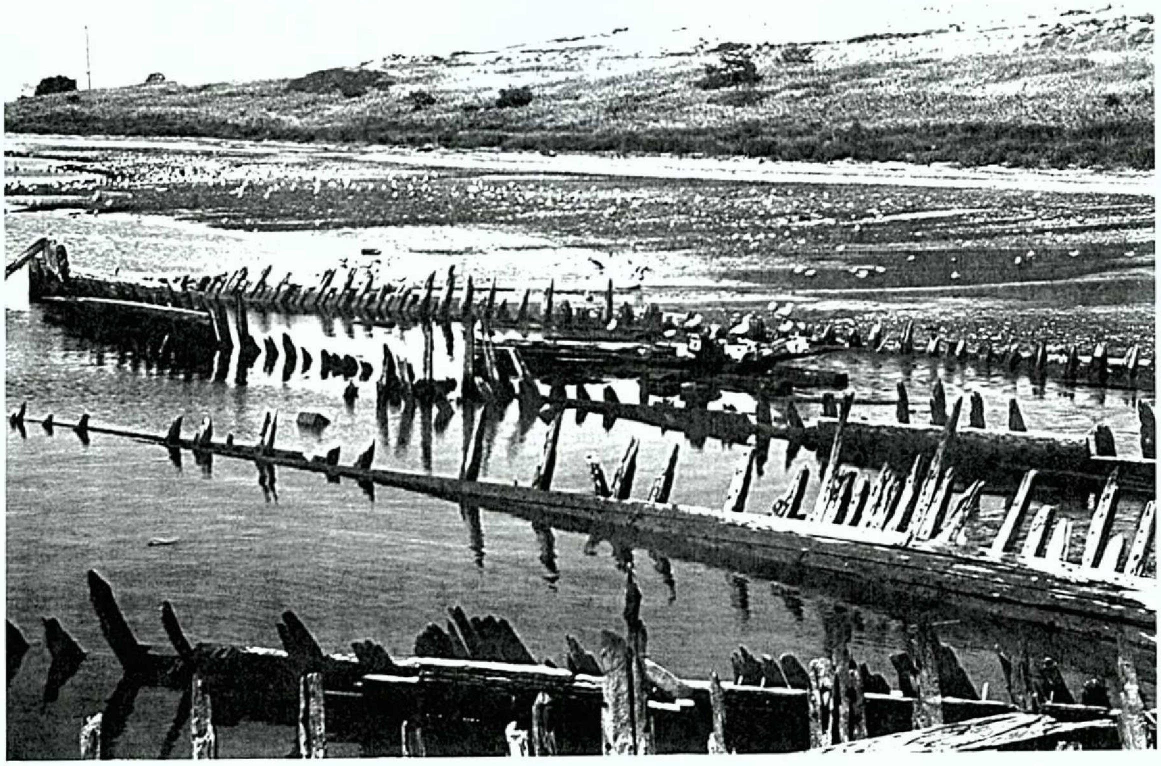

Plate 16. Derelict Vessels V12 (front) and V13 (rear, with angle frame) to northeast

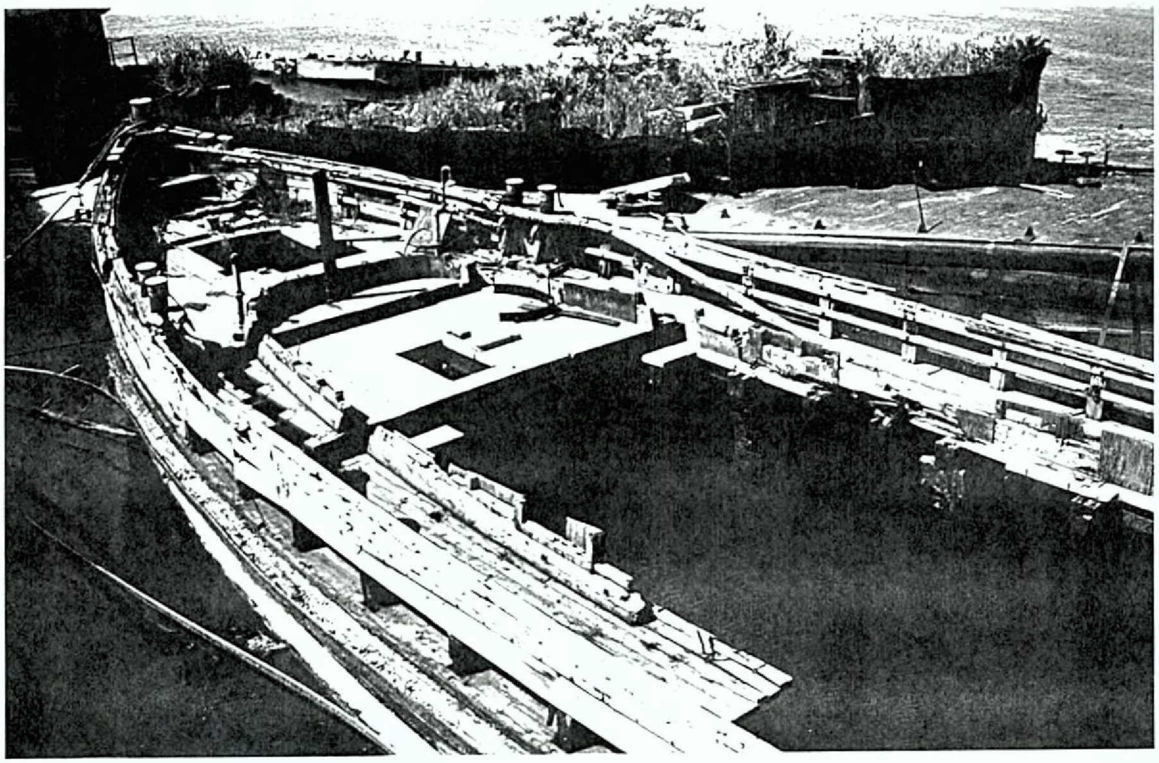

Plate 17. Derelict Vessel V41 to northwest

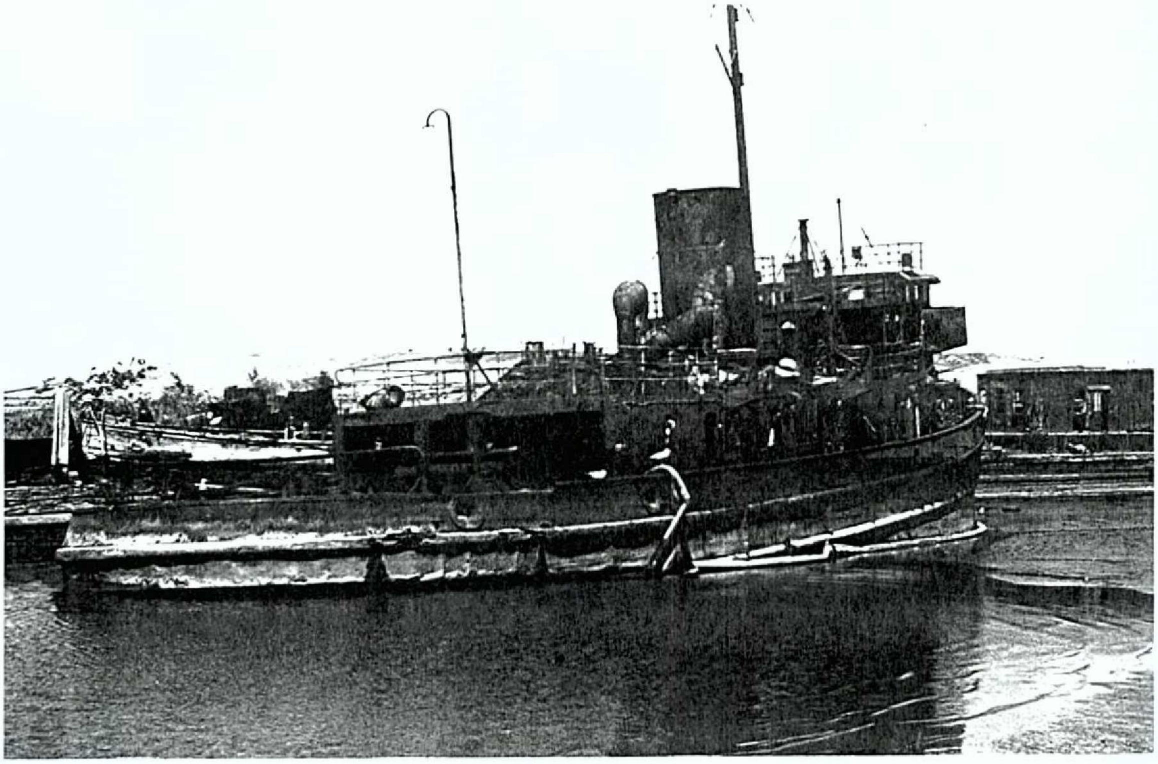

Plate 18. Derelict Vessel V43 to east

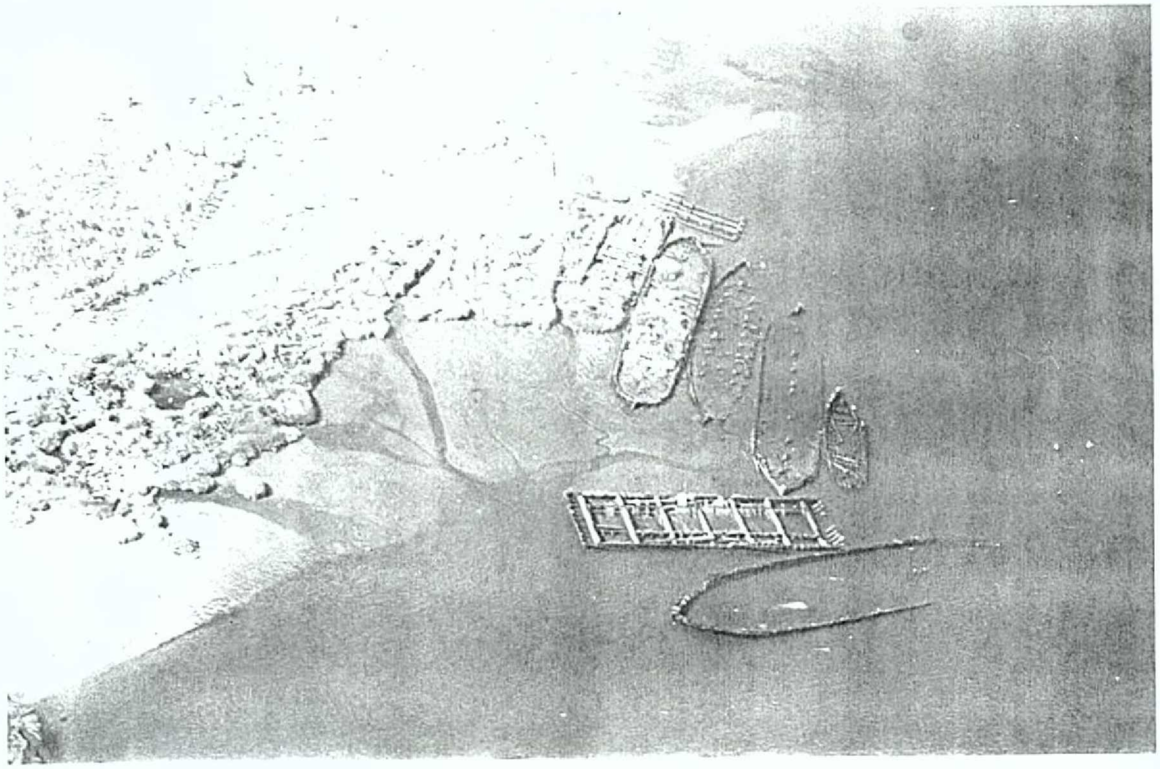

Plate 19. Derelict Vessels at Smoking Point: S56 (top-center); S51-S55 (right-left at center), V49 and V50 (right-left at bottom). View to north July 1977. Photograph by Thomas Flagg; in his possession.

Plate 20. Derelict Vessel V49 to northwest

Plate 21. Derelict Vessels V50 (center) and V52 (right) to northeast

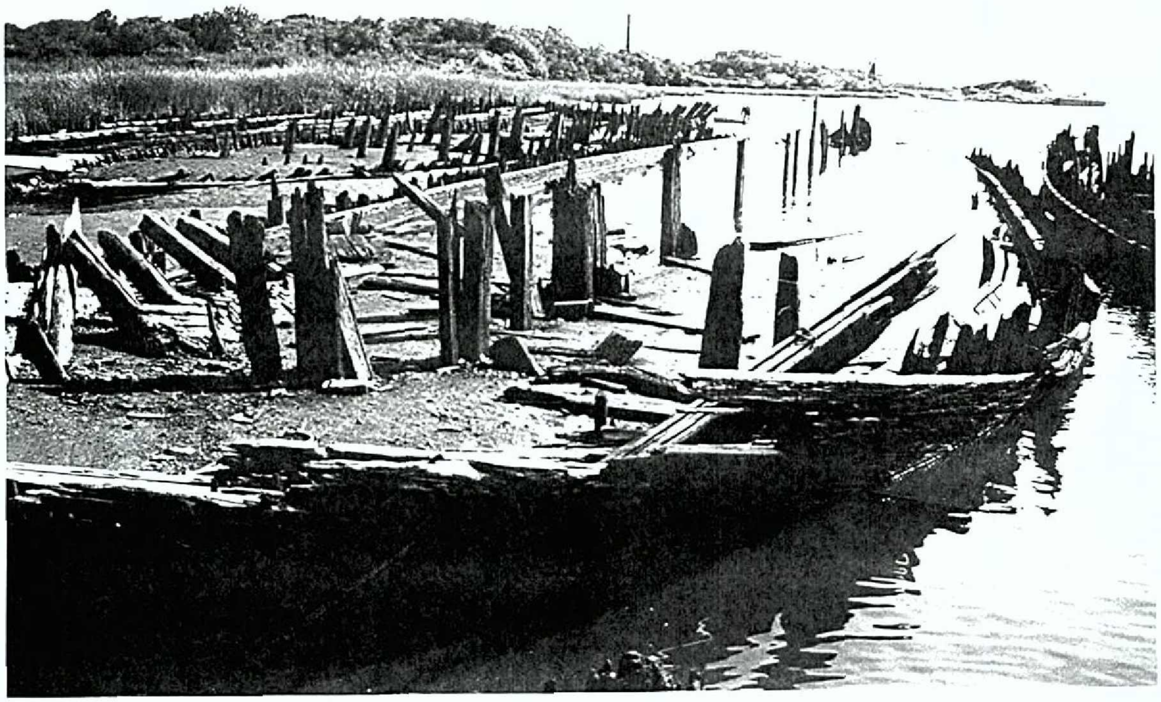

Plate 22. Derelict Vessel V52 to southeast

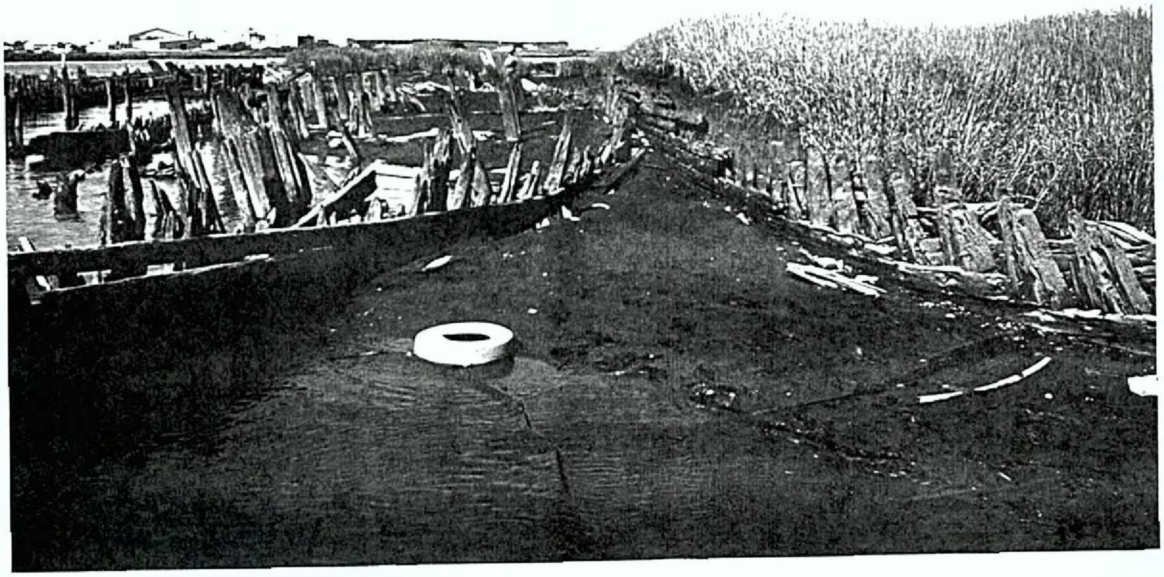

Plate 23. Derelict Vessels V53 (left) and V54 (right) to north

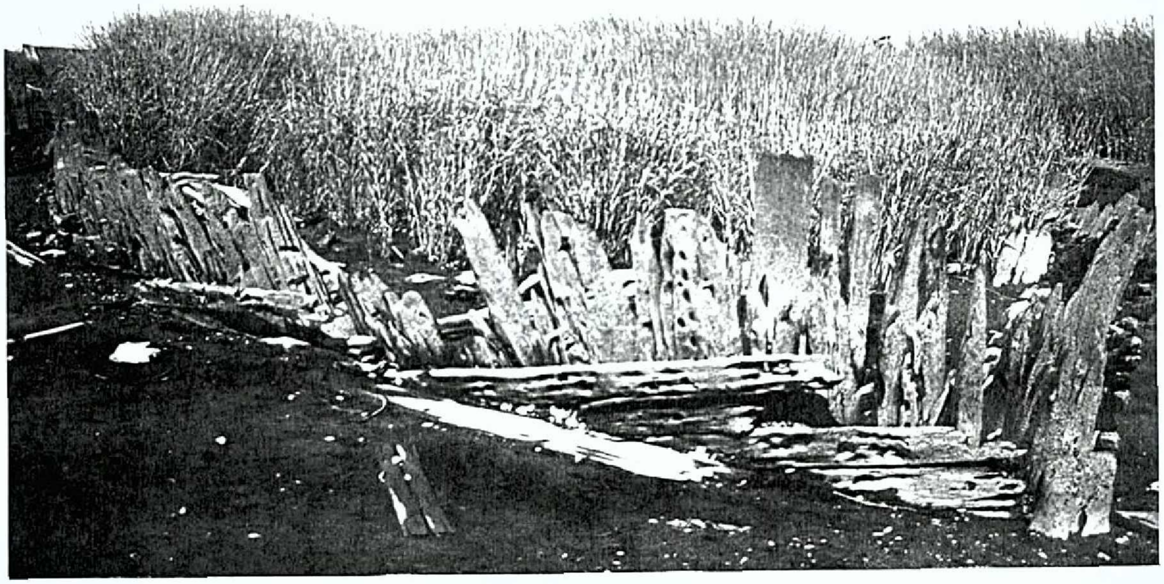

Plate 24. Derelict Vessel V54 to northeast

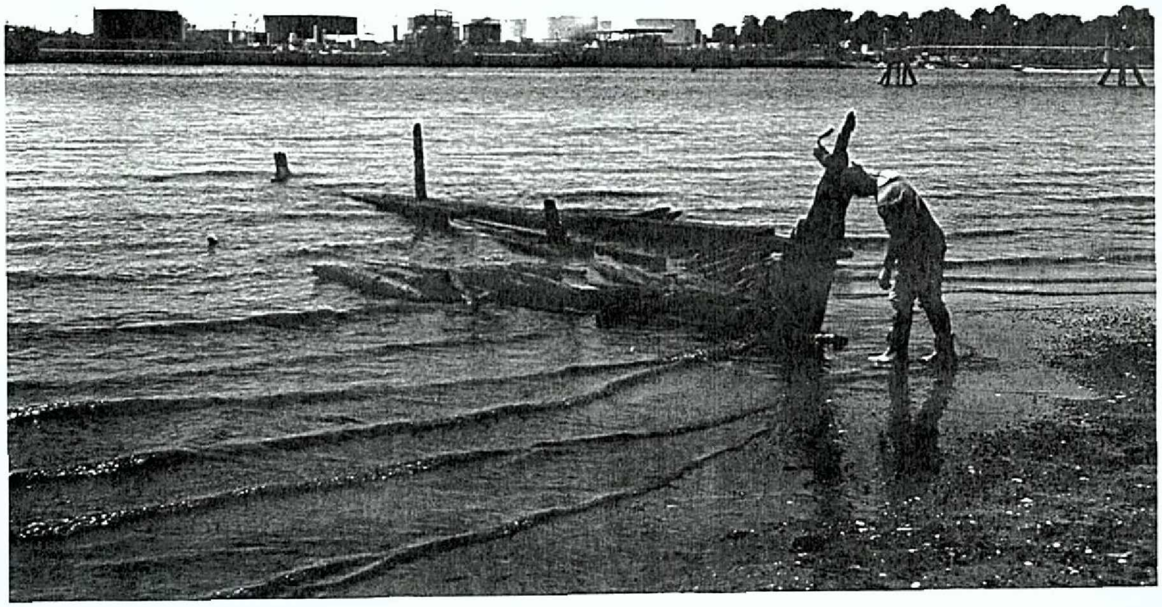

Plate 25. Derelict Vessel V57 to northeast, with Norman Brouwer, to northeast

Plate 26. Derelict Vessel V58 to northeast

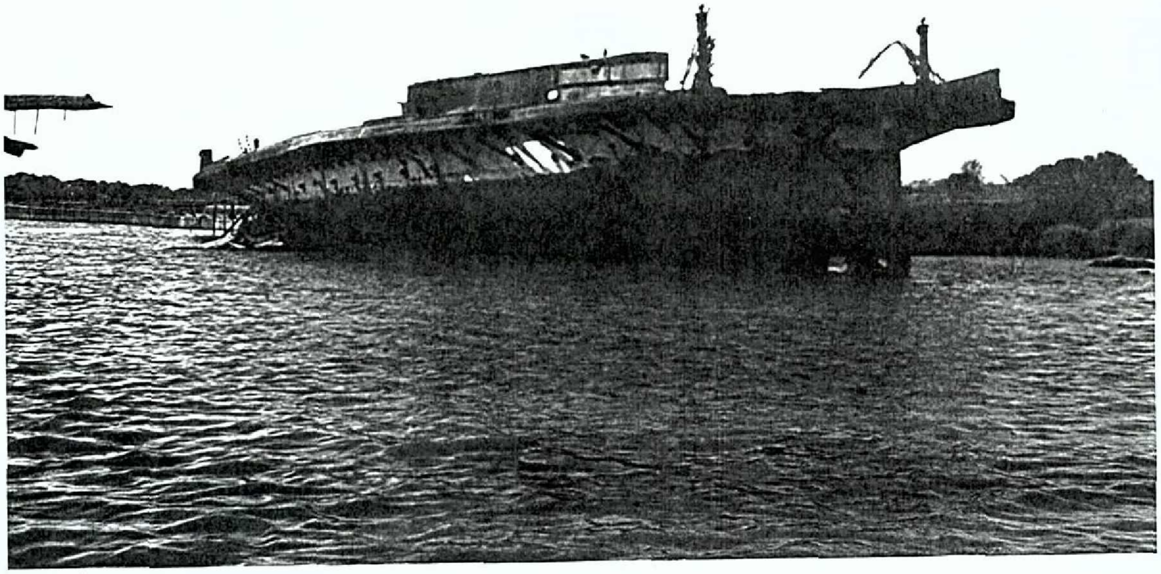

Plate 27. Derelict Vessel V62 to northwest

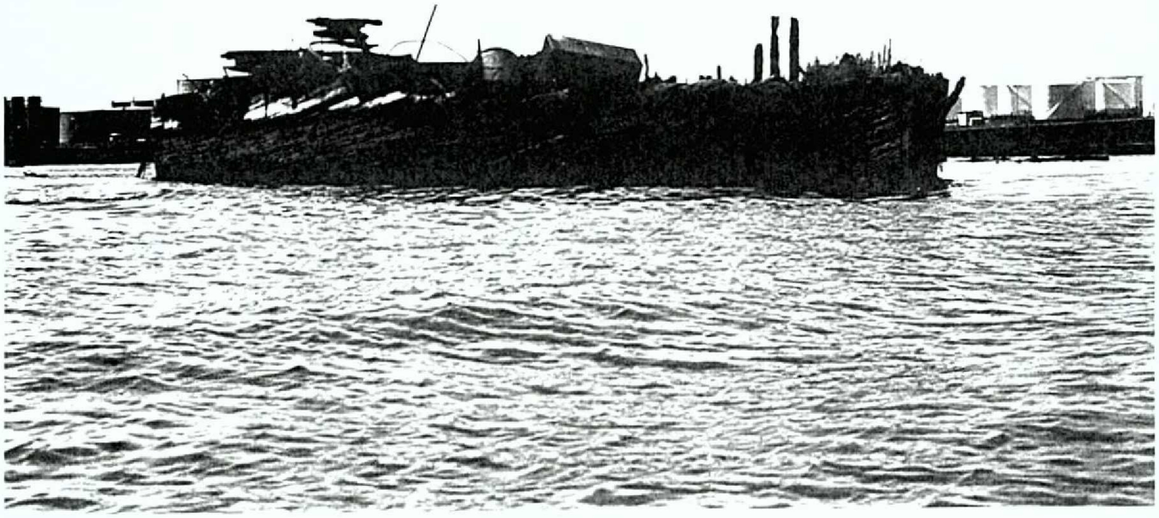

Plate 28. Derelict Vessel V72 to northwest

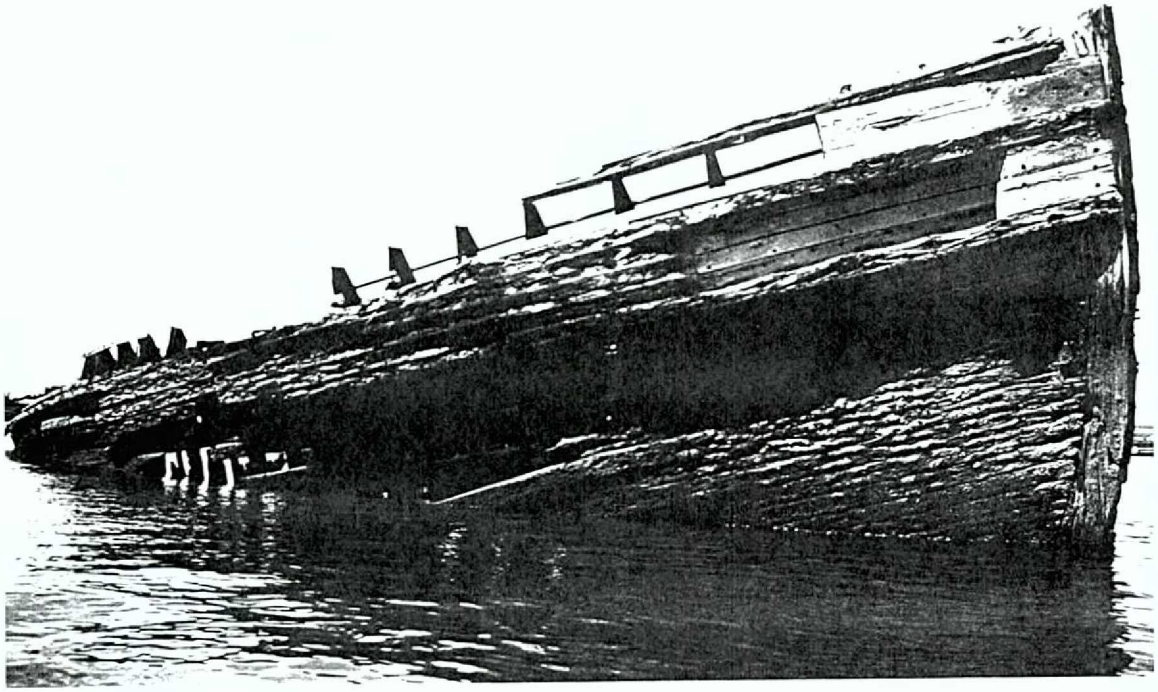

Plate 29. Derelict Vessel V75 to north

Plate 30. Derelict Vessels V76 (right) and V84 (left) to west

Plate 31. Derelict Vessels V76, V77, V78, V79, and V80 (left to right) to east

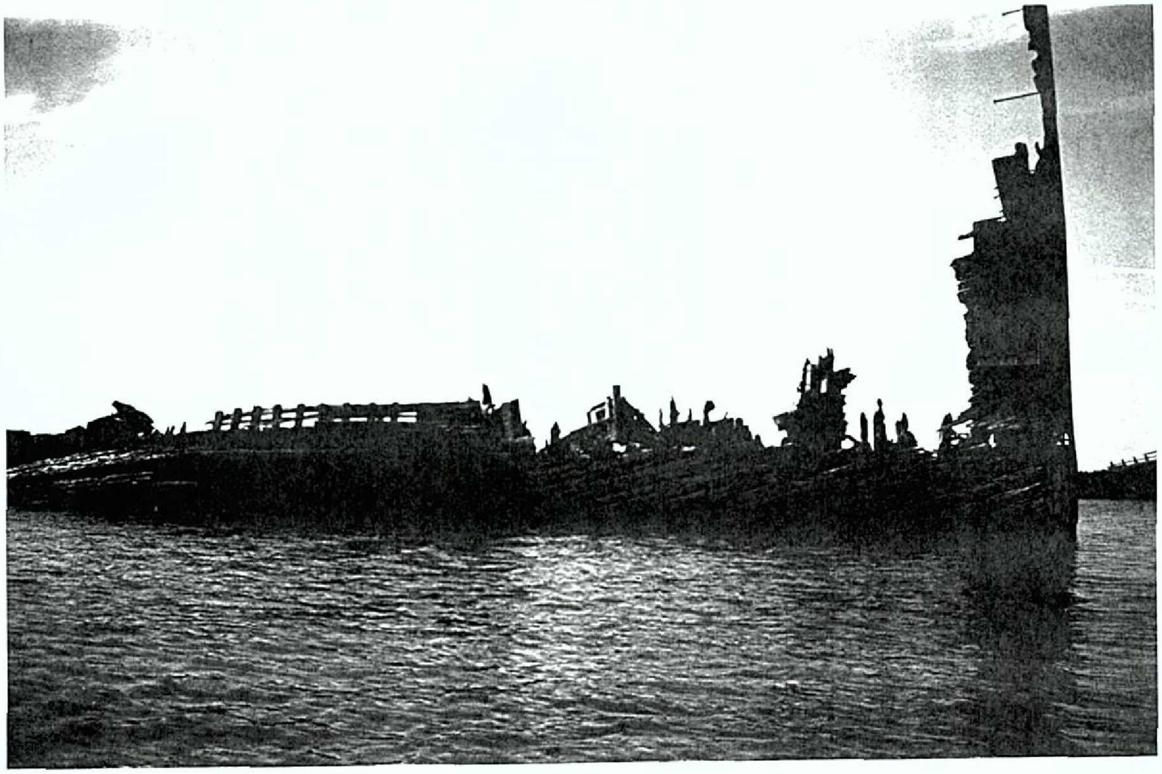

Plate 32. Derelict Vessels V78 (right-center) and V80 (left) to northwest

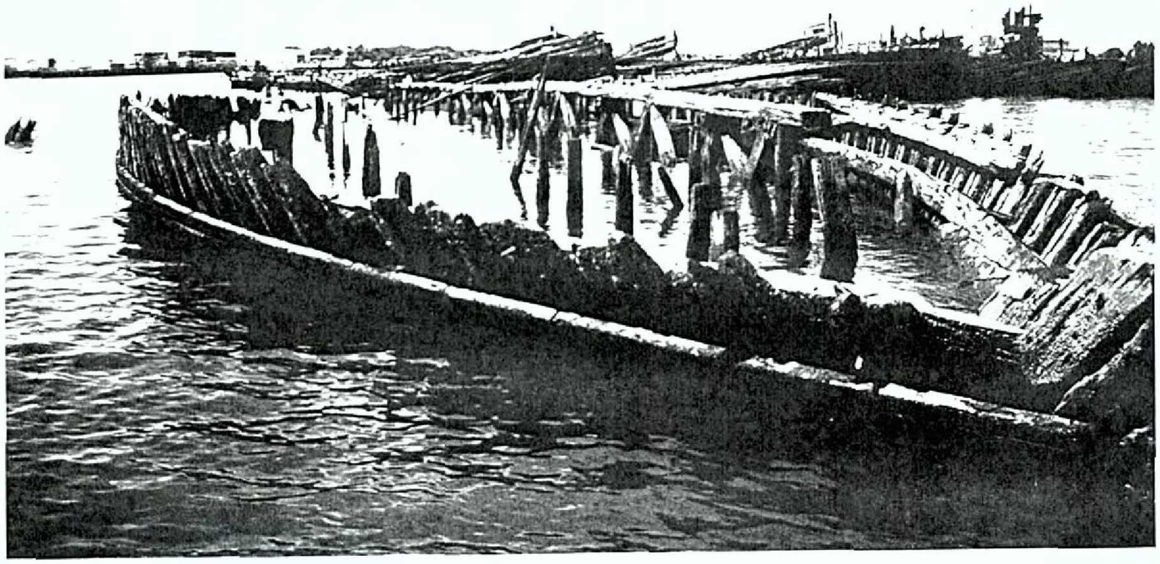

Plate 33. Derelict Vessel V81 to north

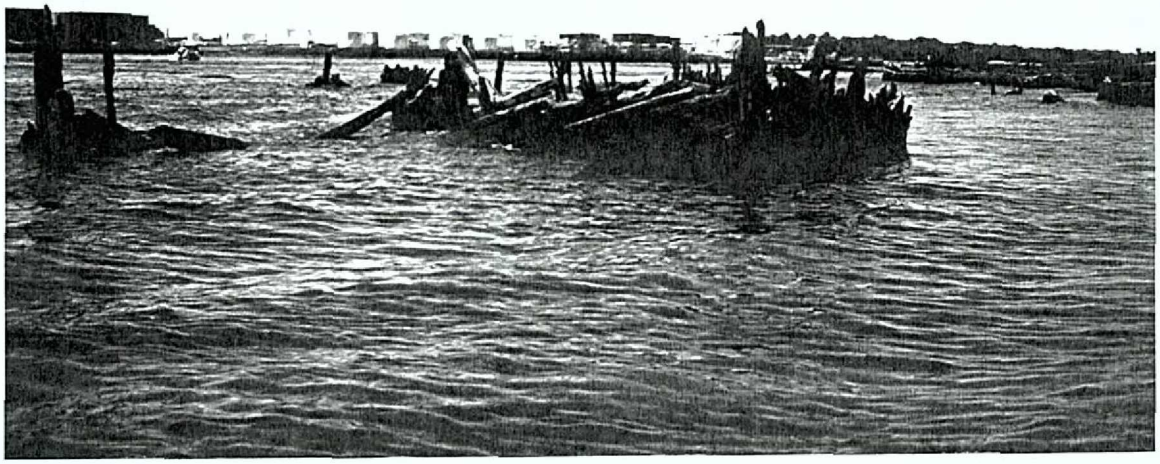

Plate 34. Derelict Vessels V82 (right) and V83 (left) to northwest

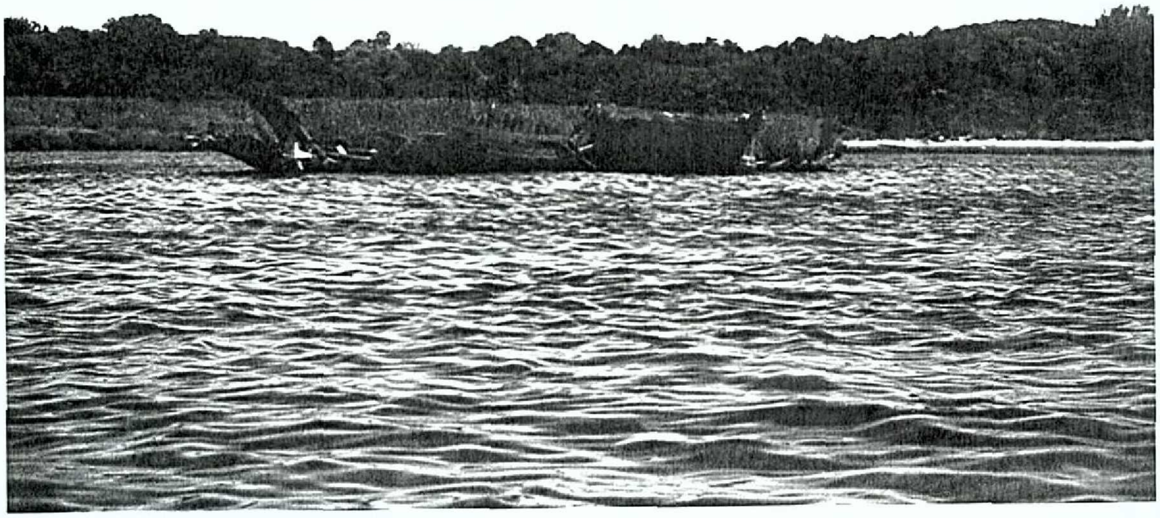

Plate 35. Derelict Vessels V97 (left) and V98 (right) to east

Plate 36. Derelict Vessel V100 to northeast

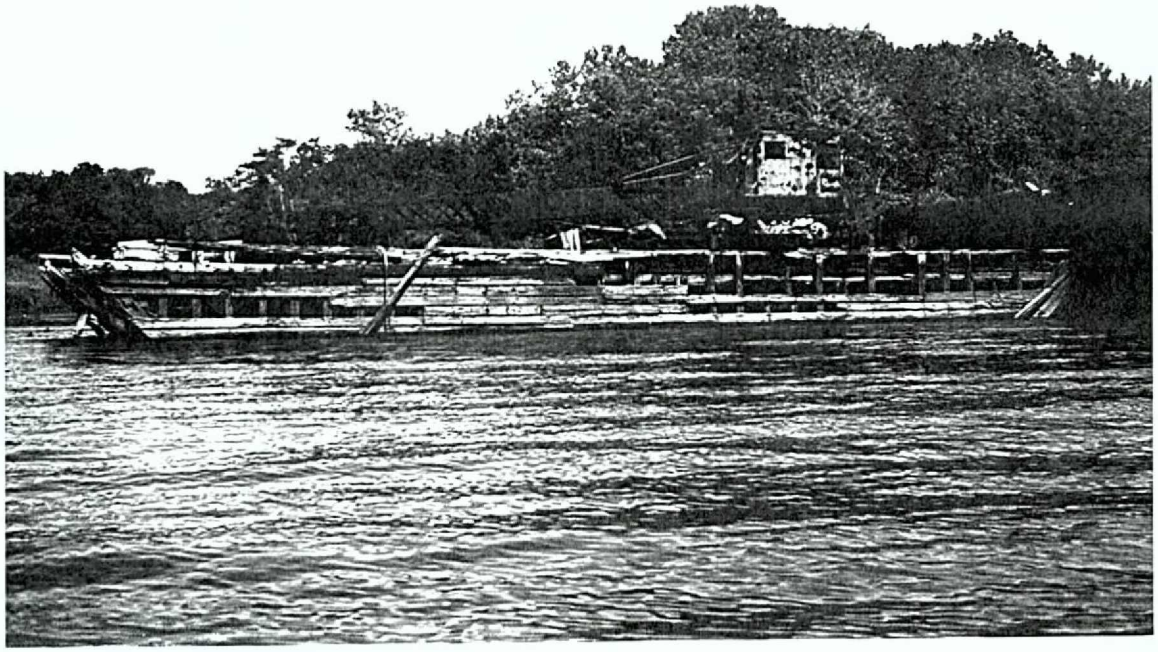

Plate 37. Derelict Vessel V104 to east

Plate 38. Derelict Vessel V106 to northeast

Plate 39. Derelict Vessel V111 to east

Plate 40. Derelict Vessel V134 to northwest

Plate 41. Derelict Vessel V135 to southwest

Plate 42. Derelict Vessel V155 to northwest

Plate 43. Derelict Vessel V160 (right) and V168 (left) to northwest

Plate 44. Derelict Vessel V179, with boiler, to northeast

Plate 45. Derelict Vessel V184 to northeast

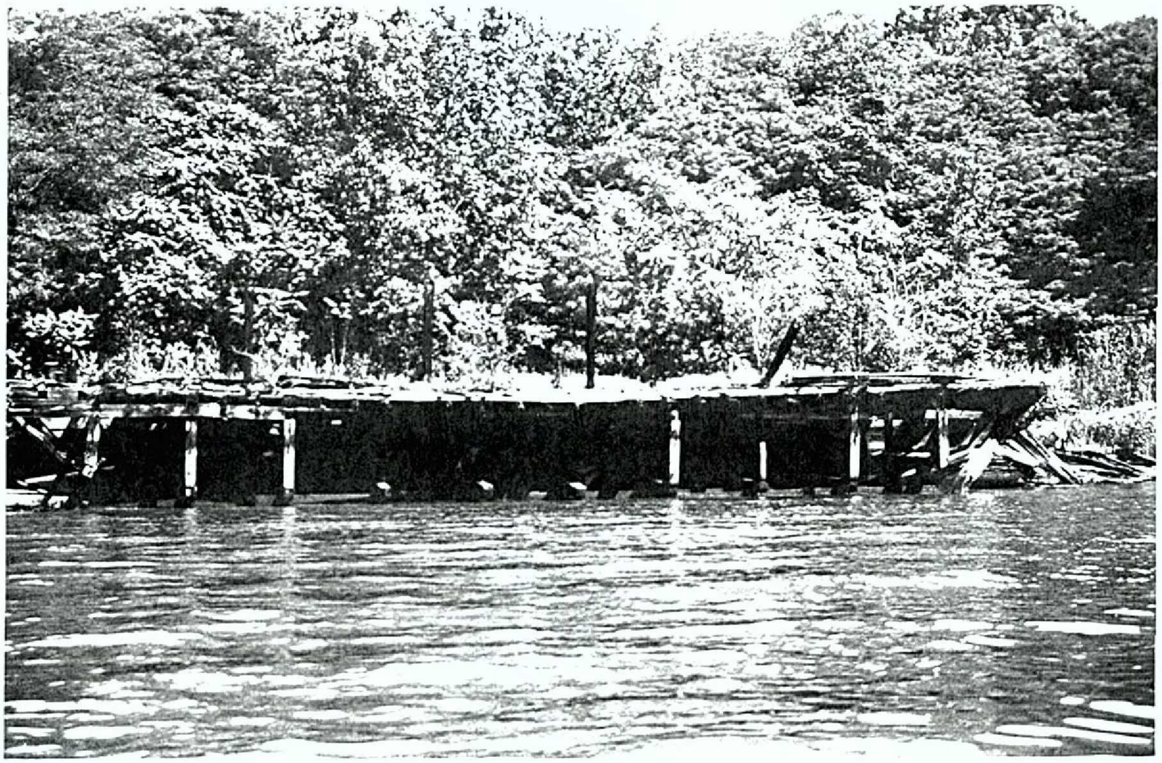

Plate 46. Derelict Vessel V189 to east

Plate 47. Derelict Vessel V193, with chain plates on side, to southeast

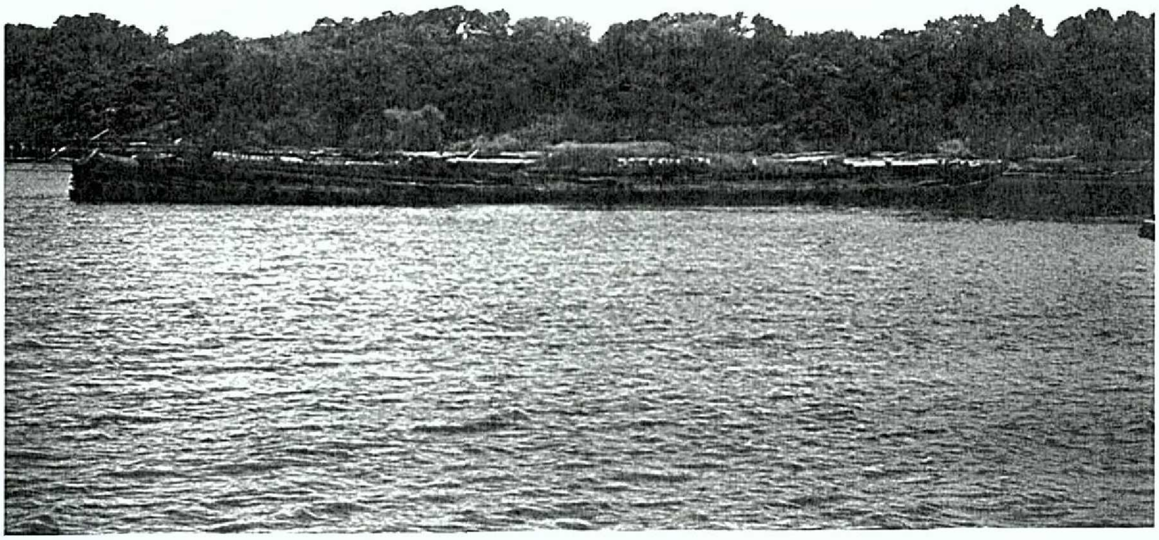

Plate 48. Derelict Vessel V194 to northeast

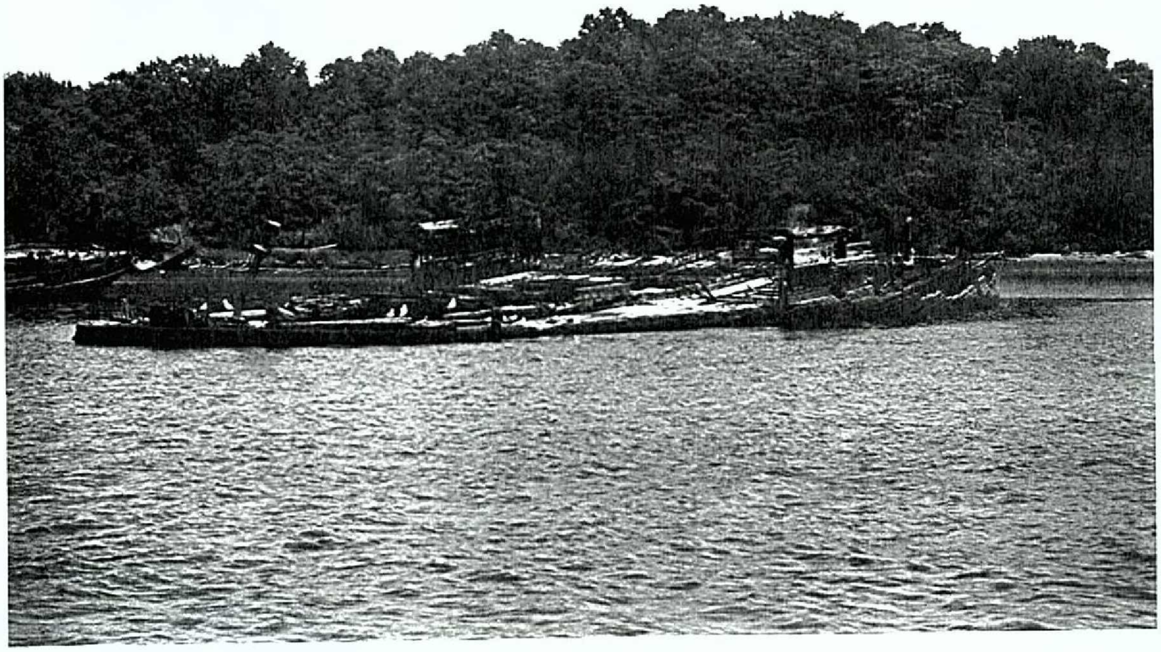

Plate 49. Derelict Vessel V195 to northeast

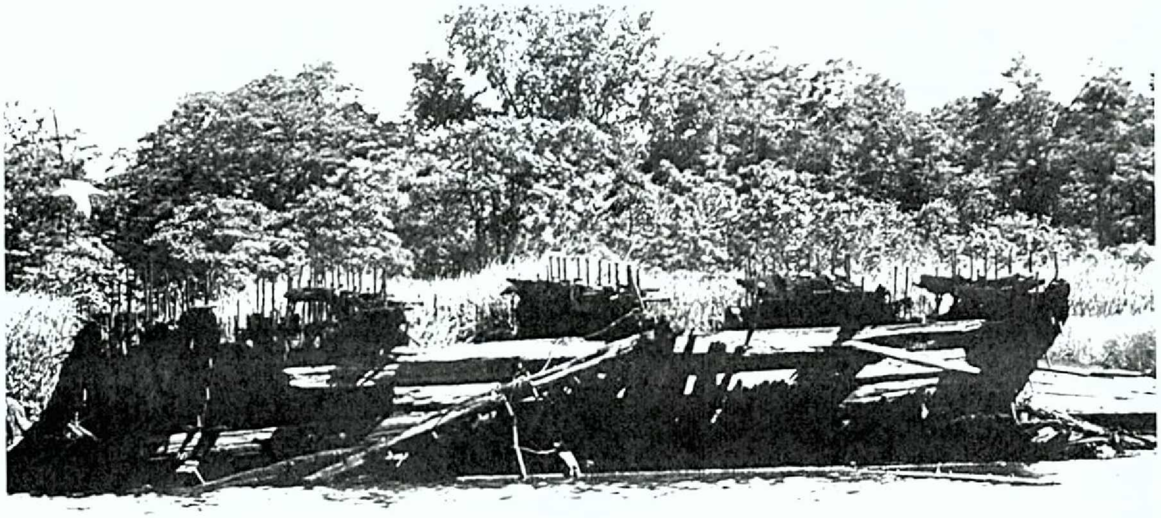

Plate 50. Derelict Vessel V196 to southeast

Plate 51. Derelict Vessel V208, showing framed trusses, to northeast, with Gerald Weinstein

Plate 52. Derelict Vessel V214 to northeast, with Gerald Weinstein

Plate 53. Derelict Vessel (Floating Drydock) V215 to southeast

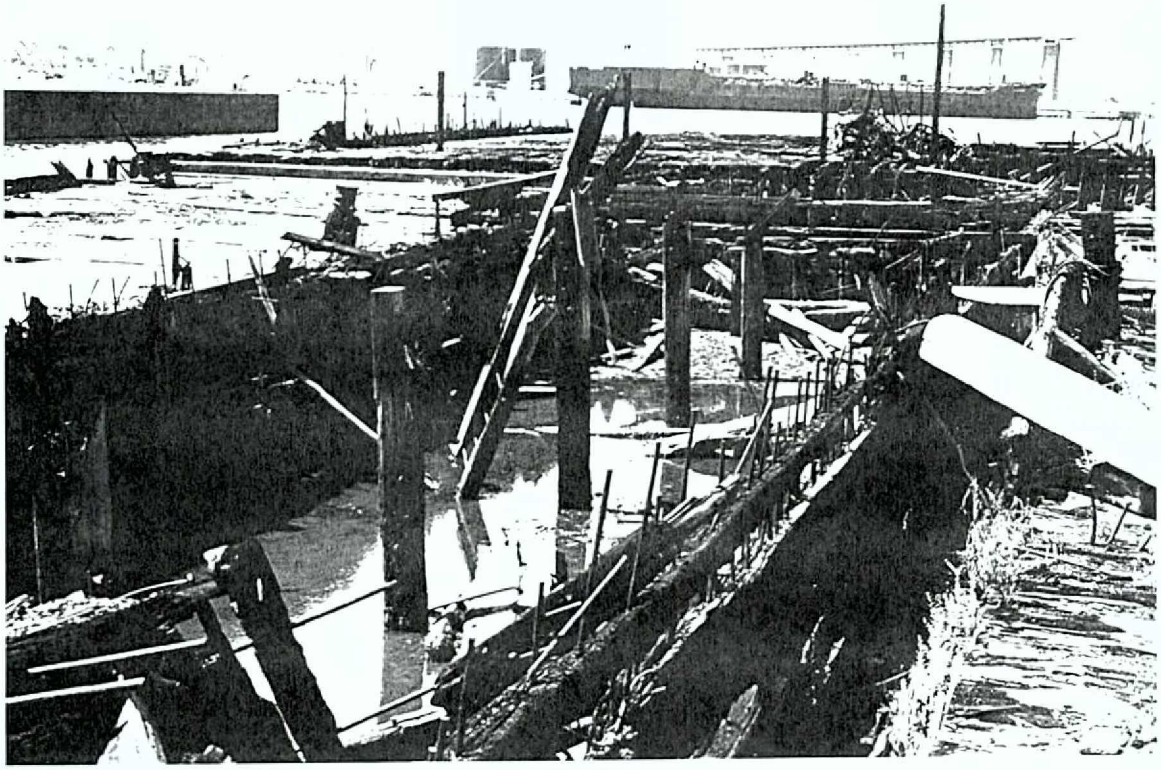

Plate 54. Derelict Vessel V219 to southeast (towards stern)

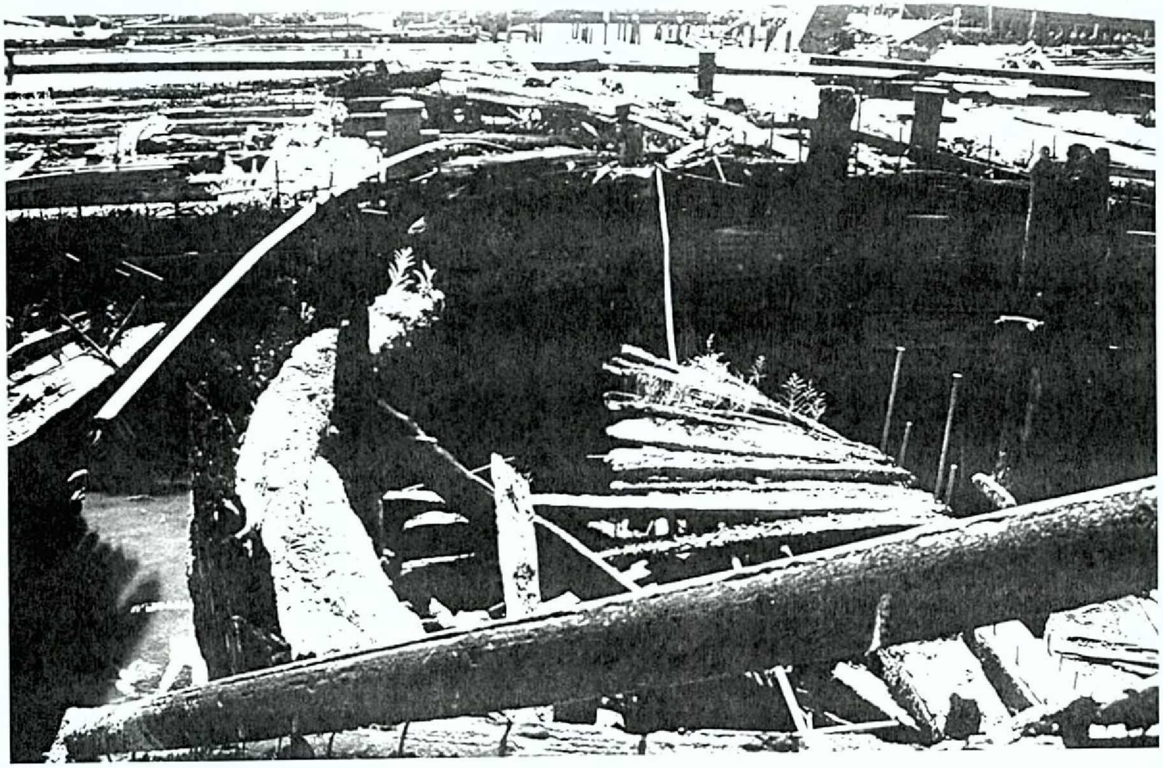

Plate 55. Derelict Vessel V219 to northwest (bow detail)

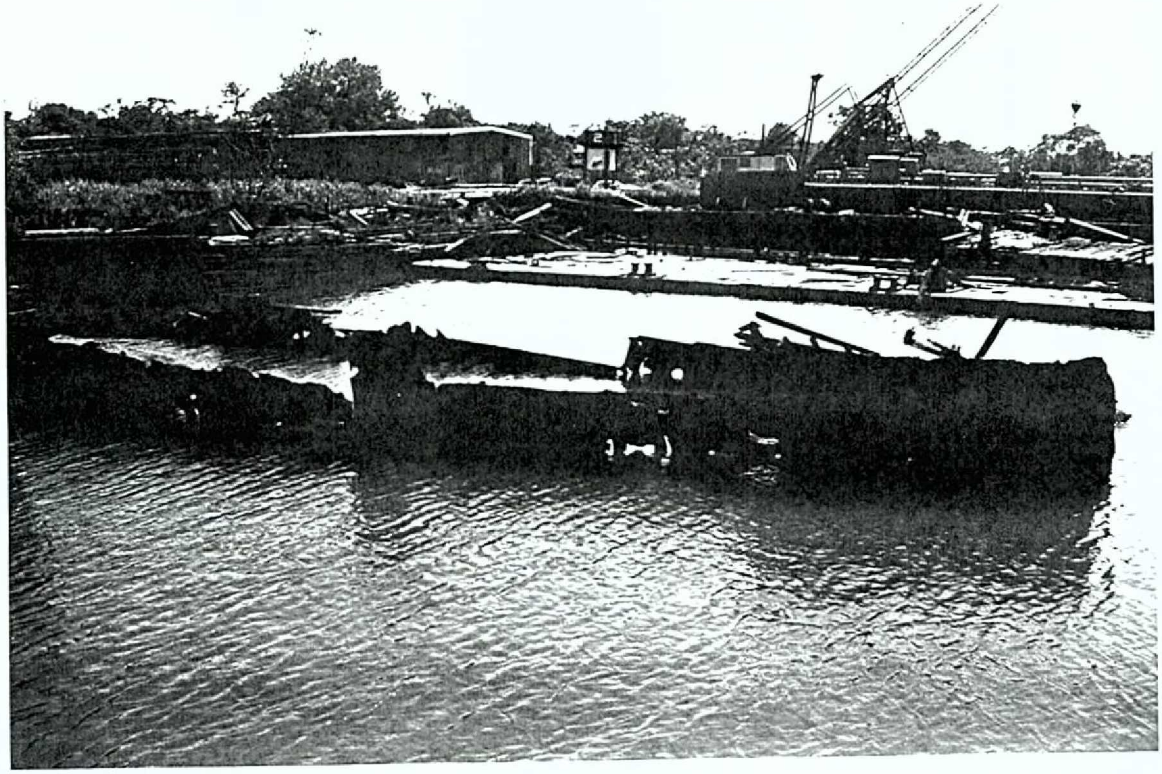

Plate 56. Derelict Vessel V225 to southeast

Plate 57. Derelict Vessel V234 to north

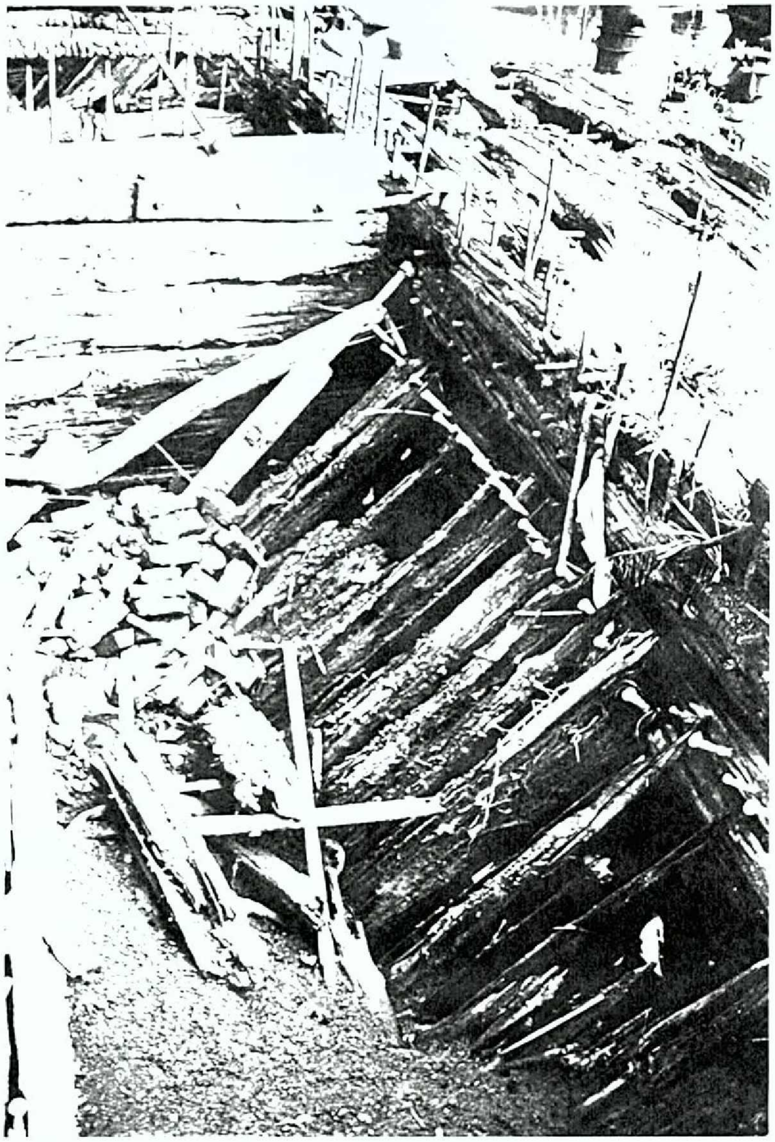

Plate 58. Derelict Vessel V238 to east (hopper detail)

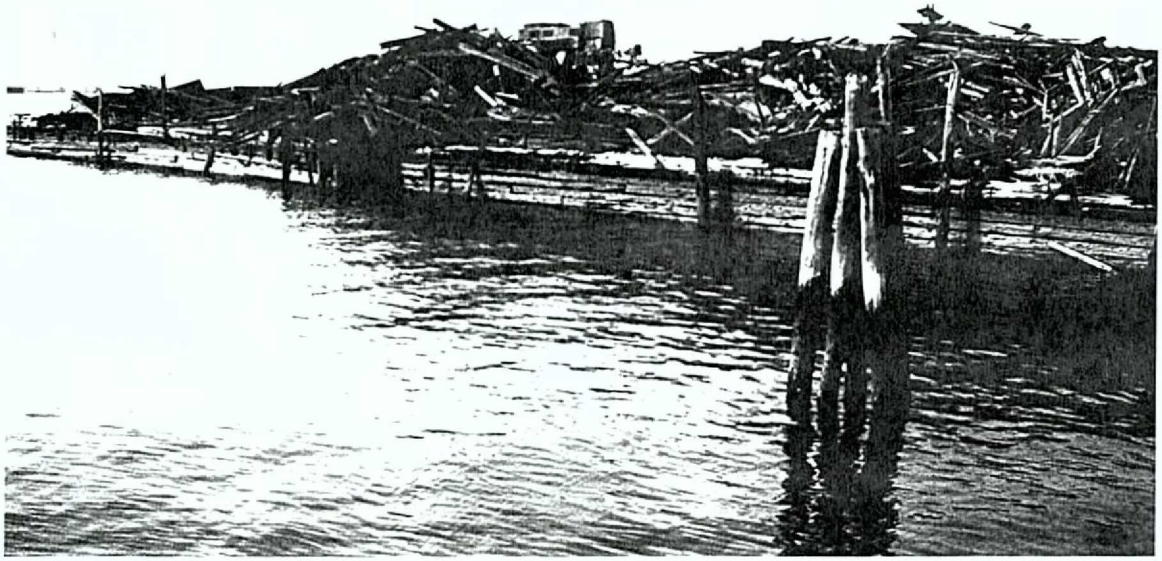

Plate 59. Derelict Vessels V241 (left) and V242 (right) to north

Plate 60. Derelict Vessel V245 to northeast

Plate 61. Derelict Vessel V252 to northeast

Plate 62. Derelict Vessel (Floating Drydock) V254 to southeast

Plate 63. Derelict Vessel V258 to northeast

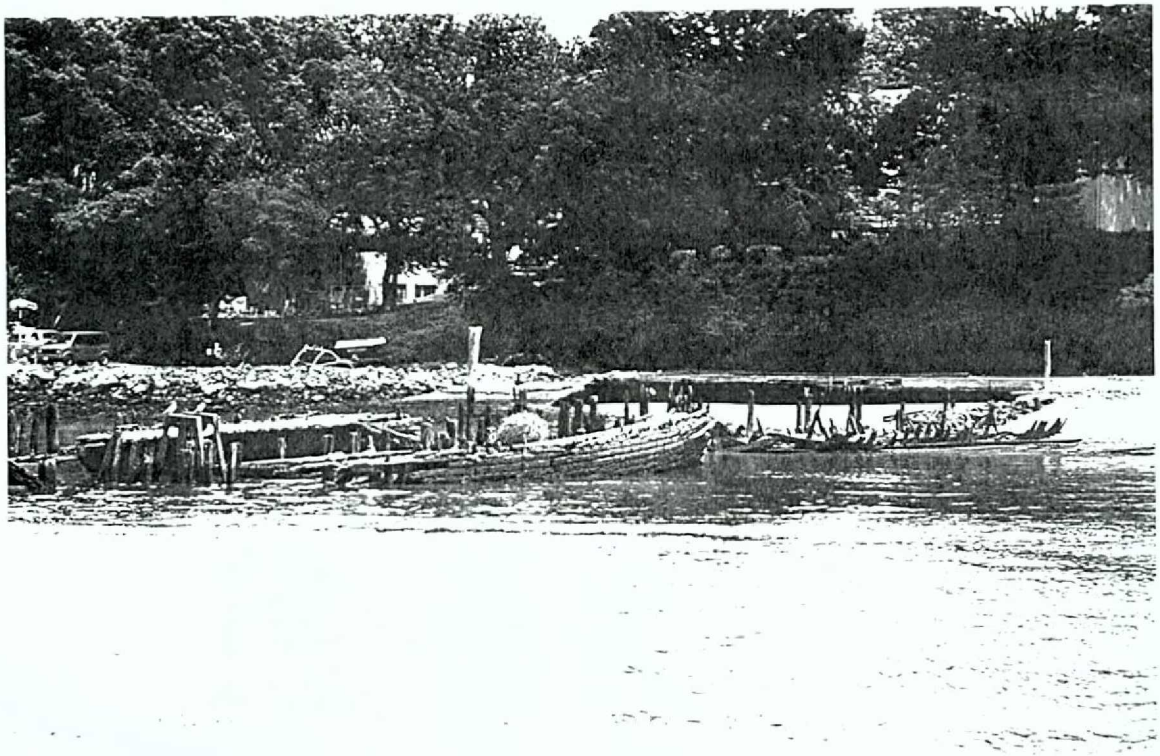

Plate 64. Derelict Vessel V260, with cast metal engine frames at left, to southeast

Plate 65. Derelict Vessel [S143] to northeast

VIII. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

There will be no adverse project effects on waterfront structures.

Proposed project actions will have adverse direct effects on the following potentially significant marine resources, totalling fifty-four individual vessels and six vessel clusters:

two wooden covered harbor barges (V189 and V252);

one probable wooden harbor open deck scows (V104);

two wooden derrick lighter (V120 and V155);

three probable transitional/smaller barge canal boats (V214, V219 and [S143]);

five wooden coastwise hold barges (V106, V134, V135, V160 and V169);

eight wooden screw harbor tugs (V9, V41, V75, V76, V84, V97, V100, and V102);

one steel Army steam tug (V43);

one possible wooden sailing lighter (V77);

two probable wooden steam lighters (V179 and V260);

one medium size steel hull A-frame crane barge (V4);

three hopper barges (V50, V238 and V242);

five wooden car floats (V3, S33, V196, V208 and V258);

three wooden inclined-engine double-ended ferries (V12, V13 and V81);

one wooden beam-engined double-ended ferry (V58);

two steel screw double-ended municipal ferries (V62 and V234);

one possible 4-masted barkentine (V49);

one possible schooner barge conversion from sail (V54);

one schooner barge conversion from steam (V53);

four as-built schooner barges (V52, V82, V83, V194);

two Ferris ocean freighters (V184 and V195);

two Ferris freighter conversions to schooner barge (V72 and V78);

one unidentified sailing vessel (V57);

two wooden floating drydocks (V215 and V254);

Vessel Cluster 2 (S33, V3, V4);

Vessel Cluster 3 (V7-V19, V28, S74A, V34, V35, V40-V47);

Vessel Cluster 4 (V49-V55);

Vessel Cluster 6 (V59-V103, S96);

Vessel Cluster 8 (V130A, V131, V134-V195);

Vessel Cluster 11 (V208-V247, V249-V252).

Horizontal and vertical extents of proposed project actions do not allow for precise determinations of possible project effects on potentially significant Native American archaeological resources. There is a possibility that creation and use of onshore equipment access roads or staging areas could effect potentially significant sites beneath existing surfaces in shoreline areas defined by catalog items S32, S79, S80, S86, S89, S91, S93, S99, 101, S109, S129, S131, S135, S139, and S144, as well as in any presently-undefined, original sandy elevations or knolls within wetland areas. It is likely that proposed project dredging will have no effects on Native American resources, but lack of detailed information on underwater material to be removed makes this last conclusion tentative.

B. Recommendations

1. Waterfront Resources

No additional cultural resource investigations appear necessary for waterfront structure project areas.

2. Marine Resources

Concurrent investigations on the Kill Van Kull, Arthur Kill New York, and Arthur Kill New Jersey reaches included identification and assessment of over 500 derelict vessels. This is the largest single vessel sample ever inventoried as historic resources at one time in the Port of New York. Many of the types identified appear in two or three of the reaches (Raber *et al.* 1994). We recommend evaluating potentially significant resources in the Arthur Kill New York Reach in the context of this sample, as well as the context of previous historic vessel studies in the port. Within this sample, and the larger population of derelict vessels in the port as available for study, we also recommend a framework of investigation and documentation focused on vessel types rather than on individual vessels. Given the varied condition and accessibility of most derelict vessels in the port, understanding vessel construction, function, design variations, and history is rarely possible with study of individual examples. Combining information from multiple examples appears to be a more effective means of documenting once-common, often-vernacular types for which original plans are frequently lacking. In the Arthur Kill New York Reach, where many derelict vessels are harbor craft for which individual histories are often unobtainable, a type-based framework of investigation appears essential.

The National Register eligibility of individual vessels in this reach revolves primarily around two related issues:

> potential to provide information needed to define vessel types and vessel conversion practices more fully (especially for covered barges, deck scows, derrick lighters, Barge Canal boats, coastwise hold barges, wooden sailing lighters, Ferris freighters converted to schooner barges, and the unidentified sailing vessel);
>
> potential to provide information on construction details and design variability for partially-documented vessel types (especially for covered barges, derrick lighters, coastwise hold barges, wooden screw harbor tugs, steel Army steam tugs, wooden steam lighters, A-frame crane barges, hopper barges, wooden car floats, wooden and steel ferries, East Coast barkentines, schooner barges and the steam and sail vessels converted to schooner barges, as-built Ferris freighters, and floating drydocks).

For individual vessels, we recommend additional field, documentary, and informant research to determine resource significance. Field investigations should include sufficient notes and photographs to describe surviving framing and fastening details, with sample measurements as appropriate. Registration numbers should be sought and taken where they survive. Documentary and informant research should include use of federal/state registration data and historic plans or drawings where available, and should compare results on a type-specific basis for all three reaches investigated under this contract. Historic photographs, especially aerial views, may prove important. Determinations of significance should define specific vessel features which contribute to understanding of one or more vessel types.

For vessel clusters, we recommend primarily documentary and informant research to determine significance. Field investigations for individual vessels should suffice to describe present cluster conditions, with limited additional photography showing overall vessel groupings. Cluster significance will hinge on the nature and quality of available information on the firms/individuals responsible for creating the clusters. Historic photographs may also prove important.

Eighteen vessels were not investigated due to insufficient catalog or location data available at the time of our field inspections (V40A, V104A, V107A, V114A, V184B, V197A, V200A, V202A, V203A, V212, V235A, V244A, V244B, V245A, V249A, V249B, V249C and V249D). We recommend inspecting these vessels to assess their significance.

3. Native American Archaeological Resources

To avoid potential effects on terrestrial Native American resources in the areas noted above, we recommend use of rubber-tired construction equipment, and avoidance wherever possible of excavation or stripping to create access road or staging areas. If excavation or stripping appears likely in any of these areas, we recommend sampling affected areas with mechanical excavation or borings to assess the depth and integrity of original soils relative to proposed subsurface disturbance. Machine-assisted subsurface testing to locate possible Native American resources, with appropriate control and screening of excavated material, would be needed if subsurface disturbance appeared likely to penetrate intact, original, post-glacial soil horizons.

We recommend gathering additional information on subaqueous materials in proposed dredging areas to assess the potential for underwater Native American resources. Since this potential appears limited, and since location or recovery of data from such resources would be difficult and expensive, we recommend proceeding carefully from most available to least available data in making this assessment. The primary objective should be identification of potentially undisturbed, outwash or related late-glacial deposits predating lacustrine, fluvial, or marine sediments. A sample of boring logs made for various purposes near the project areas may suffice to identify the likely presence or absence of sensitive material. If such material appears to exist, the likelihood of it including archaeological deposits will depend on the extent of any post-deposition erosion, and to some extent on the proximity of earlier Holocene resources like streams and small wetlands. The use of well-informed marine geologists will be crucial in assessing post-deposition erosion. Reconstructing earlier Holocene environments could prove relatively expensive, and should probably be the last type of assessment investigation made if all other factors point to the possibility for surviving resources.

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Donald Squires	Professor, Department of Marine Sciences, University of Connecticut, Groton, CT 203/445-3466
Vincent Sweeney	Former curator, Staten Island Institute of Arts and Sciences, St. George, NY. 718/727-1135
Angie Vandereedt	Merchant Vessel Enrollment Records, National Archives 202/501-5395
Craig Williams	History Division, New York State Museum, Albany, NY 518/474-5353

APPENDIX: PROJECT UPDATE CORRESPONDENCE

RABER ASSOCIATES
CONSULTANTS IN THE HISTORICAL AND SOCIAL SCIENCES

June 20, 1994

Ms. Nancy Brighton
Environmental Analysis Branch
New York District
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278-0090

RE: Project Update, May 16, 1994 - June 17, 1994
Cultural Resources Investigations, Port of New York and New Jersey
New York District, U.S. Army Corps of Engineers:
Kill Van Kull, Arthur Kill New York and Arthur Kill New Jersey Reaches
DACW51-93-D-0023, Delivery Orders 1, 3, and 5

Dear Ms. Brighton:

This letter summarizes work completed since project initiation on May 16, 1994, and outlines project catalog ambiguities or gaps which require resolution.

Work Completed

1. Aerial Photograph Annotation

As you know, the Corps did not provide project maps for the Arthur Kill, New York Reach. Such maps, normally completed prior to a cultural resource reconnaissance, are essential to our work. I compiled project catalog data on blueprint versions of undated recent aerial photographs (c1990?), comparing the current catalog with information marked on unreproducible aerial photographs by URS Consultants some ten years ago. The results will serve as a working base map. This work was not anticipated in our budget response to the Corps Scope of Work for this reach.

2. Collection of Background Data

We collected all pertinent data in the files of the New York State Historic Preservation Office and the New York State Museum. including prior archaeological/cultural resource reports, site files, survey forms, and National Register nominations. A comparable effort in New Jersey, including historic maps and photographic resources held by the Tidelands Division, is being scheduled.

We collected descriptive and cartographic data on 20th-century waterfront structures compiled in the Corps' Port Series c1919-88 (8 editions). We have begun collating these data in a detailed inventory table, pertinent sections of which will appear in each reach report when supplemented by results of field investigations and inspection of earlier historic maps.

We are collecting and collating information from a wide variety of published sources, including local histories, maps, and annual reports available for some of the waterfront industries. This task will be completed during the next month.

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We initiated contact with some knowledgeable informants on harbor conditions, including Dr. Donald Squires, Prof. of Marine Sciences at the University of Connecticut, to begin assessment of possible offshore project effects on Amerindian resources.

3. Preliminary Field Inspection

Along with Corps and other consultant personnel, we made a preliminary boat inspection of all three reaches on June 10, 1994. During this trip, we took five rolls of 35mm black-and-white photographs, all keyed to 11x17-inch versions of project maps or the annotated aerial photographs discussed above. Many of these photographs will probably suffice as illustrations for some extremely deteriorated shore structures, allowing for more focussed and rapid water-side inspections of vessels and better-preserved structures to be made this summer.

Catalog Issues

I have found discrepancies or missing data in the catalog of derelict vessels for the Arthur Kill New York Reach, relative to recent aerial views and the c1984 URS work. There are three types of problems:

1. 3 vessels in catalog not shown on URS maps, with probable locations apparent from recent aerials and the June 10 boat reconnaissance (V263, V264, V265)
2. 20 vessels in catalog and URS aerials, including 13 listed as floatable, which are not visible in recent aerials and may be gone (V6, V20-27 inclusive, V29-33 inclusive, V36-38 inclusive, V48, V212, V248, V253)
3. 12 vessels on recent aerials, but not in catalog or URS aerials, marked as "NIC" on enclosed copies of sections of annotated recent aerials (1 south of V173, 2 south of V200, 2 south of around V202, and 7 south of around V244 and V249).

We can assume a match between catalog and recent aerials for V263-265 inclusive, but we will need some clarification of problems 2 and 3 above.

Please contact me if you have questions or responses.

Sincerely,

Michael S. Raber

enclosures
xc: D. Yang, F.R. Harris w/o enclosures

RABER ASSOCIATES
CONSULTANTS IN THE HISTORICAL AND SOCIAL SCIENCES

July 25, 1994

Ms. Nancy Brighton
Environmental Analysis Branch
New York District
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278-0090

RE: Project Update, June 17, 1994 - July 24, 1994
Cultural Resources Investigations, Port of New York and New Jersey
New York District, U.S. Army Corps of Engineers:
Kill Van Kull, Arthur Kill New York and Arthur Kill New Jersey Reaches
DACW51-93-D-0023, Delivery Orders 1, 3, and 5

Dear Ms. Brighton:

This letter summarizes work completed on these three reaches since June 17, 1994.

1. Collection of Background Data

We collected all pertinent data in the files of the New Jersey State Historic Preservation Office and the New Jersey State Museum. including prior archaeological/cultural resource reports, site files, survey forms, and National Register nominations. We also collected a fairly large collection of collated published information on Arthur Kill industries from a colleague, which together with other published sources should suffice for all background needed on Arthur Kill New Jersey waterfront structures/complexes.

Inspection of selected historic aerial photographs held by the Tidelands Division, New Jersey Department of Environmental Protection is scheduled for July 27, 1994. The recent imposition of very high charges for photograph searches at Tidelands, charges not included in our original budget, will limit the number of photographic series we can use for reconnaissance purposes.

For the Staten Island reaches, we collected images of all remaining historic maps needed for this project. I gathered a variety of information, written and oral, collected over a long period by Norman Berger, now retired from the New York City Department of Economic Development. I also reviewed descriptive ledger data, held by the New York City Department of Business Services, covering all waterfront permits issued in project areas c1923-1985. Our final documentary research trip for Staten Island is scheduled for August 2, 1994, when we will visit the Staten Island Historical Society and the Staten Island Institute of Arts and Sciences.

Following the August 2 research trip, collection of documentary background material will be essentially complete. Preliminary collation and analysis of these data will continue during August.

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2. Field Investigations

As you know, we made two waterside inspection trips of catalogue items on both sides of the Arthur Kill in the Corps boat *Hudson* on July 21 and 22, 1994. We appreciate your assistance in providing us with this vessel. Together with photographs taken from the Corps boat *Hocking* on June 10, 1994, we now have sufficient photographic coverage of all waterfront structure catalogue items along the Arthur Kill for reconnaissance purposes. We were also able to collect photographic and descriptive data on a number of derelict Arthur Kill vessels from the *Hudson*, in many cases to an extent which will preclude the need for further reconnaissance inspection. We expect the scheduled August 3, 1994 trip on the *Hudson* to accomplish similar purposes for Kill Van Kull catalogue items.

We made one land inspection of most waterfront structures along the Kill Van Kull on June 30, 1994, during which we arranged for access at several points for raft-based vessel inspections as necessary. Land inspection of over 20% of the derelict vessels in the Arthur Kill New York Reach was completed on July 24, 1994. This latter trip also included arrangements for access for any raft launching needed for vessels south of Witte's yard. We will make contact with Witte's for similar arrangements needed for vessels 7-44, Arthur Kill New York.

Based on these trips, we now project approximately seven land- and/or water-based inspection trips will be needed to complete all field research for these three reaches, aside from the August 3 trip on the *Hudson*. Barring any severe weather problems, we foresee completing these inspections by the end of August, and the timely submittal of a letter report in early September summarizing all significant or potentially significant resources.

Please contact me if you have questions.

Sincerely,

Michael S. Raber

enclosures
xc: D. Yang, F.R. Harris

RABER ASSOCIATES
CONSULTANTS IN THE HISTORICAL AND SOCIAL SCIENCES

August 16, 1994

Ms. Nancy Brighton
Environmental Analysis Branch
New York District
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278-0090

RE: Project Update, July 24 - August 16, 1994
Cultural Resources Investigations, Port of New York and New Jersey
New York District, U.S. Army Corps of Engineers:
Kill Van Kull, Arthur Kill New York and Arthur Kill New Jersey Reaches
DACW51-93-D-0023, Delivery Orders 1, 3, and 5

Dear Ms. Brighton:

This letter summarizes work completed on these three reaches since July 25, 1994, and is the third progress report for these investigations. My July 25, 1994 letter neglected to note that this report would precede our September 1994 letter report summarizing investigation results.

1. Collection of Background Data

We collected a variety of written and graphic data at the Staten Island Historical Society and the Staten Island Institute of Arts and Sciences, including historical maps, articles written for these institutions' publications, 1948 aerial photographs, and collations of information on waterfront industries. From the Yale University Geology Library, we collected what appears to be the limited published information available on the geology of the area including these three reaches.

Copies of the last remaining historical maps needed for New Jersey project areas were secured at Rutgers University.

Based on an inventory you prepared of material in the New York District Cultural Resources Library, I identified a number of reports needed for these investigations. These reports, along with a copy of a 1916 Army map of the Arthur Kill in your offices, will be forwarded to me at your earliest convenience.

With the possible exception of publications or reports we may need to review during final analysis and report preparation, I believe we now have all background data needed for these investigations.

2. Field Investigations

Along with you and Corps archaeologist Lynn Rakos, we made detailed waterside inspections of Kill Van Kull Reach project areas on August 2, 1994 from the Corps boat *Hayward* and its whaler launch. This trip completed field inspections of all project structures, and of many derelict vessels. The whaler was extremely effective and probably saved one day of work from land and/or small raft. Thank you for arranging this trip.

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We also completed all field research in the Arthur Kill New York Reach requiring waterside inspection, in three days of work from a motorized raft. I now estimate one day of field research remaining for this reach, to complete land-based vessel inspections, along with one day of work on the Kill Van Kull and two days along the Arthur Kill New Jersey Reach. Weather permitting, we expect to complete this research this month.

3. Data Analysis

We have begun interpreting results of background and field investigations, including assessments of known or potential significance for field-inspected resources, the beginnings of tables collating historical information on project structures, and interpretation of early historic shorelines relative to present shorelines.

As we have discussed, I now anticipate submitting the letter report on or about September 9, 1994. Weather and tidal constraints on field research, and the very large number of derelict vessels in the three reaches, make it unlikely that we can complete sufficient analysis by September 2 to submit the letter report.

Please contact me if you have questions.

Sincerely,

Michael S. Raber

enclosures
xc: D. Yang, F.R. Harris

RABER ASSOCIATES
CONSULTANTS IN THE HISTORICAL AND SOCIAL SCIENCES

September 22, 1994

Ms. Nancy Brighton
Environmental Analysis Branch
New York District
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278-0090

RE: Project Update and Management Summary, August 16 - September 22, 1994
Cultural Resources Investigations, Port of New York and New Jersey
New York District, U.S. Army Corps of Engineers:
Kill Van Kull, Arthur Kill New York and Arthur Kill New Jersey Reaches
DACW51-93-D-0023, Delivery Orders 1, 3, and 5

Dear Ms. Brighton:

All field investigations on this project were completed September 8, 1994. As we have discussed, weather conditions in August delayed this phase of work somewhat.

I enclose a management summary of our results and preliminary conclusions. At present, cultural resource issues which may require future investigation include:

adverse effects on the Smith Street terminal of the Perth Amboy-Tottenville ferry, a National Register property (AKNJ-S180/S181);

removal of a significant transfer bridge at the former Baltimore & Ohio Railroad terminal in St. George (KVK-S8);

removal of a pier at the potentially significant American Smelting and Refining complex in Perth Amboy (AKNJ-S132), which would be an adverse effect if the complex is found to be significant;

removal of 123 potentially significant or significant marine resources (vessels and drydocks) in all three reaches.

The management summary is presented in lieu of the letter report designated as the 4th interim report in the most recent project schedule. Please contact me if you have questions. We appreciate your assistance throughout the data collection phases of this project.

Sincerely,

Michael S. Raber

enclosure
xc: D. Yang, F.R. Harris

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