HUNTER RESEARCH

CULTURAL RESOURCES INVESTIGATIONS
INTERMODAL FERRY
TRANSPORTATION CENTER

CITY OF SOUTH AMBOY
MIDDLESEX COUNTY, NEW JERSEY

Prepared for:

City of South Amboy

Prepared by:

Ian Burrow, Ph.D., RPA, Principal Investigator
Patrick Harshbarger, M.A., Principal Historian

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Hunter Research, Inc. Historical Resource Consultants 120 West State Street, Trenton, NJ 08608-1185 609/695-0122 609/695-0147 Fax
e-mail address: hri@hunterresearch.com www.hunterresearch.com

MANAGEMENT SUMMARY

This report documents the identification, evaluation of significance and both the implemented and proposed treatment of historic properties at the site of the proposed Intermodal Ferry Transportation Center (IFTC), located on the site of the former ferry terminals and rail yard facilities of the Camden and Amboy Railroad (later the Pennsylvania Railroad) in South Amboy, Middlesex County, New Jersey. The facilities form part of the Camden and Amboy Railroad (Main Line) Historic District, which the New Jersey State Historic Preservation Officer has on several occasions, beginning in 1975, determined to be eligible for inclusion in the National Register of Historic Places.

This federally licensed and funded undertaking falls under the provisions of the National Historic Preservation Act of 1966, Section 4(f) of the U.S. Department of Transportation Act of 1966, and the National Environmental Policy Act (NEPA) of 1969, as amended. Consideration of historic properties followed the Section 106 regulatory process set forth in 36 CFR Part 800, coordinated with NEPA and Section 4(f).

Beginning in late 2000, a series of studies were initiated within the defined Area of Potential Effects (APE) for this undertaking. Following an identification study for an Environmental Assessment document produced in accordance with NEPA, Phase I archaeological investigations were carried out in 2001 and 2002 in the areas immediately impacted by a proposed new access road (named Radford Ferry Road to reference the 18th-century ferry at the site) and parking area for a new passenger ferry terminal. In 2002 documentation and evaluations were carried out on the *circa* 1910 Conrail bridge (spanning Main Street and the New Jersey Transit North Jersey Coast Line) and of surviving elements of the late 1930s Pennsylvania Railroad catenary electrification installation. At the same time, a rapid photographic record was made of the two dramatic Pennsylvania Railroad coal-train thawing plants (dated 1911 and 1916) which lay to the south of the APE. Sadly, these remarkable structures have since been destroyed without further record. A Memorandum of Agreement (MOA) was executed in July 2003 in accordance with 36 CFR Part 800.6(c). In 2003 contributions were made to a revised Environmental Impact Assessment document. The MOA contained a five-year "sunset" provision meaning that the agreement expired in July 2008. An amended agreement was executed in December 2009 and governs the current work.

This report, produced in 2015, brings together a summation of cultural resources investigations undertaken from 2000 to 2003, reports on additional investigations undertaken in 2011 and 2012, and fulfills several stipulations of the MOA including Stipulation II for Photographic Documentation, Stipulation III for Field Verification of Pier/Wharf Locations, and Stipulations VI.A for Additional Research and Stipulation VI.B. for Technical Report. It also fulfills Stipulation I for Archaeological Monitoring to the extent that monitoring has been required for site remediation and construction activities to date. Further archaeological monitoring will be required as the IFTC project progresses through final design and construction.

MANAGEMENT SUMMARY (CONTINUED)

With the completion of the design for the first phase of Radford Ferry Road and the award of contracts for construction in 2011, protocols were developed (in accordance with the MOA) for archaeological monitoring of the extensive earthmoving activities required for the new access road. These grading actions were anticipated to impact features from the post-1871 Pennsylvania Railroad period, but to largely avoid the areas of earlier Camden and Amboy rail yard facilities of 1831-1871 which lay just to the north. In conjunction with these operations, the extensive complex of wooden pilings and other structures lying in the intertidal zone were mapped and analyzed and their National Register significance assessed, also per the MOA.

All these tasks were largely completed in 2012, despite some disruption to the schedule caused by Hurricane Sandy. The main effect of the hurricane on the APE was to scour away material from the intertidal zone, exposing many additional features relating to the Camden and Amboy Railroad and Pennsylvania Railroad ferry and freight terminals of *circa* 1831 to *circa* 1900, as well as fragments of the explosives pier of *circa* 1917, destroyed in the massive May 1950 ordnance explosion.

An extended historic context study of the railroad and transportation complex was researched and written per MOA Stipulation VI.A, and is included in this document as Chapter 5. Two major periods of significance were defined: the Camden and Amboy Railroad Period of 1831-1871; and the Pennsylvania Railroad Period of 1871-1965, which was itself subdivided into Coal Docks (1871-1950) and Decline (1950-1970) sub-periods.

The Camden and Amboy Railroad is highly significant in American history because of its role as one of the earliest successful passenger and freight railroads in the country, and indeed in the world. The Liverpool and Manchester line in England is usually considered to be the first railroad to combine all the elements of systematic use of steam-powered locomotives, passenger and freight haulage, and regular schedules, between major centers of population. This railroad opened in September 1830. Almost simultaneously, the Baltimore and Ohio Railroad (chartered as the first American public railroad in the late 1820s) commenced use of locomotives after successful demonstrations by the *Tom Thumb* in August of the same year. The Camden and Amboy Railroad followed soon after, with the locomotive *John Bull* running on a short length of track in November 1831. The line appears to have been intended for use by steam locomotives from the beginning, and by the end of 1832 was operating scheduled trains between Bordentown and South Amboy.

This historic context study has emphasized another aspect of the Camden and Amboy which has received less attention. The South Amboy terminal of 1832 was a very early example of a tidewater railroad terminal, perhaps without parallel in the United States. Making use of an existing steamboat ferry terminal served by regular stagecoaches, the Camden and Amboy essentially developed and refined an existing transportation system across the “waist” of New Jersey. The importance of this branch of the Camden and Amboy declined not

long after the construction of the line from Trenton to New Brunswick in 1839, but it remained significant for freight, and numerous buildings were constructed both near the ferry terminal and at the depot area around the since heavily modified crossing with Main Street.

In 1871 the Pennsylvania Railroad acquired the South Amboy terminal and moved quickly to first expand the existing facility by the addition of a freight terminal and wharf, and then by the construction of two large piers (Westmoreland and Lehigh) to the south for extensive coal-handling operations. By 1920 the Lehigh pier included two huge sheds for thawing entire coal trains, serving, when needed, two toweringly impressive McMyler dumpers for tipping the contents of the trucks into barges. The freight depot and original Camden and Amboy ferry terminal site were abandoned by 1900 and largely dismantled as emphasis was now placed on the coal docks to the south. A T-shaped barge-rack structure was built about 1912 at the former ferry terminal location and this remains a prominent remnant feature.

The Pennsylvania Railroad continued to use the approaches to the former ferry terminal as a shop-yard with sidings, engine sheds and many other facilities. Between 1917 and 1950 there was also one operational pier at this location: the explosives or powder pier. This was the site of two explosions, one in 1923, and a more serious one in 1950 which caused extensive damage to the facilities on the piers to the south and to buildings in the shop-yard. This, together with the increasing decline in the fortunes of the Pennsylvania Railroad, probably hastened the demise of the whole facility. Virtually all railroad activity ceased in 1979, although one track remained which allowed trains to access the New Jersey Coast Line from the former Camden and Amboy lines to the west of the yard area.

Despite the ferry terminal's significant history, coherent physical remains that could contribute to the Camden and Amboy Railroad (Main Line) Historic District are not numerous. In order to evaluate the significance of properties that were identified (either as standing structures or as archaeological remains), a significance grid (Table 7.1) was developed to systematize the process.

With the removal of the thawing houses and of the McMyler dumpers on the Lehigh pier there remain virtually no architectural resources with integrity at or near the site. Exceptions to this are a large light tower, elements of the late 1930s catenary system, some light poles of the Pennsylvania Railroad period and the important concentration of Camden and Amboy sleepers located near the landward end of the former explosives pier. It is strongly urged that all these components be incorporated into the design of the IFTC.

Archaeological investigations and subsequent monitoring undertaken to date showed that foundations of Pennsylvania Railroad components did remain in the area of direct effect from the construction of Radford Ferry Road. Although in some cases very substantial, these chiefly reinforced concrete elements did not meet

integrity or significance standards developed for the project. The only exception to this was the relatively coherent remains of a probable early 20th-century wooden trestle, which was documented partially *in situ* prior to removal.

It is considered that the concentration of pilings and horizontal elements in the area north and south of the timbers of the pier leading to the barge racks are significant because they probably include elements of the pre-1871 Camden and Amboy ferry terminals, and possibly also the preceding steamboat and ferry pier. If these are to be adversely affected by the as-yet-to-be-finalized design of the new ferry terminal a plan for treatment, primarily involving *in-situ* documentation to advanced HABS standards, is recommended in advance and implemented under the MOA, modified as needed.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

page

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

LIST OF PHOTOGRAPHS

LIST OF PHOTOGRAPHS (CONTINUED)

LIST OF PHOTOGRAPHS (CONTINUED)

LIST OF TABLES

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With regard to Hunter Research staff involvement, the project was conducted under the overall direction of Dr. Ian Burrow and over the course of some 15 years involved numerous individuals. Background research was carried out by Ian Burrow, Patrick Harshbarger, Damon Tvaryanas, George Cress, Alison Haley, Nadine Sergejeff, Douglas Scott and James Cox. Archaeological fieldwork and artifact analysis were performed by Ian Burrow, George Cress, Damon Tvaryanas, Benjamin Harris, Jason Uebelacker and Michael Murphy.

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Ian Burrow, Ph.D., RPA
Principal/Vice-President

Chapter 1

INTRODUCTION

A. PROJECT BACKGROUND

This document reports on the identification, evaluation of significance, and treatment of cultural resources within the Area of Potential Effect (APE) of the proposed Intermodal Ferry Transportation Center (IFTC), located on the site of the former ferry terminals and rail yard facilities of the Camden and Amboy Railroad (later the Pennsylvania Railroad) in South Amboy, Middlesex County, New Jersey (Figure 1.1). The construction of the IFTC requires the creation of access to the site across Main Street, construction of an upland access roadway between Main Street, and a new parking lot and ferry terminal building. Adjacent marine improvements include the dredging of the ferry basin, slips and access channel, the building of a breakwater and slips, and installation of a bulkhead.

This federally licensed and funded undertaking falls under the provisions of the National Environmental Policy Act (NEPA) of 1969, as amended, and under Section 4(f) of the 1966 Department of Transportation Act. Procedures for consideration of historic properties followed the regulations at 36 CFR Part 800, coordinated with NEPA and 4(f).

The Camden and Amboy Railroad (Main Line) Historic District, which includes the South Amboy project area, was originally determined eligible for listing in the National Register of Historic Places in a New Jersey State Historic Preservation Officer opinion dated June 26, 1975.

B. SCOPE OF WORK

The following specific tasks were identified under the agreed scope of work:

1. ***Archaeological monitoring of approximately 750 feet of new road construction*** (Radford Ferry Road Phase II). This task included the preparation of a Preconstruction Notice/Monitoring Procedures Document, and observational and documentary monitoring of construction.

2. ***Photographic documentation of the general site area and specific features as specified in the Memorandum of Agreement (MOA).***

3. ***Field verification of historic pier and wharf locations.***

4. ***Design considerations and site design.*** The development of standards, guidelines and approaches to the design of the new facility that will ensure compatibility of new elements with the historic site, and specific proposals for the incorporation of existing historic elements into the new facility and designs for on-site interpretive materials or displays.

5. ***Artifacts.*** All artifacts recovered during the fieldwork and not used for on-site interpretation were to be offered to the New Jersey State Museum, the New Jersey Transportation Museum and other appropriate local or railroad facilities as identified in consultation with the New Jersey Historic Preservation Office.

6. ***Reporting.*** This included additional historical research and the completion of this technical report. This report was also required to include documenta-

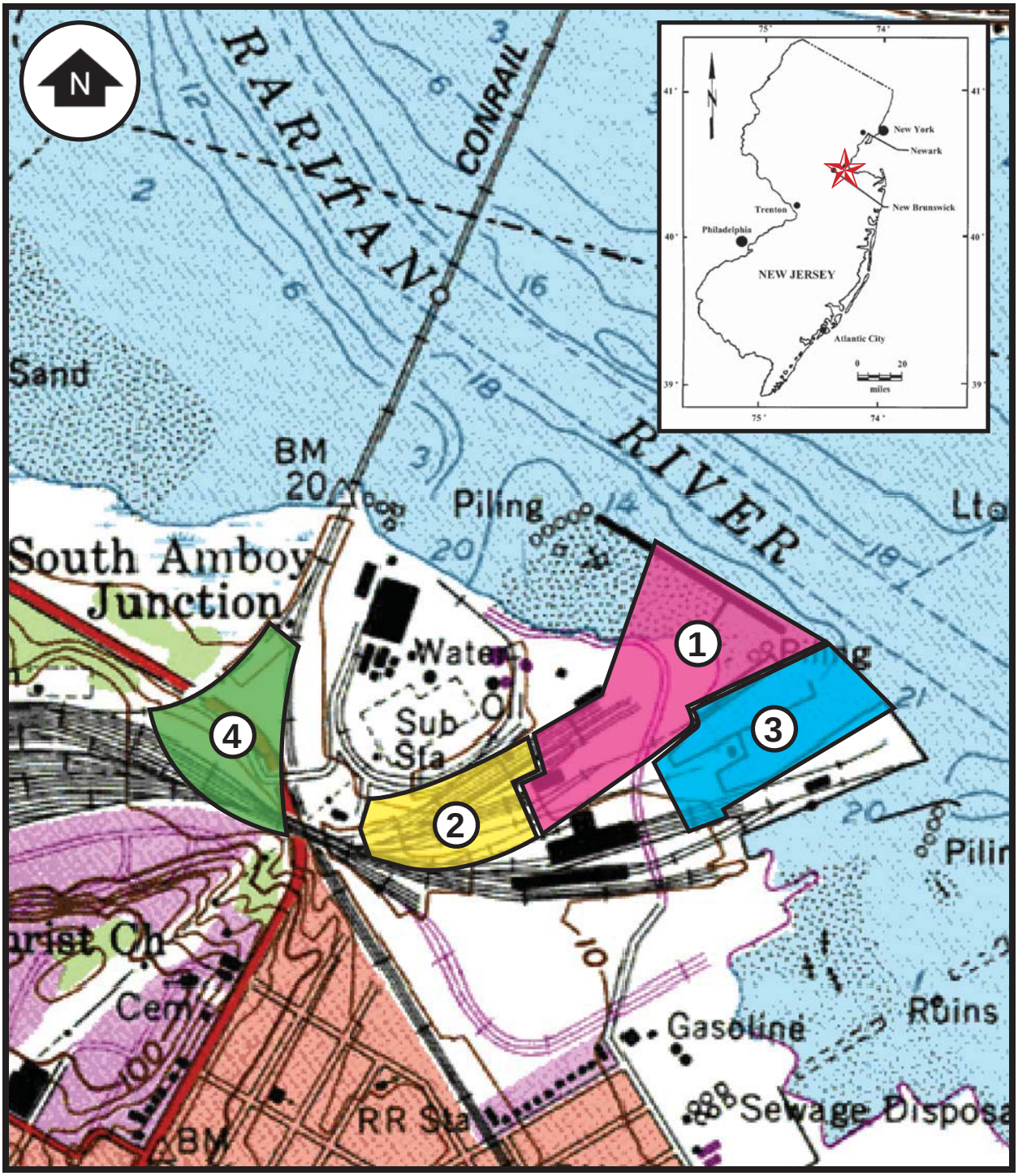


Figure 1.1. Areas of Potential Effect (1 through 4) for Archaeological Properties at the Intermodal Ferry Transportation Center Undertaking plotted onto the USGS South Amboy Quadrangle (1954). Scale: 1 inch = 600 feet approximately. Inset: Project location within the State of New Jersey.

tion of all the cultural resources investigations undertaken since 2000 and thus be a comprehensive record of the multiple tasks undertaken for the project.

7. ***Environmental Oversight.*** Technical environmental oversight was provided during the construction of Radford Ferry Road Phase II and during completion of other tasks set forth in the overall project MOA.

C. AREA OF POTENTIAL EFFECT

Since 2000, this project has undergone several changes and cultural resource investigations have been consequently amended and changed. Figure 1.1 shows the four Areas of Potential Effect that have been broadly used through the project, although some studies were undertaken beyond these boundaries for reasons that are explained at the relevant points in the text.

An Area of Potential Effect (APE) is defined in the regulations implementing the Section 106 review process for the National Historic Preservation Act as "[t]he geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" [36 CFR Part 800.16(d)].

It was found convenient to split the APE into four components that reflect the anticipated sequence of the construction of the IFTC and associated infrastructure developments.

Area 1 (APE #1) comprises the main area of construction of the IFTC facility. It encompasses the site of the 18th-century ferry, the Camden and Amboy Railroad ferry terminal and the freight-handling facilities added by the Pennsylvania Railroad in the 1870s, the early 20th-century barge racks, the site of the explosives or powder pier destroyed in the explosion of 1950, and the sites of several on-shore Camden and Amboy Railroad and Pennsylvania Railroad structures in the eastern portion of the yard.

Area 2 (APE #2) is the western portion of the Camden and Amboy Railroad and Pennsylvania Railroad yard, lying to the east of the early 20th-century concrete Conrail bridge that carried the tracks over Main Street and New Jersey Transit's North Jersey Coast Line.

Area 3 (APE #3) comprises largely offshore areas around the short Westmoreland pier (also referred to as Pier A), and part of the much larger former coal-handling Lehigh pier (Pier B).

Area 4 (APE #4) consists of areas north of the Conrail bridge where major intersection improvements were undertaken to bring traffic onto the new Radford Ferry Road from Main Street.

The majority of the work described in this report lay in Areas 1 and 2.

D. PROJECT CHRONOLOGY

Work commenced on a preliminary Phase IA identification study of the project area in September of 2000. In January 2001 this was expanded into a Phase IB study in order to allow for subsurface testing of some key locations. A first phase of field testing, including a remote sensing survey, was undertaken in June and July 2001. In July and August preliminary mapping and text for the draft Environmental Assessment (EA) document were prepared. Formal Section 106 consultation began in September 2001, and work began on the preparation of an MOA in October. January and February of 2002 saw additional research and historic map studies and photographic documentation of the Conrail bridge. Five additional archaeological tests were undertaken and reported on in May 2002.

In November and December of 2002 the surviving elements of the overhead catenary system were researched, their National Register eligibility evaluated and recommendations made for incorporation of elements into the design for the IFTC.

During 2003 the draft EA document was revised. The final document was published in November of that year and included a five-year "sunset" provision. Cultural resources were covered in Sections 4.11 and 5.2-5.3. In July 2003 the MOA was signed. The version under which the current reporting has taken place was signed in December 2009 (Appendix E). In April 2009 a draft protocol was prepared for the archaeological monitoring of the construction of the IFTC (Appendix A).

In June 2011 Hunter Research was awarded the contract for performing monitoring services during construction of the Radford Ferry Road and for completion of this report and other stipulations of the MOA. Formal Notice to Proceed was received in April 2012. Fieldwork and monitoring were completed by the end of 2012.

Chapter 2

GEOGRAPHICAL SETTING

The South Amboy ferry terminal Area of Potential Effect (APE) lies within the Inner Coastal Plain physiographic province of New Jersey, an area whose subsurface geology comprises various Cretaceous sands, clay and greensand marls hundreds of feet thick. The clay deposits inland to the west have been extensively exploited for brick making since the 19th century. The site itself lies on the south bank of the Raritan River at the point where the river empties into Raritan Bay. On the opposite bank is the City of South Amboy, facing northeast across Raritan Bay to Staten Island opposite the confluence of the Arthur Kill and the Raritan River. South Amboy was the lowest feasible ferry crossing point on the Raritan in the 18th and early 19th centuries, carrying passengers and freight from Trenton and the Lower Delaware Valley to Perth Amboy from whence they could travel to New York by boat.

The APE essentially occupies a promontory extension of the higher ground immediately to the west, where the land rises to over 120 feet northwest of Main Street. This promontory landform provided upland access to the bay for first the ferry and latterly for the Camden and Amboy and Pennsylvania Railroad lines and ferry terminals. The landform has been extensively modified in the last 275 years, but was originally a low sand ridge, possibly a large periglacial dune extending some 4,000 feet east-northeast from the higher ground to the east. A low saddle separated the two landforms, and this has been repeatedly used as a road and rail access point for both east-west and north-south traffic.

In its unaltered state the promontory probably supported a dune-like soil structure and ecosystem, but has been so excessively modified that it is mapped as Urban Land. Lower lying areas to the north and south are poorly drained Psamment soils on tidal or near-tidal flats (Powley 1987).

Chapter 3

PREHISTORIC BACKGROUND

Review of the site files of the New Jersey State Museum and New Jersey Historic Preservation Office found no information on previously identified prehistoric archaeological resources within the immediate project vicinity. Much of the western and northern portions of the easternmost project area appear to have consisted of a low sandy ridge of land extending to the water (see above, Chapter 2). In its unaltered form this ridge would have been attractive to Native American peoples seeking a location from which to exploit the surrounding riverine/estuarine environment, but would have been unappealing as a long-term encampment site, especially in late fall, winter and early spring. It is clear, however, that the greater portion of the project area was heavily modified to develop the railroad facilities in the 19th century, with higher ground surviving only on the northern and southern sides. These areas have, in turn, been heavily modified by railroad and industrial use and it is considered that there is a very limited potential for intact prehistoric archaeological resources that would meet the criteria of eligibility for the National Register of Historic Places. Archaeological investigations of the railroad facilities, summarized below, did not locate any prehistoric artifacts or other evidence.

Chapter 4

THE HISTORY OF THE PROJECT AREA IN THE PRE-RAILROAD PERIOD (TO 1831)

The South Amboy area was part of the Navesink or Monmouth patent granted to settlers from Long Island in 1665, but there is no indication of settlement here at this early date. Middlesex County was formed in 1683, and in 1693 the South Amboy area was included in the newly created Perth Amboy Township (Snyder 1969:173).

A ferry between Perth Amboy and South Amboy was in operation as early as 1684, when it was known as Redford's or Radford's Ferry or the Long Ferry (Louis Berger Group, Inc. 2001:15, 18). Its importance increased after 1706 when a regular wagon service was established between Burlington and South Amboy, and also after about 1729, by which time there was a "stage wagon" service. By 1733 this had become the first regularly scheduled stage line in America (Lane 1939:78-79).

The area was already known as South Amboy during the Revolutionary War (Munn 1976:99), when there were at least some buildings in the general vicinity of Main Street and evidently a substantial pier for the ferry at the northeastern end of the early colonial road known as the Burlington Path (see below, Figure 5.9).

South Amboy Township was set apart from Perth Amboy in 1782, and formally incorporated in 1798. At this time it was an extensive area encompassing much of the eastern portion of Middlesex County south of the Raritan River. The Borough of South Amboy replaced the Township of South Amboy as a municipal entity in 1888 (Snyder 1969:173).

Chapter 5

HISTORIC CONTEXT FOR THE CAMDEN AND AMBOY RAILROAD NATIONAL HISTORIC DISTRICT (1831-1970)

A. OVERVIEW

On November 12, 1891, a group of railway officials and invited guests gathered in Bordentown, New Jersey, arriving by special train from Philadelphia at 3 p.m. The weather for mid-November was warm, the high reaching about 64 degrees, overcast with a trace of rain (Franklin Institute 2012). The occasion was a special ceremony to dedicate a newly completed monument or "memorial shaft" to the Camden and Amboy Railroad (Figure 5.1; Photograph 5.1). Disembarking onto a specially built, temporary, trackside platform, the group was greeted by 53-year-old General William S. Stryker, a Civil War veteran and Adjutant General of the New Jersey National Guard, who presided over the ceremony. Besides his military qualifications, General Stryker was a prominent resident of Trenton, living near the State House, and a man of substantial independent wealth who spent his leisure time pursuing historical research, mostly on topics related to New Jersey's Revolutionary War history. At the time, he was serving as Vice President of the New Jersey Historical Society, rendering him a dignitary fit to represent the historical interests of the State (Honeyman 1900:346-7; *New York Times* October 30, 1900).

General Stryker welcomed the guests to New Jersey and offered a few introductory comments, no doubt noting the importance of the calendar date, carefully chosen to mark 60 years to the day in 1831 when the English-built locomotive *John Bull* had pulled the first steam passenger train in New Jersey over somewhat less than a mile of track starting at the very spot marked by the new monument. The stone memorial shaft also held a certain other geographically derived importance, located as it was about midway between Philadelphia and New York City, an overland route that since colonial times had been one of the most heavily traveled on the North American continent. This section of track, though short, was the first on the Camden and Amboy Railroad's 61.28-mile-long main line between Camden, on the Delaware River opposite Philadelphia, and South Amboy on the Raritan Bay, about 20 miles by ferry from Manhattan (Figure 5.2). The rail line from Bordentown north to South Amboy was completed in December 1832, one year after the *John Bull's* inaugural trip, and the line from Bordentown south to Camden was completed about two years after that in 1834. The railroad, which was immediately popular with the traveling public, carrying more than 100,000 passengers during its first full year of operation in 1833, was extended with a branch line from Bordentown to Trenton in 1837 and from Trenton to New Brunswick in 1839. The Trenton-New Brunswick section eventually came to carry the bulk of through passengers between Philadelphia and New York City due to its direct connections to the Philadelphia and Trenton Railroad to the south, completed in 1837, and the New Jersey Railroad to the north, completed in 1839, the three together forming a nearly continuous all-rail route, which remains in operation today as Amtrak's Northeast Corridor. The monument thus marked the nucleus from which the region's dominant passenger rail system grew (Watkins 1891:95-100; Cunningham 1997:43).

General Stryker was followed to the podium by Joseph T. Richards (Photograph 5.2), Chief Engineer of Maintenance of Way of the Pennsylvania Railroad, under whose charge the stone monument was designed and built. Richards was a lifetime railroad man, having joined the Pennsylvania Railroad as a rodman on a survey team in Altoona, Pennsylvania in 1869 and worked his way up through the ranks of the railroad's

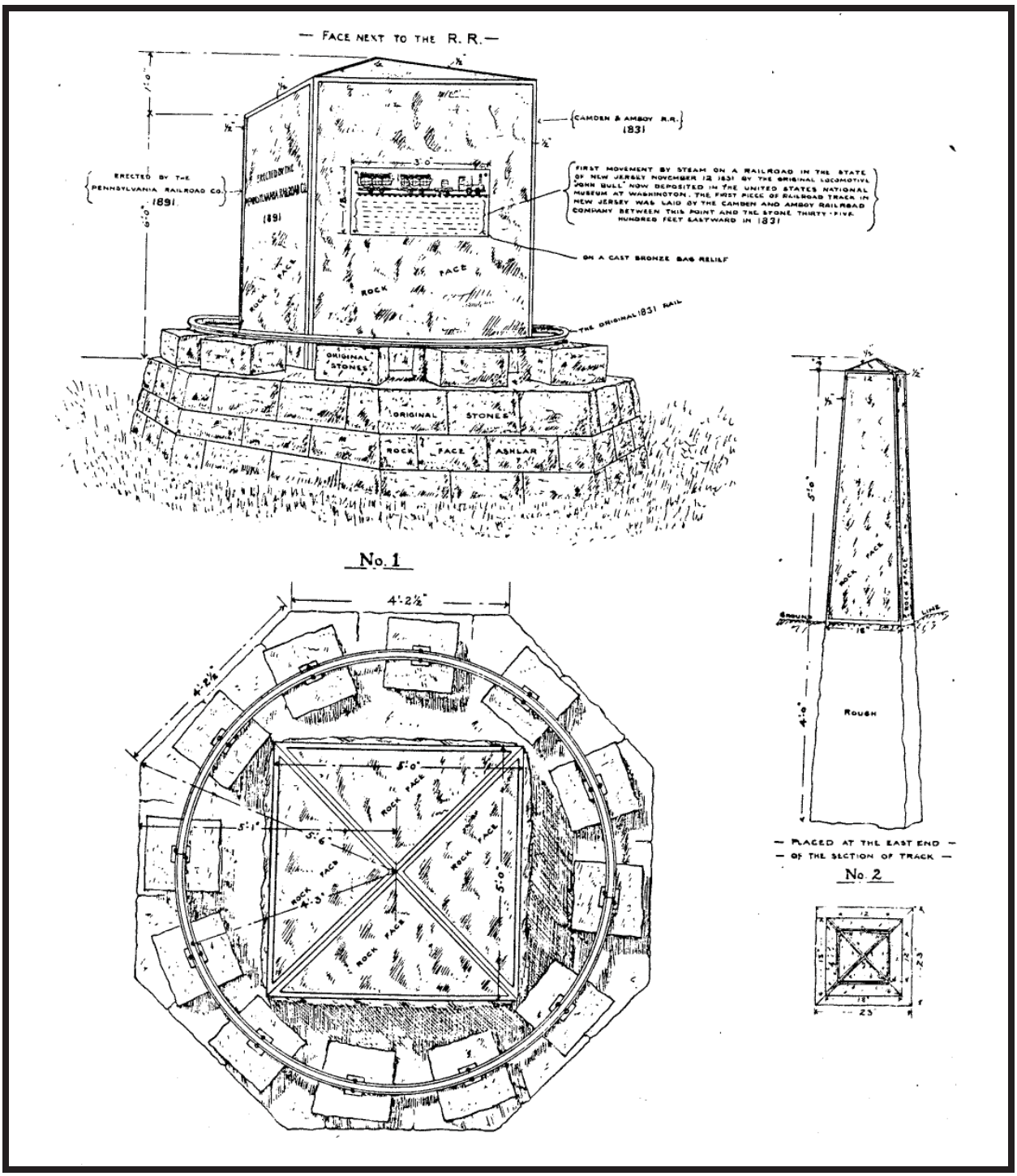


Figure 5.1. Camden and Amboy Railroad Monument at Bordentown, New Jersey, erected 1891. Note the use of stone sleepers and iron rails recovered from the original roadbed (Source: Watkins 1891).

Photograph 5.1. Camden and Amboy Railroad Monument, Bordentown, New Jersey (Photographer Patrick Harshbarger, 2012) [HRI Neg. #11027/D6:051].

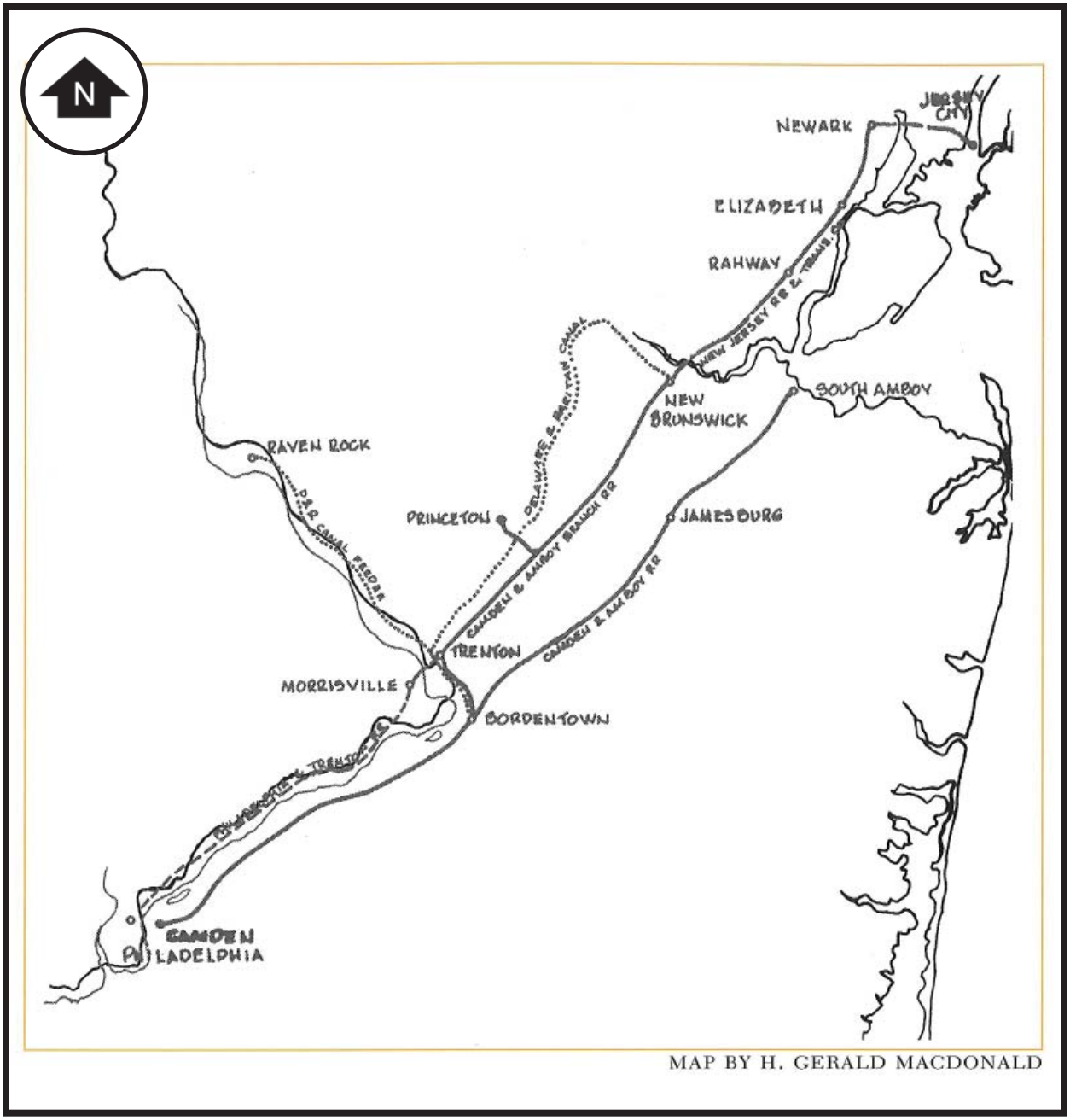


Figure 5.2. Camden and Amboy Railroad, *circa* 1839. The railroad's first section, completed in 1832, was between Bordentown and South Amboy. The second section, competed in 1834, was between Camden and Bordentown. A more logical all-rail route lay between Trenton and Jersey City, so a branch was built from Bordentown to Trenton in 1837 and extended from Trenton to New Brunswick in 1839. The New Jersey Railroad, a separately chartered company that would not be merged with the Camden and Amboy until 1867, completed the route between New Brunswick and Jersey City. Also shown are the route of the Delaware and Raritan Canal, operated with the Camden and Amboy Railroad as the Joint Companies, and the Philadelphia and Trenton Railroad, which offered service between those two cities and was operated by the Camden and Amboy Railroad beginning in 1836 (Source: Cunningham 1997).

Photograph 5.2. Joseph T. Richards, Chief Engineer of Maintenance of Way of the Pennsylvania Railroad. *Circa* 1915 (Source: Pennsylvania Railroad System 1915).

engineering corps, including a 16-year stint from 1877 to 1893 as the Assistant Chief Engineer of the New Jersey Division, which included the Camden and Amboy Railroad. Richards was promoted to Chief Engineer of Maintenance of Way in 1893, a position he held until retiring in 1915 (Pennsylvania Railroad System 1915:5). Richards offered some brief remarks describing the seven-foot-high, five-foot-square monument's construction. Unusually, the monument was built from salvaged materials – white stone "sleeper" blocks, iron rails and iron spikes recovered from the Camden and Amboy Railroad's original 1831 line. The inscribed tablet on the monument's central stone shaft contained the following description in raised letters:

> THE FIRST MOVEMENT BY STEAM ON A RAILROAD IN THE STATE OF NEW JERSEY, NOVEMBER 12, 1831, BY THE ORIGINAL LOCOMOTIVE "JOHN BULL," NOW DEPOSITED IN THE UNITED STATES NATIONAL MUSEUM IN WASHINGTON. THE FIRST PIECE OF RAILROAD TRACK IN NEW JERSEY WAS LAID BY THE CAMDEN AND AMBOY RAILROAD COMPANY BETWEEN THIS POINT AND THE STONE THIRTY-FIVE HUNDRED FEET EASTWARD, IN 1831.

Richards then formally transferred the monument on behalf of the Pennsylvania Railroad to F. Wolcott Jackson, General Superintendent of the United Railroads of New Jersey Division of the Pennsylvania Railroad, of which the Camden and Amboy Railroad was a subsidiary. Jackson, a resident of Newark, represented one of the prominent New Jersey families with a long association with the Camden and Amboy Railroad. He was the son of former New Jersey Speaker of the House John P. Jackson, who was one of the Camden and Amboy Railroad's early political backers and the company's first corporate secretary from 1831 to 1849. He was General Superintendent of the Railroad from 1849 to 1861 before being succeeded by his son (Shaw 1884:195; Watkins 1891:92-93). This symbolic transfer of the monument, legally unnecessary from a point of ownership since the United Railroads were a subsidiary of the Pennsylvania Railroad, reflected the corporate history of the Camden and Amboy Railroad and its deep intertwining with prominent New Jersey families and the state's history of business and politics. The Camden and Amboy Railroad, shortly after receiving its state charter in 1830, had become joined with the Delaware and Raritan Canal as the "Joint Companies," striking a great compromise between rival railroad and canal factions, and prominent families like the Stevens of Hoboken and the Stocktons of Princeton, who were seeking control of the prime route across the waist of New Jersey between New York City and Philadelphia. By legislative authority, the Joint Companies held a 35-year monopoly over the New York-Philadelphia route, and over the course of the next three and a half decades the financial returns not only exceeded the expectations of the stockholders, which included the State of New Jersey, but also supported the Camden and Amboy's construction, acquisition or control of more than a half dozen connecting short lines. The directors and major stockholders of the Joint Companies became so influential in state politics, due both to the tariffs paid to the State treasury and the backing of candidates favorable to the railroad's interests, that some political opponents acerbically dubbed New Jersey the "State of Camden and Amboy" (Lane 1939:284-87; Reilly 1951).

In the words of New Jersey transportation historian Wheaton J. Lane, "[t]he history of the Camden and Amboy Railroad was one of financial success from the beginning" (1939:286), but the politics were rancorous because of the power that wealth generated and the belief, among many, that it rested on an ill-founded monopoly. The 35-year monopoly came to an end in 1866, per the terms of the original charter, but in 1867, the Joint Companies and the New Jersey Railroad, which was in the best position

to challenge with construction of a competing parallel line, merged as the United New Jersey Railroad and Canal Company, bringing to an end all speculation that the termination might result in competition, whether that was healthy completion in the view of anti-monopoly forces or financially ruinous competition in the view of pro-monopoly forces. Four years later in 1871, the United New Jersey Railroads were leased to the Pennsylvania Railroad, largely ending the era of the Joint Companies' pervasive influence on state politics (Reilly 1951:215-232). Thus in 1871, the Camden and Amboy Railroad's lines became the Philadelphia to New York City link in the Pennsylvania Railroad's empire stretching westward from Philadelphia through Pittsburgh and from there on to Chicago and St. Louis (Figure 5.3). The leasing of the Camden and Amboy to the Pennsylvania shifted control of the Philadelphia-New York City rail corridor to the Pennsylvania Railroad's Philadelphia headquarters, and over a short period the Camden and Amboy became less of an independent New Jersey entity and more of an operating division of a consolidated rail system. The Pennsylvania Railroad's lease for a term of 999 years offered generous terms to the Camden and Amboy's stockholders, guaranteeing them a ten percent dividend on their capital stock, which amounted to over 19 million dollars (Lane 1939:319).

In 1891, 20 years after the signing of the historic lease, the formal transfer of the Bordentown stone monument from the Pennsylvania Railroad to the United Railroads of New Jersey thus symbolically represented the parent company offering homage to the historical accomplishments of its oldest in-house corporate ancestor. At the same time, one might suppose that this act did not give quite the weight to the Camden and Amboy Railroad's accomplishments as the Pennsylvania Railroad might to its own direct lineage descending from the railways that made up the "Main Line" between Philadelphia and Pittsburgh, itself a complex history of railroad and canal engineering that took place from 1832 to 1846. The Pennsylvania Railroad's history had interesting parallels with the Camden and Amboy Railroad, including an influential role in Keystone State politics. In all though, the monument fit comfortably with the Pennsylvania Railroad's still then-developing narrative of its own complex history of growth through construction and acquisition. By 1891, the Pennsylvania Railroad was operating lines stretching from New York City to Chicago and St. Louis, and all major points in between, carrying by some estimates an astounding 30 to 40% of the nation's rail-borne commerce while all the time making profits of from five to ten percent, outperforming on a regular basis its nearest regional rivals the Baltimore & Ohio Railroad and the New York Central. In 1916, the Pennsylvania Railroad would begin calling itself, with no small amount of well-earned arrogance, "The Standard Railroad of the World," meaning that it set the technical and business organization standards to which the rest of the world's railroads aspired. In many ways, the dedication of the monument in 1891 represented a brief respite of historic reflection during the growth of one of America's mightiest corporate enterprises. The Camden and Amboy Railroad's accomplishments were no small part of this railroad empire's heritage (Burgess and Kennedy 1949; Drury 1992:251-59).

Capping the dedication ceremony in Bordentown was a keynote address given by 39-year-old J. Elfreth Watkins (Photograph 5.3), Curator of the Transportation Department of the Smithsonian Institution. Some 18 years earlier in 1873, Watkins had been a journeyman civil engineer when he lost his leg in a railroad accident on the Camden and Amboy Railroad. His maiming was representative of an all too common occurrence, inflicted on workers and passengers alike, in the early days of American railroading. Unable to continue with his engineering duties, the Pennsylvania Railroad found employment for Watkins as a clerk, and in 1880 assigned him to preparing the *John Bull* locomotive for exhibit in the Smithsonian's

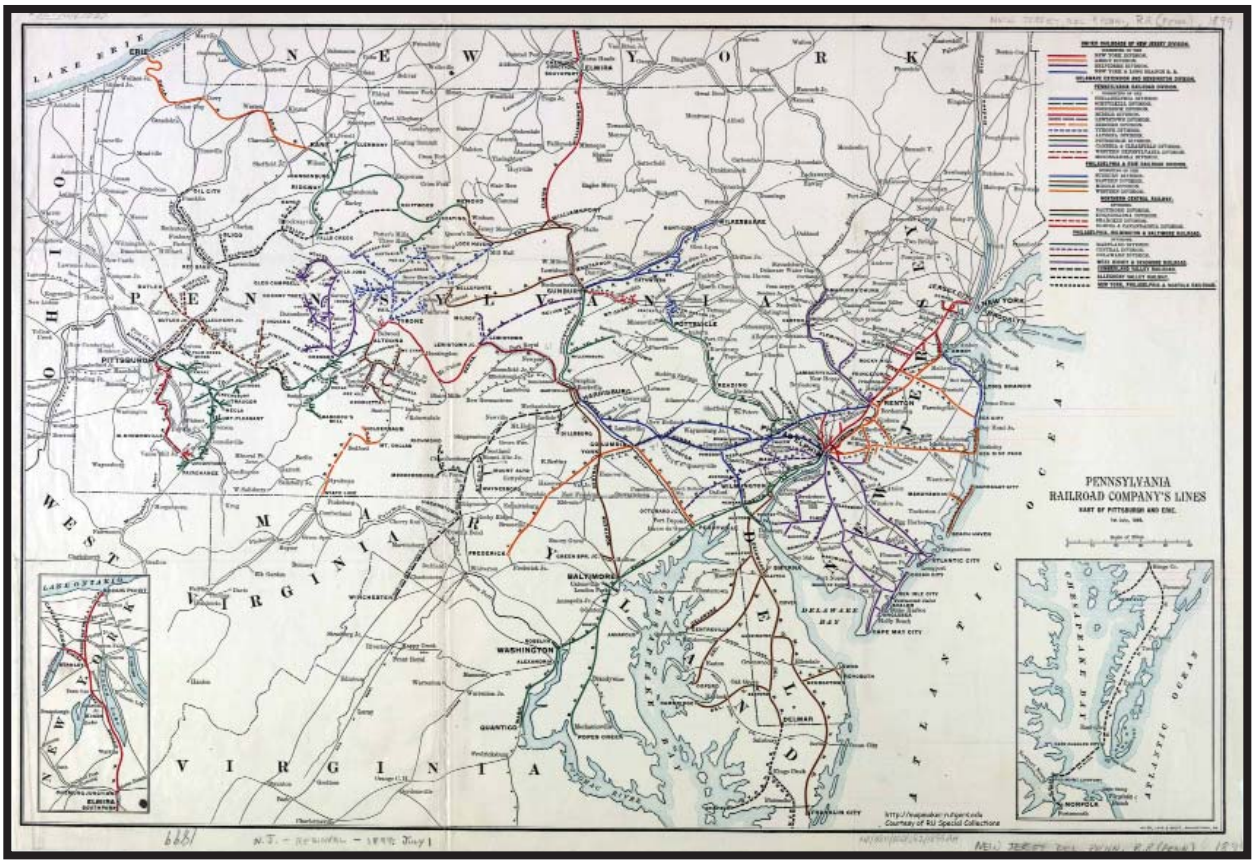


Figure 5.3. Pennsylvania Railroad Company's Lines East of Pittsburgh and Erie. 1899 (Source: Rutgers University Special Collections).

Photograph 5.3. John Elfreth Watkins, Curator of Transportation, Smithsonian Institution. *Circa* 1900 (Source: Watkins 1900).

new Arts and Industries Building in Washington, D.C. (Photograph 5.4) (The *John Bull* is an 0-4-0 locomotive that was built in 1830 in Newcastle, England by the renowned British engineer John Stephenson. The Smithsonian returned the *John Bull* to operating order in 1980 on its 150th anniversary, making it the oldest surviving operable locomotive and self-propelled vehicle in the world. It remains on exhibit at the National Museum of American History to this day.) In 1885, Watkins transitioned into a full-time curatorial position; researching the history of the Camden and Amboy Railroad and keeping the *John Bull* in operating condition became the centerpieces of Watkins' life work until he passed away at the age of 51 in 1903. Today, Watkins has achieved a small level of renown among prognosticators based on his contributions to an article entitled "What May Happen in the Next Hundred Years," published in *Ladies Home Journal* in December 1900. In this article, he quite accurately predicted technological advances such as the ability to "telegraph" photographs from any distance and trains topping speeds of 120 mph. The article was widely republished and distributed across the Internet in 2000 (Watkins 1900).

Watkins was the force behind the construction of the Bordentown monument, first having suggested and sought its approval from his former co-workers at the Pennsylvania Railroad. His presence at the ceremony as keynote speaker and as a representative of the nation's museum gave the ceremony the imprimatur of broad historical importance, although most of those attending the ceremony had such close ties to the Pennsylvania Railroad that it probably felt more like a business outing than an important national event. The ceremony was covered by reporters from local and Philadelphia newspapers, as well as railroad industry trade journals (Watkins 1891:94-102). On that warm overcast November day in 1891, Watkins spoke at considerable length on the history of the Camden and Amboy Railroad. He reminded everyone of the excitement that filled the air that same calendar day 60 years ago in 1831 when the management of the Camden and Amboy Railroad invited members of the New Jersey Legislature to Bordentown to examine the *John Bull* and ride in the train of two cars that were patterned after stagecoaches (Figure 5.4; Photograph 5.5). Many of the New Jersey lawmakers, never having seen a steam locomotive, were dubious or even frightened, the analogy today might be like taking one's first rollercoaster ride but without the proven assurance by endless repetition that the coaster returned to the same spot safely every time. Eventually, however, they rode the train, and passed back and forth over the 3,500 feet of track many times without accident or delay, achieving maximum speeds of 15 miles per hour. Relieved, the Camden and Amboy Railroad's senior management, represented by Robert L. and Edwin A. Stevens, declared the first movement of passengers by steam train in New Jersey a resounding success. Following this, they adjourned to a Bordentown hotel for a banquet sponsored by the railroad company.

Watkins' address emphasized the technical and business organization contributions of the Stevens family members (Figure 5.5) who had promoted the Camden and Amboy Railroad in its infancy, subscribed to a large portion of its stock in 1830 to get the railroad off the ground, and managed its operations for much of its first 35 years. The *pater familias* John Stevens (1749-1838) of Hoboken, New Jersey, was remembered as a great American engineer having the foresight and courage to promote travel by steamboat and railroad in the early days of the Republic. Watkins noted that many skeptics in those days had scoffed at the idea that motive steam power could ever replace traditional modes of transportation; Stevens had not only proved prescient but paid out of his own pocket for practical experiments, demonstration and patents that showed that it was possible. Robert Livingston Stevens (1787-1856) built upon his father's work, early in life earning a reputation for his technical aptitude with steamboats. Robert's business acumen was

Photograph 5.4. *John Bull* steam locomotive on display in the Smithsonian Institution. Photographed by Theodor Horydczak, *circa* 1923-1959 (Source: Library of Congress).

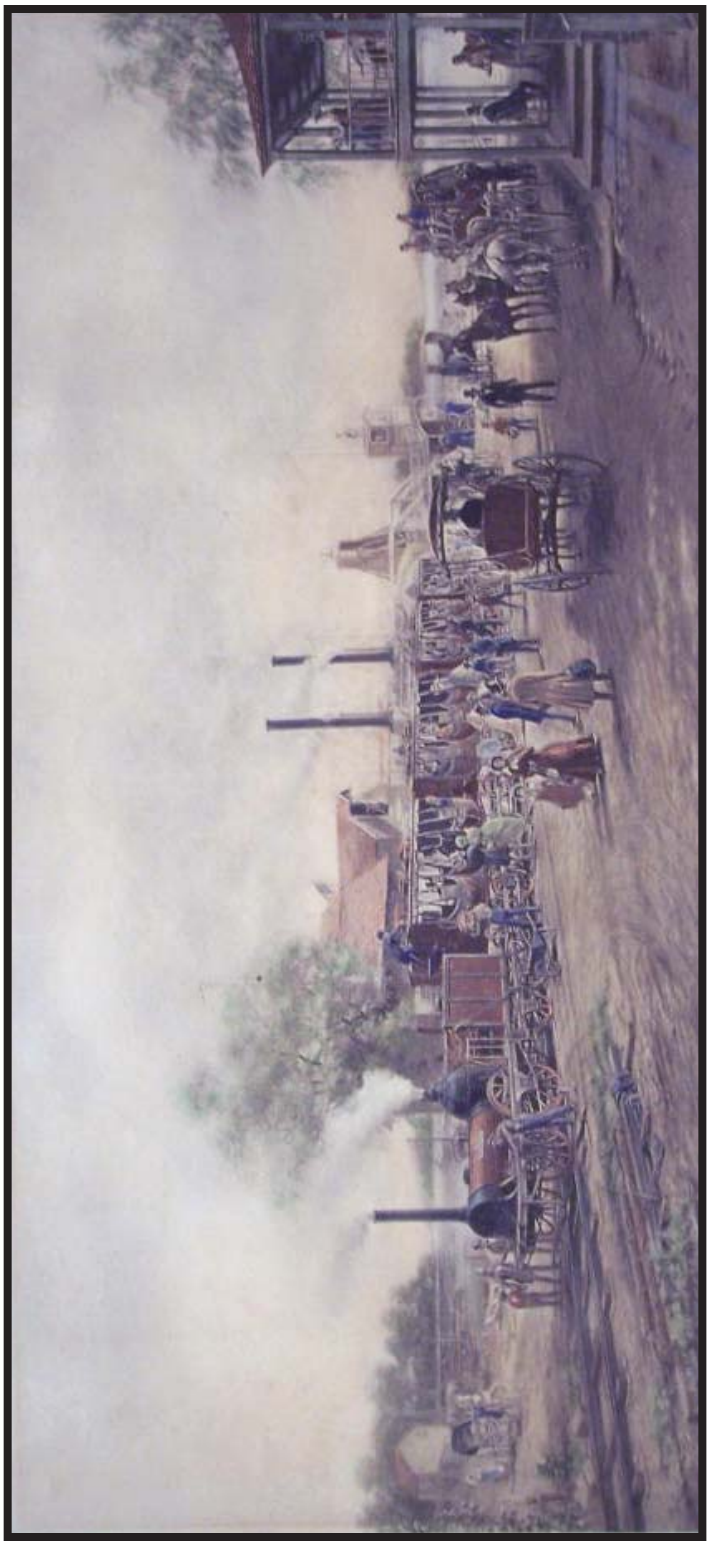
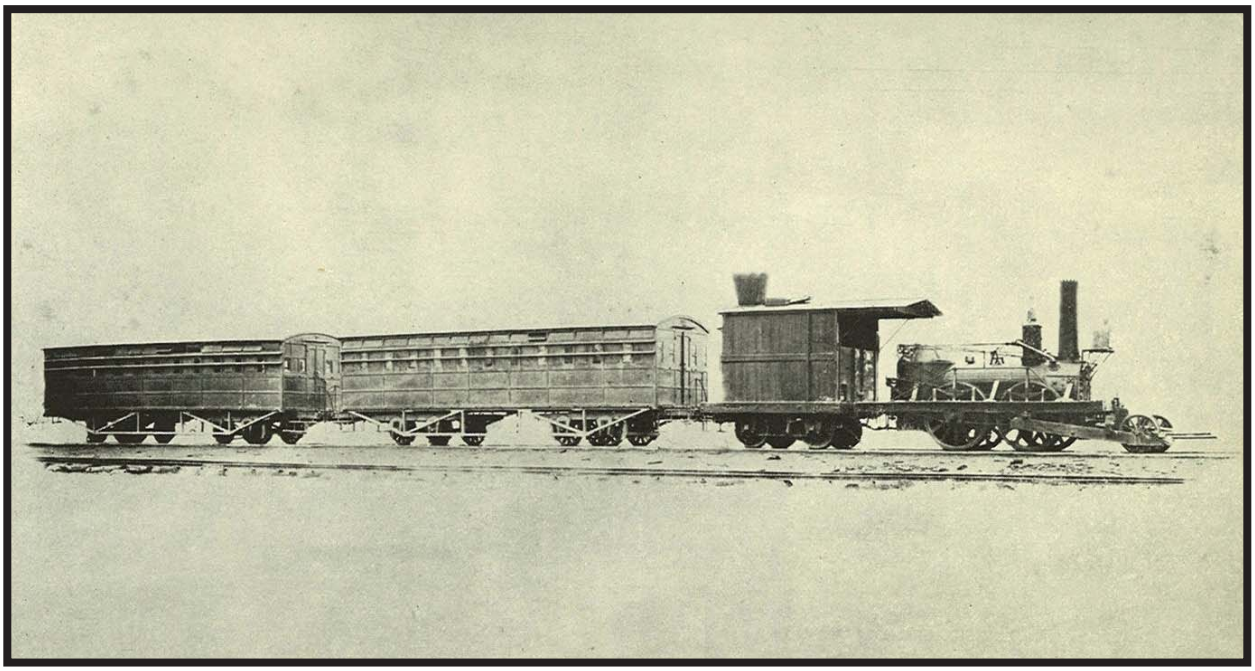


Figure 5.4. Henry, Edward Lamson. *The Camden and Amboy Railroad with the Engine Planet in 1834.* 1904. Henry prided himself on accuracy of detail, capturing the bustle and excitement of passengers boarding a train at Bordentown. The cars, resembling old-fashioned stagecoaches, were the first used on the Camden and Amboy. These quickly evolved in the late 1830s to the more familiar box-shape of the American passenger car (Source: Newark Public Library).



Photograph 5.5. The famous *John Bull*, the first locomotive of the Camden and Amboy Railroad. The rectangular cars replaced the rounded type derived from the stagecoach. This photograph was taken following the locomotive's restoration by J. Elfreth Watkins in the late 19th century (Source: Lane 1939).

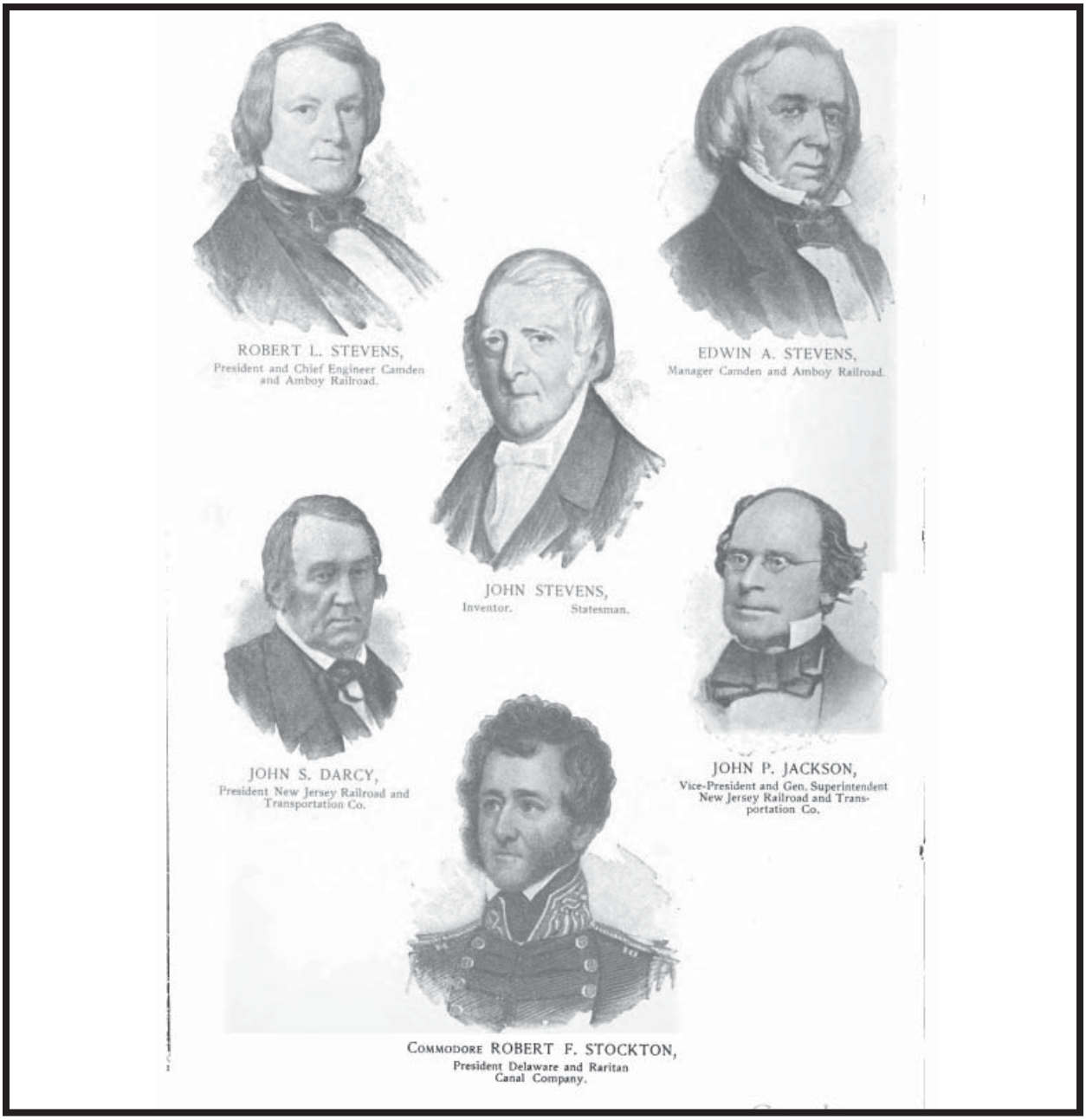


Figure 5.5. Sketches of the Principals Involved in the Establishment of the Camden and Amboy Railroad. John Stevens (center) and his two sons Robert and Edwin (top row) were leaders in the development of American railroad technology. John P. Jackson (bottom right) was one of the railroad's chief political backers in the New Jersey legislature and the railroad's corporate secretary. His son, J. Wolcott Jackson, accepted the Bordentown monument to the Camden and Amboy Railroad on behalf of the United New Jersey Companies. John S. Darcy (bottom left) was the president of the New Jersey Railroad, which provided the Camden and Amboy Railroad with connecting service between New Brunswick and Jersey City. Commodore Robert F. Stockton (bottom) served in the U.S. Navy during the War of 1812 and led American forces in California during the Mexican War. He invested heavily in the Delaware and Raritan Canal and played an important role in the formation of the Joint Companies. He was heavily involved in state politics (Source: Watkins 1891).

displayed by his hard work developing the Union Line of steamboats traveling the Port of New York, Raritan Bay and the Delaware River (Watkins 1891:13-16; Lane 1939:296-300).

Watkins acknowledged Robert L. Stevens for his genius planning and designing the Camden and Amboy Railroad in the early 1830s. A favorite story was how Robert, dispatched to England in October 1830 to observe English railroads and acquire a locomotive and rails, which were then unavailable in the United States, had passed time on the ocean passage by whittling thin wood shapes of imaginary cross sections of rails. Familiar with English rails, he noted that the design required an expensive chair to hold the rail in place, so he came up with the idea of adding the chair to the base of a "T-shaped" rail, thus dispensing with the chair as a separate piece of hardware. This novel rail cross section, first employed on the Camden and Amboy Railroad, became the standard shape used throughout most of the world (Figure 5.6). A disadvantage of the Stevens' rail shape, however, was that it was difficult to roll. Eventually, Stevens located an ironworks in Dowlais, Wales, that was willing to undertake the work, and through trial-and-error, there was eventually perfected the art of rolling the 16-foot-long wrought-iron rails for use on the Camden and Amboy Railroad. It would be about 15 years before American mills, in several locations, including Trenton, reproduced the Stevens rail. During his time in England, Stevens also developed joints fixtures, fish plates, and rail spikes, all of which would eventually become standard American practice for roadbed construction. The Camden and Amboy Railroad followed the example of English railroads and laid its first rails on stone blocks, 2-foot-square and 10 to 13 inches deep (Figure 5.7; Photograph 5.6). The railroad purchased its blocks from Sing Sing Prison in New York State, but finding these blocks slow to arrive and in limited numbers, Stevens turned to other alternatives. There has been archaeological evidence, for instance, that the Camden and Amboy also quarried some stones locally. As an expedient, Stevens eventually tried laying the rails on timber cross ties. This latter approach proved so satisfactory that it was also eventually adopted as standard practice with the Camden and Amboy undertaking some of the first experiments in treating ties with wood preservatives to extend their useful life. Robert L. Stevens' legacy in track engineering technology was preserved in the stone blocks, iron rails and spikes used to build the Bordentown monument (Watkins 1891:29-33; Dunbar 1915:751-63; Hunter Research Associates 1986).

Watkins' address, which the *Bordentown Register* described as "the result of years of research and earnest study" and as "the effort of his life," was published in 1891 as *The Camden and Amboy Railroad, Origin and Early History* (Watkins 1891:100-101). This book remains an invaluable source of information and the starting point for research on the Camden and Amboy Railroad's history because of the access Watkins had to original corporate records and the recollections of those individuals who had participated in the railroad's founding, many of whom were still living or only recently deceased when the book was published. These included such notables as: John G. Stevens, a nephew of Robert L. Stevens who became President of the United New Jersey Railroad; Benjamin Fish, a director of the Camden and Amboy Railroad; Ashbel Welch, President and Chief Engineer of the United New Jersey Railroad; and Isaac Dripps, the master mechanic who assembled the *John Bull* in 1831 (Figure 5.8). Watkins' history prefigured an abiding historical interest and curiosity in the Camden and Amboy Railroad as one of America's pioneering railroads. The Camden and Amboy Railroad has received, and no doubt will continue to receive, considerable attention in studies of American railroad history and technology (e.g., Dunbar 1915; Meyer 1917; Taylor 1951, White 1981; Zimmerman 1985; Stover 1997; Bianculli 2001) as well as in local and regional railroad histories (e.g., Lane 1939; Freeman 1953; Cunningham 1997), although, remarkably, there has

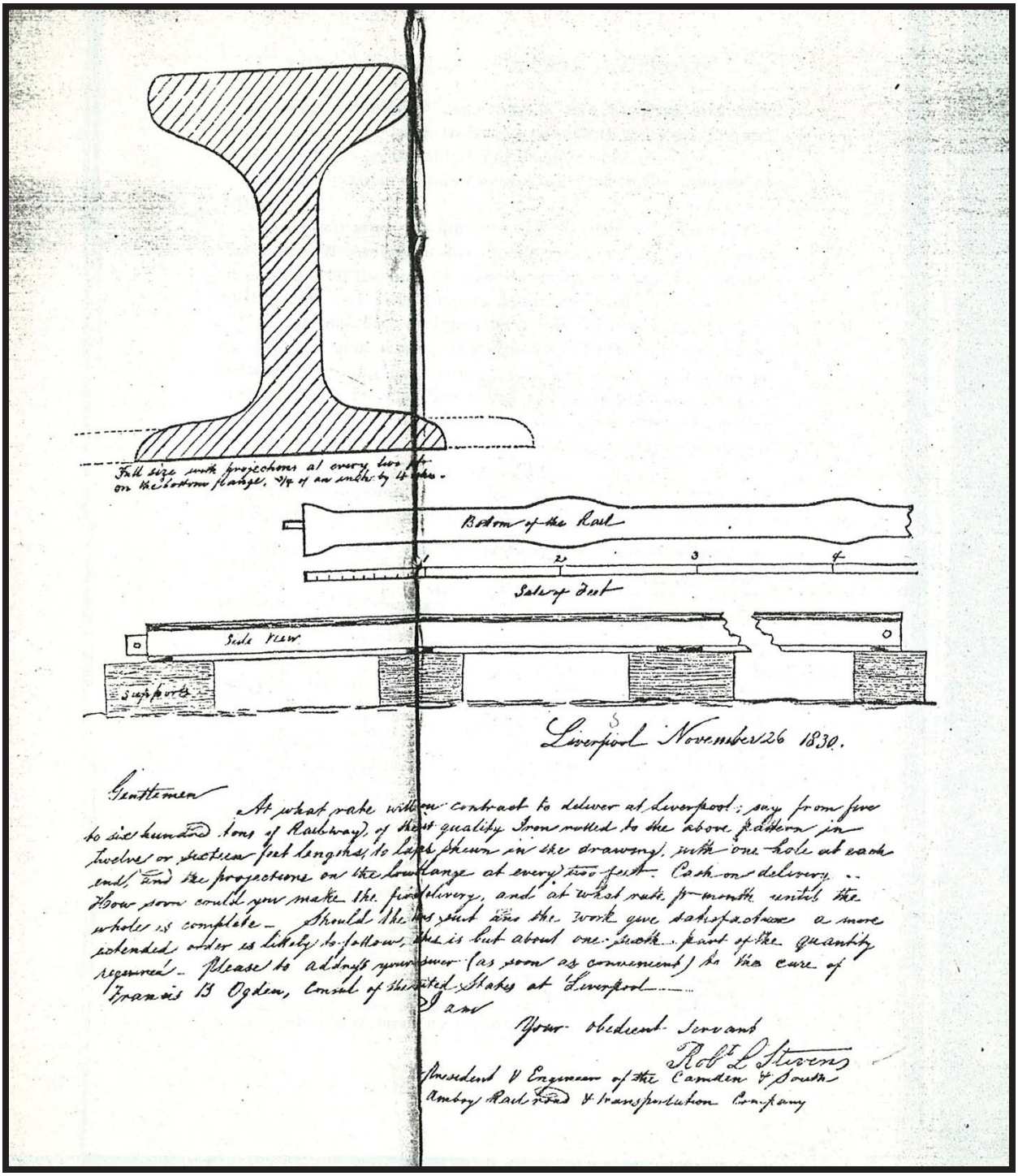
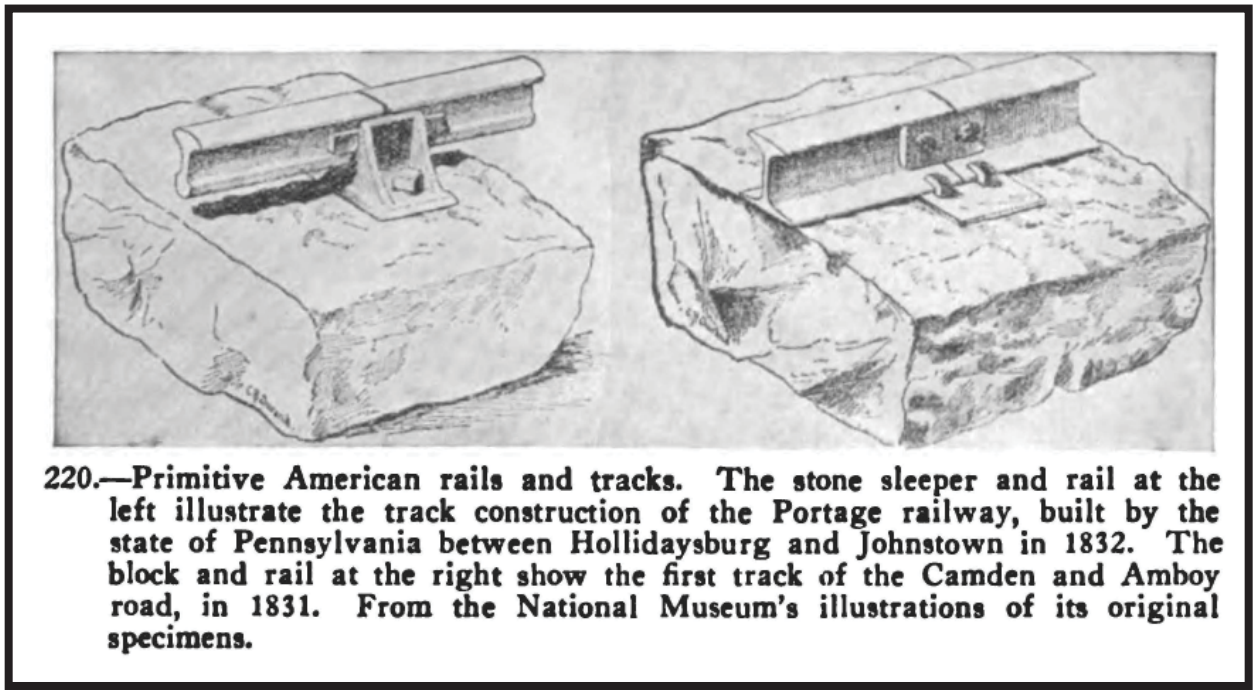


Figure 5.6. Facsimile of a Drawing of the Stevens T-shape Rail from a Letter of Robert L. Stevens Describing his Idea to English Iron Masters. November 1830 (Source: Watkins 1891)..



220.—Primitive American rails and tracks. The stone sleeper and rail at the left illustrate the track construction of the Portage railway, built by the state of Pennsylvania between Hollidaysburg and Johnstown in 1832. The block and rail at the right show the first track of the Camden and Amboy road, in 1831. From the National Museum's illustrations of its original specimens.

Figure 5.7. Primitive American Rails and Tracks. 1831-32. The drawing at left depicting the Pennsylvania's Portage Railroad shows the rails with the rounded bottom edge held within a chair, which was typical of English practice. The drawing at right shows the improvements made by Stevens with the flat-bottomed rail secured to the stone sleeper by a fish plate and spikes (Source: Dunbar 1915).

Photograph 5.6. Camden and Amboy Railroad track on stone sleepers near Jamesburg, New Jersey. *Circa* 1890 (Source: Smithsonian Institution Photograph Collections [Neg. # 21243-B]).

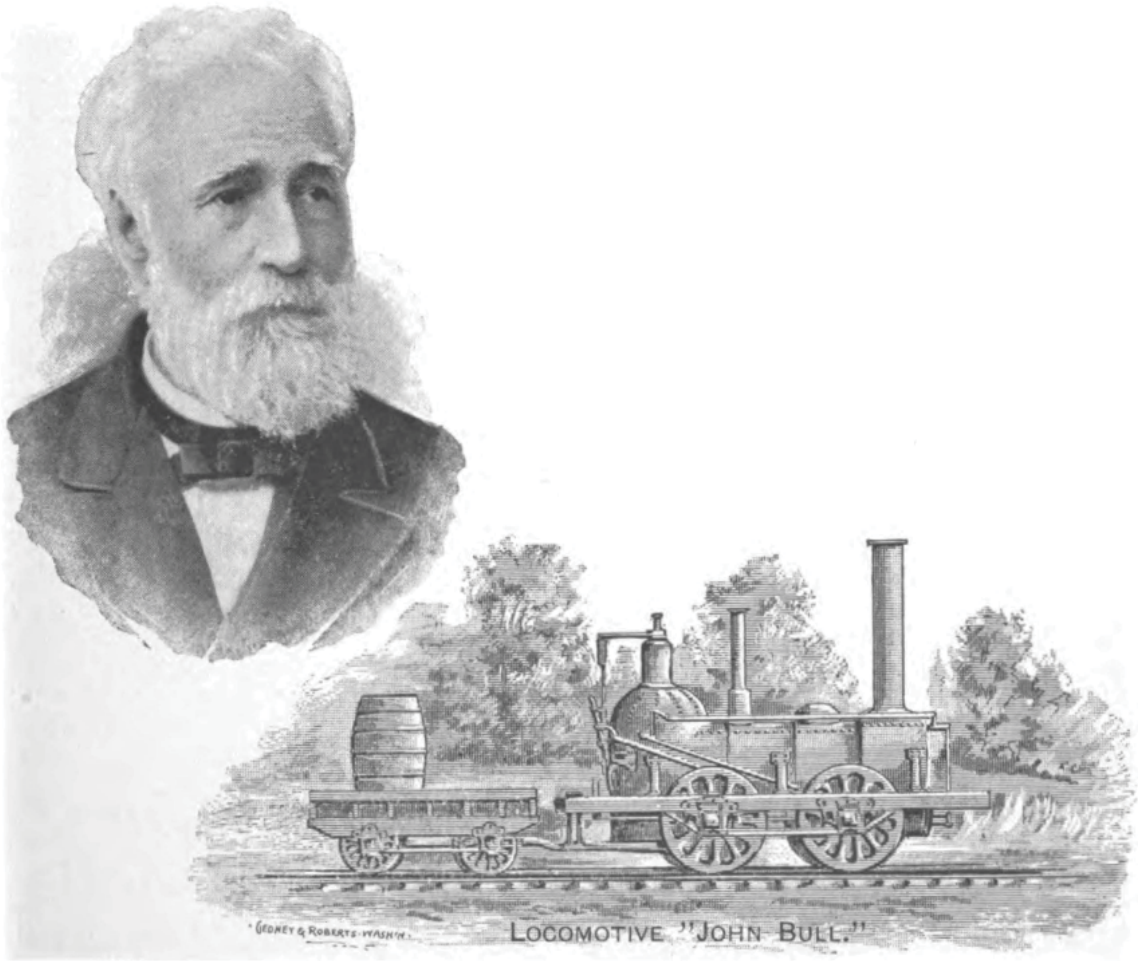


Figure 5.8. Isaac Dripps, First Master Mechanic of the Camden and Amboy Railroad and the Locomotive *John Bull*. 1891. Dripps was a young man when he re-assembled the *John Bull* without plans after its arrival by ship from England in 1831 (Source: Watkins 1891).

yet to be written an authoritative and comprehensive history. The Camden and Amboy Railroad is also the subject of at least two bibliographies of manuscripts and other original source materials (Stephenson 1947; Sinclair and Fowler 2011).

Much of the subsequent 20th-century scholarship that followed in the path of Watkins has had a curiously narrow field of vision with its focus on the Stevens rail and the *John Bull*, making it a challenge to assess other features of the railroad, like its cars, stations, terminals, ferries and bridges. The South Amboy terminal, the subject of this report, is largely absent from the standard histories and bibliographies previously mentioned. Some of this contextual narrowness is no doubt due to the traditional emphasis placed on technological "firsts" rather than the more mundane, although still quite novel for their time, operational practices. Also absent are good comparative studies that place the physical infrastructure of the Camden and Amboy Railroad in context with other railroads of the late 1820s and 1830s. The first demonstration of steam railroad technology in America is usually credited to John Stevens who operated a locomotive on a circular track on his estate in Hoboken, New Jersey, in 1826. There followed from the late 1820s to early 1830s several practical applications in places as far apart as Pennsylvania, Maryland and South Carolina. So that by the time the Camden and Amboy Railroad began regular service between Bordentown and South Amboy at the end of 1832, there were already 388 miles of railroad track in operation in the Mid-Atlantic region (Delaware, Maryland, New Jersey, New York, Pennsylvania, and Virginia) and another several hundred miles in operation in New England and the South. Perhaps the most notable of these pioneering railroads was the Baltimore & Ohio Railroad, chartered in 1828, which was already operating more than 70 miles of line west of Baltimore, Maryland, before the Camden and Amboy Railroad ever laid its first section of track (Baer 1981).

During the latter half of the 20th century, there have also been efforts to identify and preserve the Camden and Amboy Railroad's surviving infrastructure and archaeology. The significant features are largely limited to right-of-way and grade, masonry retaining walls and some abandoned sections of stone sleepers that survived later upgrades and abandonment. The right-of-way was recognized in June 1975 by the New Jersey Historic Preservation Office as the New Jersey- and National Register-eligible Camden and Amboy Railroad (Main Line) Historic District. This designation has prompted a number of regulatory investigations, most of them site-specific but occasionally branching out into larger thematic studies and discussions of the historical significance and integrity of the route (e.g., Grossman *et al.* 1979; Hunter *et al.* 1985; Hunter Research Associates 1986; A.G. Lichtenstein & Associates 1994; Hunter Research, Inc. 2002). The Camden and Amboy Railroad Historical Group, a chapter of the Pennsylvania Railroad Technical and Historical Society, hosts a website and holds regular events and meetings commemorating the railroad's history (Camden and Amboy Railroad Historical Group n.d.).

B. THE SOUTH AMBOY TERMINAL IN THE CAMDEN AND AMBOY RAILROAD PERIOD (1831-1871)

1. History and Significance

The Camden and Amboy Railroad's history and significance at the national level has been recognized foremost in the development of railroad technology, notably in the Stevens family's contributions to locomotive power and roadbed construction in the 1830s. In most of the standard histories, these early technological achievements are *de rigueur* and have been repeated so often to have become part of the lore of American railroading (Dunbar 1915; Meyer 1917; Taylor 1951, White 1981; Zimmerman 1985; Stover

1997; Bianculli 2001). At the level of New Jersey state history, the Camden and Amboy Railroad is also a perennial player, mentioned usually with reference to the development of the "transportation revolution" and the triumvirate of turnpikes, canals and railroads that quickened the state's industrial and agricultural economy during the first half of the 19th century. At some level, the Camden and Amboy Railroad usually is identified with the notion of New Jersey as a "pass through state," the railroad being the first "expressway" on the heavily traveled route between the greater New York City and Philadelphia metropolises, prefiguring Amtrak's Northeast Corridor and the New Jersey Turnpike (Lane 1939; *The WPA Guide to New Jersey* 1986 [1939]:46-48; Gillespie 1992; Cunningham 1997). Somewhat less recognized in popular history is the influence of the Camden and Amboy Railroad on state politics from the early 1830s to early 1870s. The monopoly was a major issue in the development of the state's two-party political structure, pitting pro-railroad Democrats against anti-railroad Whigs. Although the Camden and Amboy Railroad eventually lost its monopoly in 1866, New Jersey emerged as a state known for its friendliness to corporations (Reilly 1951).

A slightly different perspective on the Camden and Amboy Railroad's historical significance is achieved when viewed through the lens of the site-specific history of its South Amboy terminal on Raritan Bay, a most singular facility in its time. Research undertaken for this project indicates that the South Amboy terminal of 1832 was a very early example of a tidewater railroad terminal, perhaps without parallel in the United States. During the late 1820s to early 1830s, no tidewater terminals of comparative scope or purpose had been built specifically to transfer tens of thousands of passengers on a route between two major cities (Table 5.1).

Table 5.1. Tidewater Railroad Terminals in New Jersey prior to 1861.

Railroad Name	Terminal Location	Date of Establishment
Camden and Amboy Railroad	South Amboy, New Jersey	1832
Camden and Amboy Railroad	Camden, New Jersey	1834
Elizabethport and Somerville Railroad	Elizabethport, New Jersey	1836
Camden and Woodbury Railroad	Camden, New Jersey	1838
New Jersey Railroad	Jersey City, New Jersey	1839
Central Railroad of New Jersey	Elizabethport, New Jersey	1849
Camden and Atlantic Railroad	Camden, New Jersey	1854
West Jersey Railroad	Camden, New Jersey	1857
Raritan and Delaware Bay Railroad	Port Monmouth, New Jersey	1860

Railroads in the Mid-Atlantic region prior to 1832 were concentrated in the coal region of northeastern Pennsylvania. These railroads were designed to carry coal from the mines to rivers or canals where it was dumped into barges for shipment downstream to tidewater. Important examples included the Delaware and Hudson Canal Company Railroad at Honesdale, the Lehigh Coal and Navigation Company Railroad at Mauch Chunk, and the series of coal company railroads at the upper reaches of the Schuylkill Navigation Company canal northwest of Reading. More like the Camden and Amboy Railroad was the New Castle and Frenchtown Railroad that connected steamboat landings on the Delaware River and the Chesapeake Bay on a route between Philadelphia and Baltimore. The 16-mile-long, initially horse-drawn, railroad, completed in 1832, had very little long-term impact, finding it difficult to compete with the parallel Chesapeake and Delaware Canal, completed in 1829. Its terminals were little more than wharves with small passenger ticketing stations. It was superseded in 1838 by the Philadelphia, Wilmington and Baltimore Railroad, a more direct all-rail route. Other early railroads did not make direct connections with ferries or harbor facilities, particularly in major cities where waterfront property was expensive. The Baltimore & Ohio Railroad, for instance, perhaps the most important of the nation's early steam railroads, had its original terminal at Mount Clare, on the west side of Baltimore about one mile distant from the harbor; it did not have its own tidewater terminal until extending eastward to Locust Point in 1848. Similarly, the Philadelphia and Columbia Railroad, which reached Philadelphia in 1832, and the South Carolina Railroad, which reached Charleston in 1834, terminated their original lines on the outskirts of the cities, eventually requiring the construction of costly extensions to reach their harbors (Baer 1981).

By contrast, the Camden and Amboy Railroad did not face pre-existing urban development or high real estate costs in its efforts to build tidewater terminals in the towns of Bordentown or Camden or in the even smaller village of South Amboy. The Stevens family no doubt based the planning of the Camden and Amboy Railroad's terminals on prior experience with the Union Line of stagecoaches and steamboats. The Union Line had been in operation since 1812, offering passenger and fast freight service between Philadelphia and New York City with steamboats on the Delaware River between Trenton and Philadelphia, overland stage between Trenton at the Delaware's head of navigation and New Brunswick on the Raritan River, and steamboats between New Brunswick and New York City. This combined steamer-stage service had reached a high level of efficiency, completing the 100-mile-long trip in 11 to 20 hours depending on the weather. Passengers and freight arriving by steamboat were met upon landing by a dozen or more stages. Each passenger was assigned a stage by number, and their baggage was marked by chalk with the same number as their coach to avoid confusion and lost baggage. At the steamboat landings, the Union Line maintained taverns and inns, wood sheds for the steamers' boilers, stables for horses, and wagon houses for storing and repairing stages. The Union Line, which was considered a profitable business, carried about 50,000 passengers in 1832, the year prior to the opening of the Camden and Amboy Railroad. During the 1810s and 1820s, the Union Line repeatedly beat off rival steamer and stage lines on the Philadelphia-New York City route using as its primary economic weapon rate cutting. The Union Line also competed for fastest service, sometimes pushing speeds beyond the practical limits of safety. The Stevens understood the need to control competition, and it was, in part, this experience with steamer-stage service that persuaded state legislators to grant a monopoly to the Camden and Amboy Railroad (Stockton *et al.* 1836:6; Lane 1939:198).

The selection of South Amboy as the new railroad's northern terminal was a strategic business decision meant in part to undercut a potential rival to

the Union Line. South Amboy was advantageously situated on the Raritan Bay at the northern end of an early colonial road known as the Burlington Path, which historically connected the West and East Jersey capitals of Burlington and Perth Amboy and featured a ferry operating between Perth and South Amboy at the mouth of the Raritan River (Figure 5.9). By the late 18th century, the Burlington Path was far less important as an overland route across the waist of New Jersey than the Trenton-New Brunswick route to its west, but an attempt was made to renew its fortunes in 1816 by the Bordentown and South Amboy Turnpike, which undertook to improve the road for fast stage travel. In 1818, the Columbian Post Chaise Line began running two daily stages between Bordentown and South Amboy in conjunction with steamer service. The Columbian line established its ferry pier and tavern at the foot of what is now Main Street in South Amboy, about one-half mile north of the old town wharf at the foot of Bordentown Avenue. The stockholders of the Columbian line sold their assets to the Stevens in 1829-30, realizing that even before the railroad had started construction that the future economic prospects of the steamer-stage line were dim (Lane 1939:199). It seems likely that the earliest survey of the Camden and Amboy Railroad, conducted by engineer William Cook in the summer of 1830, actually shows the location of the buildings and wharves that had been built by the Columbian line and recently acquired by the Camden and Amboy Railroad for its terminal (Figure 5.10). In many ways, the Stevens must have viewed the construction of the pioneering Camden and Amboy Railroad as an experiment in replacing stage with rail, a technological improvement to what was already a successful business model of carrying passengers and fast freight across New Jersey to connect with steamboats.

In 1830 the Camden and Amboy Railroad acquired approximately 400 acres on the north side of the tiny village of South Amboy. The acquisition of such a large tract indicated that the company's management had already determined that the terminal might one day need room to expand. Approaching South Amboy from the southwest, Cook selected a route that paralleled the Bordentown and South Amboy Turnpike. In negotiating the final 1.5 miles from the coastal plain to the bay, Cook noted a change in elevation of 100 feet, which required the seeking out of a route with shallower grades than the turnpike. The chosen alternative was to construct a lengthy earth cut diverging to the north of the turnpike and then to curve the rail line 90 agrees around the northern flank of a 150-foot high bluff. This curve is manifest in the early surveys of the railroad, including a second survey taken by Cook in 1833 to document the as-built alignment (Figure 5.11) and the Gordon map of 1833 (Figure 5.12). Once reaching sea level, the Camden and Amboy Railroad followed a natural sandy spit crossing wetlands to reach the shallow waters of the bay some 2,000 feet east of the bluff. This spit and the wetlands to its south are visible in the U.S. Coastal and Geodetic Survey Map of 1836 along with the Camden and Amboy Railroad's distinctive T-plan wharf (Figure 5.13). The coast survey map also shows the location of the original South Amboy depot, which was located where the old turnpike, later renamed Main Street, met the railroad at the eastern edge of the bluff about two-fifths of a mile west of the wharf.

An estimated 109,000 passengers and 6,000 tons of merchandise passed through the South Amboy ferry terminal during its first full year of operation in 1833 (Table 5.2). Travel time on the route between New York City and Philadelphia by way of South Amboy was from 7 to 10 hours, weather dependent, for an average speed of between 10 and 15 miles per hour. This was a reduction of several hours over the fastest times previously achieved by stagecoaches. The number of passengers passing through South Amboy peaked in 1838-39 at around 180,000 and then dropped significantly due to competition from the opening of the Trenton-New Brunswick section of the Camden and Amboy Railroad. By the mid-1850s, the latter

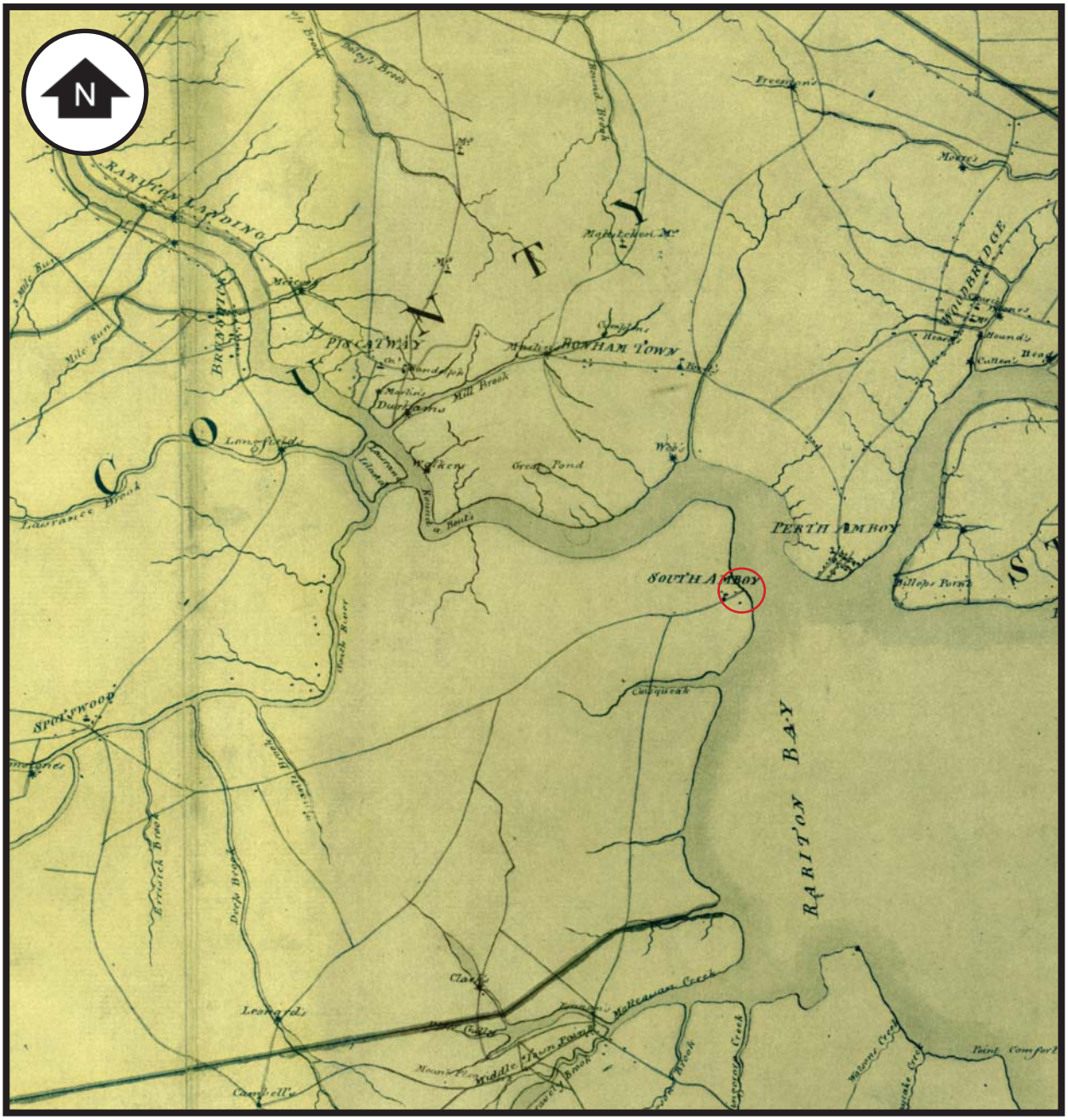


Figure 5.9. Hills, John. Detail of *A Map of Part of the Province of New Jersey.* 1781. Project area is circled. The Burlington Path is the road from the project area to the southwest. Scale: 1 inch = 2.5 miles (approximately).

Figure 5.10. Cook, William. Detail of *A Map of the Camden & Amboy Railroad. Circa* 1830. Cook conducted the initial survey in the summer of 1830. This map may actually show buildings and wharfage of the pre-existing Columbian steamer-stage line. The Camden and Amboy Railroad probably re-purposed these buildings in the early stages of the terminal's development. Scale: 1 inch = 3,600 feet (approximately).

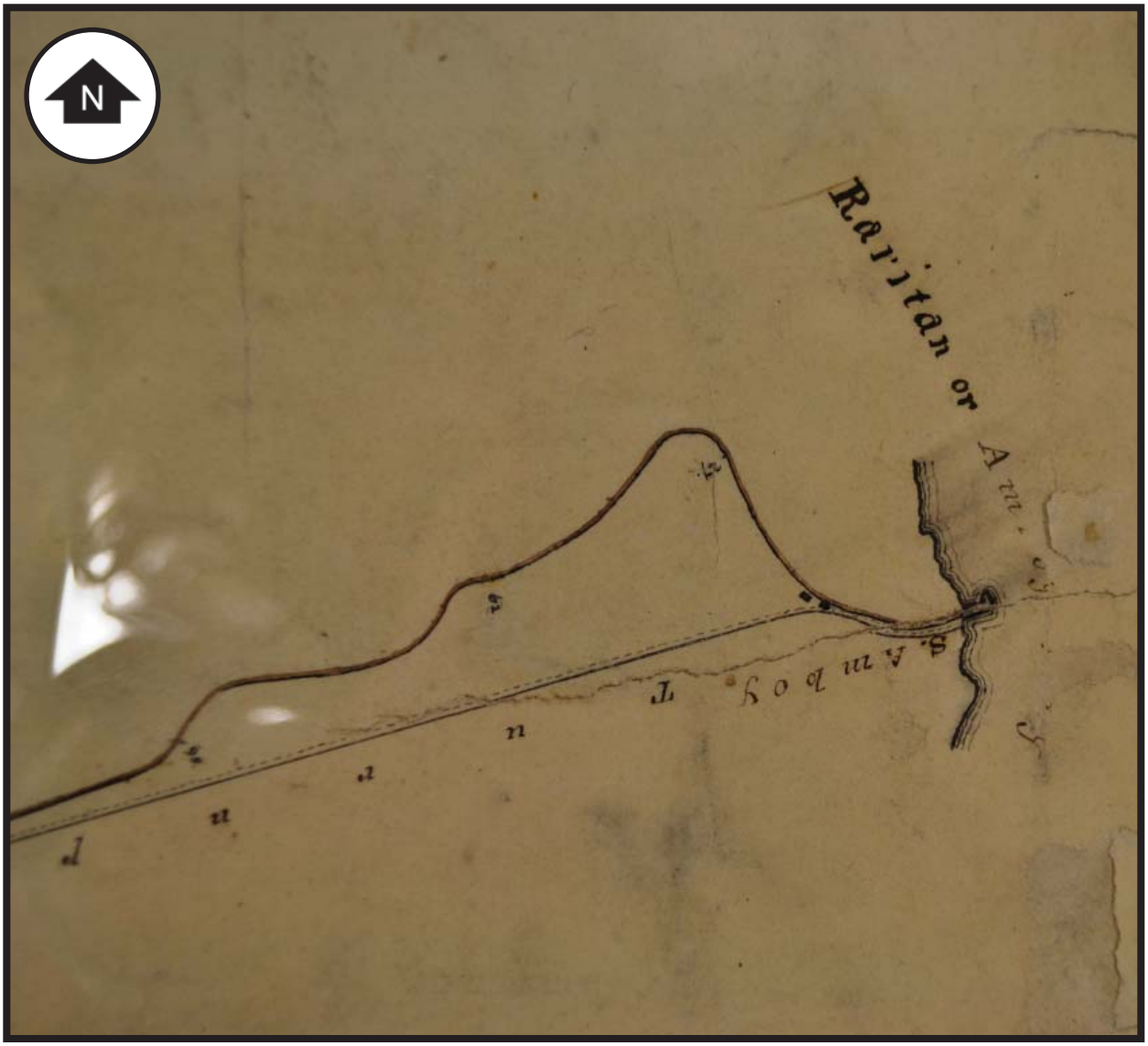


Figure 5.11 Cook, William. Detail of *Correct Map of Route and Location of the Camden & Amboy Railroad.* 1833. Scale: 1 inch = 2,150 feet (approximately).

Figure 5.12. Gordon, Thomas. Detail of *A Map of the State of New Jersey with Part of the Adjoining States*. 1833. Scale: 1 inch = 1.6 miles (approximately).

Figure 5.13. U.S. Coast Survey. Detail of *From the Highlands of Navesink to South Amboy*. 1836. Scale: 1 inch = 1,800 feet (approximately).

Table 5.2. Estimate of Passenger and Freight Traffic at the South Amboy Terminal of the Camden and Amboy Railroad, 1833-1847.

Year	Passengers	Freight (in tons)
1833	109,908	6,043
1834	105,418	8,397
1835	147,424	10,811
1836	163,731	12,508
1837	145,461	10,642
1838	164,520	11,765
1839	181,479	13,520
1840	81,681	No data
1841	64,480	"
1842	63,067	"
1843	55,966	"
1844	56,489	"
1845	59,218	"
1846	167,570*	"
1847	79,936	"

Source: ₩2ʎyŭ . 2I·₩Ř 2₮ 5ʎ₩ŜŎú2₩ǎΣ муплтмупу⌀

Note: Data for 1833 to 1839 is aggregate data for the Camden and Amboy Railroad, which did not break out local versus through traffic for this period. It is presumed based on records that most of the railroad's traffic was through traffic and that a large percentage of the reported passengers and freight passed through the South Amboy Terminal. The railroad broke out South Amboy bound traffic in its data from 1840 to 1847.

*The spike in ridership in 1846 corresponds with a equal decline in ridership on the Trenton-New Brunswick line, suggesting that the spike was temporary and related to service limits on the other line.

line was carrying more than three-quarters of a million passengers per year, while passenger travel through South Amboy had stabilized at between 50,000 and 80,000 passengers per year, except for 1846 when a service interruption on the Trenton-New Brunswick main line diverted passengers to South Amboy. To attract passengers to South Amboy, the Camden and Amboy Railroad set the fare at one dollar less than the more popular Trenton-New Brunswick route. This fare no doubt attracted economically minded travelers, but the South Amboy-Bordentown leg also was considered a more leisurely and beautiful route, better suited to site-seeing, especially in the summer (Figure 5.14). In 1849, the railroad inaugurated commuter service with a special train leaving Bordentown at 6 a.m. for the convenience of persons wanting to travel to New York City on business and return the same day. This train and others indicated the increasingly local nature of the traffic carried on the original section of the Camden and Amboy Railroad. In 1850, the railroad stopped operating steamboats with direct service between New York City and South Amboy, making South Amboy a stop on a steamboat line that also made stops in Perth Amboy and New Brunswick (Joint Board of Directors 1840:10; 1843:4; 1848:10; 1850:8, 12; *Gleason's Pictorial Drawing-Room Companion* 1854).

An enduring pattern of land use for the South Amboy terminal was established during the boom years of the 1830s when it served as the Camden and Amboy Railroad's sole northern New Jersey terminal. In 1836, F.W. Brinley produced two maps of the terminal, the first a sketch map distinguished by a charming caricature of a locomotive (Figure 5.15) and the second a sketch map intended to show the location of buildings in relationship to the rail line, which he showed as straight, not curved, presumably for simplicity (Figure 5.16). Both of these maps illustrate the great extent to which the terminal had grown in its first four years. The facility's most distinguishing feature was the T-plan wharf jutting into the shallow waters of the bay. About 15 years later, the approximately 1,000-foot-long wharf was described as a combination timber and stone structure that had been largely rebuilt in 1844-45. It had on its "lower" (or south) side 500 feet of stone wall, varying in height from 3 to 10 feet, averaging 5 feet in thickness, "as protection against the waters of the bay." At the stone wall's eastern end, near the landing, the stone wall transitioned to 320 feet of "wharfing," presumably wood plank bulkheads supported by timber piles. The wharf's "upper" (or north) side was also wharfing as was the 350-foot-long top of the "T" that served as the actual point of landing for the steam boats. The stone wall and wharfing presumably served as retaining walls for fill that carried the railroad tracks and service road. Built along the end of the wharf's upper side was a long building into which ran the railroad tracks. Opposite it on the wharf was an L-plan building, a ferry or "transportation" house, for receiving and disembarking the steamboats and their passengers and freight. The wharf also had facilities for servicing the steamers including a wood shed for steamboat fuel and a wooden water tank for boiler water and fire suppression should a fire break out on the wharf. A roadway ran along the south side of the tracks connecting the wharf with a station house about 2,000 feet to the west at the foot of Main Street. About half way along this road at the point that the tracks curved to come in line with the wharf was another building, probably an engine house (Brinley 1836; Joint Board of Directors 1840:30-35; 1848:4; Cook 1850).

The South Amboy station house was a two-story brick building that had previously served as a tavern on the Bordentown and South Amboy Turnpike. Across the tracks to the north and west of the station house were a series of at least three and possibly as many as five service buildings including a carpenter's shop, blacksmith shop, and oil room plus a wood shed and water tank. Both sketch maps also show that the railroad had built rows of workers' houses south of the station on both sides of Main Street. Company-owned

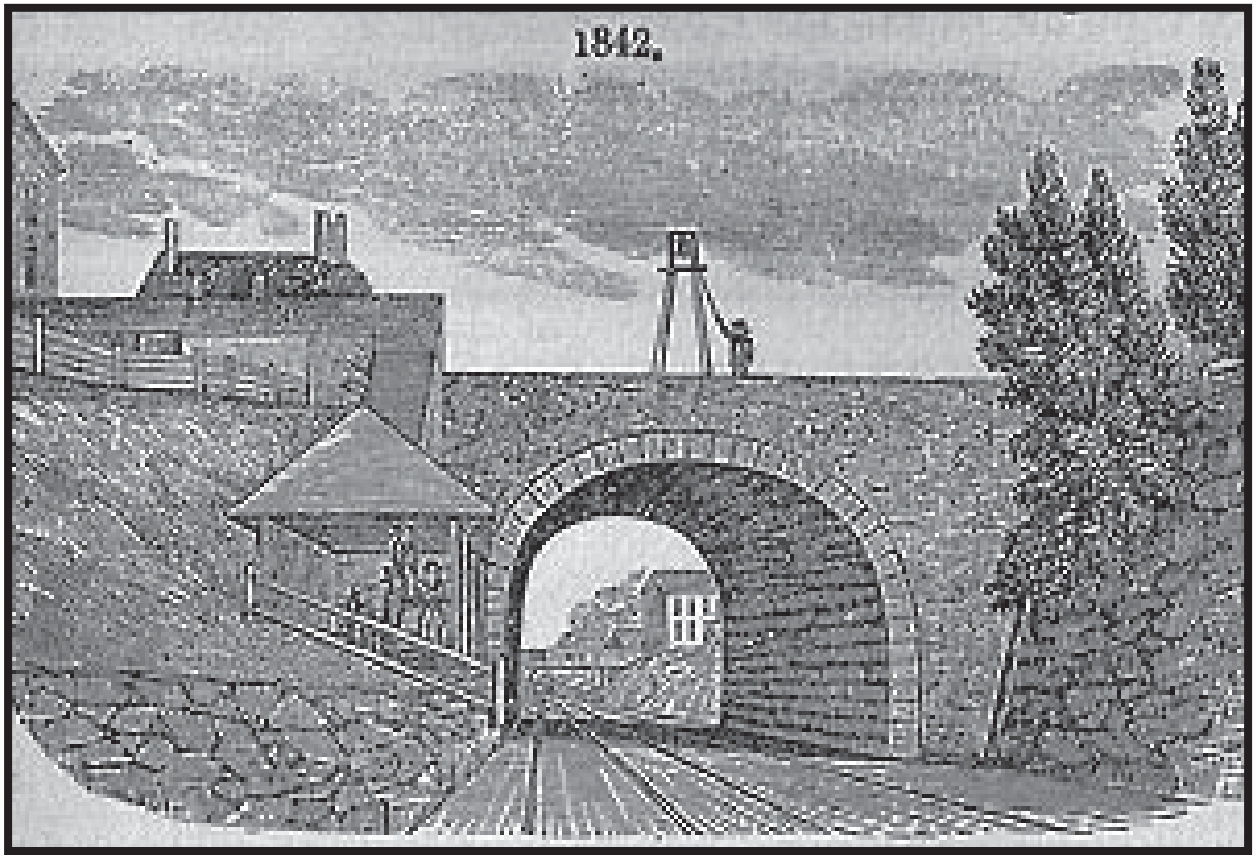


Figure 5.14. Camden and Amboy Railroad, Stone Arch Overpass near Bordentown, New Jersey. 1842 (Source: Barber and Howe 1844:99).

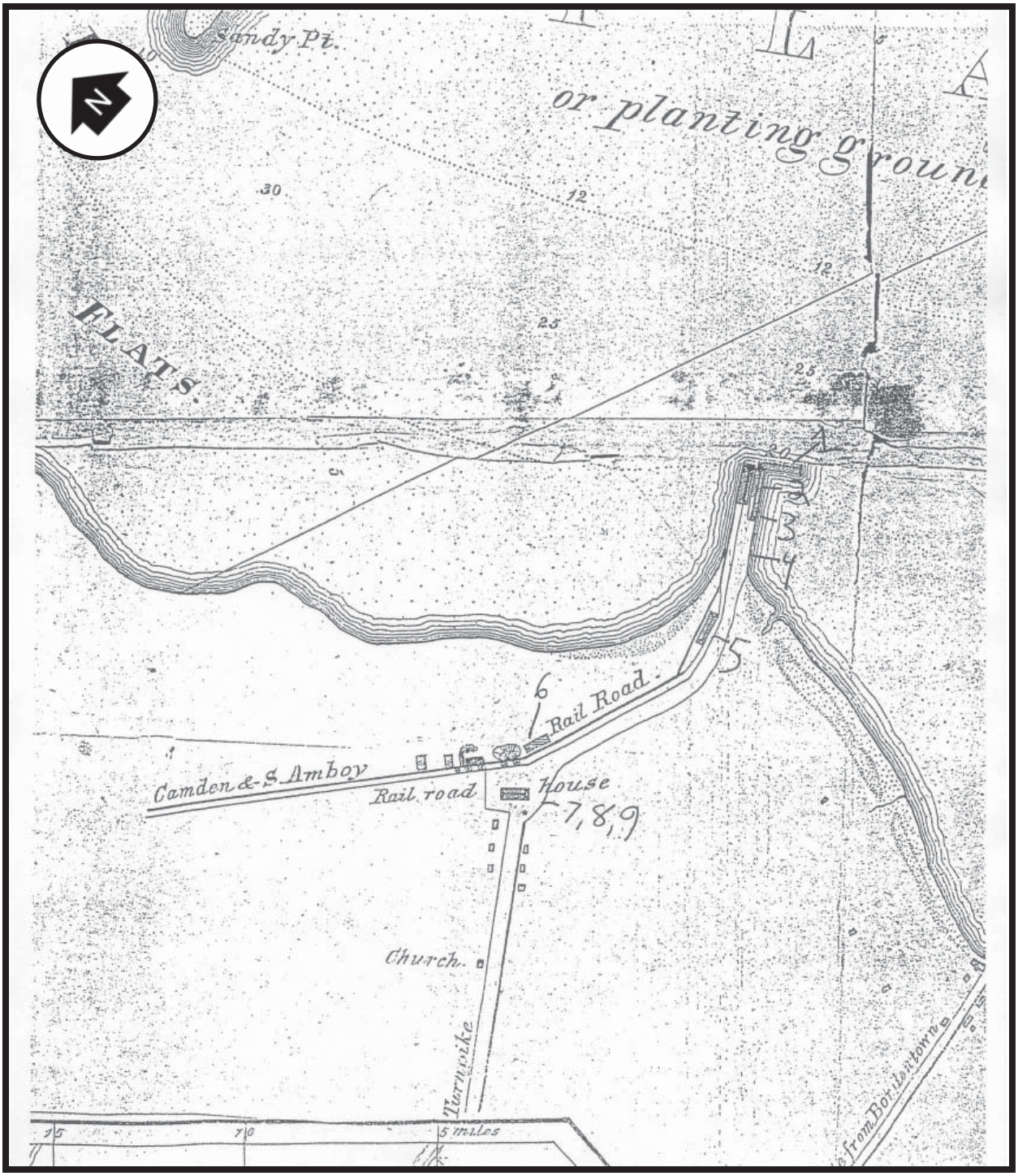


Figure 5.15. Brinley, Francis W. Sketch Map of South Amboy Terminal of the Camden and Amboy Railroad. 1836. Scale: 1 inch = 640 feet (approximately).

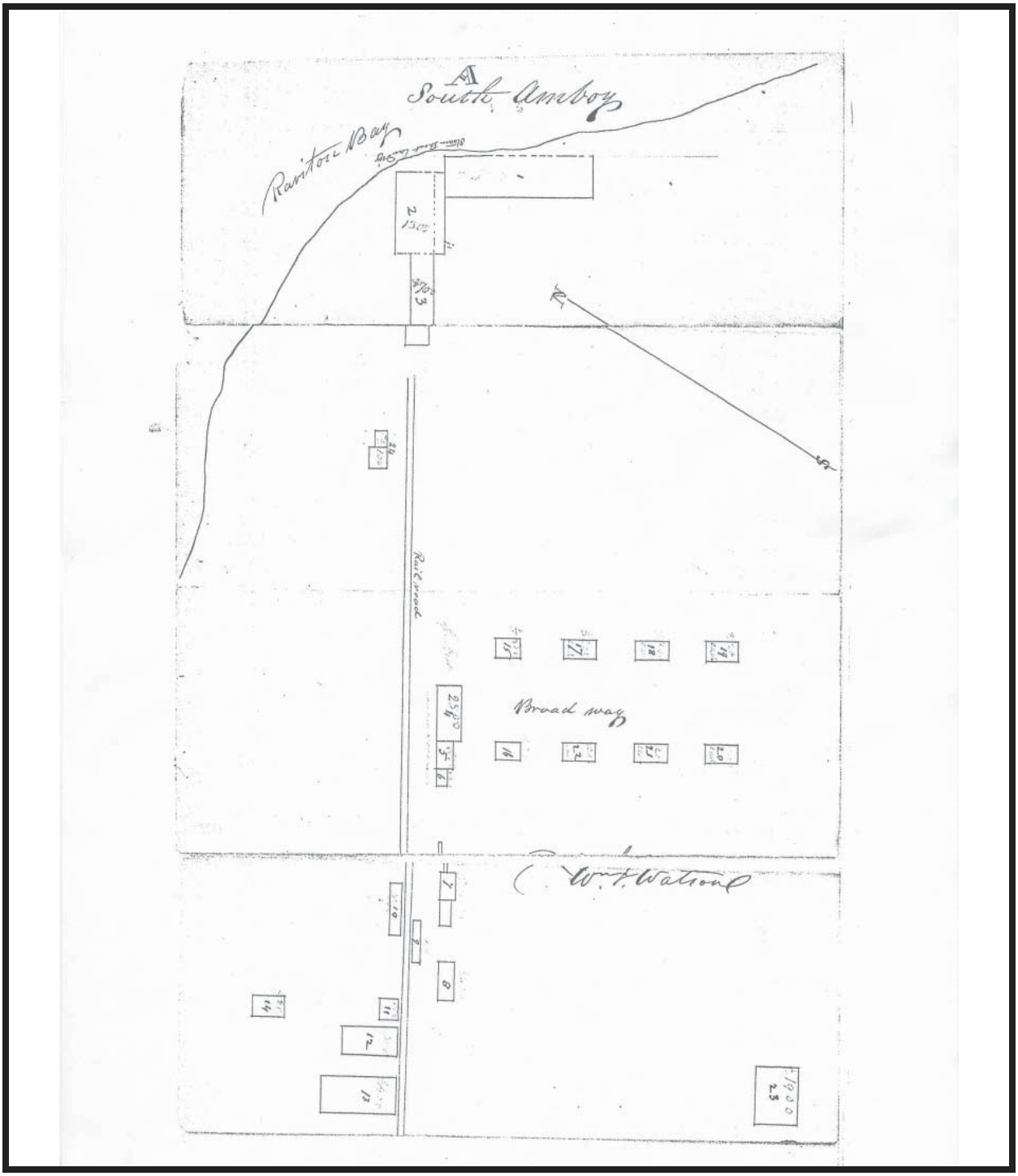


Figure 5.16. Brinley, Francis W. Sketch Map of South Amboy Terminal of the Camden and Amboy Railroad. 1836. Not to scale.

housing was an unusual feature of the South Amboy terminal, probably considered necessary because of the lack of available housing in the tiny village of South Amboy. Several other stations on the Camden and Amboy Railroad also had company housing, including Bordentown and Camden (Joint Board of Directors 1840:30-35; Cook 1850).

Operationally, the South Amboy terminal had two centers of activity, separated by about 2,000 feet: one at the end of the wharf, where trains met ferries and the transfer of passengers and freight took place (Figure 5.17). The other was at the foot of Main Street, an area the Camden and Amboy Railroad came to call the "depot," consisting of the station house, the engine house and related buildings, and the workers' village. The buildings at both of these locations were itemized in reports prepared by the railroad's engineers in 1840 and 1850 (Tables 5.3 and 5.4). In 1840, the number of buildings at the wharf was six and the number at the depot was about 30, with half of those dwellings for workers. In 1850, the number of buildings at the wharf had grown from six to nine, but the number of buildings at the depot had grown from about 30 to 50 with most of the new construction workers' dwellings (Photographs 5.7 and 5.8). The railroad had also built a company-owned market, store and schoolhouse. As early as 1833, the Camden and Amboy Railroad had allowed Christ Episcopal Church (Photograph 5.9), originally called St. Stephen's, to hold services on its property, and in 1858 a Gothic-style stone church and parsonage were built on Main Street under the sponsorship of Esther Stevens, the sister of Robert and Edwin (Joint Board of Directors 1840:30-35; Cook 1850; Francy 1998:94).

The types of railroad service buildings found at South Amboy in 1840 and 1850 included engine houses for the repair and maintenance of locomotives, car houses for the repair and maintenance of cars, and carpenter's shops, all of which had tracks running through them. There were also specialized buildings and structures like an oil house for storing the grease and oils needed for the locomotives and a relatively elaborate water supply system with a large brick tank at the depot filled by pumping action using a locomotive. Water was initially drawn from freshwater ponds located north of the depot beyond the curve in the tracks. A major difference in the building inventory of 1840 versus that of 1850 is that the latter inventory makes no mention of the three large wood sheds itemized in the 1840 inventory. While this could be an oversight, the more likely reason was that the Camden and Amboy Railroad had entirely switched from wood to coal as a fuel source for its steam locomotives and boats. This process of switching over probably began in 1843 after the railroad reported that the conversion of steamboat boilers from wood to coal on the Trenton-Philadelphia steamboat line had resulted in a reduction in fuel costs from $27.50 to $10 on each run (Joint Board of Directors 1840:30-35; 1843:6; Cook 1850).

The management of the Camden and Amboy Railroad was beginning to think by the mid-1840s that the future of the South Amboy terminal lay mainly in freight not passengers. It was a reality that as rail service improved in speed and reliability on the all-rail route from Jersey City to Philadelphia, by way of New Brunswick and Trenton, that the original South Amboy-Camden main line and its ferry service between South Amboy and New York City became less popular. As ever greater percentages of the passenger traffic chose the all-rail route, there began an effort to concentrate the company's general freight service at South Amboy, keeping it separate from the fast passenger and express service that ran through New Brunswick and Trenton. This meant that heavier crates, barrels and cargoes that were less time sensitive passed through South Amboy keeping what was generally slower moving freight off of the main passenger line. In 1836, the railroad started running a popular train known as the "Pea Line." This service picked up fresh vegetables and fruits in season from

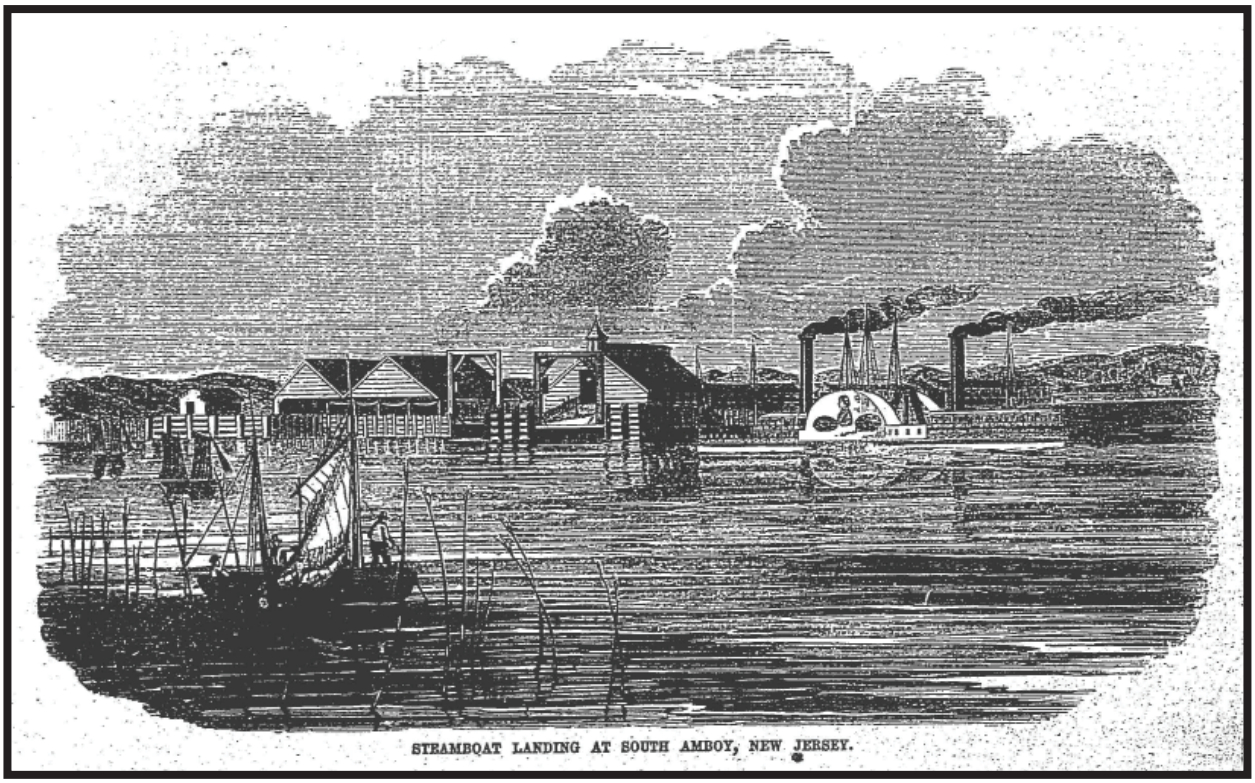


Figure 5.17. Steamboat Landing at South Amboy, New Jersey. 1854. The gable-roof buildings are the Camden and Amboy Railroad ferry terminal on the T-wharf. The two timber-frame structures are transfer bridges that were used to transfer railcars and cargo on and off vessels. The bridges had hinged leaves that adjusted with the tide (Source: *Gleason's Pictorial Drawing-Room Companion* 1854).

Table 5.3. Buildings of the Camden and Amboy Railroad at South Amboy, 1840.

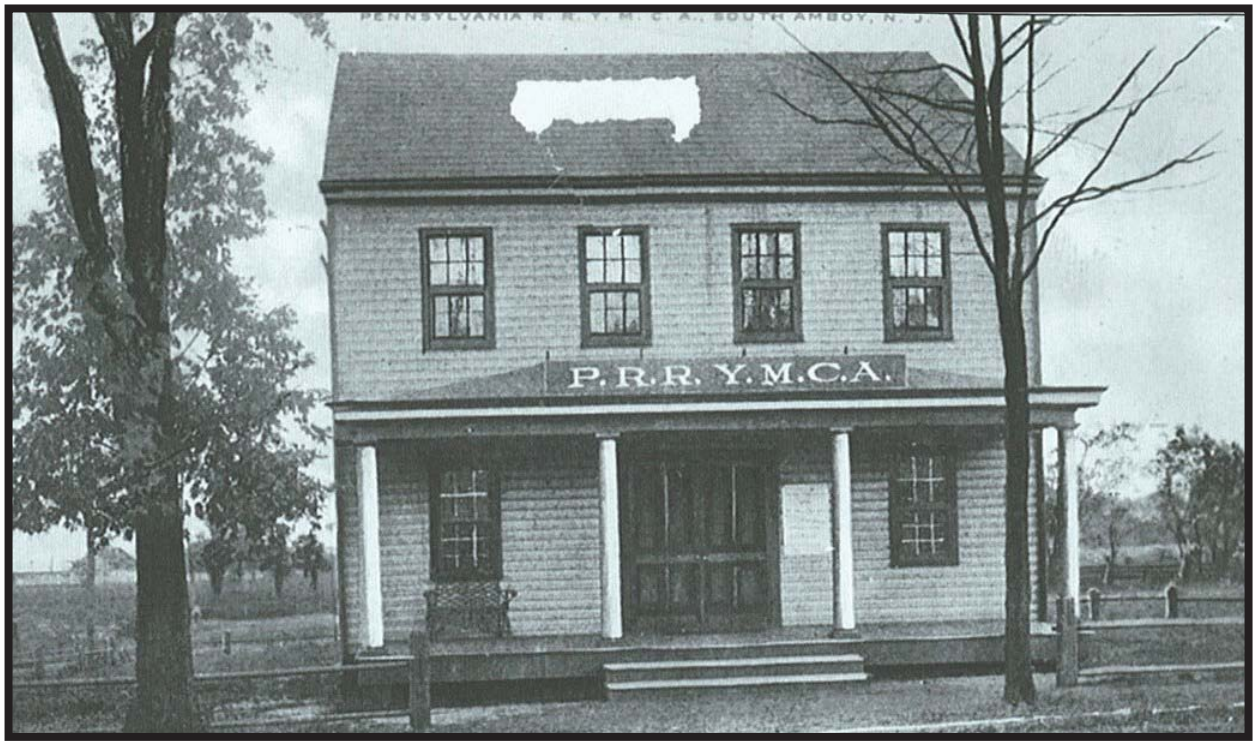
Building Name	Description
Brick Car House at the Wharf	105 x 43 ft. with four railroad tracks and
Frame Care House at the Wharf	120 x 62.5 ft. with four railroad tracks and
Frame Transportation House at the Wharf	110 x 56 ft. with three railroad tracks and
Frame House at the Wharf	25 x 10.5 ft. with one track and platform
Frame Office [at the Wharf?]	28 x 20 ft.
Wood Shed at the Wharf	240 x 30 ft.
Brick Engine House at the Depot	70 x 26.5 ft. with two tracks and metal roof
Brick Engine House at the Depot	73 x 37 ft. with three tracks
Frame Carpenter's Shop at the Depot	63 x 28 ft., 2 stories with one track through it
Frame Carpenter's Shop at the Depot	33 x 20 ft. with one track through it
Frame Blacksmith's Shop at the Depot	45.5 x 27 ft.
Frame Oil Room at the Depot	20 x 11 ft.
Wood Shed at the Depot	177 x 24 ft.
Wood Shed at the Depot	113 x 34 ft.
Brick Water Tank at the Depot and Wood Water Tank at the Wharf	large, filled by force pump worked by a locomotive. Water conducted by iron pipes, 2.5" diameter in the clear, half a mile to a wood tank on the wharf for supply of the steamboat boilers and security against damage by fire to the buildings on the wharf
Wooden Tank, Pump and Fixtures at the Depot	
Two Ice Houses	
Brick Tavern House at the Depot	82 x 34 ft., 2 stories; one frame house
Frame Kitchen for Tavern	19 x 17 ft.
Barn for Tavern	41 x 28 ft.
Shed or Cow House	49 x 19 ft.
Corn Crib	21 x 6 ft.
Superintendent's House	"large size"
Store House	
18 Dwelling Houses for Workmen	

Source: [illegible] 1840.

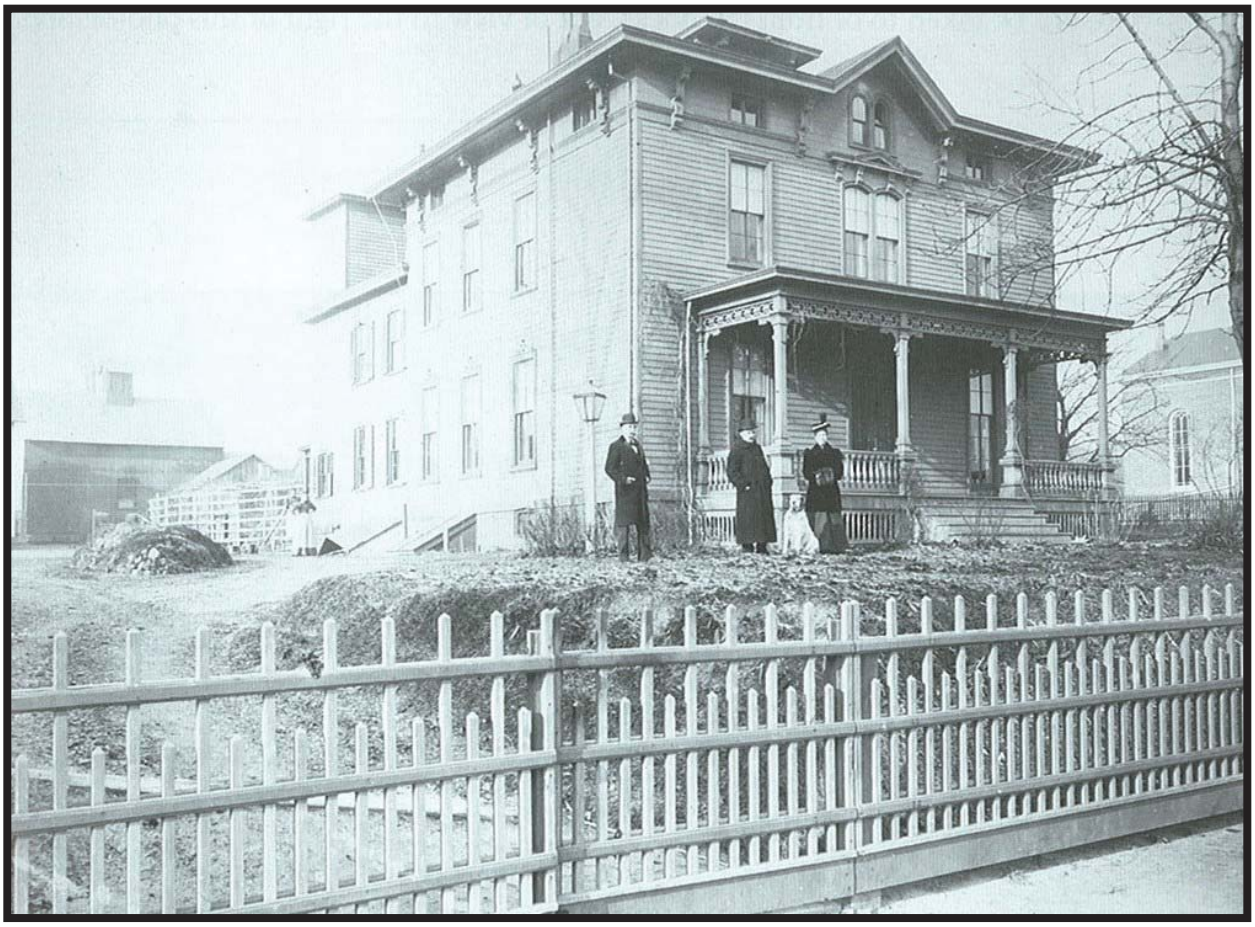
Table 5.4. Buildings of the Camden and Amboy Railroad at South Amboy, 1850.

Building Name	Description
Frame Car House at Wharf	140 x 62 ft. with three tracks. Turnaround in the house of 36 ft. diameter. Platforms and ganways to steamboats
Brick Car House at Wharf	183 x 45 ft., for extra cars. 15 ft. walls (height), board roof, containing four tracks
Continuation of Brick Car House at Wharf	156 x 49 ft., 15 ft. walls, slate roof, four tracks
Frame Transportation House at Wharf	200 x 75 ft., 15 ft. posts (supports?), four tracks, two platforms 15 ft. wide each the whole length of the building
Frame Transportation House at Wharf	110 x 56 ft., three tracks, platforms
Frame Transportation Office at Wharf	28 x 20 ft.
Frame Car Repair Building at Wharf	20 x 15 ft.
Passengers' Office at Wharf	40 x 20 ft., two-stories with three rooms
Train Shed at Wharf	"or covered way" from end of buildings to face of the wharf, 210 ft. long and 35 ft. wide with platforms and slips
Tavern House at Depot	82 x 34 ft., three stories
Barn for Tavern	41 x 28 ft.
Shed or Cowhouse	49 x 19 ft.
Corn Crib	21 x 6 ft.
Brick Engine House at Depot	108 x 37 ft.
Brick Blacksmith Shop	75 x 26 ft.
Frame Carpenter Shop	63 x 28 ft., two stories
Frame Carpenter Shop	60 x 20 ft., part used as coal shed
Frame Carpenter Shop	60 x 20 ft., one track
Wood Shed	108 x 30 ft.
Four Double Dwelling Houses for Workmen	36 x 16 ft., three stories with kitchen 16 x 12 ft., 1.5 stories and cellar under the whole house
Five Double Dwelling Houses for Workmen	36 x 16 ft., two stories with kitchen on side, 16 x 12 ft., 1.5 stories, and kitchen behind 22 x 11 ft.
Three Double Frame Dwellings for Workmen	36 x 16 ft., two stories
Frame House for Workmen	115 x 24 ft. with cellar - the building comprises three residences
Frame House for Workmen	45 x 24 ft. - the building comprises three residences
Dwelling House for Transportation Agent	
Double Dwelling House for Workmen	38 x 24 ft.
Eight Shanty Houses for Workmen	20 x 12 ft.
Five Shanty Houses for Workmen	18 x 10 ft.
Shanty House for Workmen	16 x 10 ft.
Frame House for Store	
Market House	28 x 12 ft., two stories, the upper part of which is an office, 14 x 12 ft. for the use of the Superintendent of the Shops
Slaughter House	20 x 16 ft.
Frame School House	20 x 16 ft.
Ice House	25 x 25 ft., for use of steamboats
Ice House	16 x 13 ft., for use of steamboats
Frame Stable	16 x 16 ft.
Large Brick Water Tank	

Source: William Cook 1850.



Photograph 5.7. Camden and Amboy Railroad worker's dwelling. *Circa* 1890. The house, built *circa* 1835-50, was later converted by the Pennsylvania Railroad into a YMCA (Source: Francy 1998).



Photograph 5.8. Camden and Amboy Railroad superintendent's house. *Circa* 1890 (Source: Francy 1998).

Photograph 5.9. Christ Church, South Amboy. *Circa* 1920. The church was built on railroad property in 1858 (Source: Francy 1998).

the farming communities between Camden and South Amboy for delivery to markets in New York City. In 1840, the Pea Line ran daily in season with up to 16 cars carrying peas, peaches, potatoes, asparagus, cabbages, livestock and corn (Joint Board of Directors 1840:10). In 1843, the Camden and Amboy Railroad's management contemplated the establishment of a coal depot at South Amboy with the idea of encouraging New York City dealers to store coal there, but it's unclear if this idea was turned into practice. The Joint Companies moved far more coal by way of the Delaware and Raritan Canal than it ever did by rail, and there seems to have been little incentive to divert quantities of coal to South Amboy as long as the canal was profitable and meeting demand. The transformation of the South Amboy terminal into a coal terminal necessarily waited until the post-1871 Pennsylvania Railroad period (see below) (Joint Board of Directors 1840:10, 1843:6).

The handling of a higher volume of general freight likely necessitated the expansion and rebuilding of the wharf at South Amboy in 1844-5 (Joint Board of Directors 1848:4). The Otley and Keily *Map of Middlesex County, New Jersey* of 1850 depicts the wharf as having been expanded from its original T-plan into a more triangular plan with the infilling of the downstream corner of the T to accommodate the approach of at least three tracks (Figure 5.18). Also evident on this map is the railroad workers' village with its school house, store and church, forming a northern enclave of the town of South Amboy. The town itself had grown remarkably in the 1830s and 1840s, no doubt a result of the railroad and the establishment of a thriving pottery industry apparent in the four potteries located on the waterfront on the Otley and Keily map. The Lake and Beers *Map of the Vicinity of Philadelphia and Trenton* of 1860 (Figure 5.19) and the Hughes *Map from Newark Bay to Washington Rock* of 1868 (Figure 5.21) are insufficiently detailed to provide much evidence of the plan and layout of the terminal in the middle decades of the 19th century, but the Walling *Map of Middlesex County, New Jersey* of 1861 (Figure 5.20) included a detailed South Amboy inset offering perhaps the best available documentation for the placement of the terminal buildings and rail-yard track plan on the eve of the Civil War. By this time, the railroad's approach to the wharf had been double-tracked for increased capacity and safety. The maintenance and repair shops are no longer concentrated on the north side of the tracks opposite the old tavern, labeled hotel on the map, but are within a rail yard located to the east along the north side of the access road connecting the hotel to the wharf. The rail yard at this time had two spurs on its south side, crossing the access road at grade. To the west of the rail yard, the railroad workers' village is laid out to its fullest historical extent with its axis on Main Street and a secondary row of housing on Second Street.

Near the end of the Camden and Amboy Railroad period in 1867, the railroad's management described the operations on the South Amboy line as "especially calculated" for ordinary merchandise. This was in comparison with the route via Jersey City and Trenton that handled passengers and the "more valuable kinds of merchandise" (Joint Board of Directors 1867:6-7). By this time, the railroad had adopted the use of "car floats," large-decked barges that eliminated the step of unloading the contents of the cars at South Amboy since the entire car was delivered to its final destination (Figure 5.22). The car floats tugged between Manhattan and South Amboy and between Philadelphia and Camden. At South Amboy there were at least two transfer bridges at the east end of the wharf for moving the cars between the car floats and the wharf. Once docked in Manhattan, the car floats operated like temporary wharves onto which teamsters drove their wagons and carts to receive and deliver loads (Joint Board of Directors 1867: 9). The interfacing of rail and waterborne commerce at South Amboy in the 1830s to 1860s period was arguably as important and new a phenomenon on the American

Figure 5.18. Otley, J. W. and J. Keily. Detail of *Map of Middlesex County, New Jersey*. 1850. Scale: 1 inch = 2,800 feet (approximately).

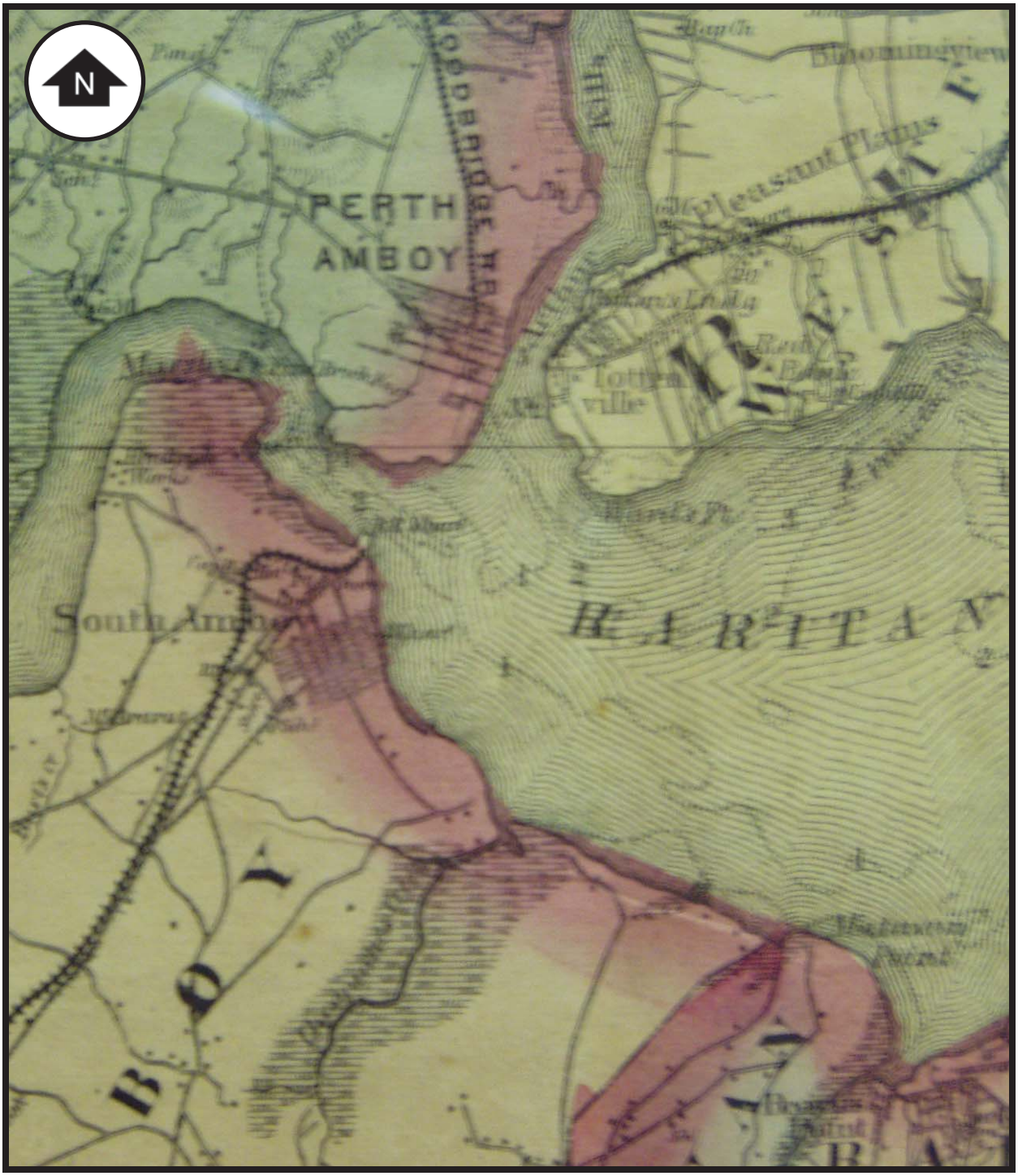


Figure 5.19. Lake, D.J. and S.N. Beers. Detail of *Map of the Vicinity of Philadelphia and Trenton*. 1860. Scale: 1 inch = 1 mile (approximately).

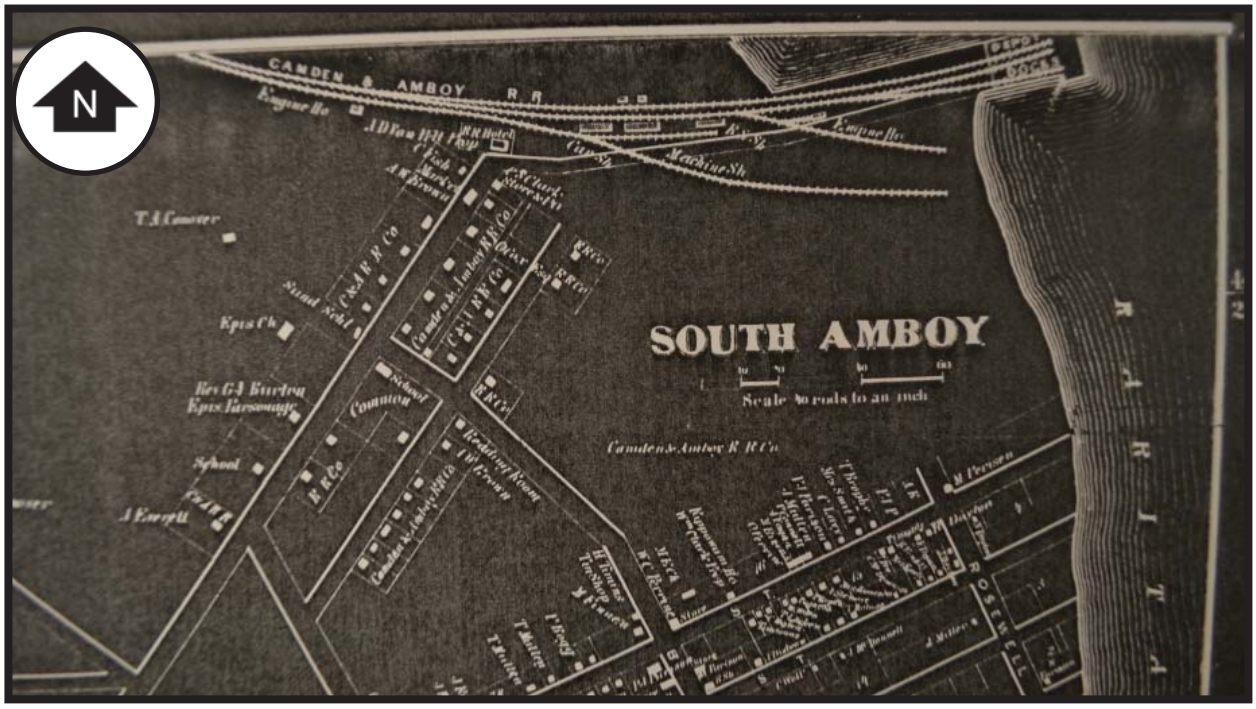


Figure 5.20. Walling. H.F. Detail of *Map of Middlesex County, New Jersey*. 1861. Scale: 1 inch = 2,400 feet (approximately).

Figure 5.21. Hughes, M. Detail of *Map from Newark Bay to Washington Rock.* 1868. Scale: 1 inch = 1,000 feet (approximately).

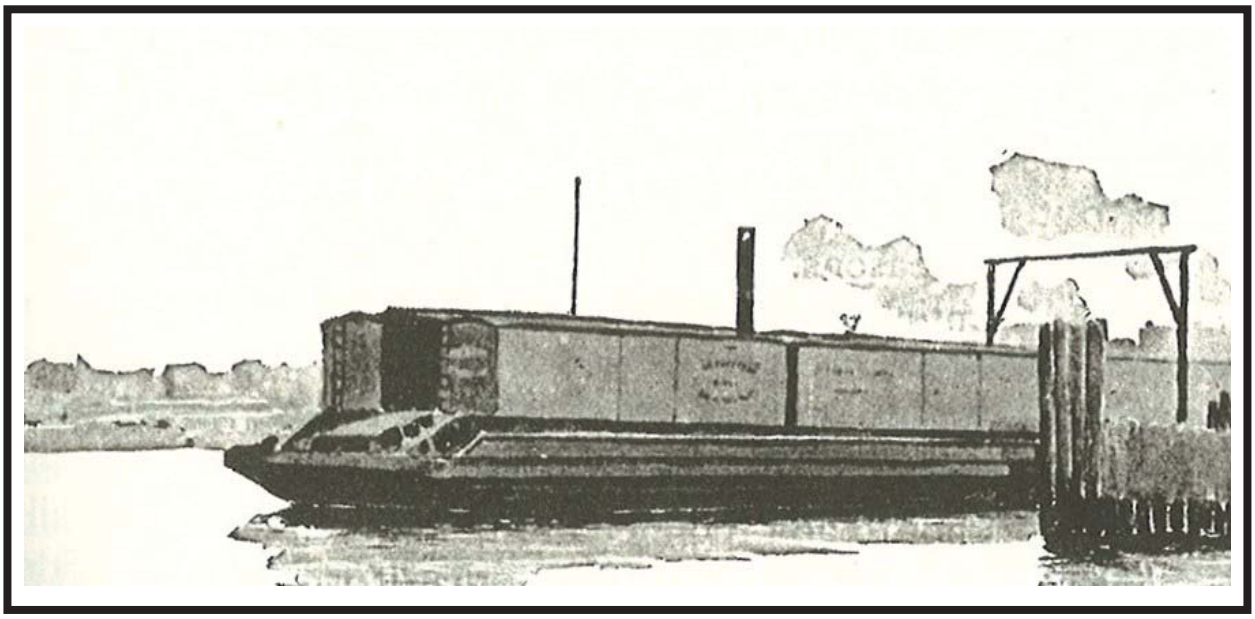


Figure 5.22. Car Float in New York Harbor. *Circa* 1880 (Source: Clarke 1988 [1889]:295).

landscape as were the rail beds and locomotives themselves. Tidewater terminals were unique places where structures were needed for the movement and comfort of passengers transferring between ferry and railroad car, the loading and unloading of freight cars, and the temporary storage of goods on an expanding scale.

2. Known Resource Types and Their Significance

Virtually nothing has survived of the wide variety of buildings and structures that once characterized the South Amboy ferry terminal in the Camden and Amboy Railroad period from 1831 to 1871. The terminal was significantly altered by subsequent improvements in the post-1871 Pennsylvania Railroad era, as well as by the massive explosion of a munitions pier that leveled the buildings in the rail yard in 1950. Resources dating to the early railroad period are rare within the project area and mainly limited to gross landscape features and deposits of old building materials reused as fill. A significant landscape feature that anchors the west end of the site is the early railroad alignment, which still curves around the north side of the bluff and crosses New Jersey Transit's North Jersey Coast Line before becoming obscured by later coal terminal development and remediation efforts within the project area.

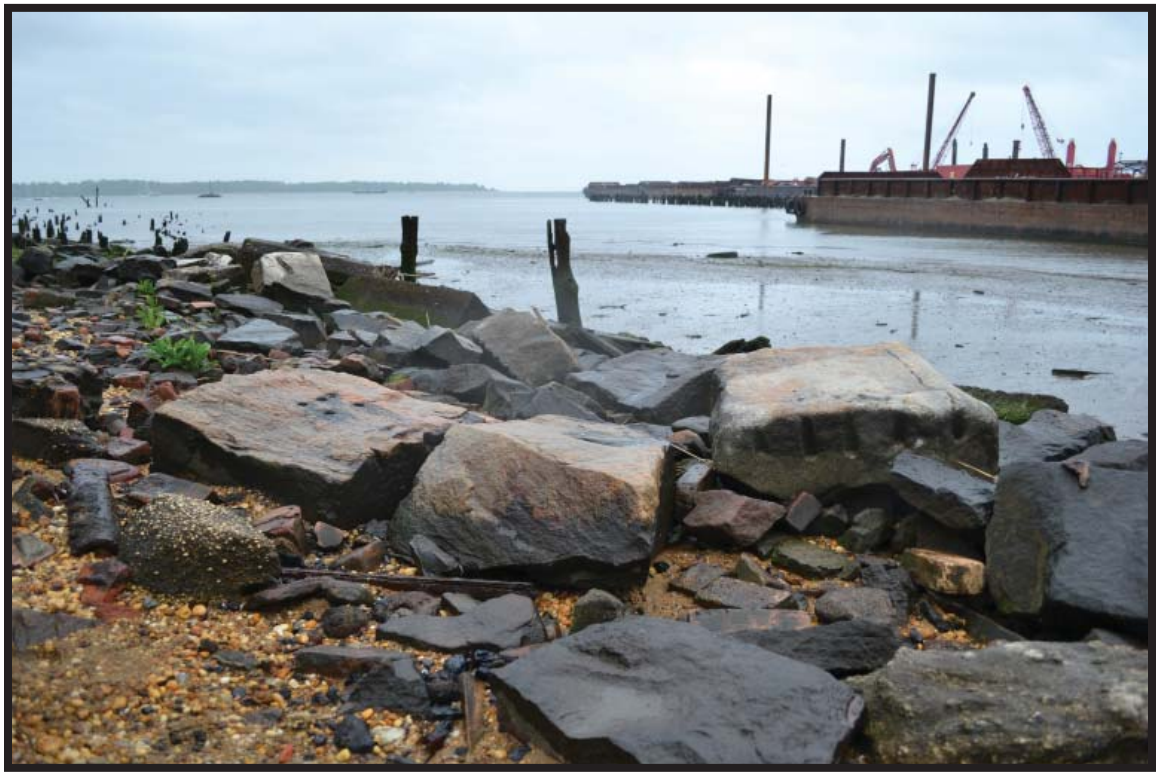
The Camden and Amboy Railroad's wharf was located at the northeast corner of the study area. Today, this location is identifiable as a sandy spit, partially submerged (Photograph 5.10). The deteriorated bulkheads and pilings in this area do not appear to be Camden and Amboy Railroad period but later construction associated with the repurposing of the wharf as a munitions pier and an area for tying up coal barges in the early 20th century. At least 19 stone sleepers exist within this corner of the project site, apparently salvaged from the original roadbed and reused as fill. The sleepers are roughly two-foot square and have outlines of iron plates and spike holes, typical of those found at other Camden and Amboy Railroad sites (Photograph 5.11). The sleepers at South Amboy are not *in situ* and should be recovered for use as interpretive features at the new ferry terminal. The sleepers are distinctive of the style of roadbed construction employed by the Camden and Amboy Railroad in the 1830s (Hunter Research Associates 1986:4-19).

In the area of the Camden and Amboy Railroad depot at the foot of Main Street, there are no surviving buildings of the early railroad period. The railroad workers' village on Main and Second Streets has fared only slightly better with the principal surviving building the Christ Episcopal Church on Main Street, a Gothic Revival-style stone church built for the workers on Camden and Amboy Railroad property in 1858. Although the southern end of Main Street has been redeveloped with modern townhouses, there are perhaps a half dozen, nearly identical houses on Second Street between New Jersey Transit and Stockton Street that could be modified railroad workers' houses dating to the mid-19th century. Further research would be required to confirm that these dwellings were originally railroad-company housing.

C. THE SOUTH AMBOY TERMINAL IN THE PENNSYLVANIA RAILROAD PERIOD (1871-1965)

In 1871, the Pennsylvania Railroad leased the United Railroads of New Jersey, which included the Camden and Amboy Railroad. This strategic acquisition gave the Pennsylvania Railroad, which had previously terminated in Philadelphia, a direct line to the north and the Port of New York solidifying its control over the regional transportation network. It brought the South Amboy terminal under the control of the largest railroad corporation in the United States. During the first year of operating the former Camden and Amboy

Photograph 5.10. View of project site looking north toward Perth Amboy. The pilings in the mid-ground mark the approximate location of the original Camden and Amboy Railroad T-wharf (Photographer: Alison Haley, 2012) [HRI Neg. #11027/D2:12].



Photograph 5.11. View of stone sleepers, looking northeast north of the coal piers (Photographer: Alison Haley, 2012) [HRI Neg. #11027/D2:24].

Table 5.5. Major New Jersey Tidewater Coal Terminals at the Port of New York.

Name of Canal or Railroad	Coal Terminal Location	Date of Establishment of Coal Terminal
Delaware and Raritan Canal	New Brunswick	1834
Morris Canal	Jersey City	1836
Central Railroad of New Jersey	Elizabethport	1852
Morris and Essex Railroad	Hoboken	1862
Central Railroad of New Jersey	Communipaw, Jersey City	1864
Pennsylvania Railroad	South Amboy*	1871
New Jersey Midland Railroad	Jersey City	1873
Lehigh Valley Railroad	Perth Amboy	1875
Pennsylvania Railroad	Harsimus Cove, Jersey City	1880
Lehigh Valley Railroad	Caven Point, Jersey City	1890
New York Susquehanna & Western Railroad	Weehawken	1892
Baltimore and Ohio Railroad	Port Reading, Woodbridge	1892
Pennsylvania Railroad	Greenville Piers, Jersey City	1906

* South Amboy was established as a terminal in 1832 but did not become a major coal terminal until after improvements by the Pennsyvlania Railroad in the early 1870s.

Railroad, the Pennsylvania Railroad invested more than one million dollars in improvements (Joint Board of Directors 1872:76).

The Pennsylvania Railroad viewed South Amboy as part of its regional network of rail lines and as one of its points of entry to the Port of New York, but not as the most important point of entry. Compared to the Pennsylvania Railroad's other Port of New York facility, which centered on Jersey City, South Amboy was geographically disadvantaged because of its distance from Manhattan, a 20-mile-long voyage around Staten Island. The Pennsylvania Railroad placed an emphasis on improving the Jersey City terminal, opposite downtown Manhattan on the Hudson River. The Jersey City terminal included the New Jersey Railroad's Paulus Hook terminal, which the Pennsylvania Railroad improved and expanded in 1879-80 with freight and coal-handling operations at the new Harsimus Cove yards, and in 1906 with the construction of the Greenville Piers on a 550-acre waterfront parcel, much of it made land. The Pennsylvania Railroad did not neglect the South Amboy terminal, but invested in its conversion into a facility dedicated to the handling of bulk materials, primarily coal. This conversion by no coincidence also pointed to the decline of the Delaware and Raritan Canal (which the Pennsylvania Railroad had also acquired with the United Railroads of New Jersey deal) as the conduit through which the tens of thousands of tons of coal needed to heat and fuel New York City and East Coast towns had traditionally flowed during the Camden and Amboy period. South Amboy joined other Port of New York coal terminals, like the Lehigh Valley terminal at Perth Amboy, the Delaware Lackawanna & Western Railroad coal terminal at Hoboken, and the Central Railroad of New Jersey terminal at Elizabethport and Jersey City as the principal suppliers of coal to the metropolis (Table 5.5) (Cunningham 1997:142-60).

Once established as a coal terminal, South Amboy fulfilled this role dutifully for nearly a century receiving periodic upgrades and several wholesale makeovers to improve the efficiency and capacity of its coal-handling operations. Major episodes of improvement were the installation of pocket piers in the early 1870s, of Dodge coal conveyor systems in 1892-93, of McMyler coal dumpers in 1910-11, of coal thawing plants in 1911 and 1916, and of electrified locomotive service in 1938. Bulk freight transfer services other than coal were also performed at South Amboy, including oil and munitions. The latter resulted in a deadly smokeless powder fire in 1923 and an even more deadly explosion in 1950 that leveled the terminal and heavily damaged the town of South Amboy. The terminal also continued to repair and maintain locomotives and cars throughout this period.

1. The Coal Docks Period (1871-1950)

History and Significance

The Pennsylvania Railroad constructed coal docks at South Amboy shortly after leasing the Camden and Amboy Railroad in 1871. These docks are clearly visible as two finger piers in the Everts and Stewart *Combination Atlas Map of Middlesex County, New Jersey,* published in 1876 (Figure 5.23). The docks were built to the south of the original Camden and Amboy Railroad wharf, which for the time being remained in use as a general freight wharf. The expansion of the rail yard with its multiple tracks is clearly evident in this map, as well as the location of rail-yard buildings immediately west of the piers. These buildings were, in east to west order: the car house, engine house, and the car and machine shop. The narrow length-to-width ration of these buildings and the track plan indicates that locomotives and cars could be moved into the buildings for service. Between the rails would have been service pits, in typical railroad fashion, for workers to inspect the

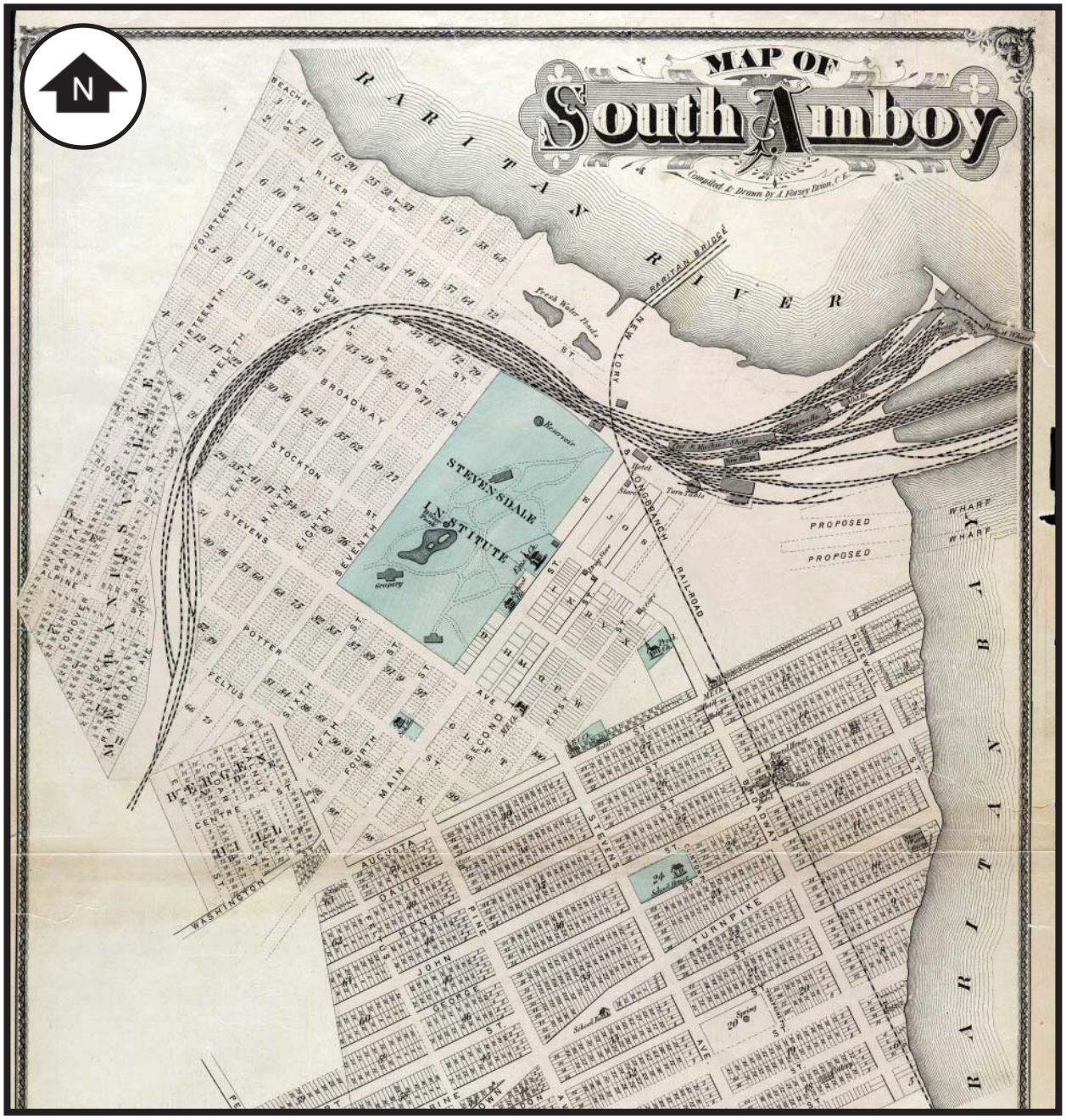


Figure 5.23. Everts and Stewart. Map of South Amboy. *Combination Atlas Map of Middlesex County, New Jersey*. 1876. Scale: 1 inch = 1,200 feet (approximately).

underneath sides of the locomotives and the cars. Other buildings of note on the map are an oil house and a saw shop. At the south end of the yard are also a turntable and two unlabeled buildings, the larger of which was likely a second engine house.

The original coal-handling piers of the 1870s were of gravity-feeding type, making use of bottom-dumping coal hopper cars that dumped coal into chutes directly into barges (Photograph 5.12). This system was relatively simple, but it relied on close coordination of train and barge movements. Loaded coal cars were held in the yards to the west of the dock waiting to be moved to the dock, requiring the Pennsylvania Railroad to expand the number of sidings, first in the area of the curve west of Main Street, and later in the area south of the docks and north of Augusta Street, currently occupied by the sand products company. Storage space was also needed in the yards for the empties returning from the dock to await formation into trains for the return to coal country. Most of the coal delivered to the South Amboy terminal originated in Pennsylvania, Maryland and West Virginia.

In 1875, the New York and Long Branch Railroad opened a new rail line from Perth Amboy south across the mouth of the Raritan River through South Amboy and on south to Bay Head (Figure 5.24). This line, jointly operated by the Pennsylvania Railroad and the Central Railroad of New Jersey, connected New Jersey's northern coastal communities with the region's rail system. Its opening soon brought an end to the need for passenger ferry and general freight service at the South Amboy terminal wharf since this traffic could now be directed north on the New York and Long Branch Railroad. Where the Camden and Amboy Railroad's original line crossed the New York and Long Branch Railroad line, a metal girder bridge was built to carry the primarily coal-hauling Camden and Amboy Railroad over the primarily passenger and general freight hauling New York and Long Branch Railroad (Photograph 5.13). Adjacent to the bridge, a new two-story station eventually replaced the old Camden and Amboy Railroad depot. The new station was called the Junction Station or the Pennsylvania Railroad Station to distinguish it from the New York and Long Branch Railroad station on Mason Avenue in South Amboy's town center. The Junction Station's upper story was built at the level of the Camden and Amboy Railroad and its lower story at the level of the New York and Long Branch Railroad facilitating the transfer of passengers (Photographs 5.14 and 5.15) (Francy 1998:31-34).

The Pennsylvania Railroad's coal agent worked with private coal companies and dealers to develop long-term business relationships at South Amboy. For many decades, the Westmoreland Coal Company was the railroad's principal partner and leased one of the South Amboy coal piers. New York City coal dealers also sought to ensure themselves reliable supplies of graded coal and contracted through the railroad to have that coal arrive at South Amboy for on-demand delivery by barge in New York City where real estate for coal storage space was at a premium. Between 1888 and 1893, the Pennsylvania Railroad undertook a major construction campaign to expand the capacity of its coal-storing and handling facilities at South Amboy. This campaign included the reconstruction of the coal piers, the construction of timber bulkheads along the shore line, filling behind the bulkheads to create fast land, dredging of shipways around the coal piers, reconstruction of the former Camden and Amboy freight pier, and the installation of Dodge Coal Storage Company conveyors and loading machines (Pennsylvania Railroad Company, Engineering Department 1888-1893). The latter technology was the innovation of James M. Dodge of Philadelphia, who patented the coal conveyor system in 1888. The system involved chain or rope driven conveyors and elevators, powered by steam engines, that shaped and screened the coal into large piles of uniform grade and then moved the coal from the piles for delivery into rail cars or barges (Figure 5.25).

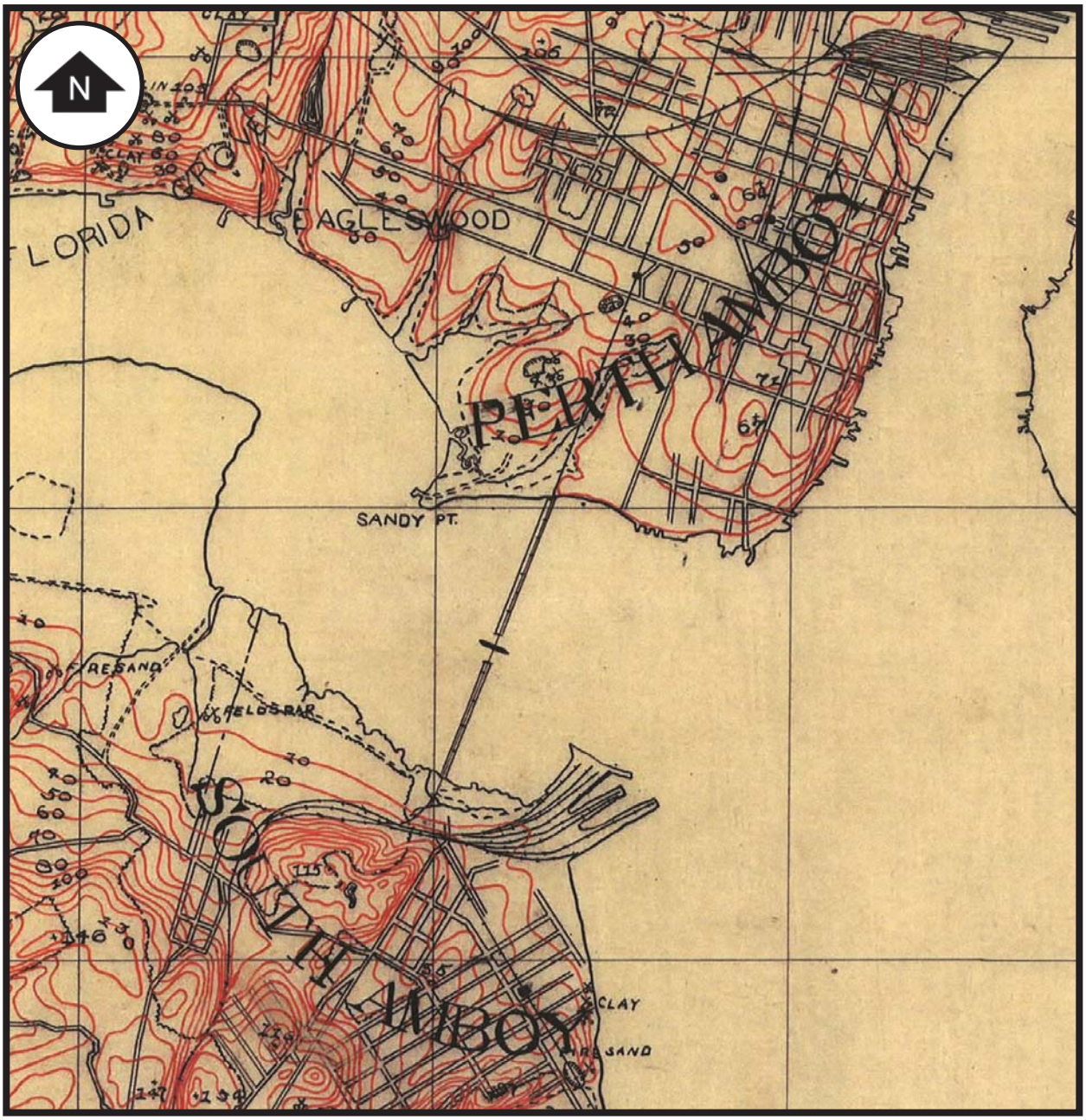
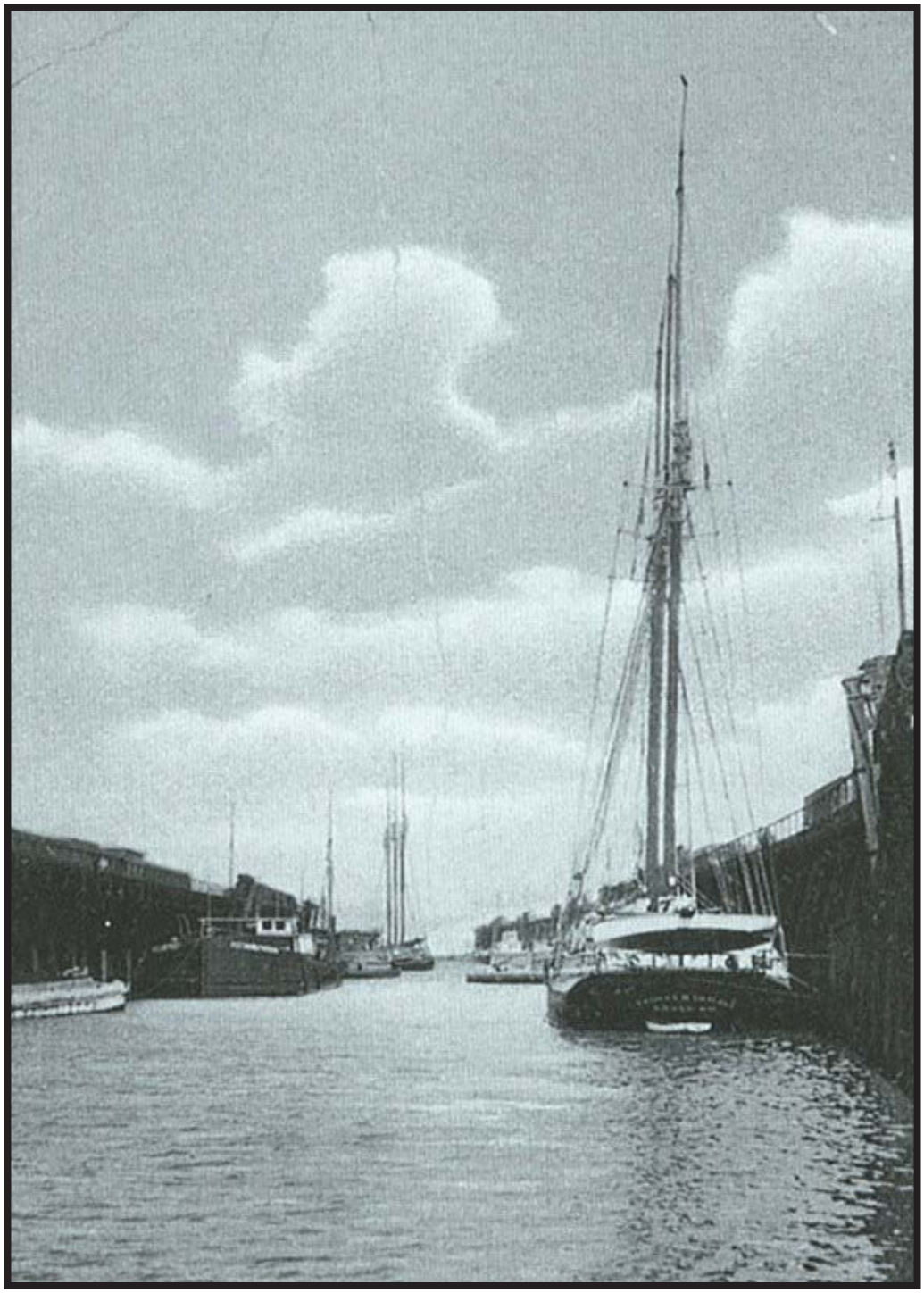
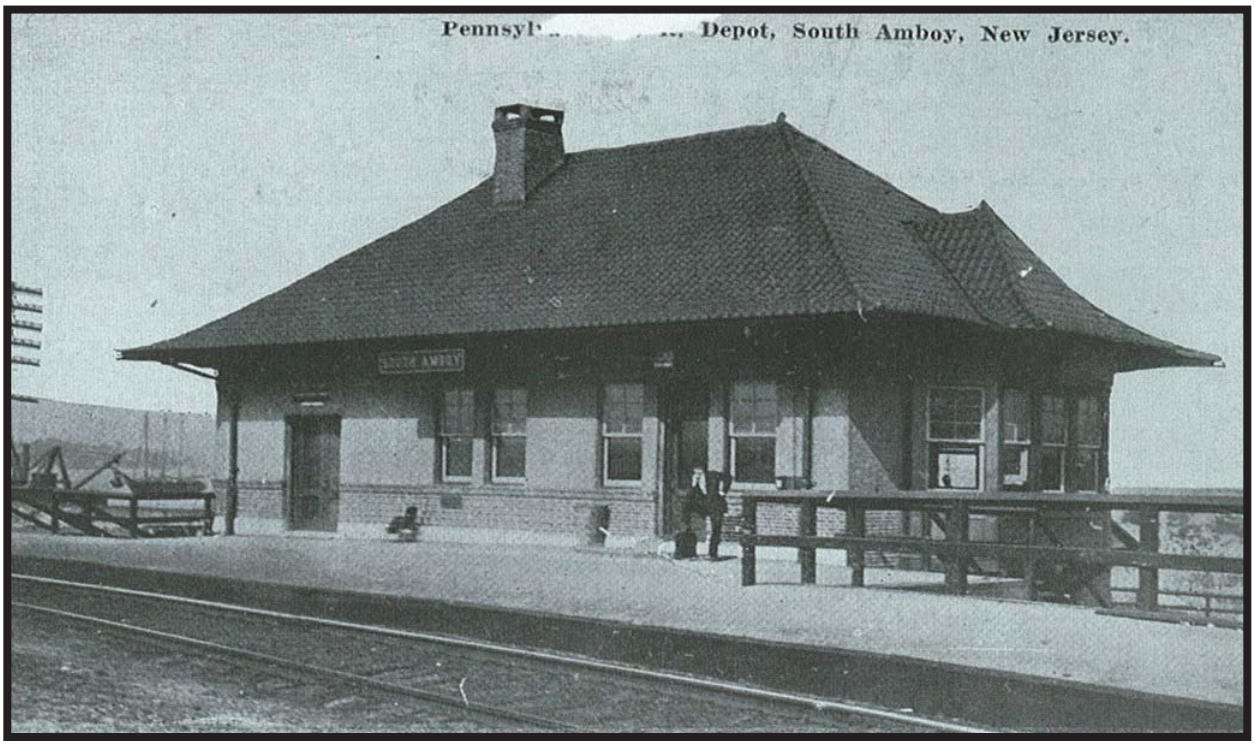


Figure 5.24. Vermuele, C.C. Detail of Sheet 39, New Jersey Geological Topographic Survey. *Circa* 1880. The map shows the New York and Long Branch Railroad's crossing of the mouth of the Raritan River, completed in 1875. The New York and Long Branch Railroad separated the coal docks from the rest of the town. Scale: 1 inch = 2,300 feet (approximately).

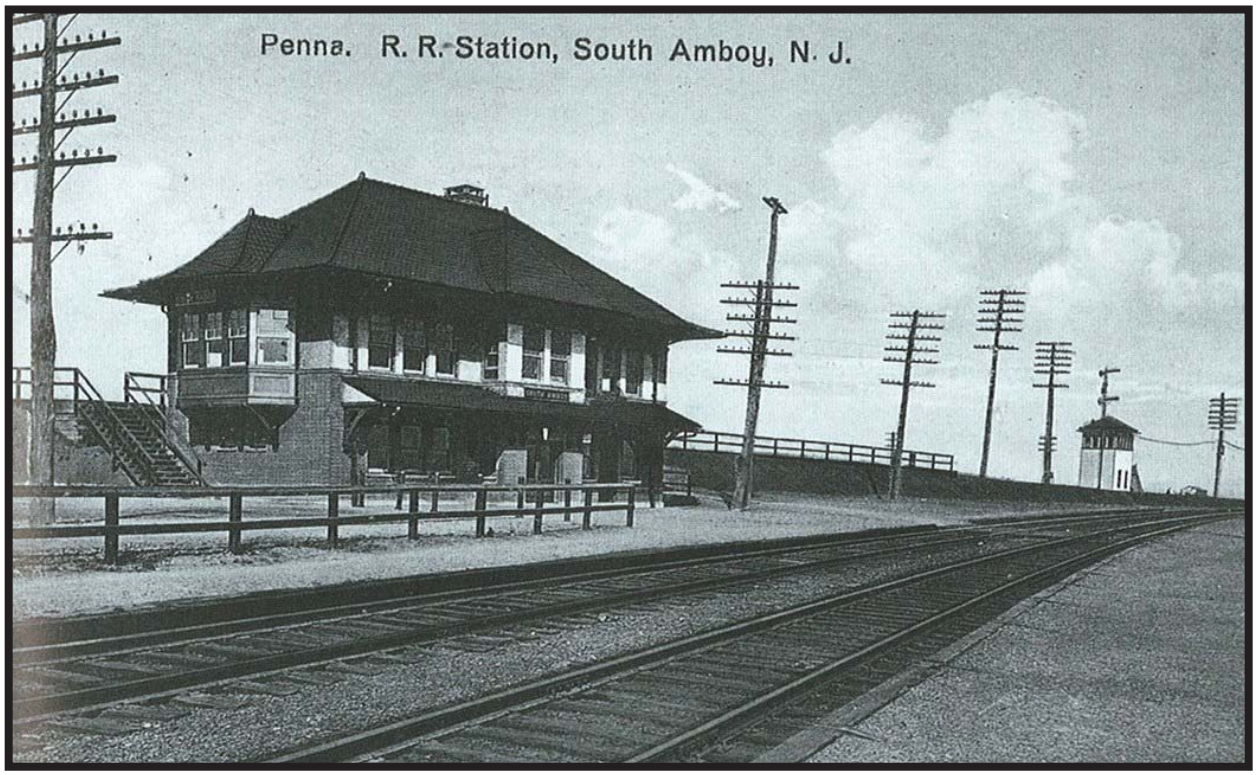


Photograph 5.12. Coal handling pier at the South Amboy Terminal. *Circa* 1880 (Source: Francy 1998).

Photograph 5.13. Camden and Amboy Railroad depot. *Circa* 1880. This view shows the depot shortly after the New York and Long Branch Railroad was built in 1875. The depot was not long after replaced by a new two-story station, known as the Junction Station, which served both lines (Source: Francy 1998).



Photograph 5.14. Junction Station. South Amboy, New Jersey. *Circa* 1910. The station was located roughly where the overpass to the Jersey Central Power and Light Plant is on Main Street (Source: Francy 1998).



Photograph 5.15. Junction Station. South Amboy, New Jersey. *Circa* 1910 (Source: Francy 1998).

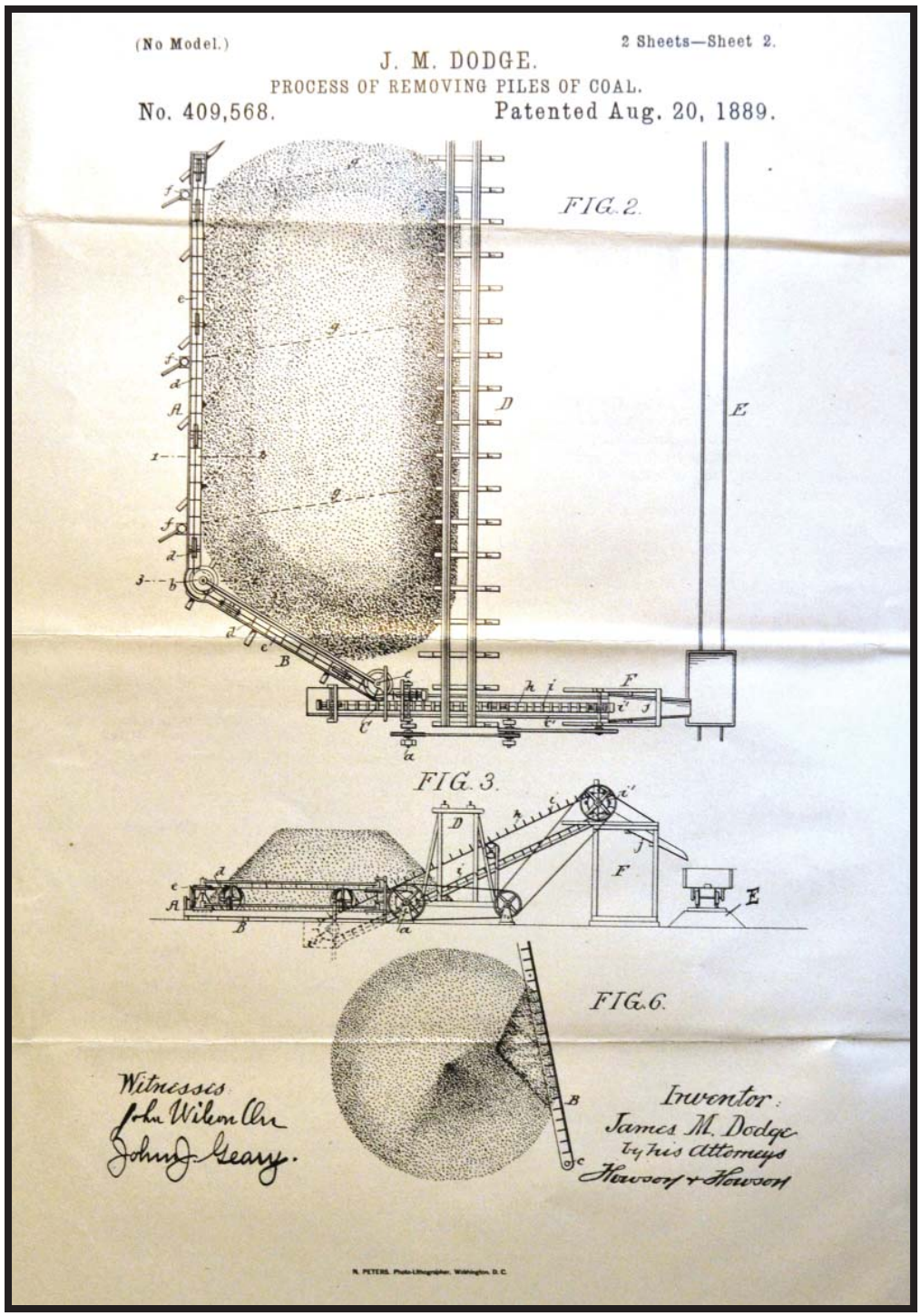
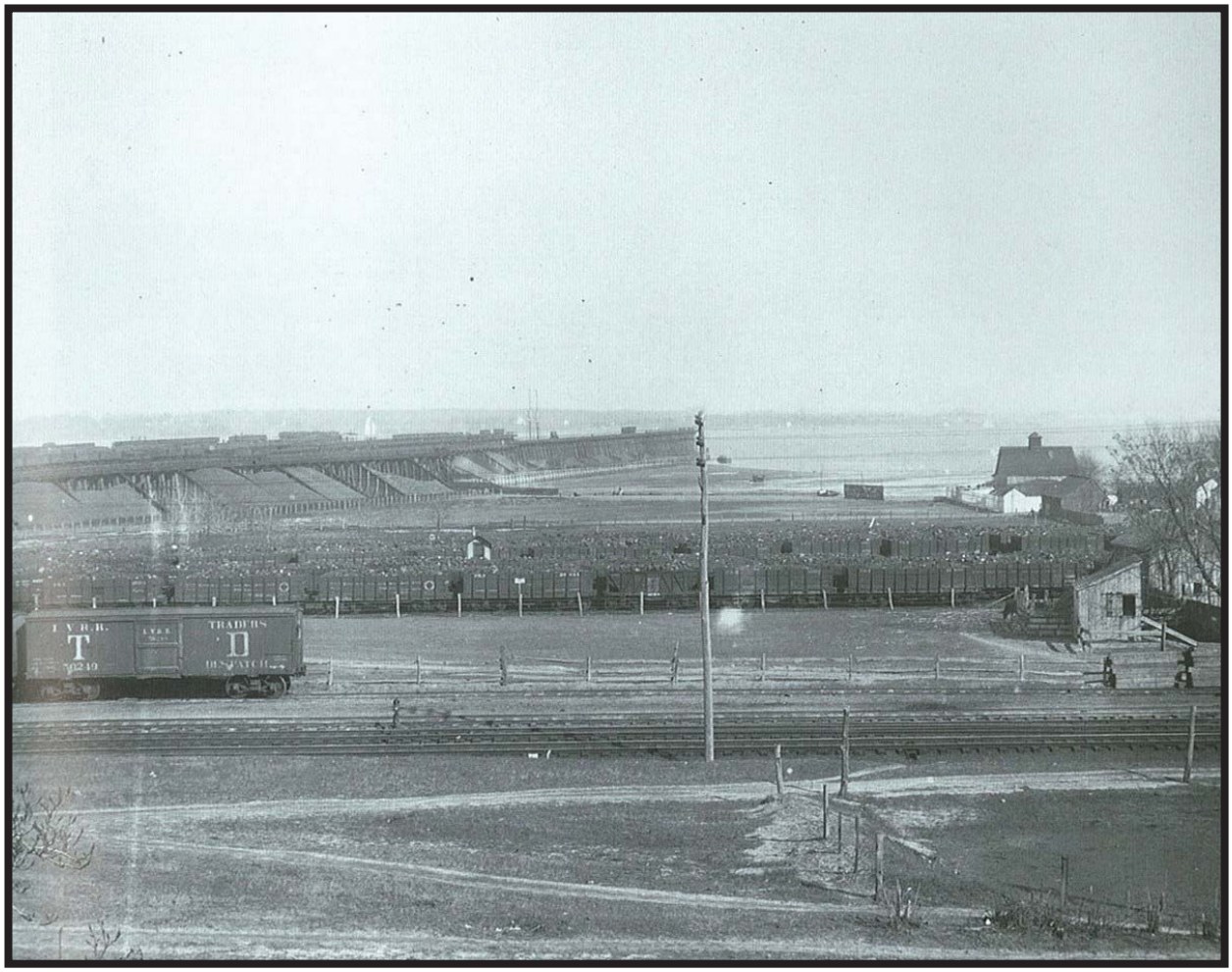


Figure 5.25. Dodge, J.M. Patent Drawing for Process of Removing Piles of Coal. 1889 (U.S. Patent No. 409,568). Dodge contracted with the Pennsylvania Railroad to install his patented machinery at the South Amboy terminal in 1892 (Source: Pennsylvania Railroad Company 1889).

At South Amboy, the Pennsylvania Railroad installed the Dodge machines for use within a coal storage yard located at the west end of the piers. The coal piles are visible in a photograph looking north over the yards from the vicinity of Second Street around 1900 (Photograph 5.16). The contract for machinery installation by the Dodge Coal Storage Company itemized provision of six trimming machines of 15,000 tons each, three reloading machines, three reloading pockets, discharge chutes, screening bins of 25 tons capacity each, three Westinghouse engines, three boilers and three screening elevators having capacity of 25 tons per hour. This added some 90,000 tons of coal storage capacity to the terminal. About this time, the Pennsylvania Railroad also deepened and lengthened the coal piers to accommodate larger barges. The dredge spoils were deposited north of the terminal in the area between the old Camden and Amboy wharf and the New York and Long Branch Railroad Bridge. This work was carried out within a bulkhead line that had been established by the U.S. Army Corps of Engineers about 1885. A comparison of navigation charts prepared by the Corps in 1885 and 1907 provides an indication of the changes to the shoreline and the changes in the shape and size of the piers (Figures 5.26 and 5.27). Photographs from this same period show a variety of barges tied up at the piers (Photographs 5.17 to 5.19) (Pennsylvania Railroad Company, Engineering Department 1888-1893; Francy 1998:40-41).

In 1910, the Pennsylvania Railroad installed the first of two giant McMyler car-dumping machines at South Amboy to replace the Dodge conveyor system (Photographs 5.20 to 5.22). The car-dumper picked up entire coal cars within a cradle, tipped the car over and dumped its contents onto an apron, which directed the coal into the hold of a waiting barge or ship. The South Amboy car-dumper was designed to handle a maximum car length of 47 feet and a loaded car of 170,000 pounds. This remarkable machine lifted cars to a maximum height of 11.5 feet by use of steam pressure and counterweights. A steam plant to power the dumper was built on the pier. In 1911, the railroad installed a second McMyler car-dumping machine at South Amboy. By this time, the Pennsylvania Railroad already had about two dozen McMyler dumpers at work in various terminals in New York, Philadelphia and the Great Lakes by the time the two machines were installed at South Amboy, so they were a proven technology. The manufacturer was the McMyler Machine Company of Cleveland, Ohio, a firm specializing in coal and ore handling machinery. The McMyler dumper was patented in 1896 by John McMyler with subsequent patented refinements over the next decade (Figure 5.28). Chief Engineer George H. Hulett, who was with the McMyler Machine Company from 1903 to 1907, is largely credited with making the dumper technology practical, and the machines like those employed at South Amboy were sometimes alternatively called Hulett Car Dumper Machines (Pennsylvania Railroad Company, Engineering Department Correspondence 1910-11; Avery 1918:130-31).

The McMyler car-dumping machines allowed the Pennsylvania Railroad to reorganize the approach to handling coal at South Amboy, by making use of higher tonnage coal cars and eliminating the coal storage yard previously handled by the Dodge conveyors. The new system required a continuous flow of full cars approaching the dumpers, and after being tipped and emptied, the empties were rolled by gravity to a kickback at the end of the pier, which redirected the empties back up the pier onto a siding where they were formed into a train to be pulled back to the yard and returned to service. The elimination of the coal storage yard meant that the South Amboy terminal required standing room to accommodate a sufficient quantity of coal cars to fulfill the demands of their customers in New York City (Photograph 5.23). In the mid-1910s, the yard was expanded to have space for 3,500 coal cars each with a 40-ton capacity. Thus at maximum capacity, the South Amboy terminal



Photograph 5.16. View looking east with the coal yards and piers of the South Amboy ferry terminal in the background. *Circa* 1900 (Source: Francy 1998).

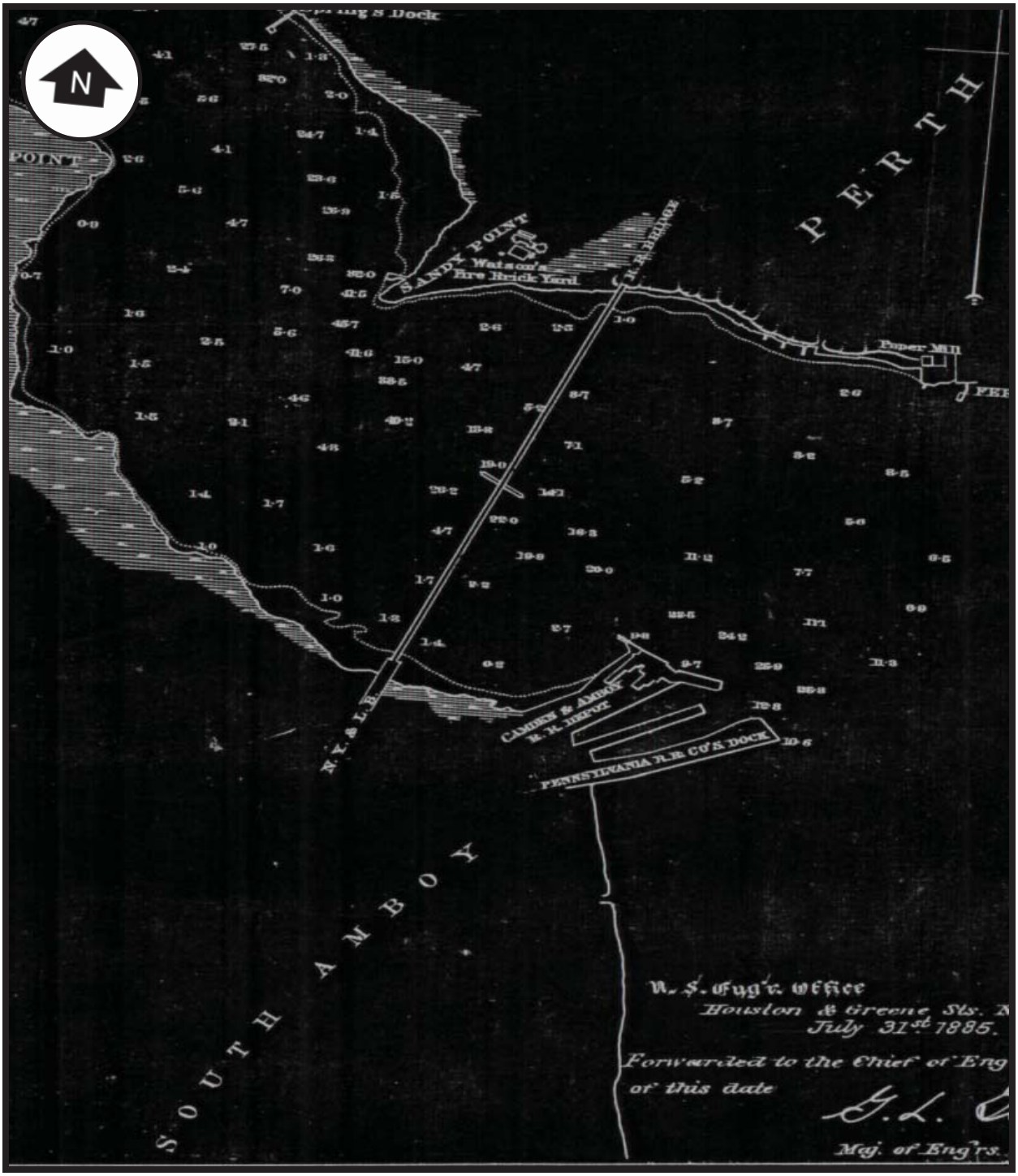


Figure 5.26. U.S. Army Corps of Engineers. Detail of *Raritan River, New Jersey from Its Mouth to Sayreville*. 1885. Scale: 1 inch = 1,100 feet (approximately).

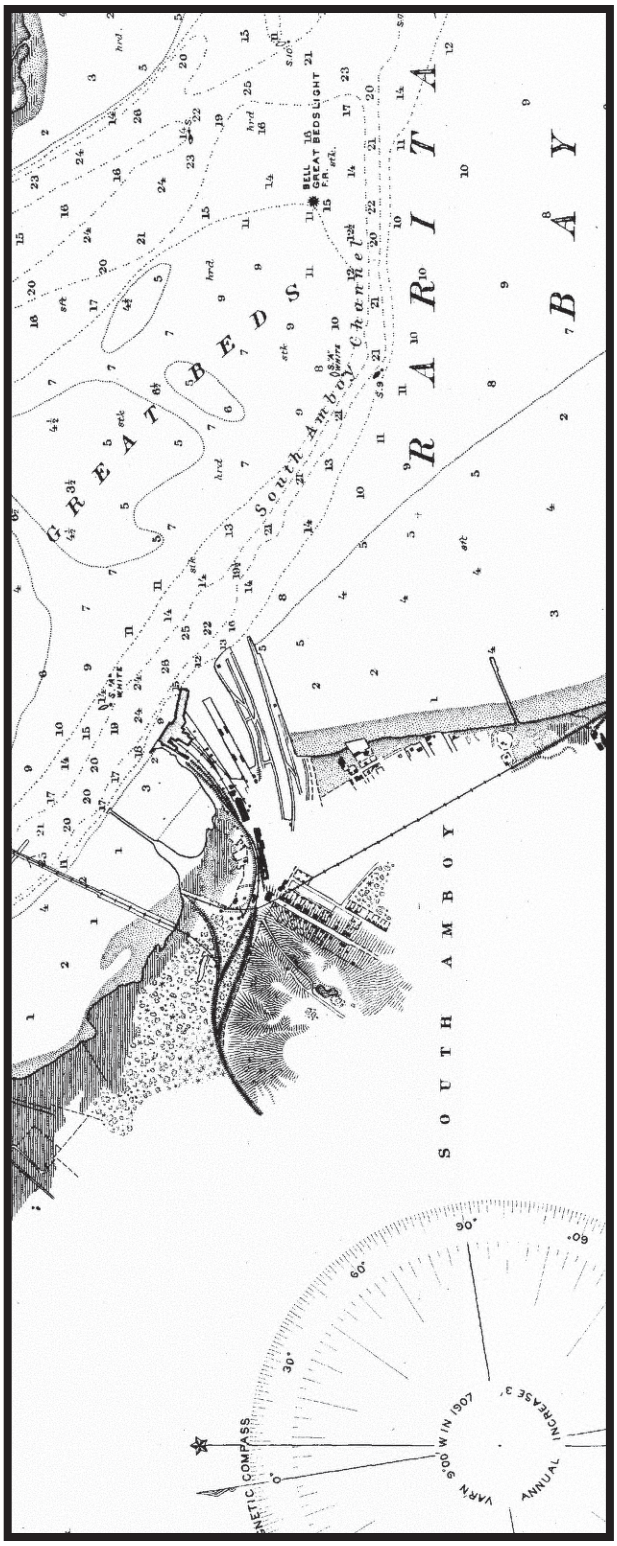


Figure 5.27. U.S. Coast and Geodetic Survey. Detail of *Raritan River from Raritan Bay to New Brunswick, New Jersey*. 1907. Scale: 1 inch = 2,000 feet (approximately).

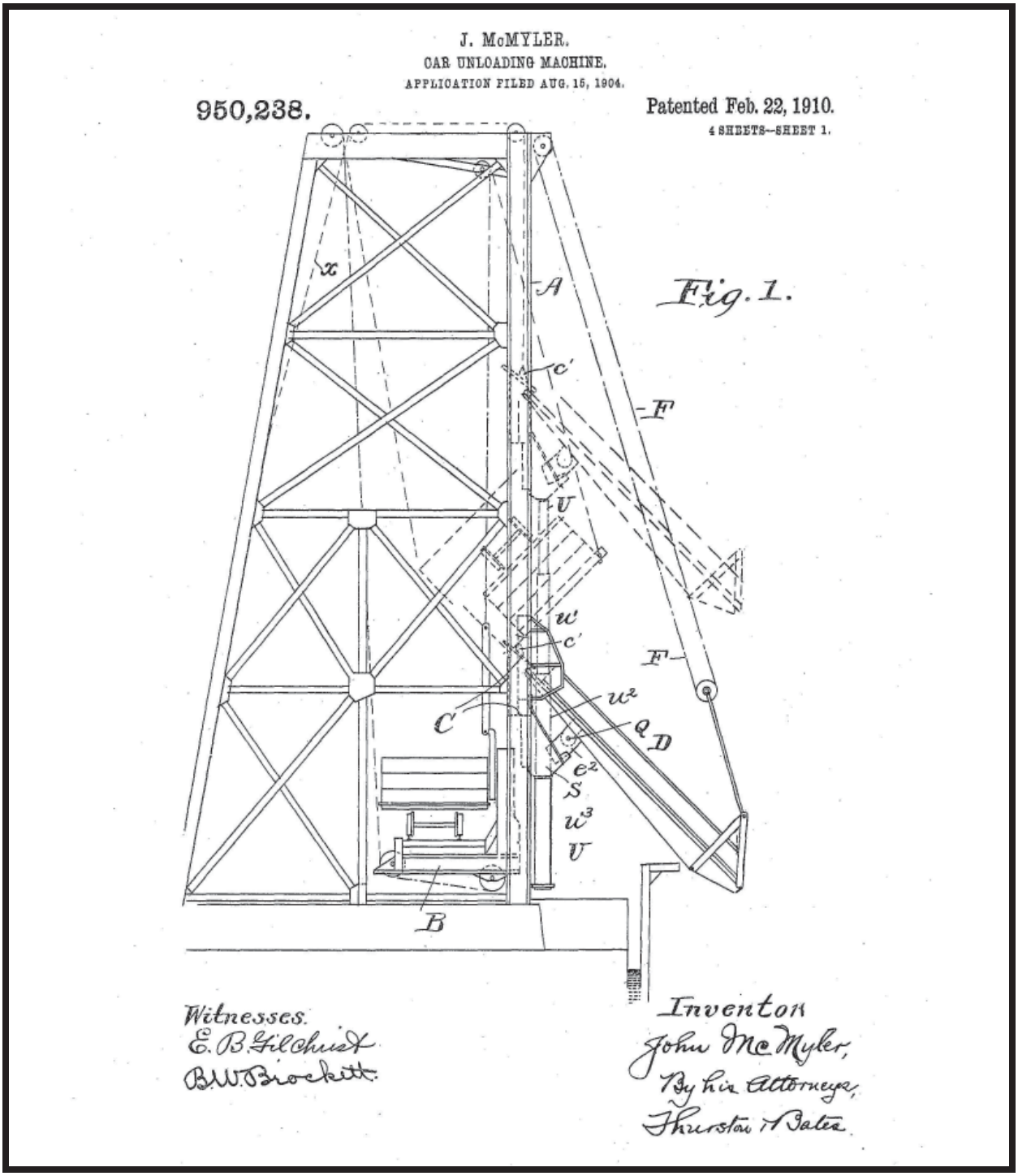
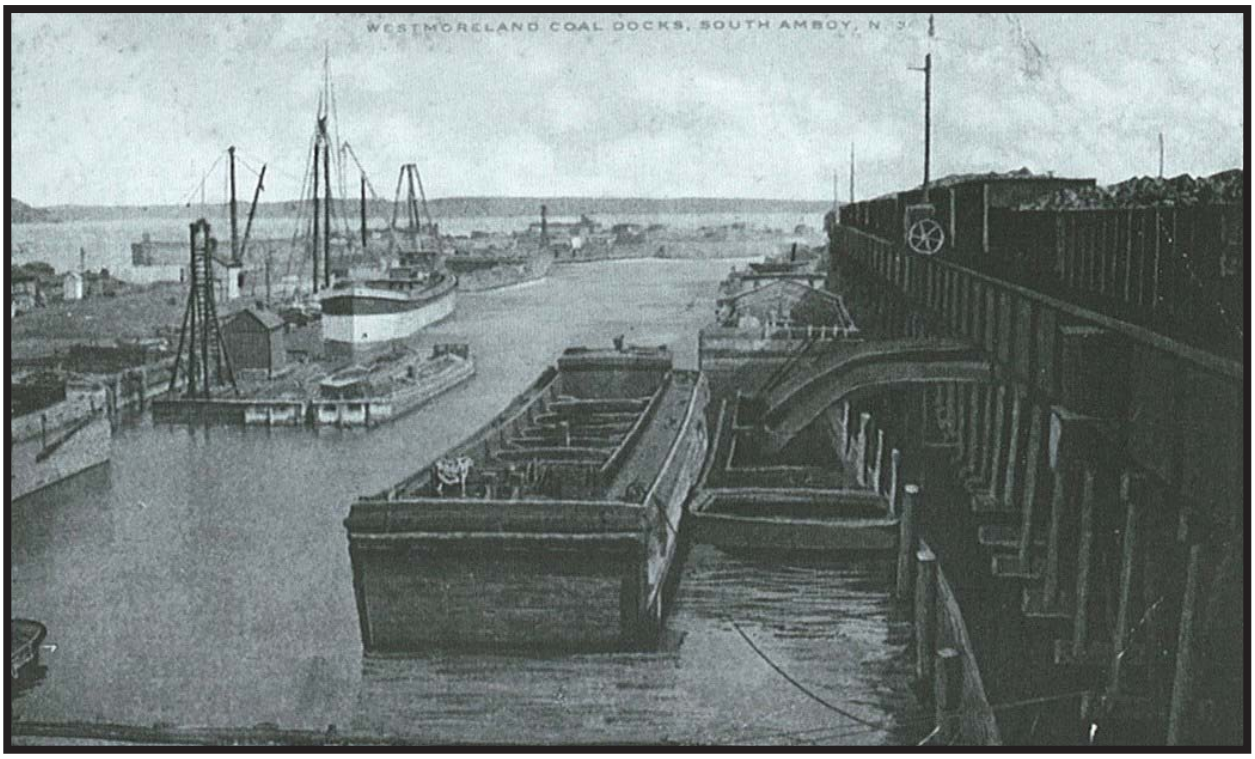
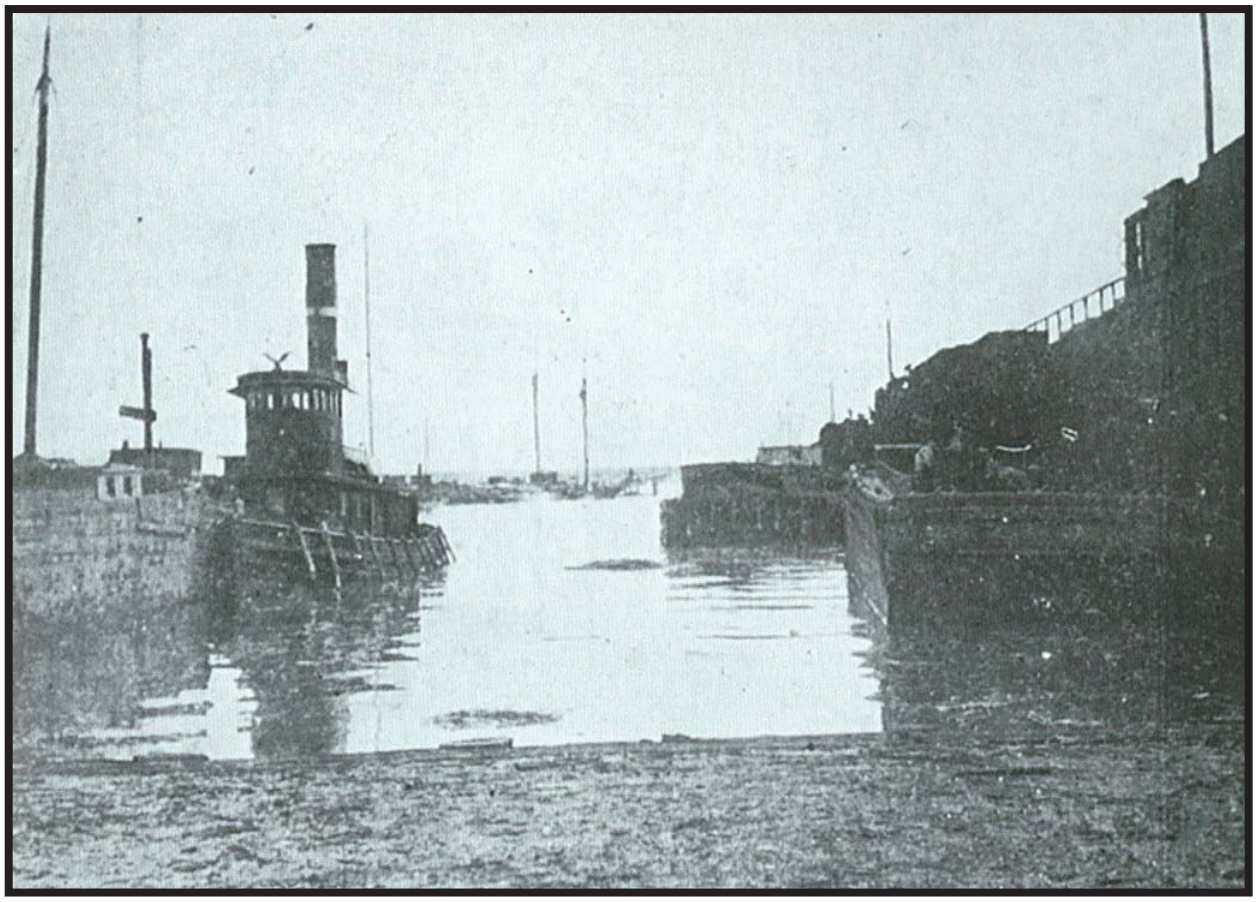


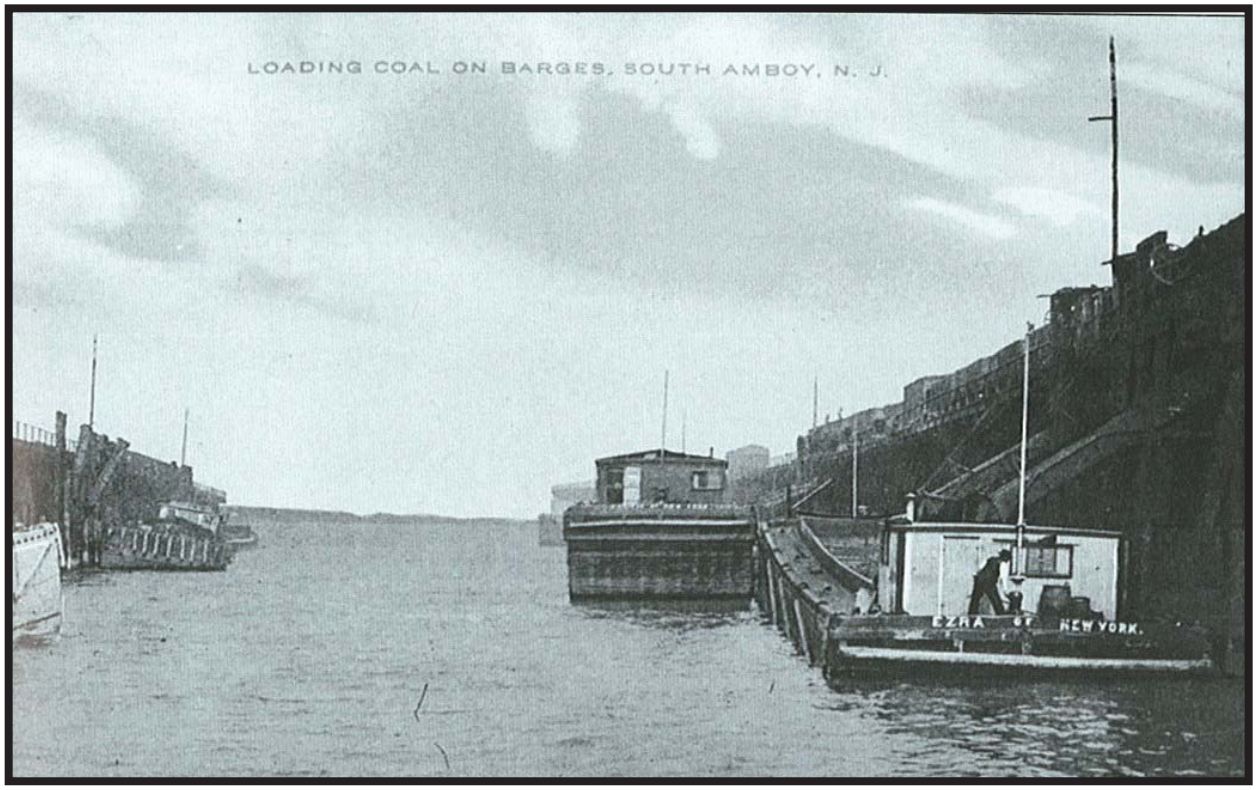
Figure 5.28. McMyler, J. Patent Drawing for Car Unloading Machine. 1910 (U.S. Patent No. 950,238).



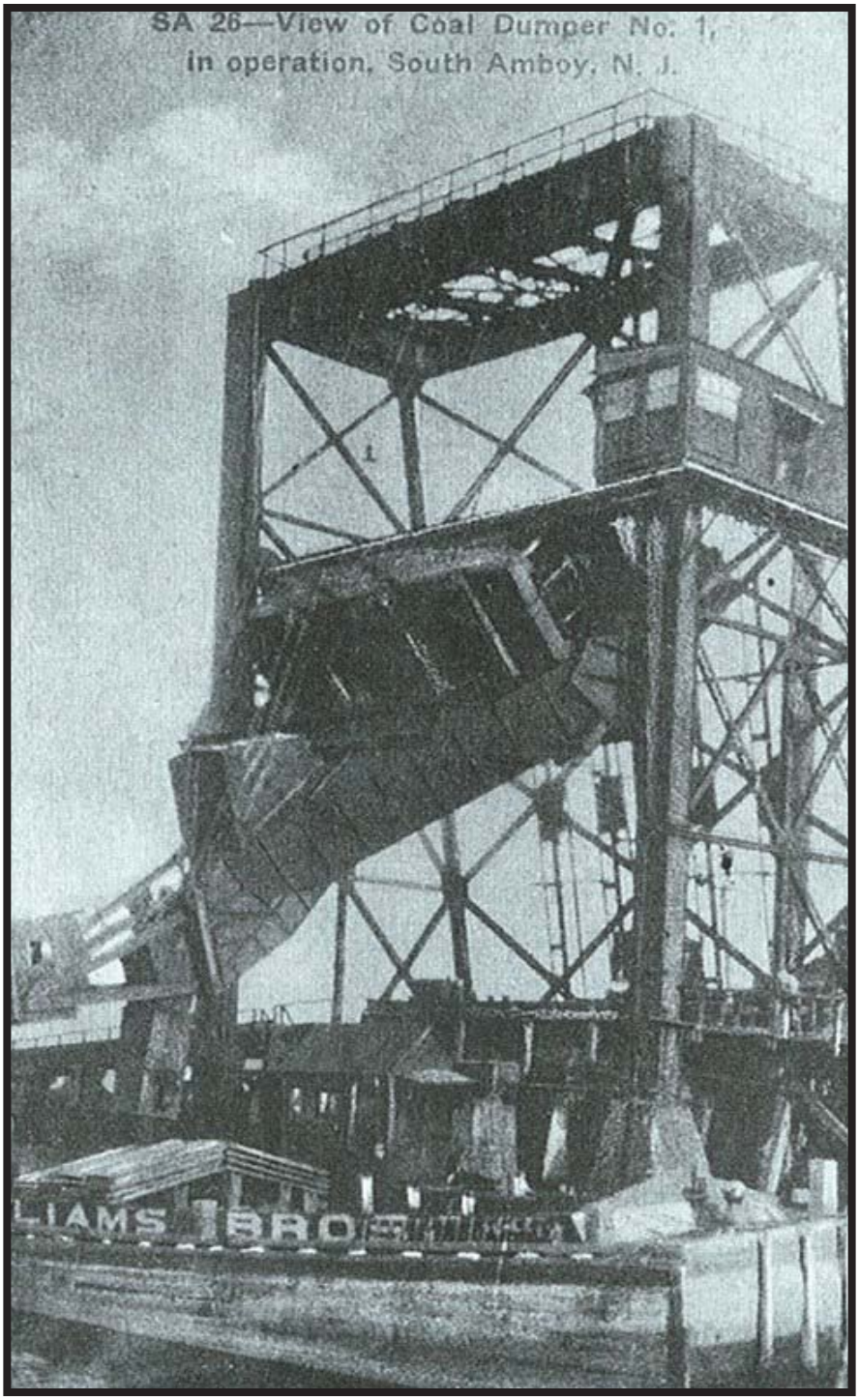
Photograph 5.17. Westmoreland coal pier, South Amboy, New Jersey. *Circa* 1900 (Source: Francy 1998).



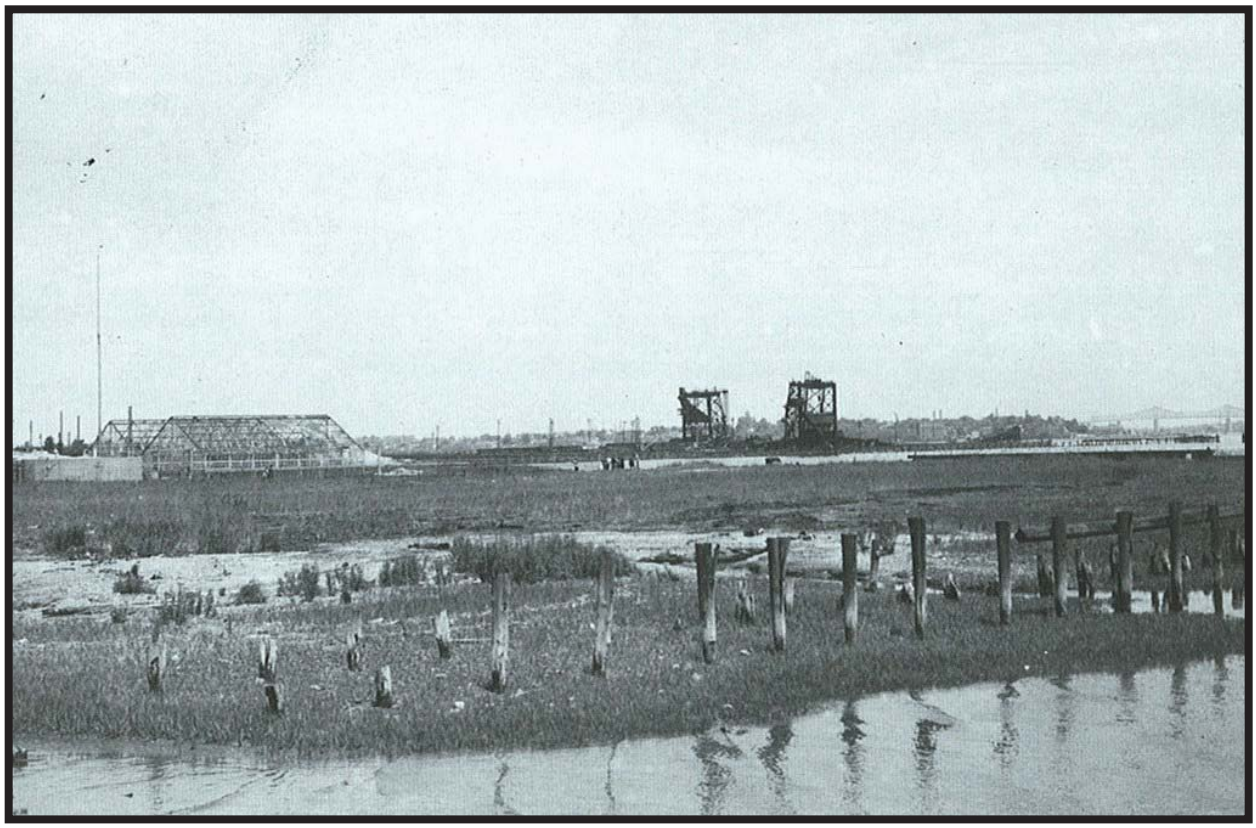
Photograph 5.18. Coal pier, South Amboy, New Jersey. *Circa* 1900 (Source: Francy 1998).



Photograph 5.19. Loading Coal on Barges. South Amboy, New Jersey. *Circa* 1900. (Source: Francy 1998).

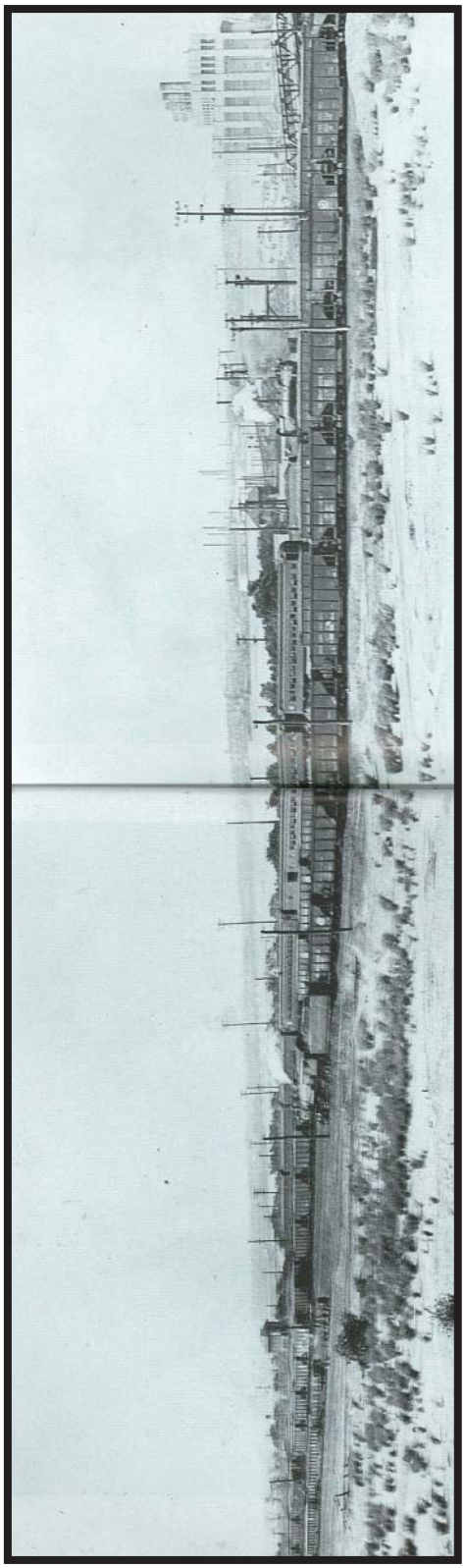


Photograph 5.20. View of Coal Dumper No. 1 in operation, South Amboy, New Jersey. *Circa* 1920 (Source: Francy 1998).



Photograph 5.21. Panoramic view of coal piers and dumpers, South Amboy, New Jersey. *Circa* 1950 (Source: Francy 1998).

Photograph 5.22. Panoramic view of South Amboy shoreline with coal piers and dumpers in background, South Amboy, New Jersey. *Circa* 1920 (Source: Francy 1998).

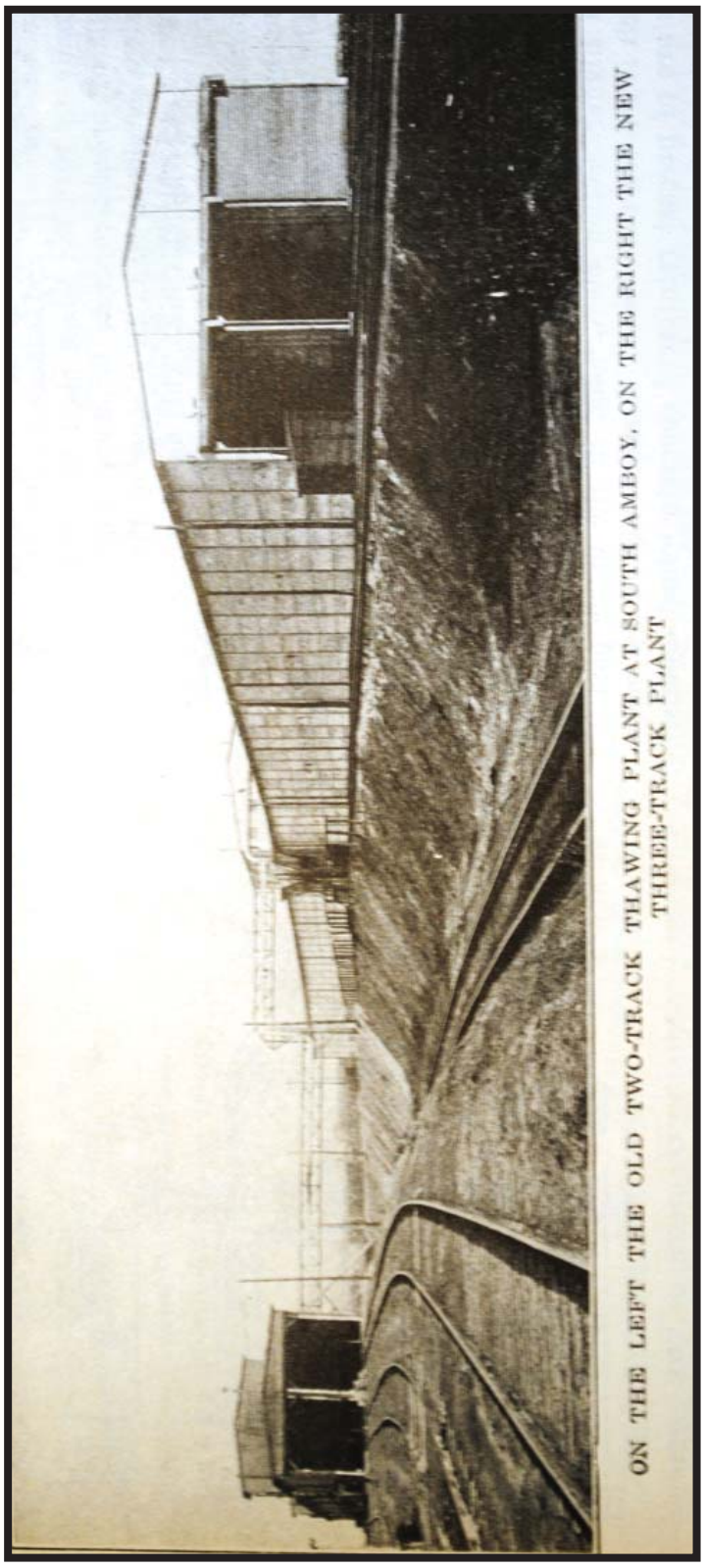


Photograph 5.23.Panoramic view of the Pennsylvania Railroad's South Amboy yard, looking north. *Circa* 1920 (Source: Francy 1998).

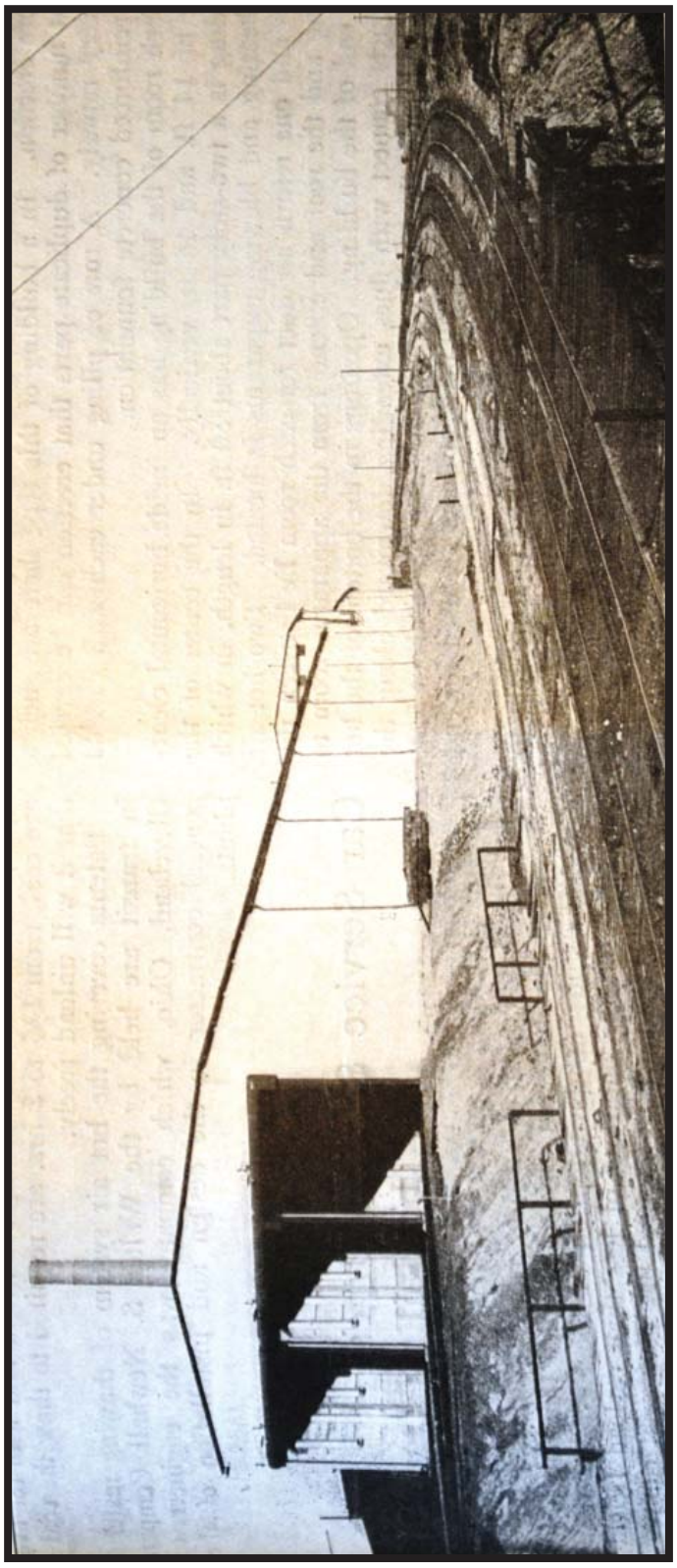
could house 140,000 tons of coal. During the winter heating season, the terminal was transferring from rail to barge on average a half a million tons of coal per month. The terminal also featured a row of pilings known as the "tied-up racks" where up to 70 loaded or empty coal barges could be stored. The tied-up racks were located immediately offshore of the Camden and Amboy's old freight pier, which had fallen into disuse. The Pennsylvania Railroad's Coal Freight Agent H.C. Clevenger made note in April 1915 that the South Amboy terminal was earning the railroad about six million dollars per year, making it "beyond doubt the most profitable freight tonnage handled by our system" (Pennsylvania Railroad Company, Engineering Department Correspondence 1910-1918).

Cold weather was a persistent challenge to shipping coal. This was not a new problem; during the canal era, coal was delivered to the coast during warm months and stockpiled for the winter prior to the canals freezing over, but demand was difficult to predict, storage space was at a premium and coal shortages were not uncommon. The railroads delivered coal year round, but long freezes could bring their operations to a halt because the coal would freeze in the cars making it almost impossible to release from the car when it arrived at the port. Bituminous coal, because it was dustier than anthracite and the dust captured moisture, was more problematic than cleaner anthracite. The Pennsylvania Railroad was a major carrier of bituminous coal to New York City because its lines tapped the southern Appalachian coal fields, whereas most of the other coal haulers had their lines primarily in the northeastern Pennsylvania anthracite fields. Frozen coal was particularly troublesome at terminals that adopted car-dumpers since the process of unloading was designed to be continuous. To solve this problem, terminals with coal dumpers often installed thawing plants. In 1910-11, contemporaneous with the installation of the McMyler car-dumpers, the Pennsylvania Railroad built a coal-car thawing plant at South Amboy, located over the tracks to the west of the coal piers in the area previously occupied by the coal yard.

The 1910-11 South Amboy coal-thawing plant was a 500-foot-long, wooden building capable of thawing twenty cars at a time, ten on each of two covered tracks (Photograph 5.24). A steam plant, adjacent to the north side of the coal-thawing building, provided steam to underground lines placed parallel to and between the tracks. About every 20 feet, a rubber hose connected to the steam supply, and to the end of each hose was attached a 10-ft.-long cast-iron pipe with a perforated, pointed end that could be driven into the frozen coal and live steam injected through the perforations. After the first winter season, this novel system of injecting steam into the coal was determined to be awkward and inefficient, plus being dangerous to workers. The coal tended to thaw around the pipe allowing the steam to blow out suddenly through the top of the coal. The pipes had to be driven into the cars multiple times, and the coal became very wet. The system's manufacturer, the Walter S. Newhall Company of Cleveland, Ohio, considered other approaches and in November 1911 Walter S. Newhall, along with contractor Scott W. Linn and Alva C. Hezlep, applied for a patent on a hot-air system of thawing coal cars (Figure 5.29). This system consisted of blowers that forced air, heated to 250F°, through ducts in the ceiling that ran the length of the building. At intervals flues forced the air down to be vented through the floor and upwardly toward the bottom of the cars, usually thawing the ice in the coal in one to two hours. This system was installed in the South Amboy plant and proved satisfactory. It was installed in several other coal thawing plants in locations other than South Amboy between 1912 and 1916 before a second plant of this design was built at South Amboy to increase capacity. The second plant differed in several respects from the first plant: it had three tracks rather than two, was 70 foot longer, and had a 42-car capacity as compared to the



Photograph 5.24. Coal thawing plants, South Amboy, New Jersey. *Circa* 1918. The two-track plant at left was built in 1910-11. The three-track plant at right was added in 1916 (Source: Linn 1918a).



Photograph 5.25. TThe three-track coal thawing shed at the Pennsylvania Railroad's South Amboy ferry terminal. *Circa* 1918 (Source: Linn 1918b).

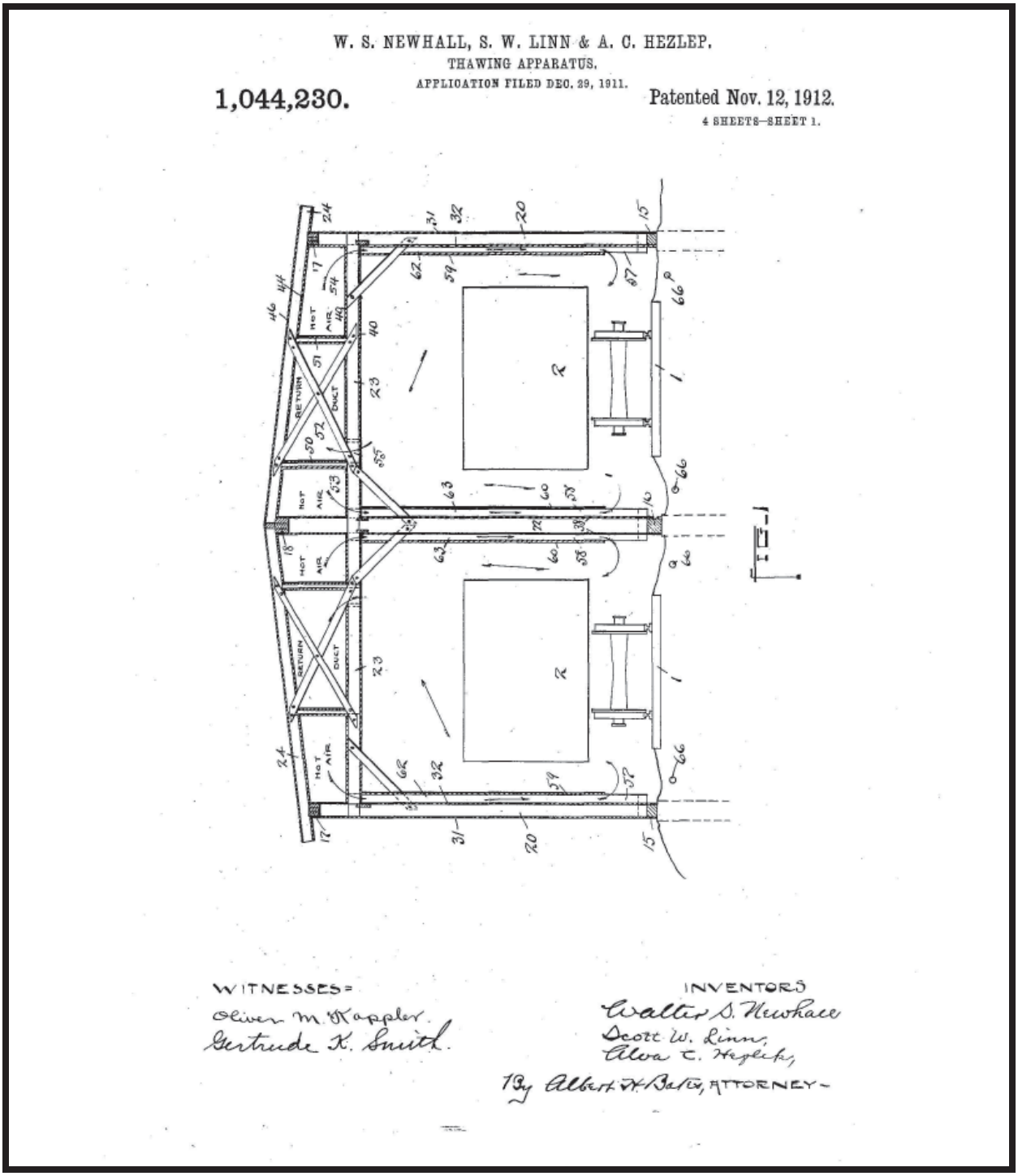


Figure 5.29. Newhall, W.S., S.W. Linn and A.C. Hezlep. Patent Drawing for Thawing Apparatus. 1912 (U.S. Patent No. 1,044,230).

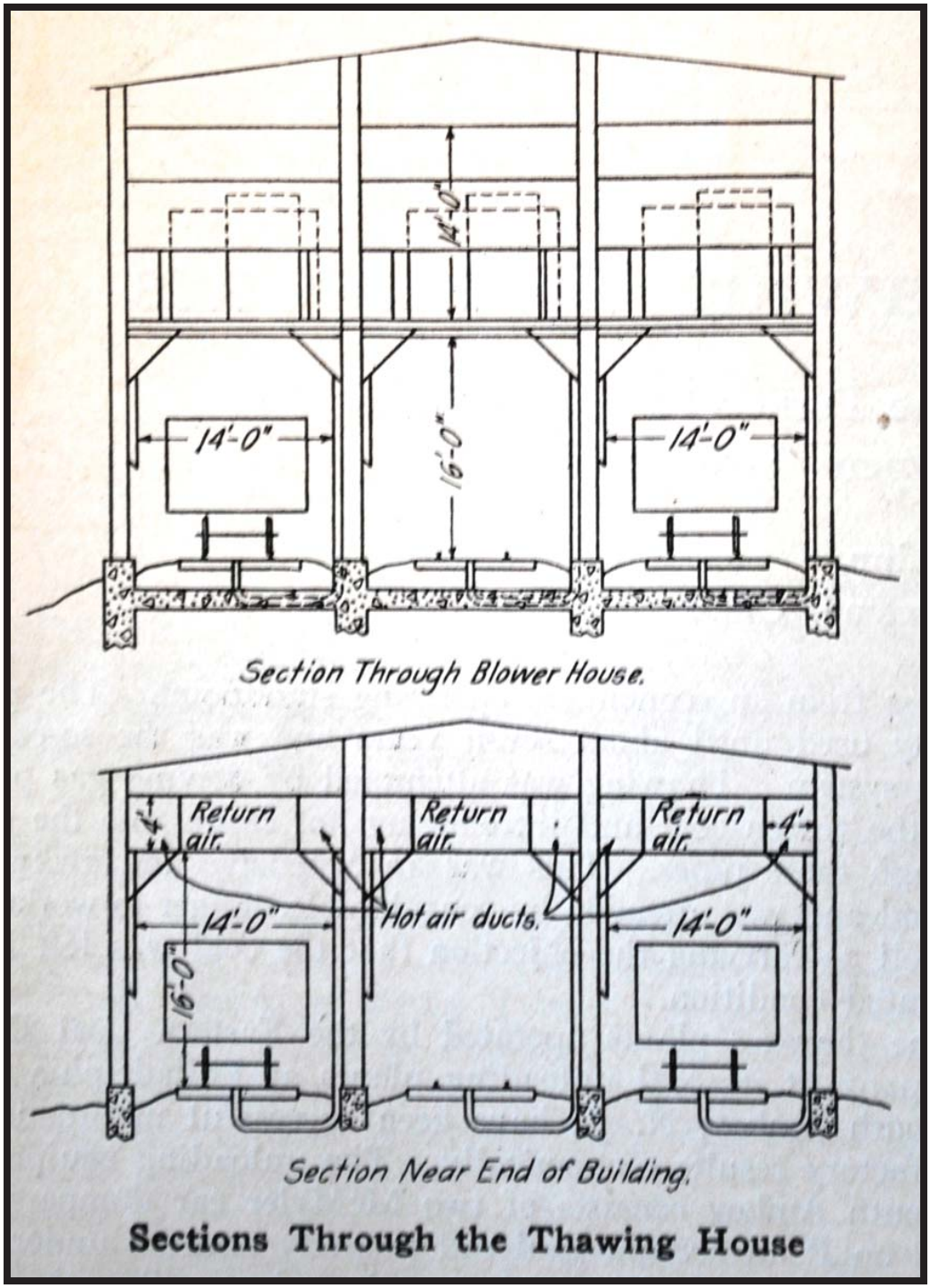


Figure 5.30. Cross Section of the Three-Track Coal Thawing House, Pennsylvania Railroad, South Amboy Terminal. 1916 (Source: Linn 1918b).

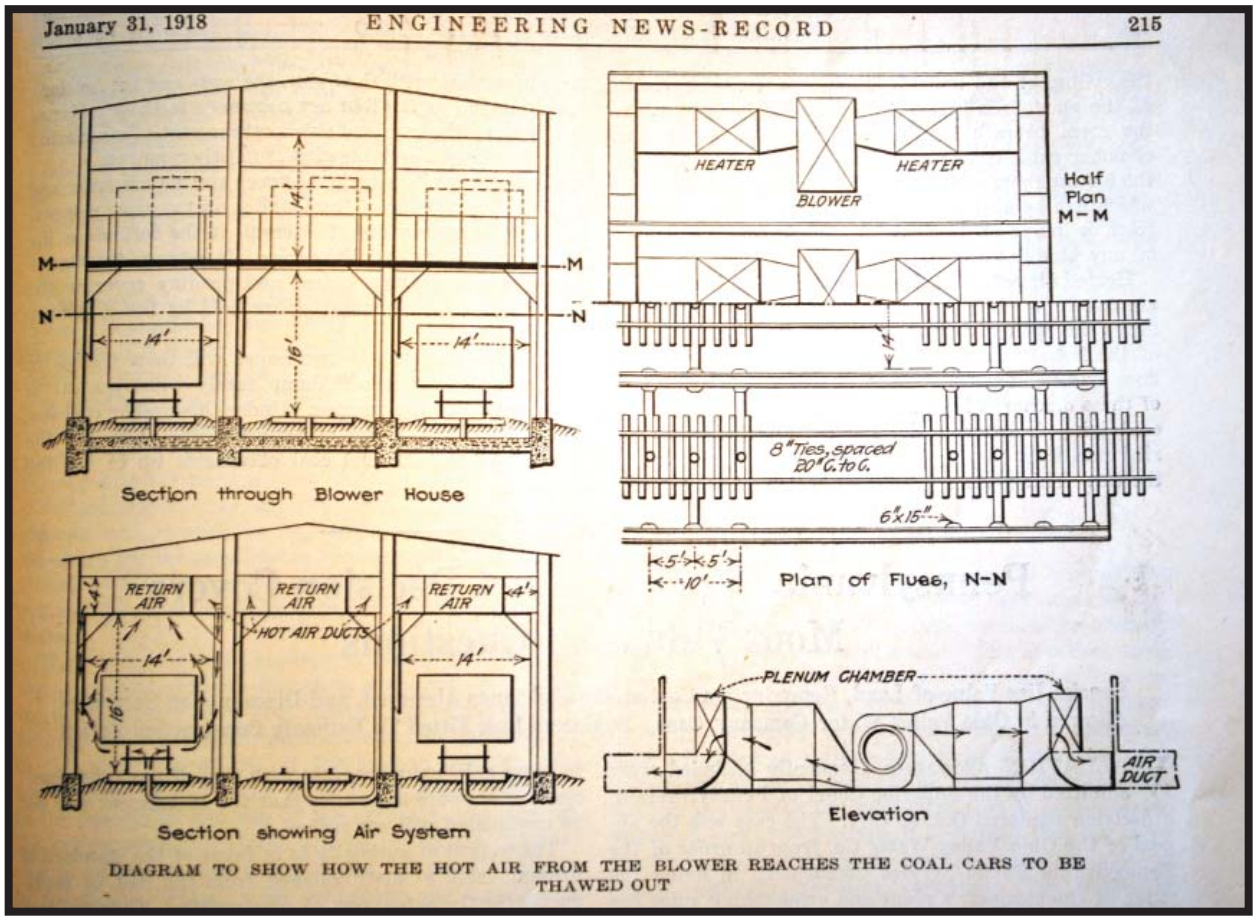


Figure 5.31. Cross Section of the Three-Track Coal Thawing House and Diagram to Show How Hot Air Reaches the Coal Cars To Be Thawed Out, Pennsylvania Railroad, South Amboy Terminal. 1916 (Source: Linn 1918a).

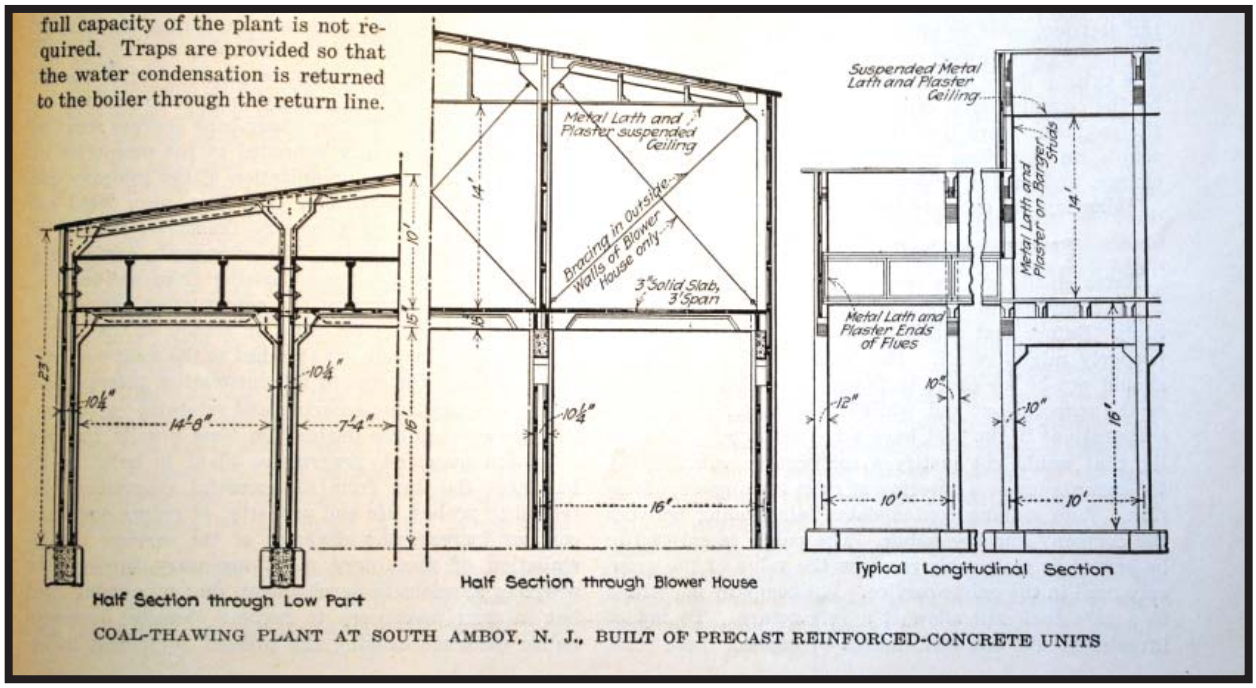


Figure 5.32. Cross Section of Framing for the Three-Track Coal Thawing House, Pennsylvania Railroad, South Amboy Terminal. 1916 (Source: Linn 1918a)

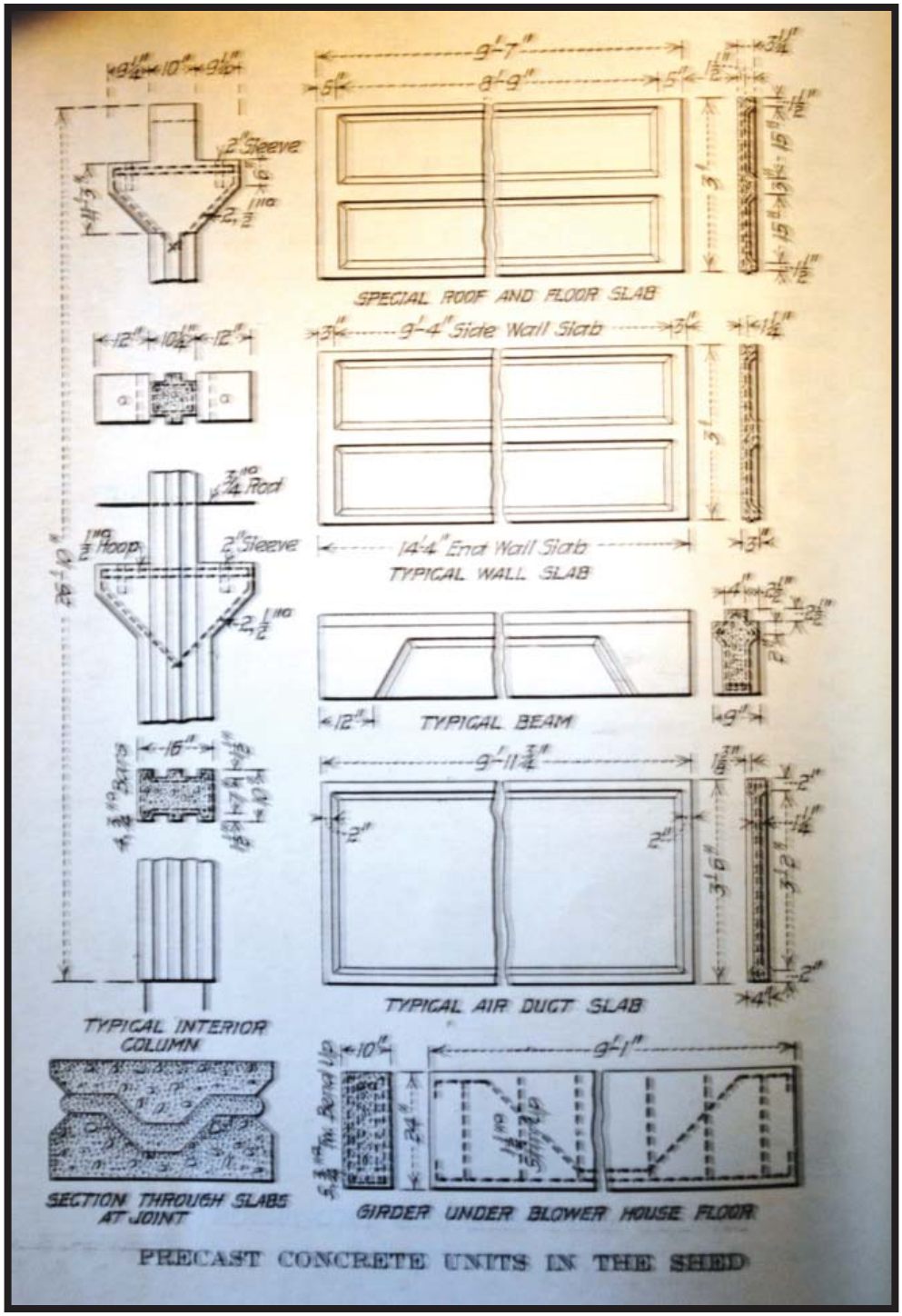
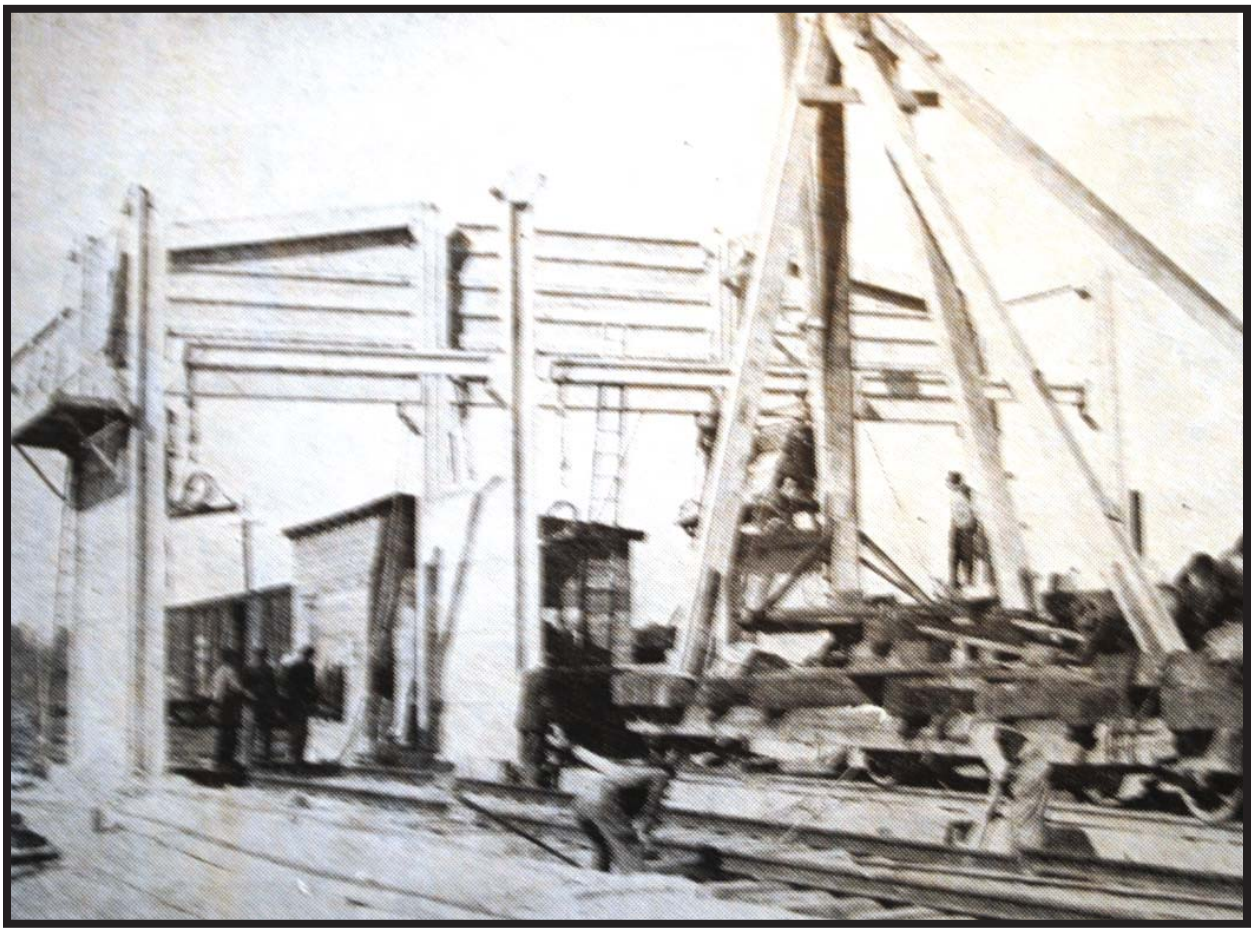


Figure 5.33. Precast-Concrete Columns, Slabs and Panels Used in the Construction of the Three-Track Coal Thawing House, Pennsylvania Railroad, South Amboy Terminal. 1916. The design made use of innovative pre-cast concrete wall and ceiling units (Source: Linn 1918a).



Photograph 5.26. Erecting the three-track coal thawing shed using precast-concrete units, Pennsylvania Railroad's South Amboy ferry terminal. 1916 (Source: Linn 1918a).

20-car capacity of the first plant (Photograph 5.25). A novel feature of the second plant was its construction using a modular system of reinforced-concrete columns and panels for the sidewalls and roof, facilitating speedy erection (Figures 5.30 to 5.33; Photograph 5.26). This was among the earlier precast (as opposed to cast-in-place) reinforced-concrete buildings in the United States (Linn 1918a:213-16; 1918b:805-6).

There appear to have been few major changes to the plan of coal-handling operations at South Amboy from the late 1910s to 1940s (Figures 5.34-5.36; Photograph 5.27). During the late 1930s, Jersey City Power and Light built an electric generating station north of the terminal, no doubt to capitalize on the availability of coal (Photograph 5.28). A spur was built to the plant from the former Camden and Amboy Railroad line. At the terminal itself, the work was confined mostly to periodic repairs and enhancements, such as the installation of additional boilers in the coal-thawing steam plant in 1932 (Figure 5.37), the addition of two more tracks to the original two-track thawing plant of 1910-11, and reconstruction of the boiler house's brick chimney in 1940. That same year, the hydraulic operation of the McMyler dumpers was switched from steam to electric power and the lifting mechanisms modified to handle 50-ton and 70-ton coal cars, as opposed to the old 40-ton cars. A series of shop buildings on the pier used to service the dumpers were replaced by a single metal-clad building (Figure 5.38). In 1943, the bulkheads of the coal pier were "renewed," essentially replacing all of the original timber bulkheading and reinforcing the bulkhead with a concrete tie-back wall (Pennsylvania Railroad Company, Engineering Department Correspondence, 1920-1943).

Perhaps the most significant change at the South Amboy between the two world wars was its integration into the Pennsylvania Railroad's electrification program. The Pennsylvania Railroad's involvement with electrification began in 1895 with the installation of an experimental direct-current system on 7.2 miles of line from Burlington to Mount Holly, New Jersey. This experiment was not totally successful, but it laid the groundwork for further technological developments that were successfully applied to the subsidiary Long Island Railroad in 1904-05 and the Northeast Corridor's Hudson River tunnel when it opened in 1910. The electric motive power, replacing steam, had several advantages, the foremost being the elimination of choking smoke from the tunnel, but eventually electric operations were seen as ideal for commuter trains because of the quicker acceleration and deceleration responsiveness over steam operations between closely spaced stations. These early electrification projects all relied on direct-current, third-rail systems, but in 1914-15 the Pennsylvania Railroad began using alternating-current, overhead catenary systems on its Paoli-Philadelphia commuter line. It was so successful, both economically and in terms of public enthusiasm for the much cleaner trains, that electrification using catenary had been extended to all the suburban passenger lines around Philadelphia by 1924 (Middletown 2002; Hunter Research, Inc. 2002:1-2).

Over the next decade, the Pennsylvania Railroad progressively electrified its lines, focusing on the Washington, D.C. to New York City corridor (Figure 5.39). The first electric passenger train made the complete run between the two cities in 1935. That same year, electrification was introduced at South Amboy, first with the electrification of the New York and Long Branch Railroad between Perth Amboy and South Amboy, primarily to handle commuter service. In 1938, electrification was extended from the New York and Long Branch Railroad on to the Amboy branch and the numerous tracks leading from that line into the South Amboy terminal yard in the vicinity of the junction. The primary support structures for the overhead catenary was steel H-section poles and bents that maintained the electrification wire at 22 feet above the rail. Pantographs mounted atop the locomotives

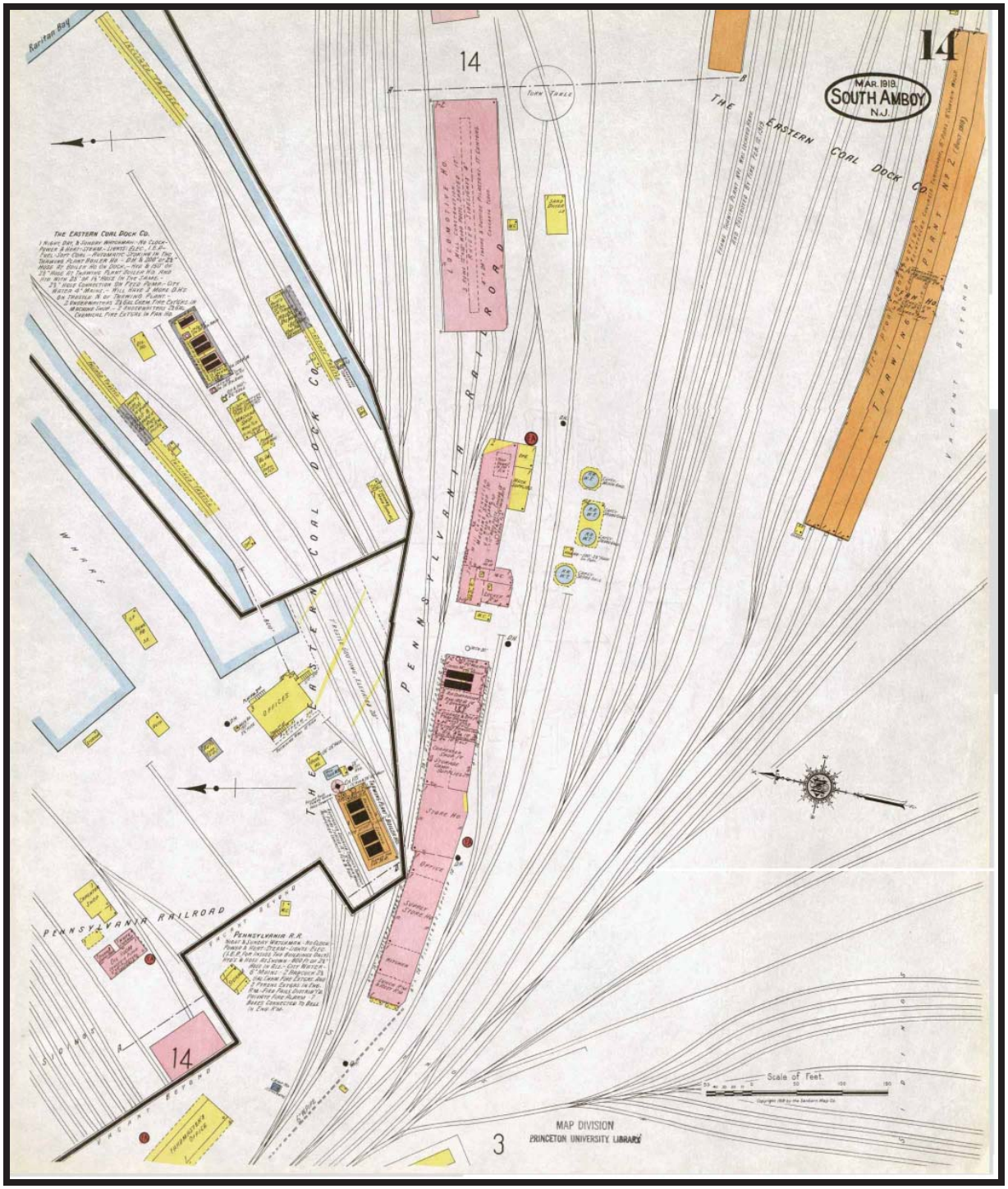


Figure 5.34. Sanborn Map Company. *Insurance Maps of South Amboy, Middlesex County, New Jersey*. 1918. Scale as shown.

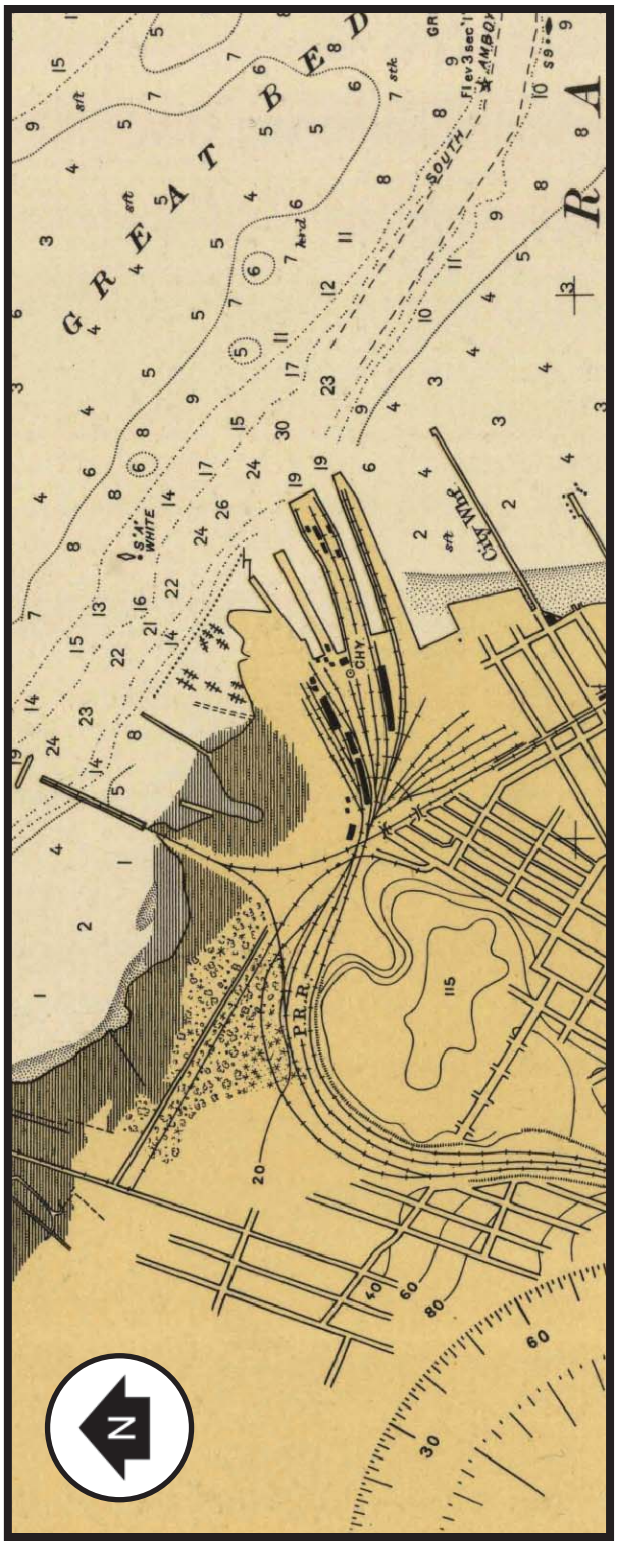


Figure 5.35. U.S. Coast and Geodetic Survey. Detail of *Raritan River From Raritan Bay to New Brunswick, New Jersey*. 1924. Scale: 1 inch = 1,500 feet (approximately).

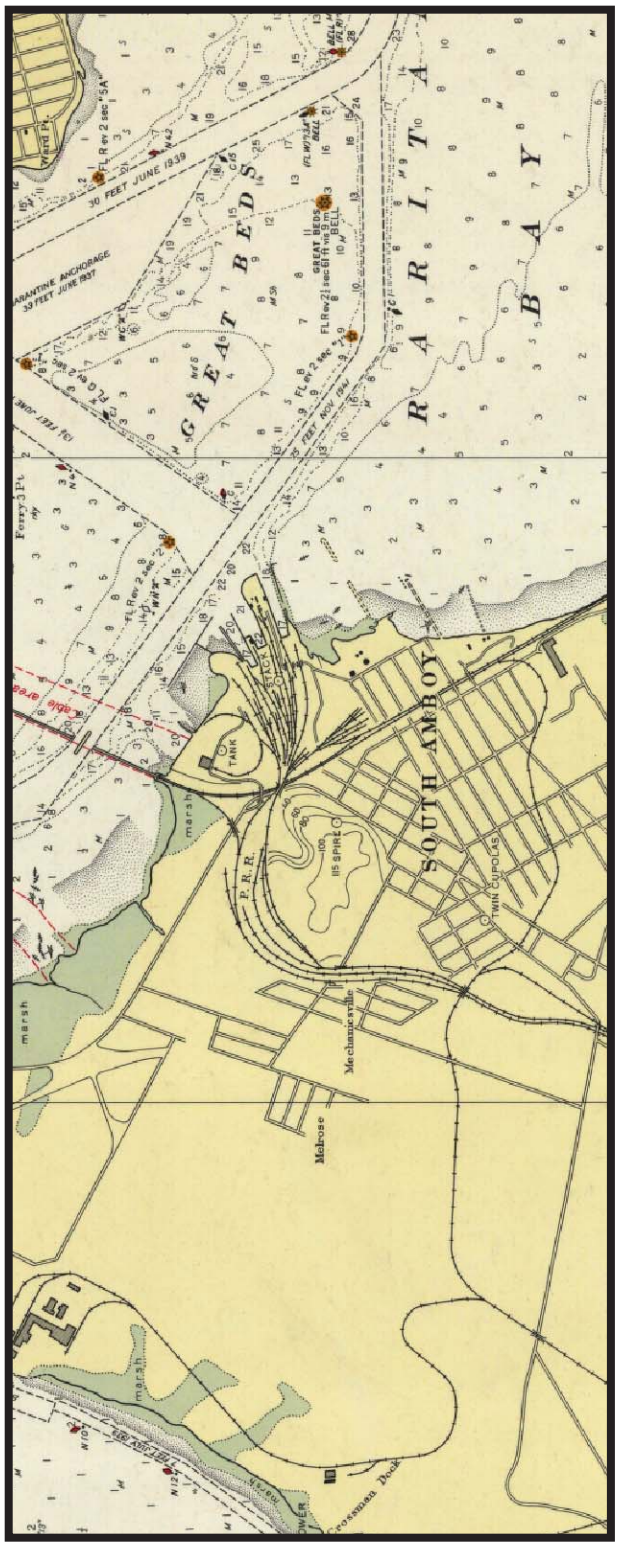


Figure 5.36. U.S. Coast and Geodetic Survey. Detail of *Raritan River from Raritan Bay to New Brunswick, New Jersey.* 1942. Scale: 1 inch = 2,700 feet (approximately).

Photograph 5.27. Aerial view of the mouth of the Raritan River. *Circa* 1941 (Source: *Journal of Industry and Finance*, April 1941).

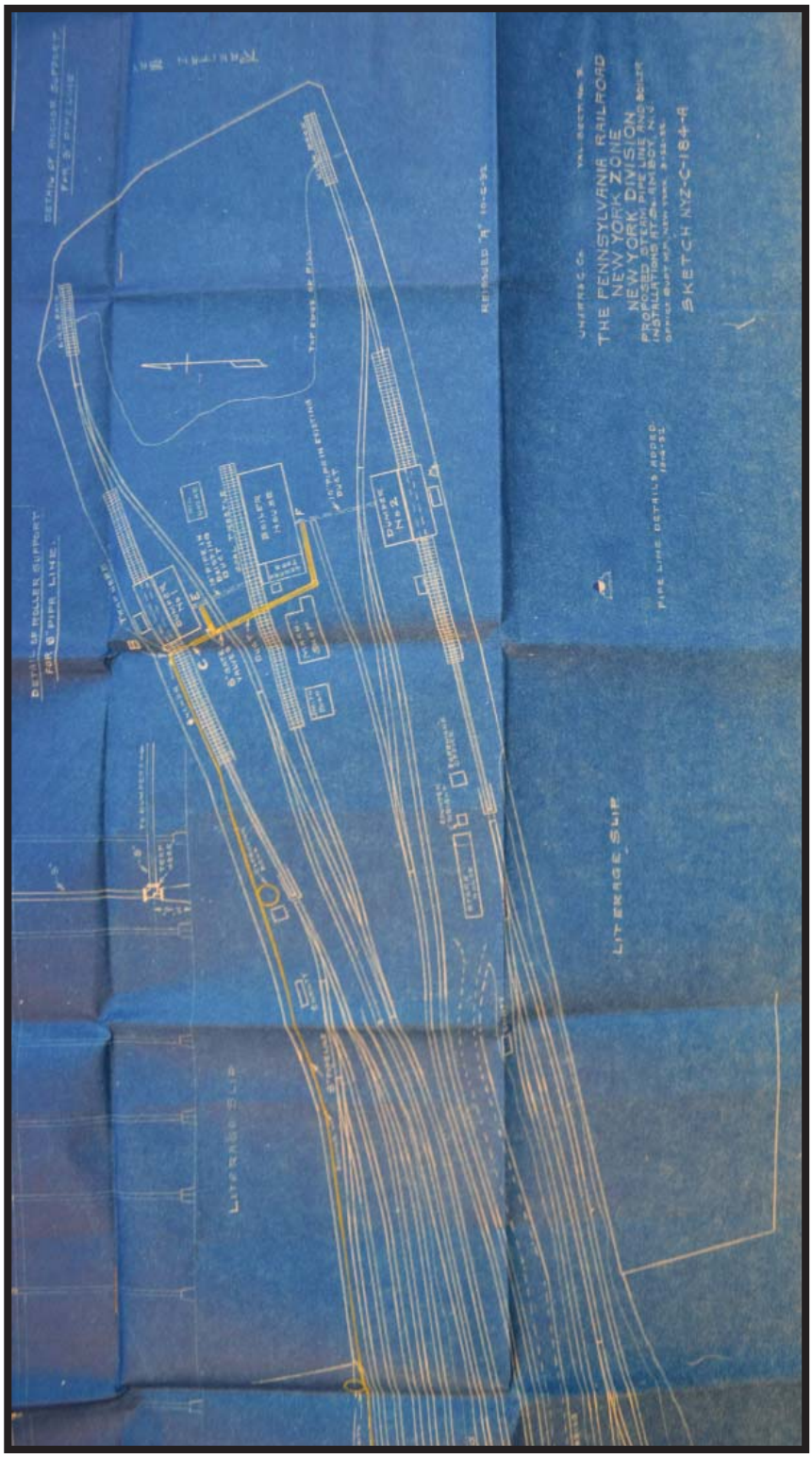


Figure 5.37. Pennsylvania Railroad Company. *Proposed Steam Pipe Line and Boiler Installation at South Amboy, N.J.* 1932. Scale: 1 inch = 150 feet (approximately).

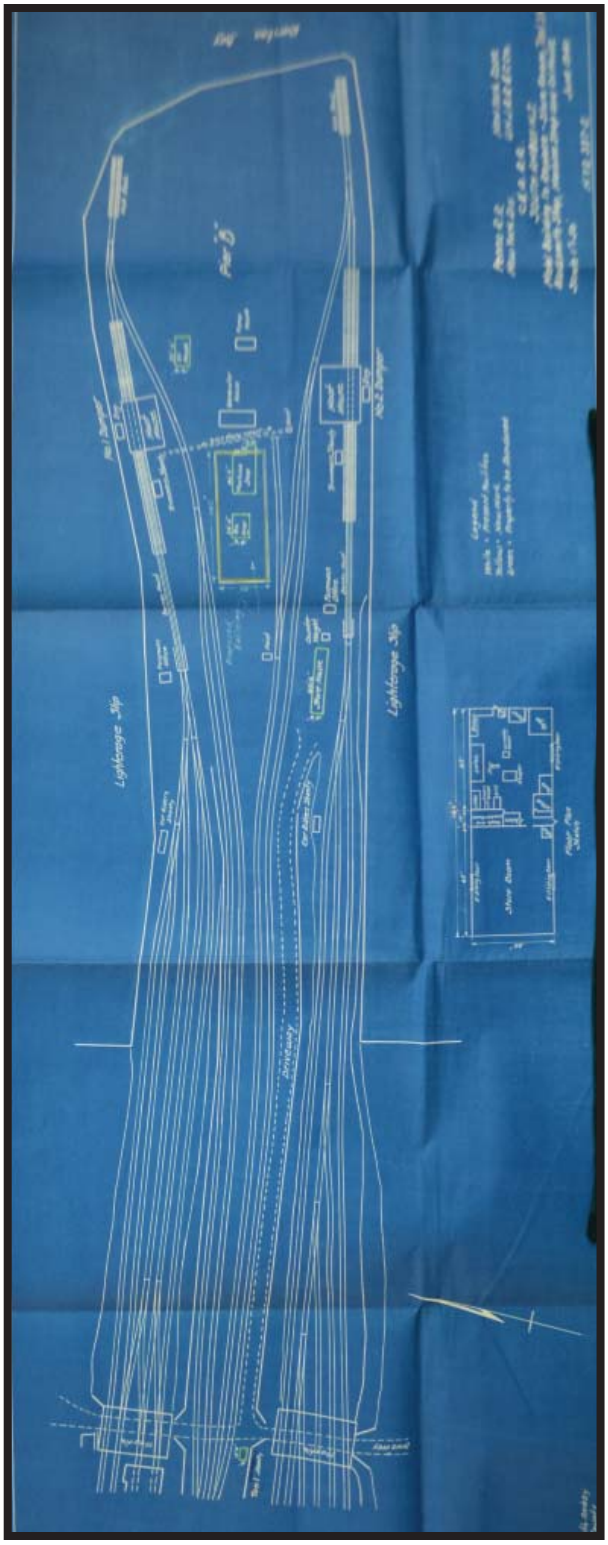


Figure. 5.38. Pennsylvania Railroad Company. *Metal Building to Replace Shops at South Amboy, N.J.* 1940. Scale: 1 inch = 200 feet (approximately).

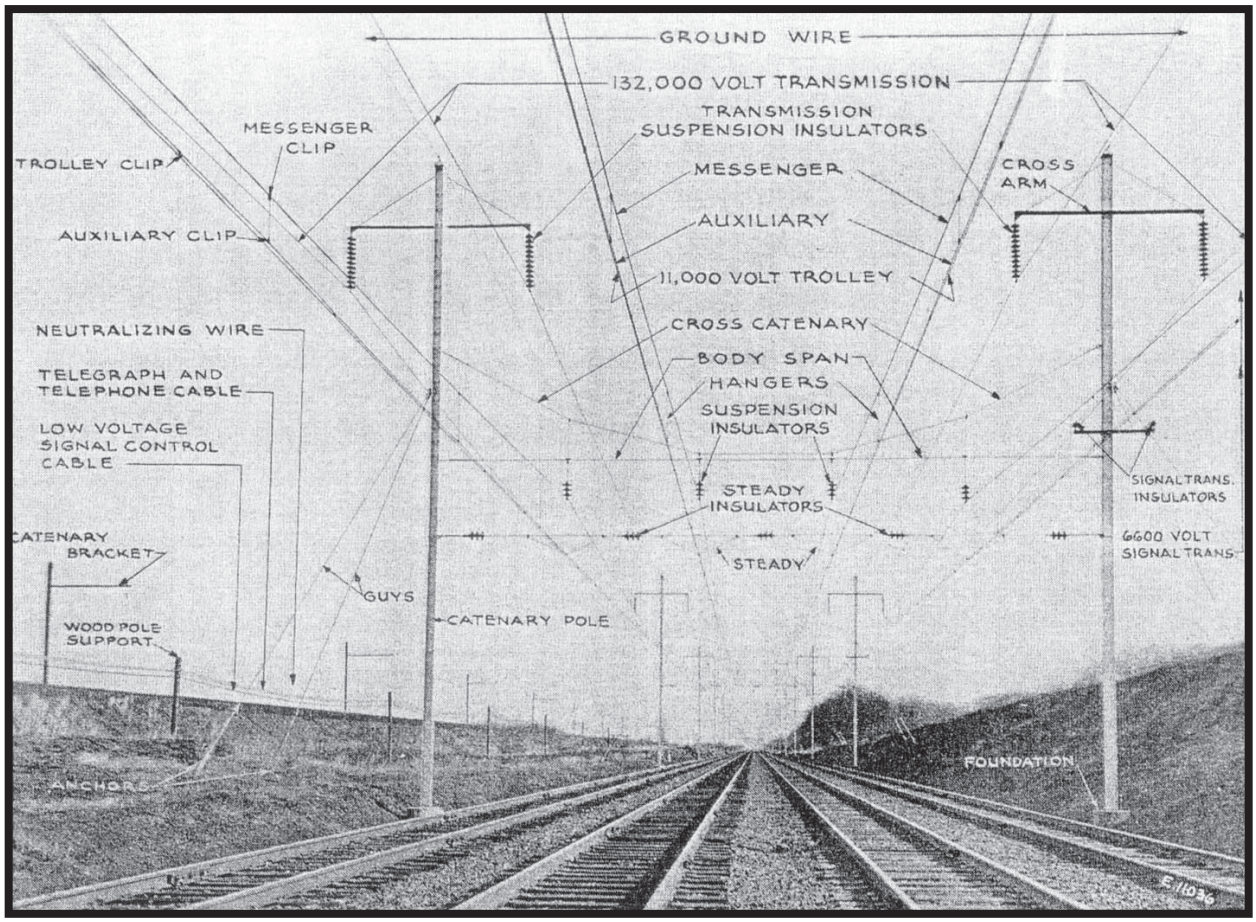


Figure 5.39. Typical Catenary Structure Used on the New York to Philadelphia Line in the 1930s (Source: Nesladek 1996).

maintained connection with the wire to complete the circuit and deliver power. The intervention of World War II, the introduction of diesel-electric locomotives, and worsening economic conditions for the railroads in competition with automobiles prevented the Pennsylvania Railroad from implementing any further expansion of its electrification program (Hunter Research, Inc. 2002:2).

During World War I, the Pennsylvania Railroad expanded the volume of munitions and explosives transfers at the South Amboy terminal. This decision had major safety ramifications for the terminal's future, although coal always remained by volume the most important material handled at South Amboy. The concentration of explosives handling at South Amboy was related at least in part to the famous Black Tom pier explosion of July 30, 1916. Black Tom was a Lehigh Valley Railroad terminal located in Jersey City opposite the Statue of Liberty and the tip of Manhattan. The pier had bunkers for the storage and transfer of military ammunition, at the time much of it destined for the war in Europe. On the night of July 30, a fire broke out on the pier, igniting between one and two million pounds of ammunition, setting off a massive explosion. Although no definitive proof was ever produced, the belief was that the fire was an act of sabotage. Remarkably, the number of fatalities was no more than seven, but the incident greatly frightened and outraged the public, especially since it had taken place so close to a major population center. In response to the outcry, many municipalities in New York and New Jersey passed laws prohibiting the transfer of large quantities of ammunition. This caused the railroad companies to move those operations to facilities away from the inner parts of New York Harbor. For the Pennsylvania Railroad, South Amboy was a logical location because of its distance from New York City, and the City of South Amboy cooperated with the railroad to pass a very simple explosives ordinance in March 1917 making South Amboy one of the few communities within the Port of New York where the transfer of explosives in quantity was allowed by municipal authorities (Dunn 1923).

The Pennsylvania Railroad built a new explosives pier immediately south of the old Camden and Amboy Railroad freight pier at South Amboy and north of the coal piers. The explosives pier had two tracks and space for three or four barges to tie up along its south side. Unlike the coal piers with their mechanical McMyler dumpers, the transfer of explosives between boats and railcars was a manual process with teams of stevedores handling the crates and barrels. The dangers became immediately apparent on September 6, 1923 when a fire broke out on the explosives pier in a rail car loaded with smokeless powder (Photographs 5.28 and 5.29). The fire spread to an adjacent barge, which was cut adrift but still caused considerable damage to the wharf and several nearby boats. The engineer and conductor at considerable risk to themselves pulled the burning train from the pier moving it west through the yard before stalling on the Main Street overpass. The hope was that they could cutaway the burning cars and position them beneath a water tank to prevent the spread of the fire. Unfortunately, a group of spectators gathered at the overpass and when two of the cars exploded five of onlookers were killed and 28 others seriously burned. An investigation of the fire by the U.S. Bureau of Explosives made no recommendations on changes to procedure at South Amboy, somewhat glibly concluding that "the cause of the ignition is relatively unimportant" and recommending nothing more than increased vigilance (Dunn 1923:10, 15). Explosives continued to be handled in large quantities at South Amboy, and during World War II it was among the most important munitions transfer points in the Port of New York, joined by the Military Ocean Terminal at Bayonne and the Naval Weapons Station Earle, both of which opened during the war. South Amboy's busiest year on record for munitions was 1943 when it handled 1,627 cars carrying over 107

Photograph 5.28. Munitions pier at the Pennsylvania Railroad's South Amboy ferry terminal. 1923. View is looking northeast with the coal barge tie-up pilings in the background (Source: Dunn 1923).

Photograph 5.29. Remains of a box car at the Pennsylvania Railroad's South Amboy ferry terminal following the explosion and fire of September 1923 (Source: Dunn 1923).

million pounds of explosives (Pennsylvania Railroad Company, Engineering Department Correspondence 1940-51).

Although the South Amboy terminal safely negotiated the war years, it was not so lucky on May 19, 1950. On that day the terminal was handling a 12-car train holding about 825,000 pounds of gelatin dynamite, anti-tank mines, and anti-personnel mines. At about 7:26 p.m., the explosives were being transferred from the railcars to lighters, which were to carry the explosives out into the harbor to a freighter bound for Pakistan, when a violent explosion shattered the pier. The blast immediately killed 26 dock handlers and five barge captains (Figures 5.40-5.42). The wharves, buildings and equipment at the South Amboy terminal sustained serious structural damage with many of the railroad service buildings leveled (Photographs 5.30-5.36). Buildings over a half mile away within the town met with shattered windows and structural damage caused by flying debris. The force of the explosion was felt 25 miles away, but thanks to the swift reaction of local police and firemen, panic was kept to a minimum. Total insured property damage eventually exceeded ten million dollars. The immediate cause of the explosion was never determined although the National Board of Fire Underwriters and the Pennsylvania Railroad Company considered the most likely cause a faulty detonating fuse in an anti-tank mine. The U.S. Coast Guard and the Interstate Commerce Commission were publicly criticized for lax regulations and issuing a permit for the handling of such a large explosives shipment, which far exceeded the federal government's recommended weight for a single shipment (National Board of Fire Underwriters 1951; Francy 1998:84).

The Pennsylvania Railroad estimated its damages from the explosion of May 19, 1950 at four million dollars but spent only about half that amount in restoring the terminal to operation (Figure 5.43). The explosives pier was not rebuilt, but the oil pier and the coal pier were repaired. The McMyler dumpers and the coal-thawing plants were returned to operation by January 1951. Later that same year, the Pennsylvania Railroad closed down its coal-handling operations at the Greenville Pier in Jersey City, consolidating them at South Amboy and replacing one of the South Amboy McMyler dumpers with one salvaged from Greenville. The coal business, however, was on the decline, particularly as a home-heating fuel, and South Amboy was increasingly relegated to a customer base of public utilities operating coal-fired generating plants (Pennsylvania Railroad Company, Engineering Department Correspondence 1951-53).

Known Resource Types and their Significance

Surviving above-ground resource types associated with the coal terminal period of 1871 to 1950 are confined mainly to landscape features, including timber bulkheads, timber pilings, masonry walls and other features outlining the location of piers; timber pilings in the water associated with the piers and barge tie-up racks; and the foundations of buildings, mostly in the form of concrete pads of 20th-century structures. Most of the rails and tracks were removed in the 1980s, but in a few locations, mostly on the northern side of the site some rails, ties and ballast remain to identify track locations within the rail yard. No significant buildings survive on site, and those that were there were there prior to decommissioning were for the most part heavily rebuilt or repaired following the 1950 explosion. In 2002, 30 catenary support structures were present within the project area, reflecting a variety of single and double-pole configurations (Photographs 5.37 and 5.38) (Hunter Research, Inc. 2002:3-4). In June 2012, it was noted during a field visit that most of these catenary support structures had been removed in the intervening decade.

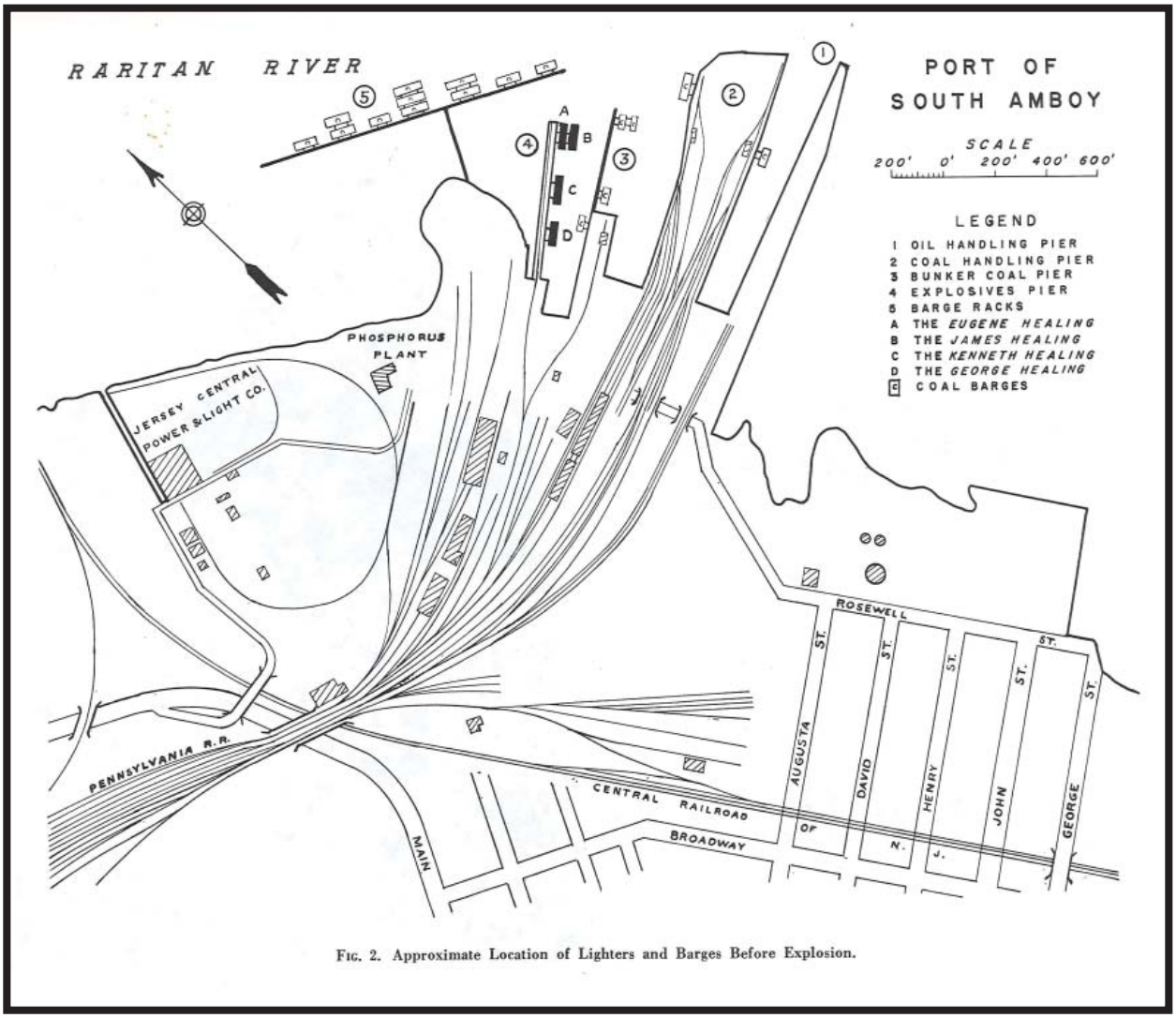


Figure 5.40. Plan of the Port of South Amboy Showing the Location of Lighters and Barges before the Explosion of May 19, 1950 (Source: National Board of Fire Underwriters 1951).

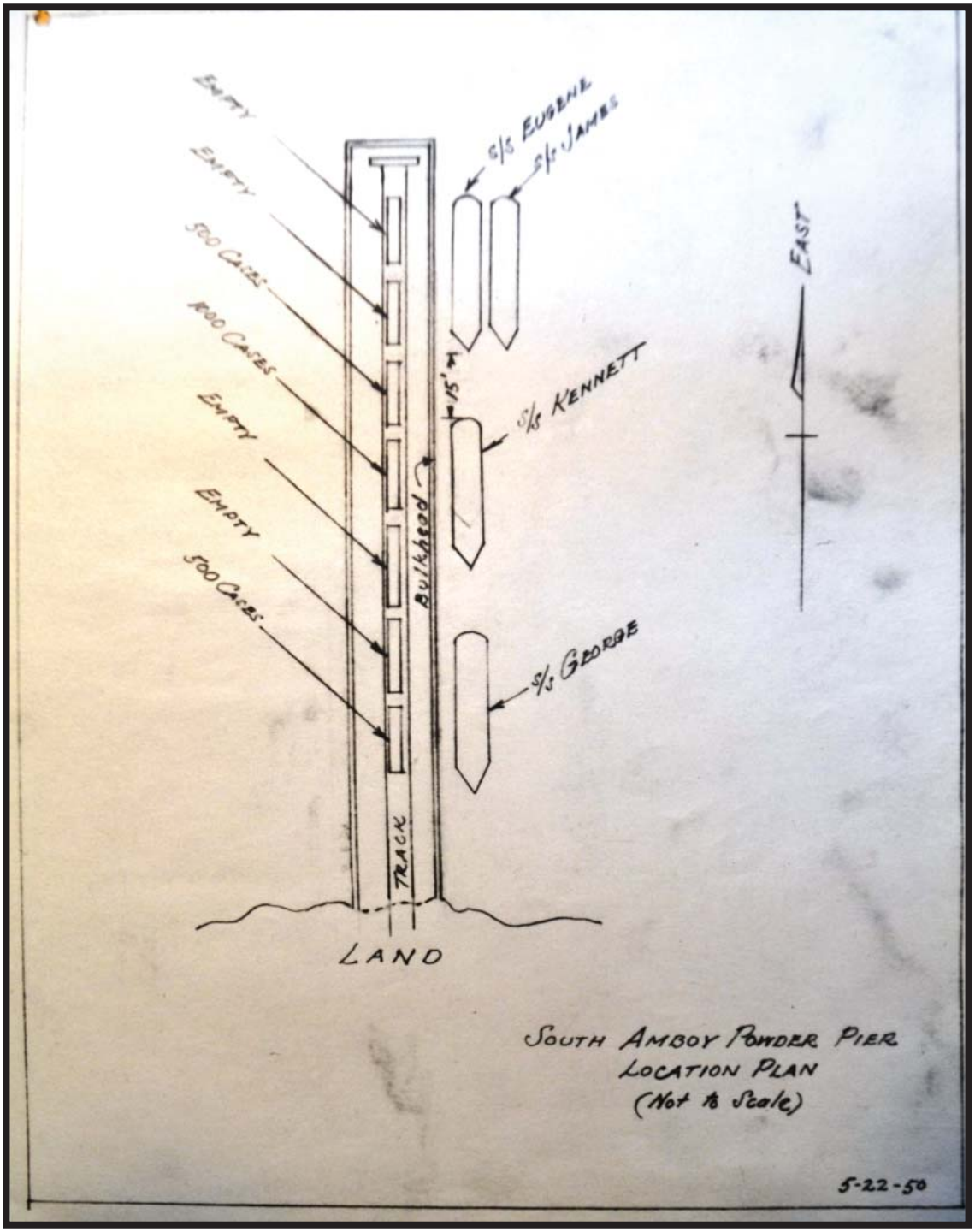


Figure 5.41. Sketch of the Powder Pier at the Time of the Explosion on May 19, 1950 (Source: Pennsylvania Railroad Company, Engineering Department Correspondence 1950).

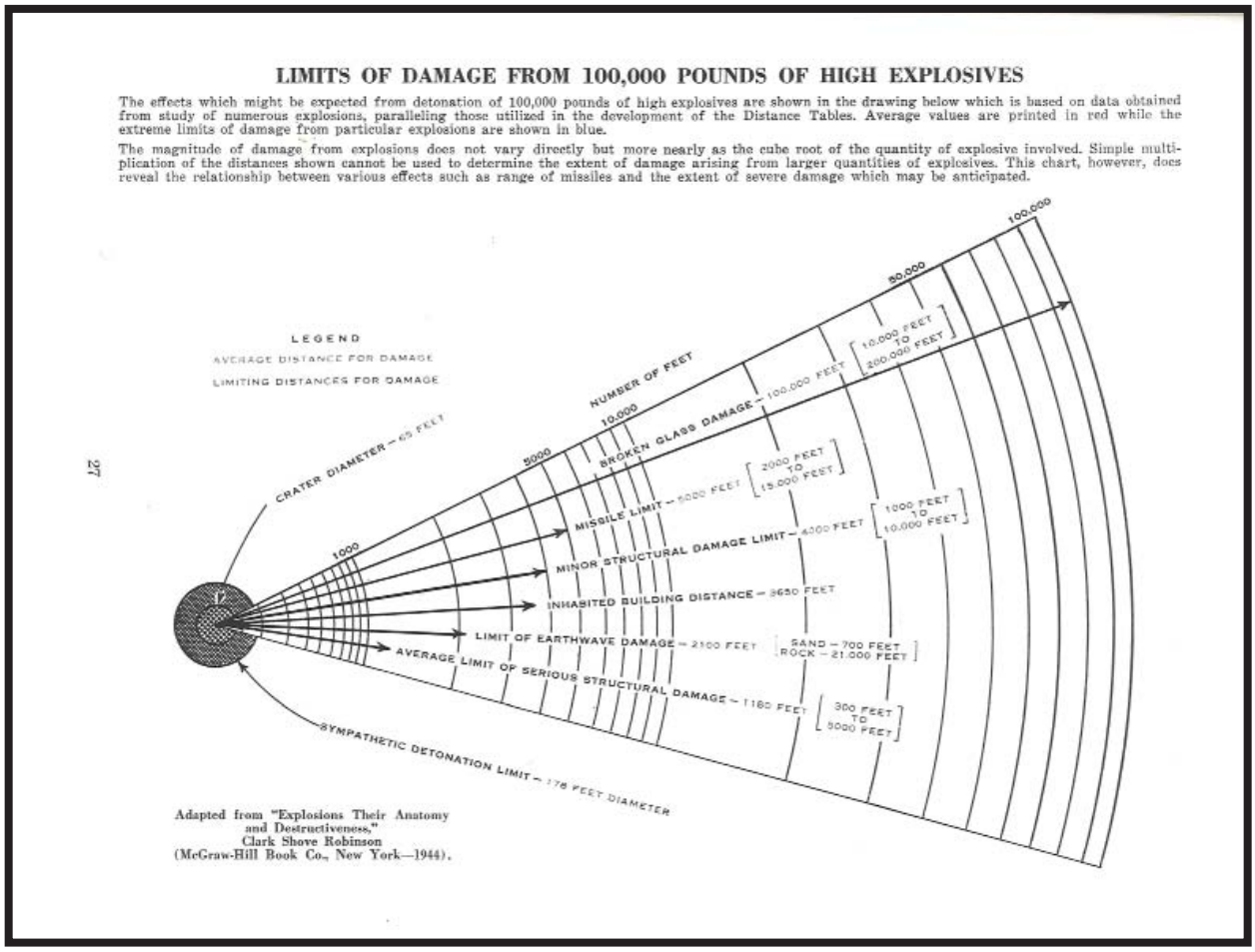
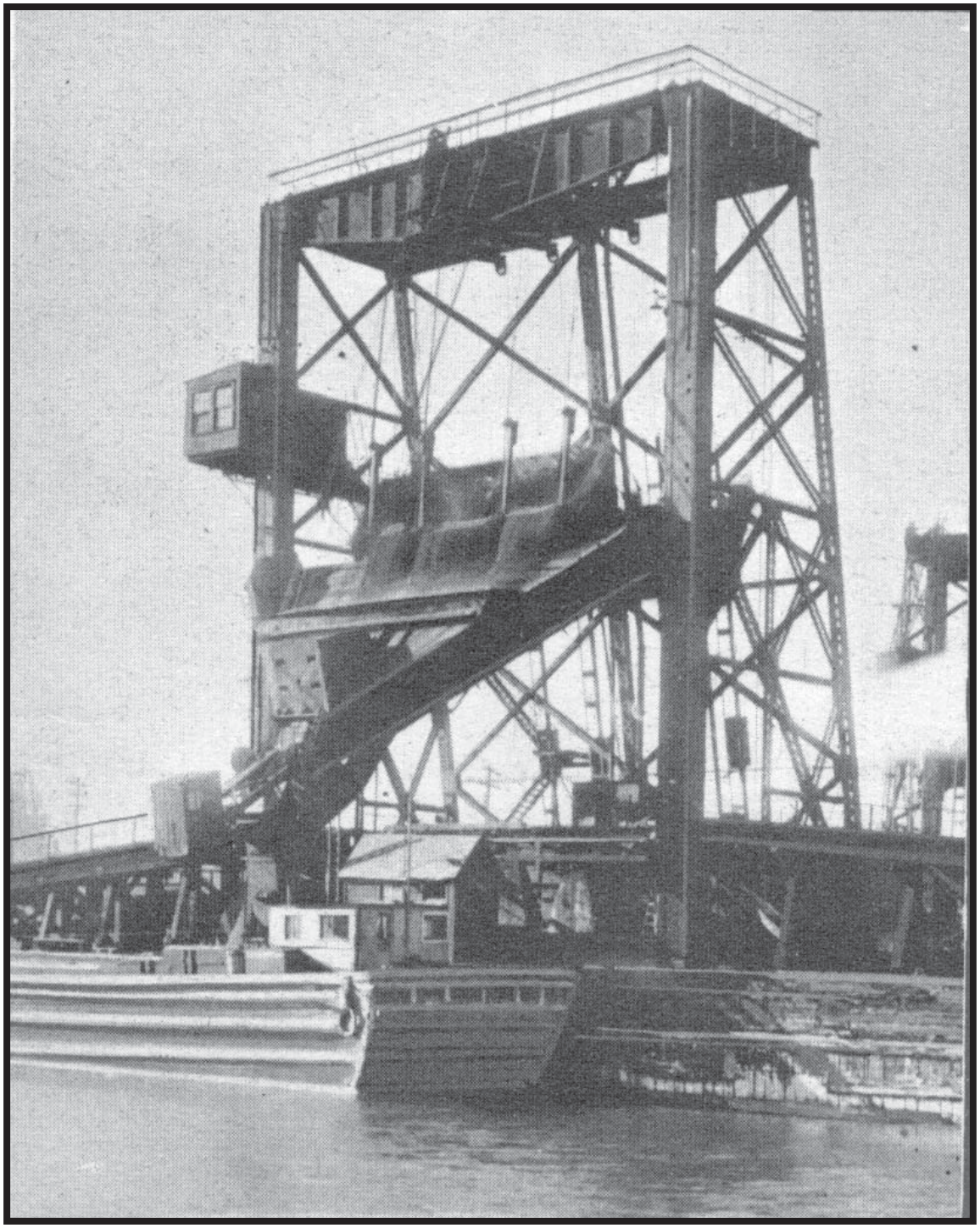


Figure 5.42. Limits of Damage from the Explosion of May 19, 1950 (Source: National Board of Fire Underwriters 1951).



Photograph 5.30. View of Coal Dumper No. 1 shortly before the explosion of May 19, 1950. *Circa* 1949 (Source: Pennsylvania Railroad Company 1949).

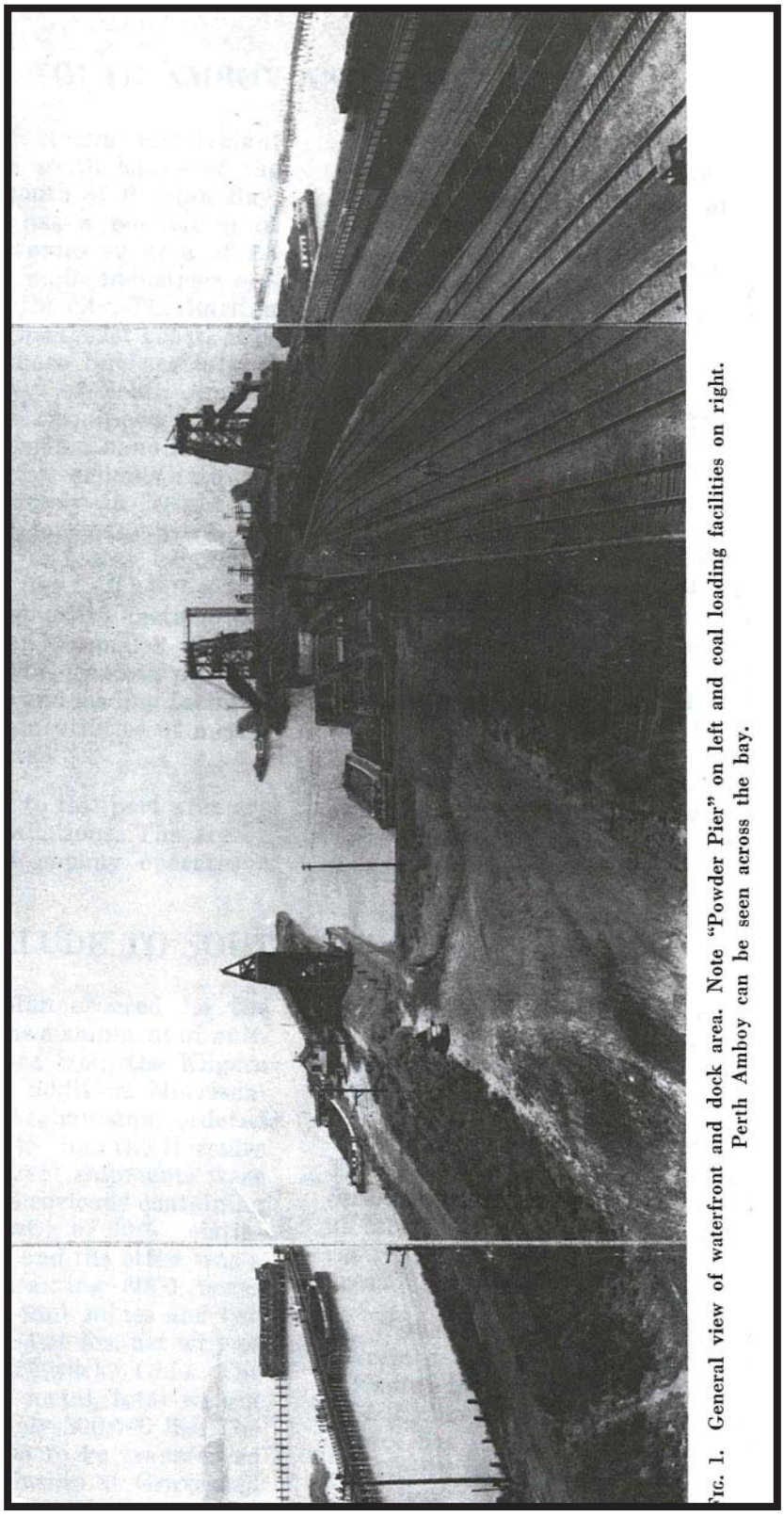


FIG. 1. General view of waterfront and dock area. Note "Powder Pier" on left and coal loading facilities on right. Perth Amboy can be seen across the bay.

Photograph 5.31. General view of the South Amboy ferry terminal, looking east, prior to the explosion of May 19, 1950 (Source: National Board of Fire Underwriters *circa* 1951).

Photograph 5.32. Aerial view of the South Amboy ferry terminal, looking west, showing damage from the explosion of May 19, 1950 (Source: Pennsylvania Railroad Photographs Collection).

Photograph 5.33. Aerial view of the South Amboy ferry terminal, looking west, showing damage from the explosion of May 19, 1950 (Source: Pennsylvania Railroad Photographs Collection).

Photograph 5.34. Aerial view, looking down on the coal handling pier, showing damage from the explosion of May 19, 1950 (Source: Pennsylvania Railroad Photographs Collection).

Photograph 5.35. Photograph, looking west, showing damage to the machine shop on the coal handling pier from the explosion of May 19, 1950 (Source: Pennsylvania Railroad Photographs Collection).

Photograph 5.36. Aerial view of the South Amboy ferry terminal, looking south, showing damage from the explosion of May 19, 1950 (Source: Pennsylvania Railroad Photographs Collection).

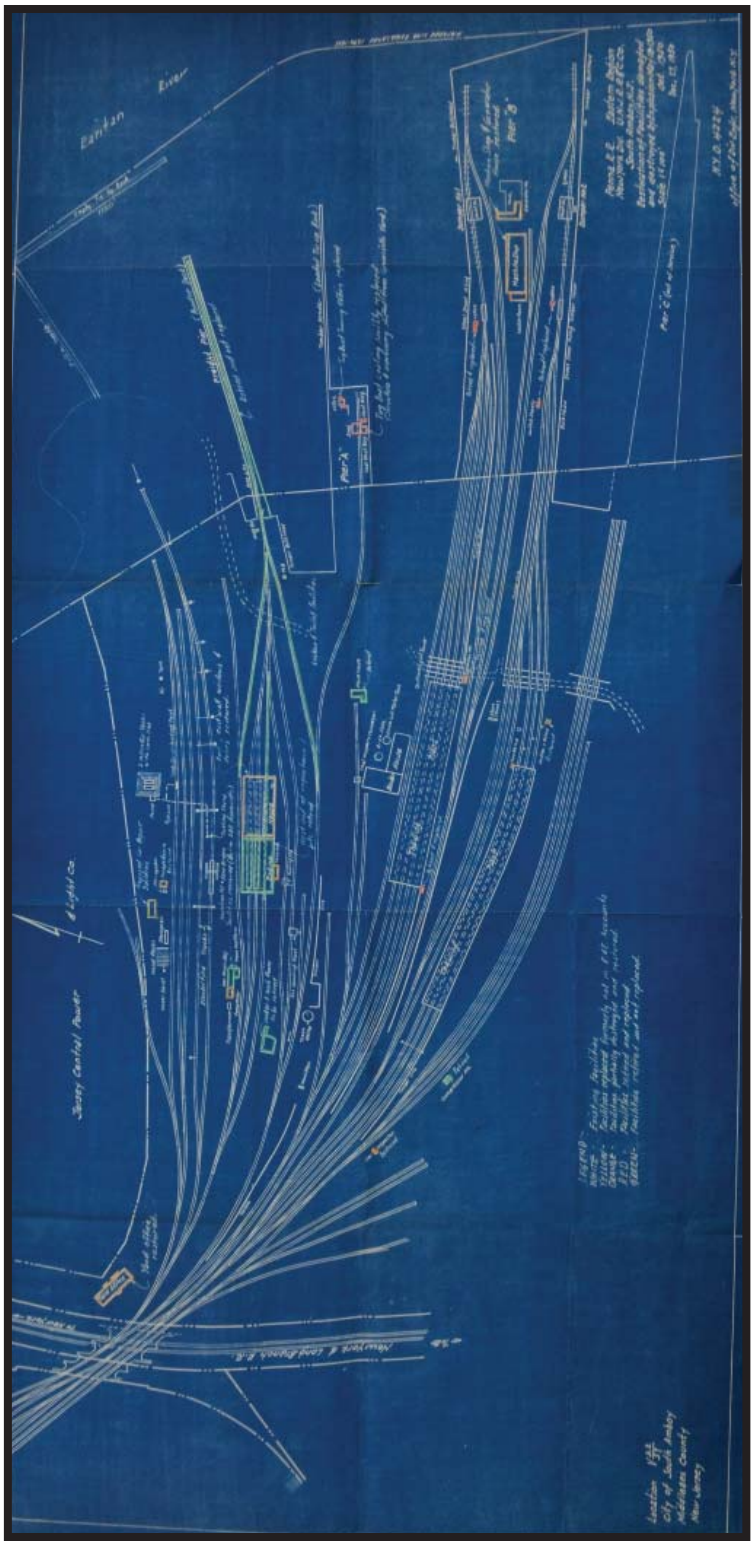


Figure 5.43. Pennsylvania Railroad Company. *Restoration of Facilities Damaged and Destroyed by Explosion May 19, 1950.* 1950. Scale: 1 inch = 450 feet (approximately).

Photograph 5.37. Catenary structure at the South Amboy ferry terminal (Photographer: Ian Burrow, 2002) [HRI Neg. #02081/D1:02].

Photograph 5.38. Light pole at the South Amboy ferry terminal (Photographer: Ian Burrow, 2002) [HRI Neg. # 02081/1:08].

2. Decline (1950-1970)

History and Significance

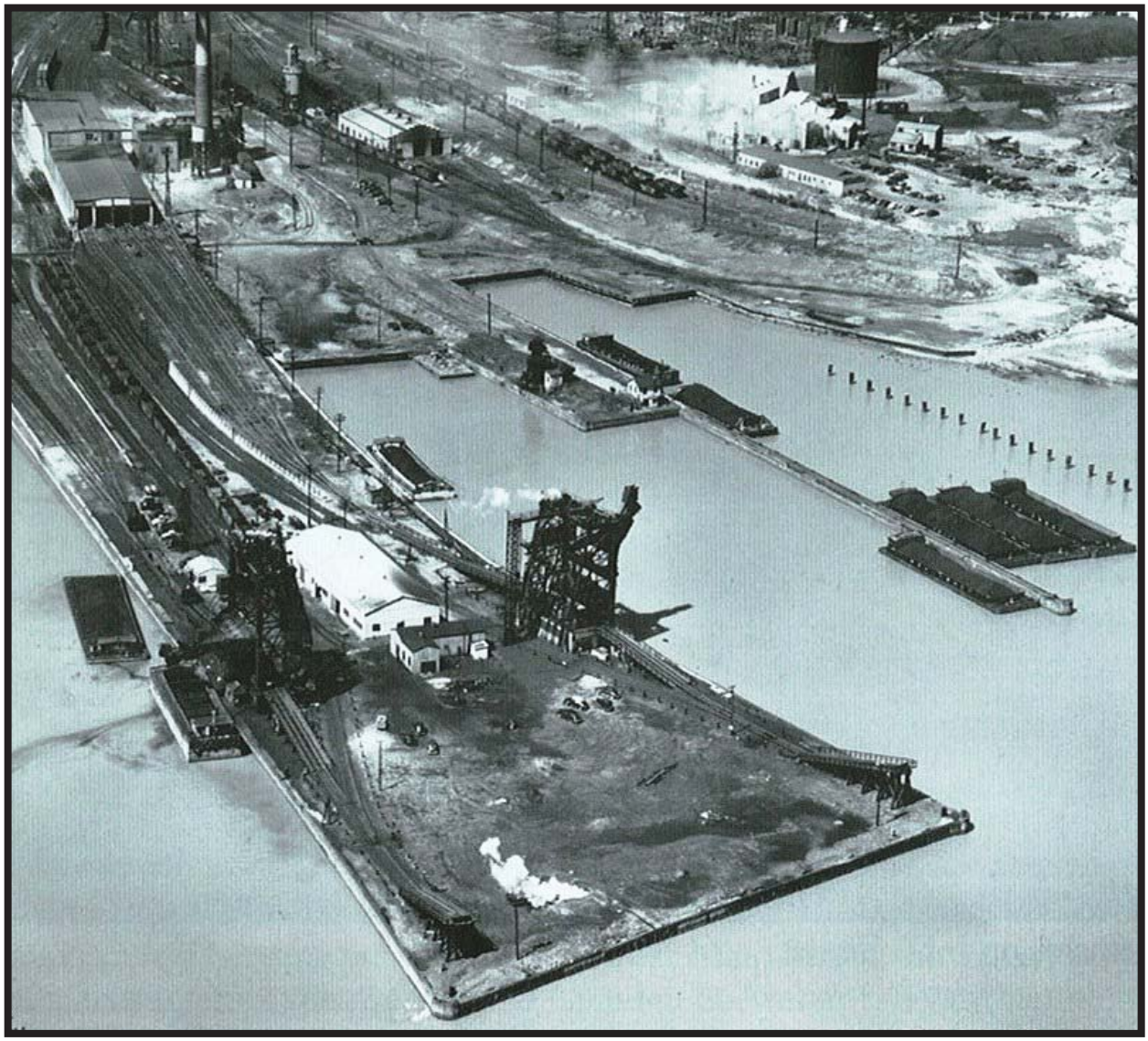
During the 1950s and 1960s, the general economic climate for the Pennsylvania Railroad was unfavorable as high fixed costs and increasing competition from the airlines, passenger automobiles and over-the-road trucking cut into its market share. In 1957, the Pennsylvania Railroad in an effort to control costs and competition announced it was merging with the rival New York Central, which operated routes running nearly parallel with the Pennsylvania. The merger was anticipated to result in closure of duplicate services and under-capacity facilities. Merger discussions with the New York Central took eleven years to complete and had little immediate direct impact on the South Amboy terminal, but investment in maintenance and repair throughout the Pennsylvania Railroad declined during this period. In 1968, the merger was consummated and the Penn Central came into existence, only to fall apart and declare bankruptcy two years later in June 1970. No major developments or changes in service occurred at the South Amboy ferry terminal during this period of declining investment in the railroad's infrastructure (Photographs 5.39 to 5.41)

Known Resource Types and their Significance

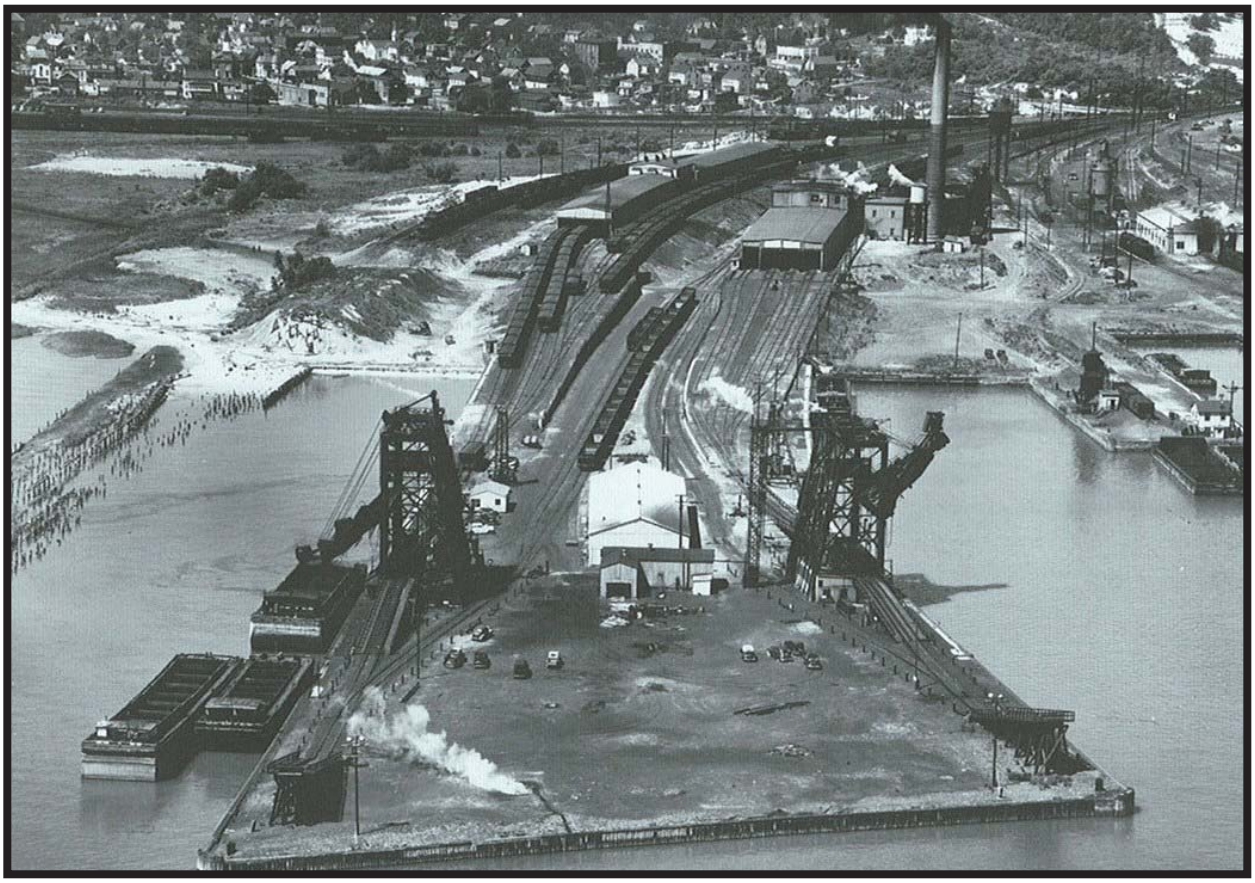
There are no known significant resources or resource types dating to the period of decline from 1950 to 1970. The significant resources that were rebuilt following the explosion of 1950, including the McMyler dumpers and coal-thawing plants, have been demolished. The thawing plants were documented in 2001 prior to demolition.

D. Developments since 1970

Coal handling operations continued at South Amboy during the bankruptcy of the Penn Central but it was a gloomy period since the future of the terminal was constantly in question (Photograph 5.42). Penn Central continued to operate the terminal under bankruptcy protection until 1976 when the U.S. Congress created Conrail to take over Penn Central and five other bankrupt railroads in the Northeast. Conrail transferred Penn Central's commuter passenger operations in New Jersey to New Jersey Transit in 1979. That same year Conrail received permission to abandon unproductive facilities and many miles of track including the South Amboy terminal and a section of the former Camden and Amboy Railroad line between Bordentown and Monmouth Junction. Conrail sold the South Amboy property in 1979 to the Modern Transportation Company, later known as Spectraserve, which used the facility mainly for storage of bulk materials, like sand and aggregate, and for the tying up of barges at the piers (Photographs 5.43 and 5.44). The engine house remained in use until the late 1980s. In the 1990s, the City of South Amboy along with partners at the New Jersey Department of Transportation and the Federal Highway Administration began looking at alternatives for redeveloping the site as an intermodal transportation center with marina and ferry terminal.

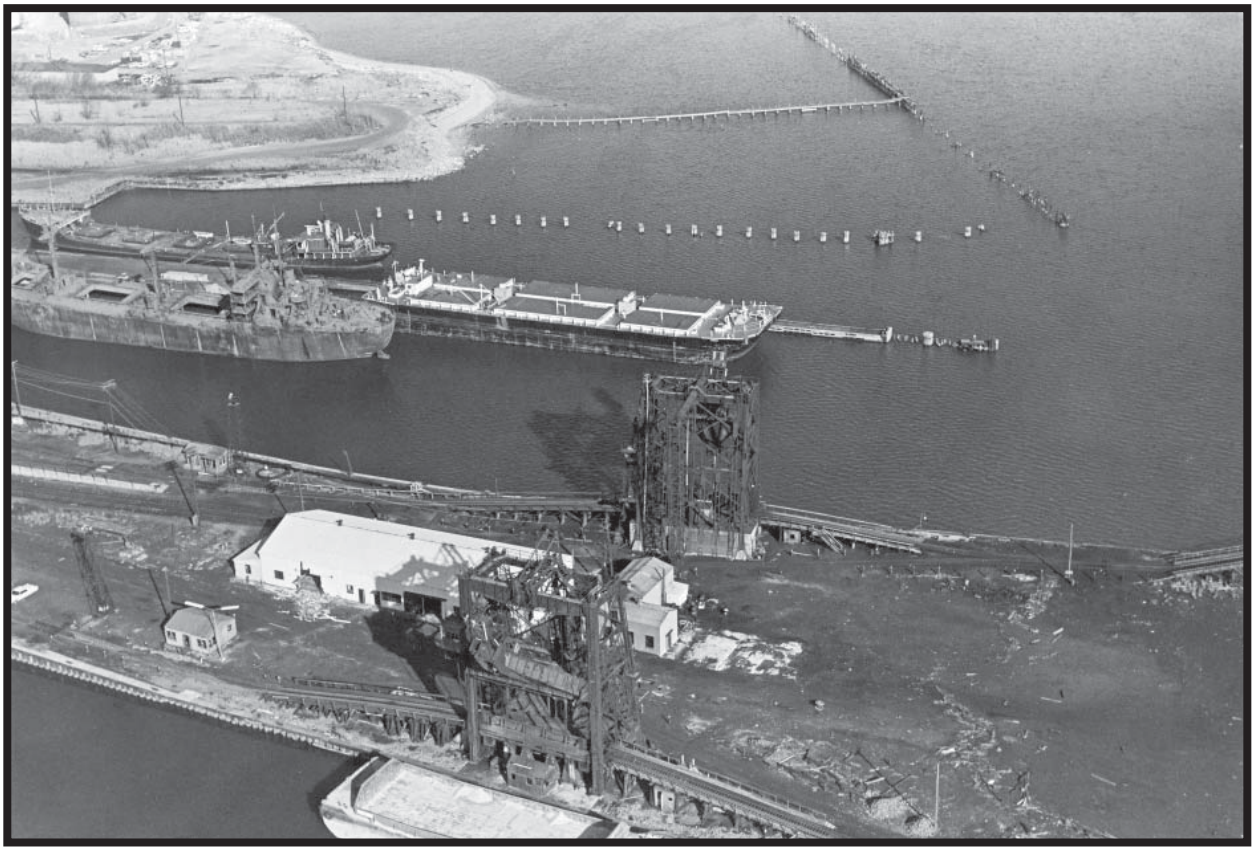


Photograph 5.39. Aerial view, looking west at coal handling pier. *Circa* 1953 (Source: Francy 1998).



Photograph 5.40. Aerial view, looking west at coal handling pier. *Circa* 1953 (Source: Francy 1998).

Photograph 5.41. View looking east at coal handling pier and dumpers. *Circa* 1953 (Source: Francy 1998).



Photograph 5.42. Aerial view of the Penn-Central South Amboy ferry terminal. 1972 (Photographer: Tom Flagg).

Photograph 5.43. Aerial view of the Conrail South Amboy ferry terminal. 1979. This photograph shows the west end of the terminal with many of the yard tracks already removed (Photographer: Tom Flagg).

Photograph 5.44. Coal dumper, Conrail South Amboy ferry terminal. 1983 (Photographer: Tom Flagg).

Chapter 6

IDENTIFICATION AND EVALUATION OF HISTORIC ARCHITECTURAL RESOURCES

A. THAWING PLANTS

In October 2001 a rapid photographic survey was taken of the 1911 and 1916 coal-thawing plant structures. These were not within the Intermodal Ferry Terminal Center (IFTC) project area as then defined, and the objective was simply to obtain a preliminary impression of the structures and to determine if a more formal survey and evaluation might be appropriate in the future.

Photographs 6.1-6.7 provide a partial overview of the deteriorated but still impressive buildings as they existed in late 2001. At some point between 2002 and 2012 they were torn down, and the subsequent massive changes in landscaping have removed any last traces of them. In the light of their technological interest (see above, Chapter 5 and Photographs 5.24-5.26) it is unfortunate that there was evidently no regulatory mandate to require their documentation prior to demolition. This was also the case with the 1910-11 McMyler dumpers, removed some years before the current project began.

B. CONRAIL BRIDGE 1.98

Conrail Bridge 1.98 over Main Street and the New Jersey Transit North Jersey Coast Line was built by the Pennsylvania Railroad in about 1910. It was a four-span concrete-encased stringer bridge with concrete abutments and solid concrete piers. In anticipation of the need for documentation of the bridge prior to its demolition, 18 large format photographs were taken in 2002 to provide representative views of the structure. These remain on file at Hunter Research, Inc. in Trenton, New Jersey (Hunter Research Project #02007). This material supplemented the structural assessment and historical summary of the bridge completed in 2011 (T & M Associates, Inc. 2001).

C. CATENARY STRUCTURES

In 1938-39 the Pennsylvania Railroad installed an overhead electric catenary system along the alignment of the former Camden and Amboy Railroad branch that served the ferry terminal. Electric locomotives continued to use the lines into the late 1950s. In December 2002 the surviving catenary installations were surveyed, mapped and photographed (Hunter Research, Inc. 2002, included as Appendix E to this report). A total of 30 support structures from the 1938-39 installation remained at that time, including a large lighting tower, two portal bridges, cross-catenaries or body spans, bracket-arm bridge structures and single poles. It was recommended that one of the portal bridges (reference C15a/b) and two bracket arms be retained as a historic entrance feature for the new ferry terminal.

D. MAIN STREET IMPROVEMENTS

A cultural resource reconnaissance survey was undertaken in 2005 for proposed Main Street improvements in South Amboy and Sayreville (Hunter Research, Inc. 2005). While not part of the IFTC project, it was immediately proximate to it and in particular to areas of early development associated with the Camden and Amboy Railroad. No significant architectural resources were identified and the archaeological potential was considered to be low.

Photograph 6.1. General view of the thawing sheds and part of the heating plant looking east. The 1911 shed is at left center and the 1916 shed is at right (Photographer: Ian Burrow, October 2001) [HRI Neg. #01005/D3:11].

Photograph 6.2. General view looking east showing the relationship of the 1911 shed to the heating plant (Photographer: Ian Burrow, October 2001) [HRI Neg. #01005/D3:3].

Photograph 6.3. View looking northwest showing detail of the superstructure of the 1911 shed (Photographer: Ian Burrow, October 2001) [HRI Neg. #01005/D3:14].

Photograph 6.4. View looking west showing the western portal of the 1916 shed (Photographer: Ian Burrow, October 2001) [HRI Neg. #01005/D3:1].

Photograph 6.5. View looking west-northwest showing the eastern end of the 1916 shed, with part of the 1911 shed visible at right (Photographer: Ian Burrow, October 2001) [HRI Neg. #01005/D3:13].

Photograph 6.6. View looking east showing the lattice bridge from the 1911 shed (left) to the 1916 shed (right) (Photographer: Ian Burrow, October 2001) [HRI Neg. #01005/D3:19].

Photograph 6.7. General view looking southwest showing the 1916 shed (Photographer: Ian Burrow, October 2001) [HRI Neg. #01005/D3:9].

Chapter 7

IDENTIFICATION AND EVALUATION OF ARCHAEOLOGICAL RESOURCES

A. METHODOLOGY AND PROJECT-SPECIFIC EVALUATION CRITERIA

The primary task for the identification and evaluation of archaeological resources was the mapping of all known railroad features onto a modern base map (Figure 7.1). A wide range of sources were used for this endeavor, with a key role being played by the Interstate Commerce Commission records (see above, Chapter 5). The historic maps of the area were the second major source. Figure 7.1 attempts to show all railroad features known to have existed within the archaeological Area of Potential Effects, with the exception of the tracks themselves, which were considered not be potentially significant because of their multiple replacements, mostly in the Pennsylvania Railroad period. The distinctive Camden and Amboy Railroad stone sleepers, and the late 1930s catenary system, were however included in the mapping and subsequent documentation.

Although, as has been emphasized, the whole project area has historical significance, surviving physical resources may not all have the same value as contributing elements to the Camden and Amboy Railroad (Main Line) Historic District. These resources are analyzed in a simple evaluation grid in which the primary organizing principle is the historic periods into which the district has been divided, i.e., different types of physical evidence are evaluated as having different values, depending on the period (Table 7.1). Generally, the earlier the period to which a feature belongs the more likely the feature is to be a contributing element of the Camden and Amboy Railroad (Main Line) Historic District.

Within this evaluation grid, any features relating to the Camden and Amboy Railroad period (1831-71) are considered to be contributing, because this period is so significant for railroad history, and little is known about the form, structure and evolution of early railroad infrastructure on the Camden and Amboy

Table 7.1. Evaluation Grid for Railroad Resources.

Elements	1831-1871: Camden and Amboy Period	1871 to 1950: Coal Docks Period	1950 to 1965: Decline and Reduced Levels of Use
Individual components (ties, fixtures)	Contributing	Contributing	Contributing (if substantially intact)
Foundations alone	Contributing	Non-contributing	Non-contributing
Foundations with interior features and details	Contributing	Contributing	Non-contributing
Architecturally distinctive structures or functions	Contributing	Contributing	(none present)

Railroad. Individual elements such as the stone ties, are of considerable historic value and should be considered for salvage and conservation.

For the subsequent Coal Docks period (1871-1950), which forms the greater part of the Pennsylvania Railroad period, a higher standard is proposed, in that building foundations without associated interior stratification and features are not regarded as contributing elements. It seems likely, from the assessment already completed, that the majority of the identified structures will fall into this category. Individual elements, such as signaling structures or other fixtures, will only be considered contributing if they show substantial integrity. No elements of this period have been identified with certainty other than the light poles. In the final Decline period (1950-70), toward the end of the Pennsylvania Railroad period, only distinctive and intact railroad features are judged to be contributing. This evaluation system offers a framework for current and future decision making concerning the appropriate treatment of archaeological resources that may be adversely affected by the proposed project.

Following the provisions of the field verification proposals each identified feature was considered in relation to the following:

- Dimensions of the building or facility
- Internal layout
- Specific function
- Materials of construction
- Date or use date range of building or facility
- Integrity
- Significance

B. GEOPHYSICAL AND ARCHAEOLOGICAL INVESTIGATIONS AND MONITORING IN APES #1 AND #2

1. Methodology

A first campaign of field testing, including a remote sensing survey, was undertaken in June and July 2001, followed by a second campaign of field testing in May 2002. The latter was undertaken under the program of field verification called for under stipulation I.2 of the Memorandum of Agreement.

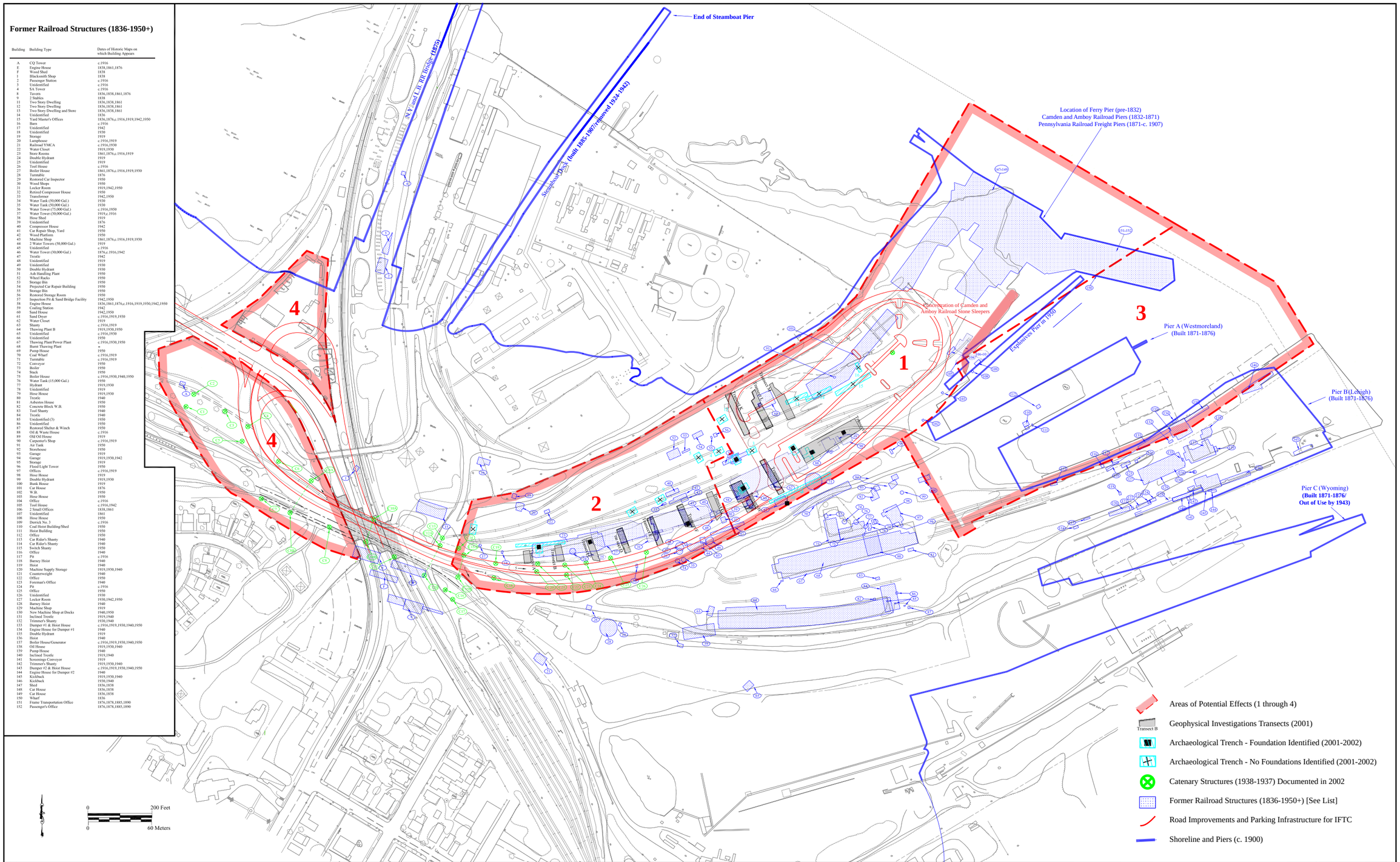
A total of 17 archaeological trenches were excavated with the aid of a backhoe, and 13 larger transects were subjected to geophysical survey. The trenches were placed to intercept the predicted locations of major buildings of the three defined periods in the main areas of the anticipated project. The geophysical survey was subsequently undertaken to obtain a more general impression of below-ground conditions over the undisturbed parts of the immediate impact area. The accessible sections of each transect were investigated by Geo-Graf, Inc. utilizing ground penetrating radar (GPR), electromagnetic (EM) and magnetic non-intrusive geophysical techniques in an attempt to delineate buried building foundations and other subsurface targets and anomalies of a historic nature (Appendix D). Foundations were encountered at several points along the length of the low central zone within APE #1 and #2.

2. The 2001 Investigations

In the spring of 2001 twelve archaeological trenches were excavated using a backhoe, followed in June and July 2001 by geophysical investigations undertaken on the 13 transects (A through M on Figure 7.1), with the objective of identifying anomalies related to railroad structures. The southern row of geophysical investigations (Transects A through J) was designed to

Former Railroad Structures (1836-1950+)

Building	Building Type	Dates of Historic Maps on which Building Appears
A	CQ Tower	c.1916
E	Engine House	1838,1861,1876
F	Wood Shed	1838
1	Blacksmith Shop	1838
2	Passenger Station	c.1916
3	Unidentified	c.1916
4	SA Tower	c.1916
8	Tavern	1836,1838,1861,1876
9	2 Stables	1838
11	Two Story Dwelling	1836,1838,1861
12	Two Story Dwelling	1836,1838,1861
13	Two Story Dwelling and Store	1836,1838,1861
14	Unidentified	1836
15	Yard Master's Offices	1836,1876,c.1916,1919,1942,1950
16	Barn	c.1916
17	Unidentified	1942
18	Unidentified	1930
19	Storage	1919
20	Lamphouse	c.1916,1919
21	Railroad YMCA	c.1916,1930
22	Water Closet	1919,1930
23	Store Rooms	1861,1876,c.1916,1919
24	Double Hydrant	1919
25	Unidentified	1919
26	Tool House	c.1916
27	Boiler House	1861,1876,c.1916,1919,1930
28	Turntable	1876
29	Restored Car Inspector	1950
30	Wood Shops	1950
31	Locker Room	1919,1942,1950
32	Retired Compressor House	1950
33	Transformer	1942,1950
34	Water Tank (50,000 Gal.)	1930
35	Water Tank (50,000 Gal.)	1930
36	Water Tower (75,000 Gal.)	c.1916,1950
37	Water Tower (50,000 Gal.)	1919,c.1916
38	Hose Shed	1919
39	Unidentified	1876
40	Compressor House	1942
41	Car Repair Shop, Yard	1950
42	Wood Platform	1950
43	Machine Shop	1861,1876,c.1916,1919,1930
44	2 Water Towers (50,000 Gal.)	1919
45	Unidentified	c.1916
46	Water Tower (30,000 Gal.)	1876,c.1916,1942
47	Trestle	1942
48	Unidentified	1919
49	Unidentified	1930
50	Double Hydrant	1930
51	Ash Handling Plant	1950
52	Wheel Racks	1950
53	Storage Bin	1950
54	Projected Car Repair Building	1950
55	Storage Bin	1950
56	Restored Storage Room	1950
57	Inspection Pit & Sand Bridge Facility	1942,1950
58	Engine House	1836,1861,1876,c.1916,1919,1930,1942,1950
59	Cooling Station	1942
60	Sand House	1942,1950
61	Sand Dryer	c.1916,1919,1930
62	Water Closet	1919
63	Shanty	c.1916,1919
64	Thawing Plant B	1919,1930,1950
65	Unidentified	c.1916,1950
66	Unidentified	1950
67	Thawing Plant/Power Plant	c.1916,1930,1950
68	Burnt Thawing Plant	-
69	Pump House	1950
70	Coal Wharf	c.1916,1919
71	Turntable	c.1916,1919
72	Conveyor	1950
73	Boiler	1950
74	Stack	1950
75	Boiler House	c.1916,1930,1940,1950
76	Water Tank (15,000 Gal.)	1950
77	Hydrant	1919,1930
78	Unidentified	1919
79	Hose House	1919,1930
80	Trestle	1940
81	Asbestos House	1950
82	Concrete Block W.B.	1950
83	Tool Shanty	1940
84	Trestle	1940
85	Unidentified (3)	1950
86	Unidentified	1950
87	Restored Shelter & Winch	1950
88	Oil & Waste House	c.1916
89	Old Oil House	1919
90	Carpenter's Shop	c.1916,1919
91	Air Tank	1950
92	Snowhouse	1950
93	Garage	1919
94	Garage	1919,1930,1942
95	Storage	1919
96	Flood Light Tower	1950
97	Offices	c.1916,1919
98	Hose House	1919
99	Double Hydrant	1919,1930
100	Bunk House	1919
101	Car House	1876
102	W.Ib.	1950
103	Hose House	1950
104	Office	c.1916
105	Tool House	c.1916,1942
106	2 Small Offices	1838,1861
107	Unidentified	1861
108	Hose House	1950
109	Derrick No. 3	c.1916
110	Coal Hoist Building/Shed	1950
111	Hoist Building	1950
112	Office	1950
113	Car Rider's Shanty	1940
114	Car Rider's Shanty	1940
115	Switch Shanty	1950
116	Office	1940
117	Pit	c.1916
118	Barney Hoist	1940
119	Hoist	1940
120	Machine Supply Storage	1919,1930,1940
121	Counterweight	1940
122	Office	1950
123	Foreman's Office	1940
124	Pit	c.1916
125	Office	1950
126	Unidentified	1930
127	Locker Room	1930,1942,1950
128	Barney Hoist	1940
129	Machine Shop	1919
130	New Machine Shop at Docks	1940,1950
131	Inclined Trestle	1919,1940
132	Trimmer's Shanty	1930,1940
133	Dumper #1 & Hoist House	c.1916,1919,1930,1940,1950
134	Engine House for Dumper #1	1940
135	Double Hydrant	1919
136	Hoist	1940
137	Boiler House/Generator	c.1916,1919,1930,1940,1950
138	Oil House	1919,1930,1940
139	Pump House	1940
140	Inclined Trestle	1919,1940
141	Screenings Conveyor	1919
142	Trimmer's Shanty	1919,1930,1940
143	Dumper #2 & Hoist House	c.1916,1919,1930,1940,1950
144	Engine House for Dumper #2	1940
145	Kickback	1919,1930,1940
146	Kickback	1930,1940
147	Shed	1836,1838
148	Car House	1836,1838
149	Car House	1836,1838
150	Wharf	1838
151	Frame Transportation Office	1876,1878,1885,1890
152	Passenger's Office	1876,1878,1885,1890



Hunter Research, Inc.	Figure 7.1. Comprehensive Mapping of All Known Railroad and Railroad-Related Structures and Features Within the Study Area. The location of archaeological and geophysical survey locations in 2001 within APEs 1 and 2 are also shown.	**Cultural Resource Investigations Intermodal Ferry Transportation Center City of South Amboy Middlesex County, New Jersey**	120 West State Street Trenton, NJ 08608 Tel 609-695-0122 hri@hunterresearch.com www.hunterresearch.com

A full-scale version of this figure is included in the pocket at the back of this report.

locate foundations of the line of 19th- and 20th-century railroad structures that extended for over 1,000 feet along the southern side of the low central zone at the foot of the slope leading up to the raised area of the thawing sheds and the Pennsylvania Railroad coal piers. Numerous targets were identified, and were divided into six categories:

- Magnetic Targets: buried iron-containing targets
- EM Targets: Large metallic objects or conductive subsoils.
- GPR T-1: Probable foundations (1-3 feet)
- GPR T-2: disturbed subsoil (possible demolished structures)
- GPR T-3: Deeper (3-5 feet) isolated targets
- GPR Utilities: Large subsurface utilities

Foundations were encountered in the archaeological trenches at several points along the length of the low central zone in APE #1 and APE #2. These are summarized from west to east:

Trench 7 and Transect C both encountered evidence of a building foundation. A brick wall extending to a depth of five feet below the ground surface was exposed beneath rail yard gravel in Trench 7, and was also strongly indicated in Transect C. The wall is likely to be part of the large car and machine shop complex forming the western structures in this part of the site. There was probably a building at this location in 1836, and the site was continuously used until World War II, after which the buildings were successively demolished. Transect F probably also encountered foundations of the machine shop.

Trenches 1 and 2 (3 by 20 feet) were excavated at the probable location of the multi-phase locomotive house/engine house. Trench 1 was located at the northeast corner of the rectangular concrete slab floor of the building that replaced the locomotive house after the 1950 explosion. A concrete pad floor was exposed directly beneath with a truncated brick wall three courses thick forming the north wall of an earlier building. Trench 2 to the west contained a concrete pad floor abutting a concrete wall or footing. Positive readings in Transect J may relate to these buildings or to the oil house that lay to the west.

Trench 11 was placed just to the north of this complex of buildings. Two parallel sections of concrete curbing, oriented east-west, each one-foot wide located six feet apart, were exposed beneath fill. A one-foot wide concrete and wood railroad tie shelf was located 0.50 feet below the top of each concrete curb. The alternating one-foot-wide wood and concrete sections appear to have supported iron rails. A demolition deposit consisting of concrete, metal and silty sand filled the four-foot-wide space between the concrete curb and rail support. This deposit extended below the concrete curb and rail at least three feet, possibly providing access to the underside of rail cars.

Trench 10 was located in the area of the turntable structure shown on the 1918 Sanborn fire insurance map (see above, Figure 5.34). Excavation revealed fill deposits consisting of silty sand with coal and ash, and a strong petroleum odor. Two two-foot-wide east-west brick footings extending more than 40 feet were located. These foundations may have supported tracks leading into the turntable. The turntable had been demolished by 1940.

Transects and trenches in the raised area in the northern portion of APE #1 did not encounter any structural remains. It seems probable that the car house shown on the 1876 Everts & Stewart map (see above, Figure 5.23), and probably the 1836 Brinley map (see above, Figure 5.15), lay just to the east in the area destroyed by the construction of the firing range. In this elevated part of the project area a more complete stratigraphic profile consisting of remnant A-horizon and B-horizon soils overlying C-horizon soils was encountered, supporting the contention that the original grade survives in this area.

Evaluation of Significance

Using the methodology of the Evaluation Grid in Table 7.1 it was concluded that none of the resources identified in 2001 contribute to the significance of the Camden and Amboy Railroad (Main Line) Historic District.

3. The 2002 Investigations

In May 2002 a total of five trenches were excavated, four at the east end of the elevated rail yard that comprises the north half of the project area, and one at the southern lower rail yard. These trenches were numbered 13 through 17, continuing the sequence used in the initial identification survey. The locations of all archaeological tests performed for the project are shown on the attached map (Figure 7.1), together with the locations and identifications of all known former structures. Pedestrian survey was also undertaken to locate the foundations of water towers and other structures on the alignment of the proposed access road.

Engine House (Structure 58) in the Lower Rail Yard Area

Trench 17 was excavated along the east edge of the existing concrete slab to investigate and confirm the location of the engine house. The east wall of the engine house was encountered at the west end of the initial 40-foot long trench. The wall was comprised of a section of brick at least one foot wide. The bricks included Sayre and Fischer products, probably of late 19th- or early 20th-century date. The total width of the brick foundation wall could not be determined because the brick was partially covered by the concrete slab. A concrete foundation wall, 0.50 feet wide, had been constructed against the east side of the brick foundation. Both foundation walls extended to a depth of 2.50 feet below the present ground surface.

A concrete pad 0.40 feet thick was encountered six feet east of the engine house wall. It was 11.5 feet east-west. A cross trench was excavated to investigate the north-south limits of the pad, which was found to extend approximately 15 feet north-south. Fill exposed beneath the pad contained ventilated brick manufactured in the early to mid-20th century, indicating a recent date of construction for the concrete pad. Sandy clay subsoil contaminated with petroleum was encountered at 2.70 feet below ground surface. There were no distinctive features on the pad to indicate its function.

Car House (Structure 101) on the Elevated Rail Yard

Recent research more accurately located the Camden and Amboy-era car house structure on the elevated rail yard, repositioning it approximately 350 feet east of the initial placement based on preliminary map analysis. An attempt was made to locate this structure through the excavation of Trenches 13 through 16, all five feet wide and ranging in length from 30 to 125 feet.

Trenches 13-15 were oriented east-west between track rails, east of the geophysical survey Transect M, and immediately southwest of the firing range cut. Stratigraphy was similar in Trenches 13 (70 feet long) and 14 (90 feet long), consisting of coal, coal ash and cinder fill, approximately 1.50 feet thick, overlying a mottled sand B horizon. Trench 15 (125 feet long) extended east to a point where the railroad tracks and terrace edge converge along the upper terrace forming the elevated portion of the rail yard. The soil profile showed a stratigraphy gradually sloping down toward the water, indicating that the pre-railroad topography of the terrace sloped down to the east, beginning approximately 500 feet west of the present terrace edge. Fill approximately eight feet thick had been deposited to extend the terrace eastward. Trench 16 (30 feet long) was oriented north-south and straddled

the south edge of the firing range cut and northern portion of upper terrace. The trench was excavated to a depth of five feet below the ground surface. Sand fill overlying coal, coal ash and cinder was encountered to that depth. No evidence of a structure was revealed.

Pedestrian Survey along Proposed Road Alignment (Water Tower Foundations 44)

A pedestrian survey was carried out along the proposed access road alignment to investigate possible surviving resources, notably features relating to the series of water towers shown on early 20th-century maps of the rail yard. Two linear concrete foundations approximately 40 feet long were identified at the base of the slope along the south edge of the rail yard. Also, a square concrete shaft was observed between the two walls. This feature was further recorded during monitoring in 2012 (see below). Due to slope wash and debris dumped over the edge of the south bluff, only the north edges of the foundations were exposed. These concrete footings probably relate to Structure 44 on the building inventory map (Figure 7.1).

Photographic Documentation and Survey of Surviving Above-Ground Elements

A group of eight light poles was identified in the northwestern portion of APE #1. These were recorded photographically and are among items that may be considered salvageable as part of treatment of historic elements. It was recommended that identified light poles be appropriately flagged, stockpiled and incorporated into the ferry terminal facility with the advice of the State Historic Preservation Officer.

Evaluation of Significance

Using the methodology of the Evaluation Grid in Table 7.1 it was concluded that none of the resources identified in 2002 contributed to the significance of the Camden and Amboy Railroad (Main Line) Historic District.

4. 2012 Monitoring of Radford Ferry Road Construction

Archaeological monitoring of the construction of Radford Ferry Road took place on August 2, October 8, November 12, November 14, November 15 and November 26, 2012.

Monitoring was undertaken on August 2, 2012 in conjunction with the excavation of a remediation pit by Potomac-Hudson Environmental, Inc. An area about 10 by 25 feet in plan and three feet in depth was excavated by machine to obtain data on an Area of Concern (AOC) associated with oil contamination. A simple profile comprising natural yellow gravelly sand was overlain successively by black coal ash, white sand and black soil with a high coal ash content. The excavation was photographed and documented, and locational information was obtained from the engineer.

Monitoring on October 8, 2012 was carried out to observe the excavation of four test pits along the road alignment. These were excavated by the contractor (Petillo, Inc.) to provide data on soil conditions preparatory to making final decisions on grading and materials. All the vegetation had been removed from the site, enabling the approximately ten-foot-high, steep slope, which formed the north side of the approach ramp to the late 19th-century Westmoreland pier, to be fully observed. The four test pits all revealed that the upper layers of this approach ramp were for the most part composed of loosely compacted ashy loam soils

containing railroad ties, tree roots and modern debris. Two circular concrete catenary bases, with embedded cut-off I-beams forming the catenary pole shafts, were recovered and stockpiled. The deposits lay on orange and yellow sand that was, at the time, assumed to represent the natural subsoil, but which subsequent large-scale observations have shown to be at least in part an extensive fill deposit probably forming the main portion of the approach ramp. Three structural features were exposed along the base of the slope: a concrete headwall structure about 25 feet long with an integral concrete tank about 7.5 feet square and five feet deep; a concrete well-house measuring ten feet by 4.5 feet in plan internally; and a poorly constructed brick tank 4.8 feet by 3.5 feet in plan internally. These were all mapped using the road station stakes as reference points, photographed, documented and then removed by the contractor.

Construction resumed on November 12, 2012, after decisions about grading and filling following delays caused by Hurricane Sandy, which had washed debris into the lower portions of the project area. On the foreshore three pleasure boats had been marooned among the trees. At least four large steel barges had been washed up onto the top of the Westmoreland pier, at least ten feet above mean sea level. Damage to the numerous pier supports for the former ferry terminals and barge racks appeared to be minimal, however, and these were observed in some detail under very low tide conditions. Numerous Camden and Amboy Railroad stone sleepers lying in the shore area just north of the former explosives pier were still present. A previously unrecorded bracket-arm catenary was observed south of the police shooting range. At the road construction site itself, machine removal of the surface material of the ramp was in progress. Railroad items were stockpiled by the contractor after removal. Several large reinforced concrete pyramidal piers set onto vertical wooden pilings were exposed, recorded, removed and stockpiled. These were from an area known to have been the site of several successive water towers in the first half of the 20th century. The ridged bonded rebar used in the structures was made no earlier than the early 20th century.

On November 14, 2012 two additional reinforced concrete structures were documented after exposure during grading. These were mapped by Petillo under Dr. Burrow's direction using Petillo's base-station GPS system, which had ±1 cm accuracy. Foundation 11/14 A was a rectangular basement with a concrete floor and was probably part of a larger structure. It was tentatively identified as part of the 1919 hose shed (Structure 38 in Figure 7.1). This was detailed in the Interstate Commerce Commission records of 1919. The second structure (11/14 B) was a more massive building with battered pier supports at the four corners and an extension to the north. Typically for Pennsylvania Railroad construction, the concrete structure was set onto vertical wood pilings sunk into the clay and sand of the site. The interior of the building was filled with clean sand into which two parallel east-west I-beams, five feet apart on center, were set. Steel plates one foot wide had been welded to the top of the I-beams. The location corresponds to that of the ash handling plant documented in 1950 (Structure 51 in Figure 7.1). After mapping, documentation, and photography, all of 11/14 A and the southern one-third of 11/14 B were broken up with a pneumatic hammer because they lay within the right-of-way.

Removal of the bulk of the material from the Westmorland pier approach ramp was accomplished by the contractor on this day. This largely comprised clean orange sand fill that overlay very dark gray-brown sandy loam with brick and coal ash, possibly a surface predating this portion of the pier.

Monitoring on November 15, 2012 comprised observation of the removal of the above structures, and of the removal of the remaining deposits of the Westmoreland Pier approach ramp. The orange sand of the latter appeared to have been placed over a

wooden trestle structure made chiefly of pine logs, but also using some massive square beams. Vertical posts about nine feet long, each with a single rectangular or lunate notch containing an iron or steel spike, were spaced a maximum of 12 feet apart, at which locations transverse beams appeared to have run across their tops, and lateral beams were spiked to one side. The structure was badly distorted by the overlying fill, the transverse and lateral timbers were badly decayed, and the large size of the trackhoe machine made it difficult to avoid dislodging the timbers. However, a tentative reconstruction of the feature was made (Appendix F). It lies in an area mapped as containing a trestle in 1942 (Structure 47 in Figure 7.1), although the technology used in its construction would appear to date it to the late 19th century. Given the known history and development of the site it is unlikely to date to before about 1875, since before 1871 the Camden and Amboy Railroad operations were all to the north of this area. A massive concrete pier with recesses for baseplates was recovered from very loose fill above and to the east of this location.

Monitoring on November 26, 2012 was undertaken in connection with the remediation of contaminated soils around foundations 11/4 A and 11/4 B. Prior to this, observation was made of the removal of debris at the extreme eastern limit of the road contract. At this point, the grading and filling of the road alignment was virtually complete, with the final phase of filling taking place at the western end adjacent to the bridge.

Remediation was undertaken along the south side of foundation 11/4 B, the area within the limit of construction for the road. After the pumping out of contaminated water, about two feet of dark gray-brown sandy loam (traversed by several pipes, wires and cables running east-west down the axis of the site) were removed down to the natural yellow gravelly sand. A square grid pattern of nine vertical posts was exposed south of, and parallel to, the eastern end of the south wall of 11/4 B, and vertical planking was exposed against the exterior of its south wall. The posts were truncated at the top and their function and relationship to 11/4 B could not be established.

The foundations of 11/4 A were removed and stockpiled. The rebar used in these structures, and seen elsewhere on the site, is known as “Corrugated Round Bar Type C.” It was produced by Carnegie Steel starting about 1911, and appeared in Carnegie’s book of sections until at least 1923, and may have been available at a later date. The structures are therefore probably part of the flurry of activity at the site around World War I. Wooden support posts and rebar rods were exposed and removed during the remediation, which similarly removed about three feet of dark gray-brown sandy loam (the upper portions full of miscellaneous building and railroad debris), as well as the upper sandy portion of the subsoil, exposing orange gravel below.

These observations confirmed the presence of the lower portions of Pennsylvania Railroad-era structures, chiefly of reinforced concrete using rebar with bonding ridges, in this part of the site. The timber structure along the northern side of the Westmoreland pier approach may be a later 19th-century trestle that became incorporated into the pier. There was no indication of the presence of pre-1871 Camden and Amboy Railroad-era features or artifacts.

All the work was completed under the Observational Monitoring Protocols and there was no need to invoke the procedures for Documentary Monitoring (Appendix A).

Evaluation of Significance

Using the methodology of the Evaluation Grid in Table 7.1 it was concluded that the trestle structure contributed to the significance of the Camden and Amboy Railroad Historic District, but that treatment

through documentation in Appendix F was sufficient. Although other features were documented they were not considered to meet the eligibility standards.

C. OFFSHORE FEATURES OF THE CAMDEN AND AMBOY AND PENNSYLVANIA RAILROAD PIERS AND TERMINALS

The inter-tidal and near-offshore area at the north-eastern end of APE #1 presented an initially baffling picture of multiple linear settings of vertical posts and horizontal timbers extending in to Raritan Bay. The problem was compounded by the difficulty of precisely relating the earlier historic maps to modern topography and detail in an environment where most common reference points had been removed. It was originally intended to undertake a detailed survey of all the timberwork visible at the time of the lowest tides and then to relate this to features on historic maps and aerial photographs. It became clear, especially after the impact of Hurricane Sandy, that this would be an extremely time-consuming task that was well beyond the resources available for this project, with major problems being the short time-frame at extreme low-water when many (but not all) of the features could be reached and inspected from onshore across treacherous mudflats, and the similarly limited exposure of features only reachable by boat.

Figures 7.2-7.4 and Photographs 7.1-7.14 therefore present the fullest feasible documentation of these features based on site inspection notes and photography, historic maps and the graphic compilation presented in Figure 7.1. Using these various sources it was possible to relate much of the timbering to specific features known from the historic record.

Figure 7.2 shows a simplified model of the evolution of the Camden and Amboy Railroad and Pennsylvania Railroad piers and terminals from the early 1830s through the completion of the Pennsylvania Railroad freight terminal by 1876. The Camden and Amboy Railroad structures are shown in various configurations before 1871 and it is likely that they were altered and enlarged more than once. It is assumed, from comparison with the historic maps that the evidently substantial pre-railroad ferry pier was at the same location and was incorporated (and presumably strengthened to take the weight of railroad cars and locomotives) into the Camden and Amboy Railroad ferry terminal.

Figure 7.3 provides a location key to Photographs 7.1-7.14, which are a visual record of the visible structures visible at a very low tide in late 2012 after Hurricane Sandy, which exposed areas of timber previously covered with sand.

Figure 7.4 is a simplified interpretational depiction of the main structural elements which can be observed on aerial photographs and confirmed from inspection along the shoreline.

It is clear that the northerly components lying to north and south of the barge rack pier are the oldest and most complex, probably incorporating features from the Camden and Amboy Railroad ferry terminal and possibly from the pre-railroad-era ferry pier.

Evaluation of Significance

Using the methodology of the evaluation grid in Table 7.1 it was concluded that the northerly components lying to north and south of the barge rack pier are contributing resources to the Camden and Amboy Railroad (Main Line) Historic District and merit treatment under 36 CFR 800 and the Memorandum of Agreement for the project (Appendix E).

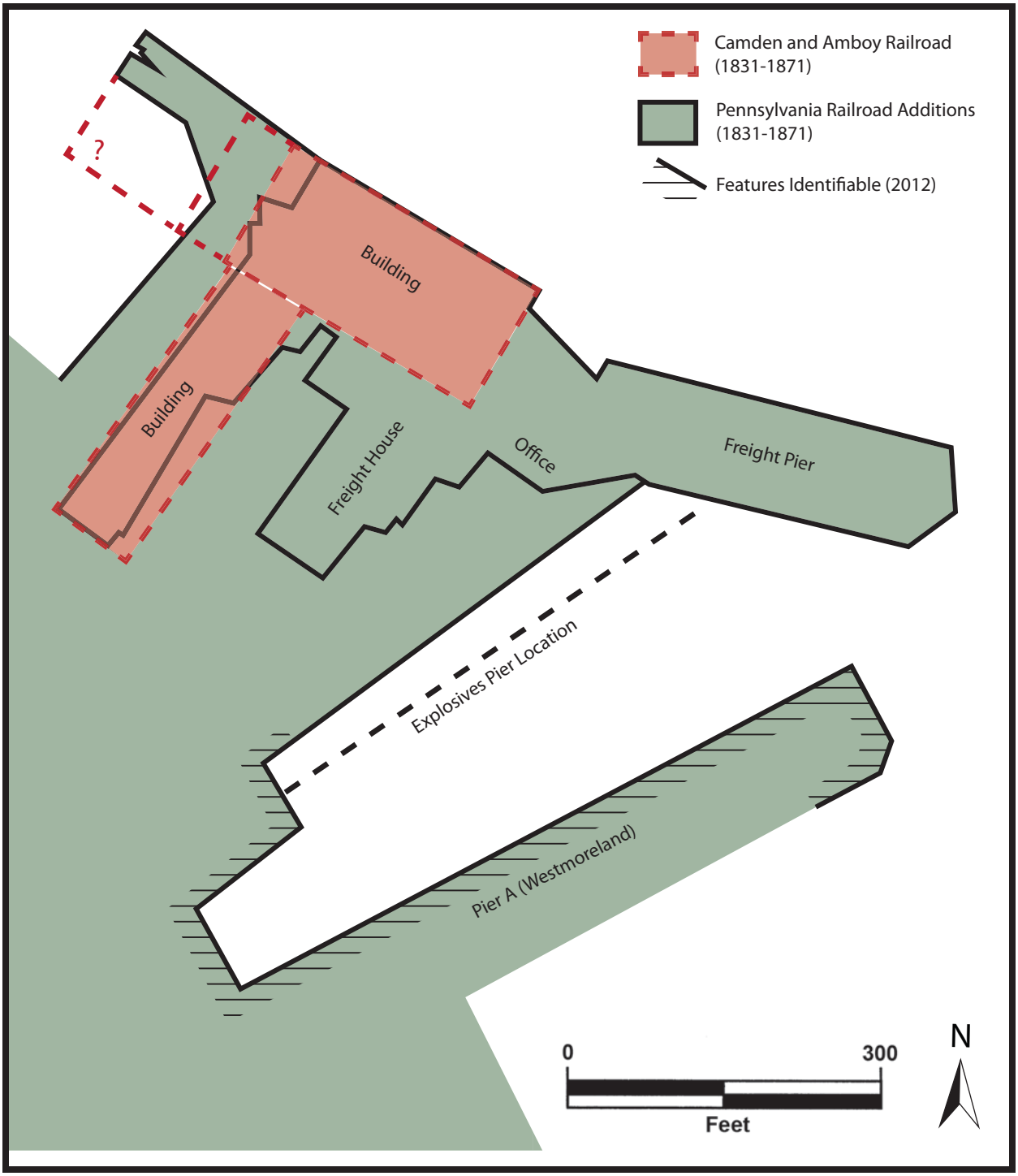


Figure 7.2. Simplified Structural Development of the Camden and Amboy Railroad and Pennsylvania Railroad Facilities in the Area of the Proposed Intermodal Ferry Transportation Center. The Camden and Amboy Railroad facilities are shown in slightly different configurations on the historic maps from 1833 through 1861 and were probably frequently modified through time. The Camden and Amboy Railroad pier appears to have been built on the site of, and probably incorporated, the earlier ferry pier.

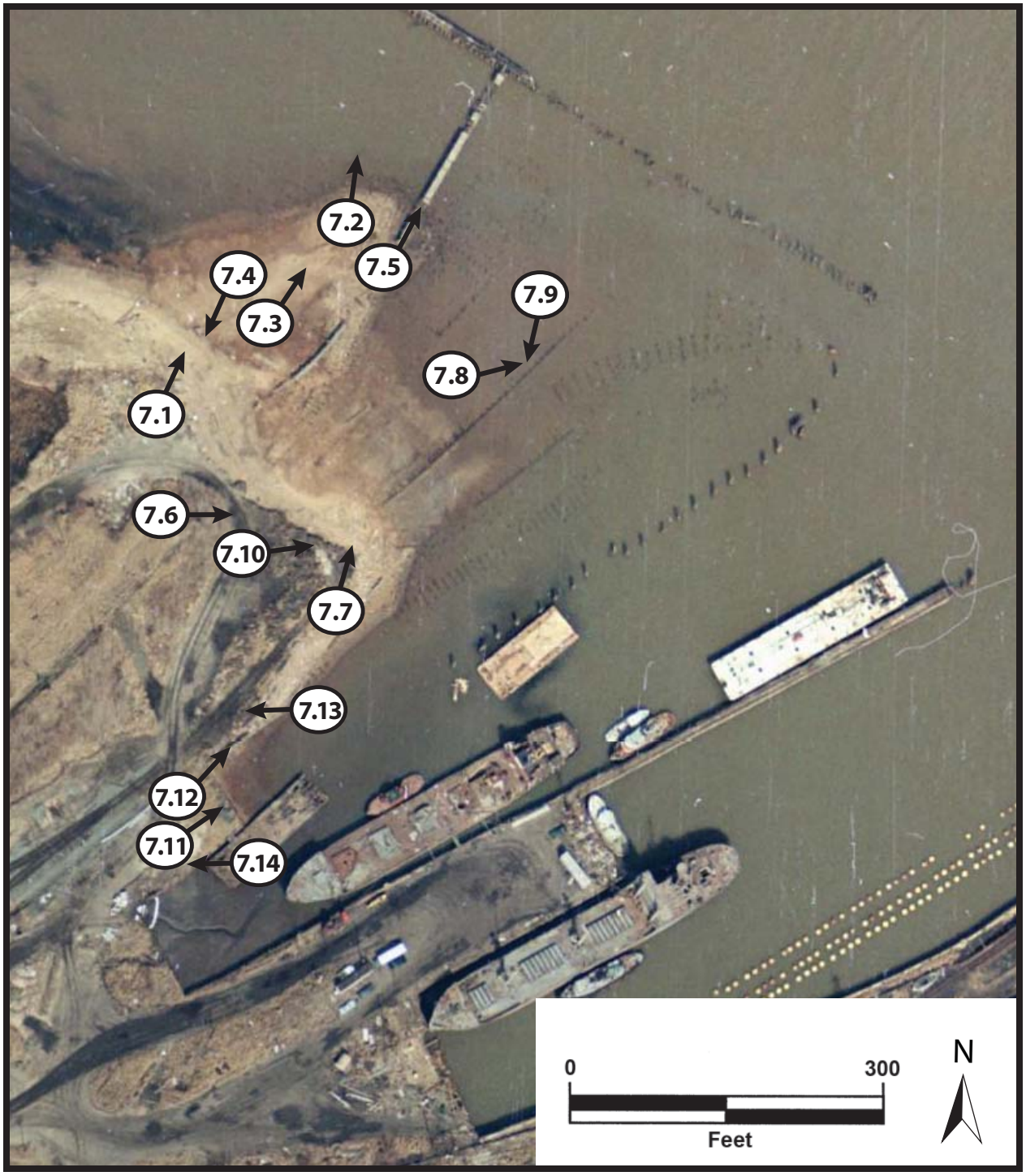


Figure 7.3. Location Key to Photographs 7.1-7.14. The base photograph is a 1979 aerial view, which shows the most detail of the timbers shown in these photographs (Source: National Environmental Title Research 1979).

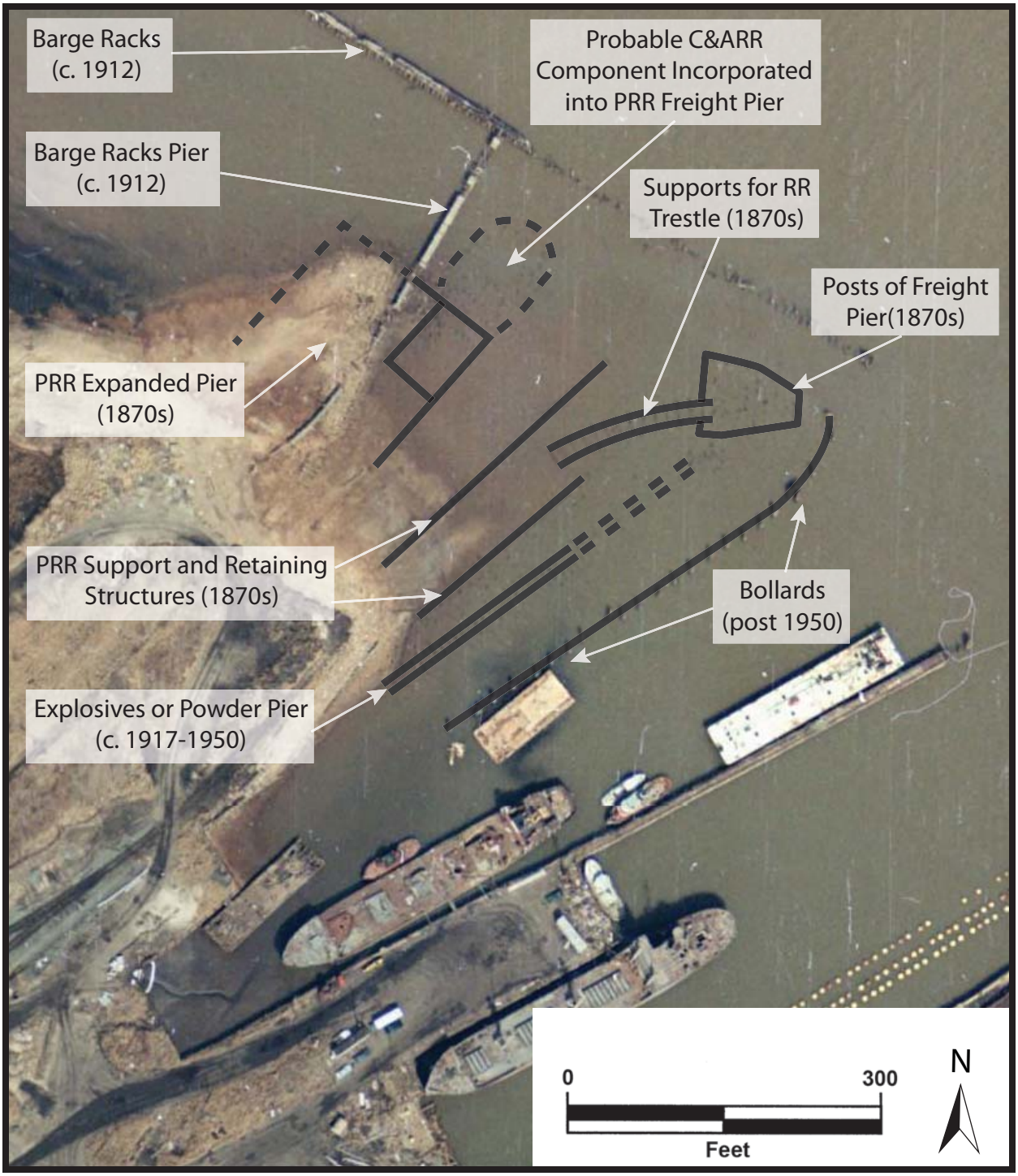


Figure 7.4. Main Surviving Elements of the Camden and Amboy Railroad and Pennsylvania Railroad Facilities in the Area of the Proposed Intermodal Ferry Transportation Center. Also shown are the locations of the c.1917-50 explosives or powder pier and the bollards placed to the south after 1950 and removed after 1971. The base photograph is a 1979 aerial view. See also Figures 7.1 and 7.2 and Photographs 7.1-7.14 (Source: National Environmental Title Research 1979).

Photograph 7.1. View looking northeast from the shooting range mound showing the complex horizontal and vertical timbering in the area northwest of the barge rack pier (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03653].

Photograph 7.2. View looking north showing the northern half of the c.1912 barge racks (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03630].

Photograph 7.3. View looking northeast showing the complex horizontal and vertical timbering in the area northwest of the barge rack pier. These support structures lie in the core area of the Camden and Amboy passenger terminal later used by the Pennsylvania Railroad, which also attached freight facilities to the southeast. Some of the timbers are probably of the pre-1871 Camden and Amboy Railroad era (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03640].

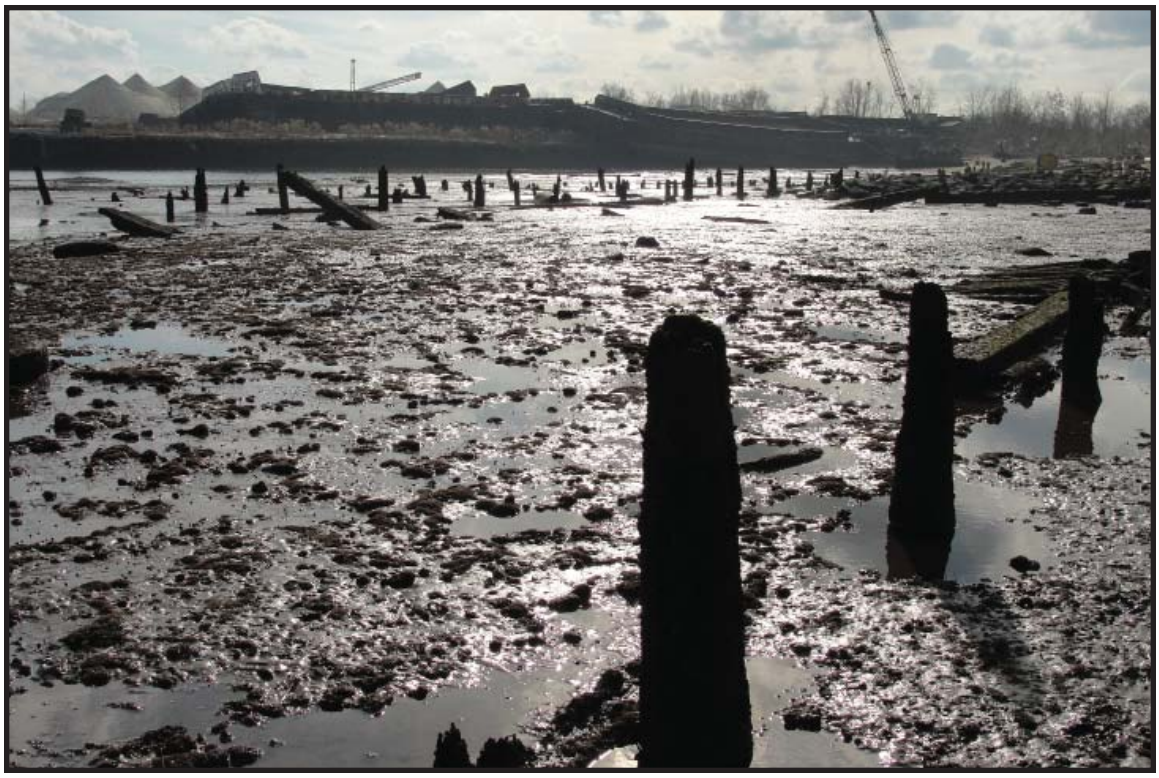
Photograph 7.4. View looking southwest at 180° from view in Photograph 7.3 showing mostly horizontal timbers probably placed by the Pennsylvania Railroad in the 1870s to form the northwest side of the expanded pier facilities. The large mound is a protective structure behind the targets of the police shooting range, which lies on the other side (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03639].

Photograph 7.5. View looking northeast toward Perth Amboy showing the timber supports for the pier which led to the c.1912 barge or "tie-up" racks built by the Pennsylvania Railroad to moor barges awaiting loading from the McMyler coal dumpers installed on the Lehigh pier to the south. The posts at right and left in the middle distance remain from the barge racks themselves (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03634].

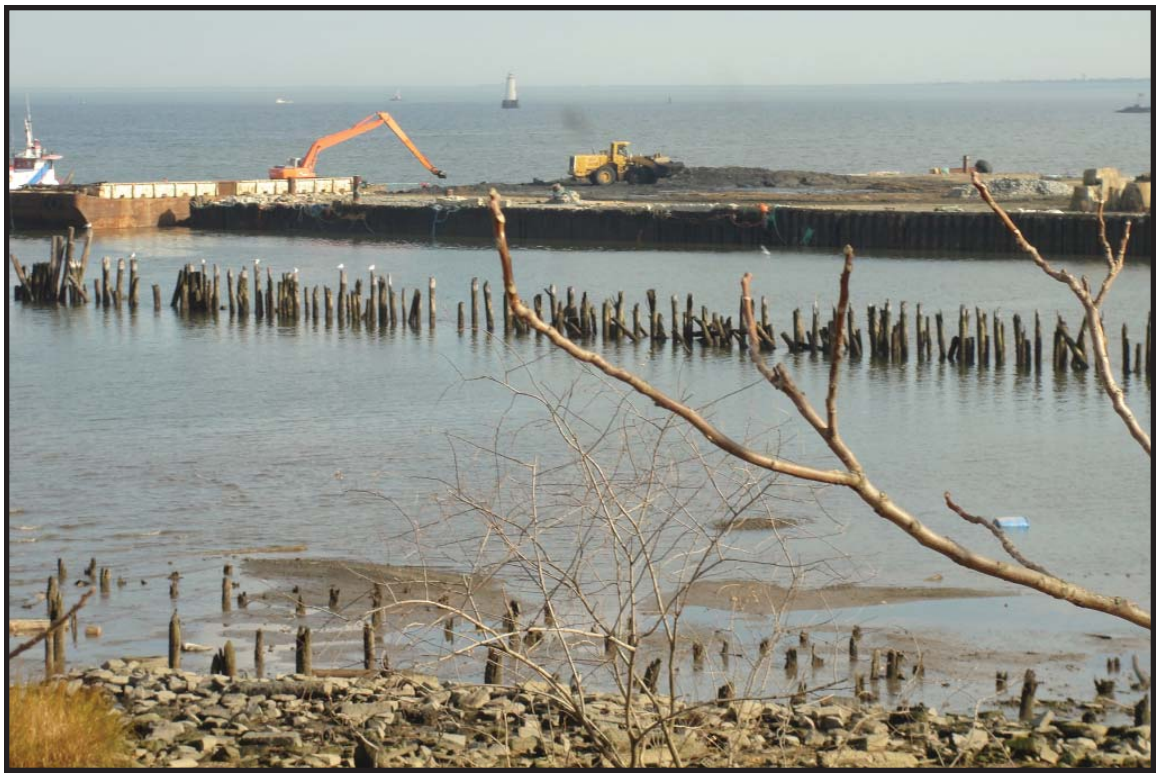
Photograph 7.6. Contextual view looking east-northeast from the shooting range mound. The complex timbering at left supported the central portion of the Camden and Amboy Railroad and Pennsylvania Railroad piers (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/ D5:DSC03648].

Photograph 7.7. View looking northeast showing the massive dressed stone masonry forming the onshore facing of the southeastern side of the 1870s Pennsylvania Railroad structure that supported additional sidings and a new freight house added to the existing Camden and Amboy Railroad passenger piers (Photographer: Patrick Harshbarger, May 2012) [HRI Neg. #11027/D1:19].

Photograph 7.8. View looking northeast showing a group of posts at center which are the remains of the freight wharf built by the Pennsylvania Railroad in the early 1870s as an angled easterly extension of the Camden and Amboy Railroad-era facilities. The posts in the foreground are part of the southeastern side of the Pennsylvania Railroad structure supporting additional sidings and a new freight house (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03622].



Photograph 7.9. View looking south showing the remains of the *circa* 1917-1950 explosives or powder pier, seen at low tide from the alignment of one of the 1870s Pennsylvania Railroad structures which supported additional sidings and the new freight house. The larger angled and vertical timbers are apparently part of the original wider explosives pier. This had been narrowed by 1950, possibly as a result of the 1923 explosion. The 1950 part of the pier is represented by the rather shorter posts beyond. Pier A (Westmoreland) is at rear, with several large barges washed onto it by Hurricane Sandy (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/ D5:DSC03625].



Photograph 7.10. Contextual view looking southeast from the shooting range mound. Pier B (Lehigh), the former location of the major Pennsylvania Railroad coal handling facilities, is at the rear, with tie-up rack timbers (placed 1924-1931) extending from the end of Pier A (Westmoreland) (out of view to right) in the center of the view. Timbers of the explosives pier are in the foreground (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03656].

Photograph 7.11. General view looking east showing the site of the 19th-century Camden and Amboy Railroad and Pennsylvania Railroad piers and terminals. The timbering in the foreground is Pennsylvania Railroad-era bulkheading, possibly from the early 20th-century and associated with modifications related to the construction of the explosives or powder pier in 1917-18, fragmentary posts of which remain in the middle of the view (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03613].

Photograph 7.12. View looking north-northeast showing the timber and stone revetment probably placed after 1950 to stabilize the shoreline after the 1950 explosion that destroyed the explosives pier. The stones include a number of Camden and Amboy Railroad-era stone sleepers which should be salvaged and used for interpretive purposes at the new ferry terminal (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03614].

Photograph 7.13. Close-up view looking southeast showing Camden and Amboy Railroad stone sleepers used as backing for a wooden revetment probably constructed after the 1950 destruction of the explosives pier (Photographer: Patrick Harshbarger, May 2012) [HRI Neg. #11027/D1:14].

Photograph 7.14. View looking west showing a probable early 20th-century wharfage structure southwest of the site of the explosives pier (Photographer: Ian Burrow, October 2012) [HRI Neg. #11027/D5:DSC03610].

Chapter 8

CONCLUSIONS AND RECOMMENDATIONS

The construction of Radford Ferry Road encountered a number of Pennsylvania Railroad-era foundations of buildings and other structures. None of these, except for a portion of a wooden trestle, present in 1942 and probably built in the earlier part of the Coal Docks period (1871-1950), were considered to meet the eligibility criteria of the National Register of Historic Places as part of the Camden and Amboy Railroad (Main Line) Historic District. Documentation of the trestle undertaken during road construction (Appendix F) is considered to have been appropriate treatment under the stipulations of the Memorandum of Agreement (MOA) (Appendix E).

As final design and construction for the Intermodal Ferry Transportation Center (IFTC) progresses, the MOA, which remains in effect until December 2019, should continue to govern cultural resources compliance and activities. The principal outstanding stipulations of the MOA will be Stipulation I for monitoring of ground disturbing activities and Stipulation IV for Design Considerations.

Since the design for the IFTC is not yet finalized, specific areas requiring archaeological monitoring will need to be identified based on knowledge of the site's history, as described in the contexts, maps and tables contained in this report and per the monitoring protocols developed for this project.

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Appendix A

MONITORING PROCEDURES

INTERMODAL FERRY TRANSPORTATION CENTER, CITY OF SOUTH AMBOY, MIDDLESEX COUNTY, NEW JERSEY:

ARCHAEOLOGICAL MONITORING DURING CONSTRUCTION

Purpose

Archaeological monitoring of construction at the Intermodal Ferry Transportation Center, City of South Amboy, Middlesex County, New Jersey (IFTC) is intended to fulfill the requirements of Section 106 of the National Historic Preservation Act of 1966 (as amended). There is a need to ensure that archaeological resources that may be eligible for the State and National Registers of Historic Places be identified and appropriately treated within the framework of the construction schedule.

This document sets out procedures to ensure that the archaeological monitoring is carried out in the most efficient manner during construction activities. The objective is to minimize or eliminate time and cost delays to the construction, while ensuring that significant archaeological materials relating to the history of this nationally significant property are correctly treated.

Definitions

"Observational Monitoring" means the rapid recordation of archaeological discoveries made during Contractor's operations. This is accomplished by archaeologists, using visual observation, photography and written notes, the inspection of back dirt piles, and the mapping of discoveries in plan and profile. **Short-term cessation of work** (as defined below) may be required in order to complete some recordation actions. Such cessations do not disrupt the Contractor's schedule and are not subject to claims from the Contractor.

"Documentary Monitoring" means the detailed archaeological investigation of discoveries while Contractor's operations are suspended at a particular location for an agreed period. These costs may be recoverable by the Contractor if such stoppages are specifically authorized. Authorization will be through specific procedures set out below.

"Short-term cessation of work": a period of not more than two hours during observational monitoring

"Contractor" means the company responsible for the construction activities covered under the Memorandum of Agreement

"Archaeological Monitors" Means archaeologists meeting the Secretary of the Interior's Standards set forth in 48 FR 44716 and contracted to perform this monitoring.

Contractor Responsibilities
The Contractor will:
1. Ensure that the Archaeological Monitors have access to the site at all reasonable times.
2. Work with the Agent to ensure that the Archaeological Monitors are aware of the project schedule and have two business notice of operations requiring monitoring.
3. Communicate the requirements and procedures for monitoring to any subcontractors.

Agent Responsibilities
The Agent will:
Work with the Contractor to ensure that the Archaeological Monitors are aware of the project schedule and have two business days' notice of operations requiring monitoring.

Archaeological Monitor Responsibilities
The Archaeological Monitors will:
1. Maintain regular contact with the Contractor.
2. Conform to Contractors' procedures and schedules on worksites.
3. Seek to perform the required archaeological monitoring so as to limit, as far as possible, disruption to the overall construction schedule.
4. Provide adequate staff to complete appropriate recording for short-term cessation of work and for Documentary Monitoring procedures.
5. Consult with appropriate NJDOT and NJ SHPO staff relative to Section 106 consultation issues (as defined herein)

POINTS OF CONTACT

Archaeological Monitors:
Hunter Research, Inc., 120 West State Street
Trenton NJ 08608
609-695-0122

Ian Burrow, Principal; xtn 102; Mobile 609-462-2363. iburrow@hunterresearch.com
Alternate:
Joshua Butchko, Principal Investigator, xtn 116. Mobile 908-528-2846. jbutchko@hunterresearch.com

Contractor (Hereafter "Contractor":
Petillo Incorporated
J. Loescher, Project Manager; Mobile 973-886-4593; Office 973-347-3337

Agent for Client (Hereafter "Agent"):
CME Associates
David Coats; Mobile 908-461-7721; Office 732-727-8000
Alternate:
Paulo Benatti; Office 732-727-8000

NJDOT Bureau of Environmental Program Resources
Lauralee Rappleye, Environ. Specialist IV; Mobile 302-530-9672; Office 609-530-2990

NJ State Historic Preservation Office – contact one of the following in this order
Kate Marcopul; Office 609-984-5816
Alternates:
Vincent Maresca; Office 609-633-2395
Jesse West-Rosenthal; Office 609-984-6019

ACTIONS REQUIRING MONITORING
Construction activities that will require monitoring comprise:

-Excavation: trenching for utilities and drainage, and any other bulk removal of material by machinery or hand digging
-The removal of soils from existing grade

PROCEDURES:
1. Flow of Information
The Agent will facilitate a regular exchange of information on Contractor's work schedule and the requirements for archaeological monitoring. Arrangements will be made to ensure that Archaeological Monitors will be on site when excavation or soil removal is in progress (see above, Responsibilities).

2. General considerations
Safety:
Archaeological Monitors will report to the Contractor's representative responsible for site safety prior to monitoring operations.

Human Remains:
There is a minimal possibility that human remains, either as intact burials or disarticulated skeletal fragments from previously disturbed interments, will be located during Contractor's operations. If such remains are found the Contractor will immediately notify the Client and the Archaeological Monitor. The Archaeological Monitor will then proceed according to the attached protocols . In addition, the Archaeological Monitor shall immediately contact both the NJDOT-BEPR and NJSHPO points of contact, informing them of the find and any actions taken.
3. Observational Monitoring
Observational monitoring will entail one or more of the following:
A. Non-intrusive observations
Archaeological Monitors will observe Contractor's excavations, inspecting back dirt piles and exposed trench profiles, and taking notes and photographic records, and collecting artifact and soil samples.

B. Short-duration work stoppages

On the basis of observations, the Archaeological Monitor may request the Contractor for a short-term cessation of work at a particular location in order to record information in more detail, or to more thoroughly evaluate exposed material. **"Short-term cessation of work"** is defined as a **period of not more than two hours**. Stoppages in excess of two hours will fall under Documentary Monitoring, and require authorization as set out below.

4. Documentary Monitoring

A. Decision-making process

The decision on the necessity for Documentary Monitoring will be made by the Archaeological Monitor in consultation with NJDOT-BEPR and the NJ SHPO. If the Archaeological Monitor on site determines that there are significant archaeological resources at the work location, and that these cannot be adequately evaluated and recorded through Observational Monitoring (up to and including a two-hour cessation of work), he/she will inform the Contractor and the Agent immediately, and in any case within the two hour cessation period if implemented.

The Agent will convene, as soon as reasonably possible, a site meeting or conference phone call between the Contractor, the Archaeological Monitor, NJDOT-BEPR and the NJ SHPO and other parties as considered necessary by the Agent, to discuss the need for documentary monitoring, recommend appropriate documentation procedures and identify the anticipated extent and duration of the work needed. This work will not proceed without the consensus of the NJDOT-BEPR and NJ SHPO QUESTION: what if NJDOT and SHPO do not agree? Does the DOT, as agent for FHWA, have the final say? This language leaves a possibility for an impasse which could leave the contractor in a state of uncertainty. A summary record of each decision will be emailed (by whom?), to the Client and to Ms. Lauralee Rappleye at NJDOT, and Ms. Kate Marcopul and the NJ SHPO point of contact involved in the decision (if not Ms. Marcopul).

B. Procedures

For the duration of the Documentary Monitoring the defined portion of the site will be under the control of the Archaeological Monitors, who will be free to operate, within the terms of the agreement, at that location. The Archaeological Monitor will conform to the Health and Safety plan provisions that apply at the project site, and will consult with the Contractor's Site Safety and Health Officer before starting work.

The Archaeological Monitor will inform the Contractor and Agent as soon as Documentary Monitoring is complete.

5. Procedures for Unanticipated Discovery by the Contractor

When excavating operations encounter prehistoric or structural remains, or artifacts of historical or archaeological nature and the Archaeological Monitor is not present, operations will be temporarily discontinued at that location for a period of not more than

24 CAN THIS BE REDUCED hours The Client will be contacted immediately, and will subsequently contact the Archeological Monitor. In consultation with the NJDOT-BEPR and SHPO points of contact, the Archeological Monitor will determine if Observational or Documentary Monitoring will be required. If monitoring will be required, it will proceed as described above.

Guidelines for assessing whether "historically or archaeologically significant" items have been encountered:

The following items may be encountered and should be regarded as potentially significant:

-foundations or structures of brick, metal, stone or wood
-concentrations of artifacts (ceramics, glass, building material, bone). Particular attention should be paid to bone or teeth fragments or concentrations in case they represent human remains.
-concentrations of charcoal or building materials
-strikingly unusual colors or textures of soil (occupation sites or industrial activity).

Ian Burrow
Vice President
Hunter Research, Inc.
Revised 10/10/12, 10/11/12

Procedures for discovery of potential historic and prehistoric period human burials for projects requiring State and/or federal review by the Historic Preservation Office

If potential human burials or human skeletal remains are encountered, all ground disturbing activities in the vicinity shall cease immediately. The potential burials shall be left in place unless imminently threatened by human or natural displacement. Reversible actions such as careful obscuring and/or securing the burial(s) through backfilling of soils or other means shall be undertaken. The Historic Preservation Office shall be contacted immediately. Legal authorities (defined as?) and, as appropriate (when is this appropriate?), the County Medical Examiner should be contacted to determine jurisdiction and legal measures that may be required. For the protection of the potential burials, information regarding the discovery shall not be disclosed to others except for individuals who have a need to know (e.g., site managers). If informative types of identification as to affiliation, condition, etc. prior to securing the potential burial(s) can be achieved without further displacement or excavation, this should be accomplished.

Excavation and other activities in the vicinity may resume after approval is provided by relevant parties potentially including, but not limited to, the Historic Preservation Office, the State Medical Examiner's office, and site managers (this needs to be made more specific on a project-by-project basis. As written, it leaves the door open to multiple and potentially conflicting directives form different agencies) For most archaeological site types, if avoidance is not possible, archaeological data recovery can be accomplished prior to project implementation. However, for Native American and certain other human burials, exhumation may not be an acceptable alternative. The process of notification and consultation with lineal descendents; individuals and groups of similar cultural descendency; and interested public and professional communities may be involved in consultation to determine appropriate disposition of human burials (who is responsible for doing this?). Regardless of disposition of the remains, dignity and respect should accompany all treatment.

Investigation of historic or prehistoric period archaeological remains including skeletal remains and other burials shall be accomplished by a professional archaeologist meeting the National Park Services Professional Qualifications Standards for Archaeology.

Exhumation and analysis of historic or prehistoric period skeletal remains shall be accomplished by a professional skeletal analyst having: 1) a graduate degree in a field involving the study of the human skeleton such as skeletal biology, forensic osteology or other relevant aspects of physical anthropology or medicine; 2) a minimum of one year's experience in conducting laboratory reconstruction and analysis of skeletal remains, including the differentiation of the physical characteristics denoting cultural or biological affinity; and 3) demonstrated ability to design and execute a skeletal analysis including the written results and interpretations of such analysis. This is an excellent requirement. Perhaps SHPO could maintain a consultants' list and post it on the website?

In instances where human remains may be encountered during implementation of a development or other project and after any archaeological survey has been accomplished, depending on the project circumstances, an archaeologist should either be on site or be immediately available in the event a potential human burial be encountered. In either instance, project documents must make note of this potential and provide information including: 1) full contact information for the archaeologist; 2) specification of the number of days prior to project implementation that the archaeologist will be notified that the project is about to proceed; 3) a chain of command including identification of the individual(s) with the authority to require work cessations in areas where potential human burials are encountered; 4) the likely number and duration of work cessations; and 5) if known, the location(s) on the project site illustrated and identified on site plans where human burials may be encountered.

The project permittee or other agent ultimately responsible for the project and therefore for the unearthing of the human burials or human skeletal remains shall be responsible for all costs associated with their investigation, exhumation, analysis and reinterment or other disposition.

Appendix B

RESUMES

IAN C. BURROW
Vice President/Principal Archaeologist, Ph.D., RPA

EDUCATION

Ph.D., History and Archaeology, University of Birmingham, England, 1979
B.A., History and Archaeology, University of Exeter, England, 1971

EXPERIENCE

1988-present Principal Archaeologist
Hunter Research, Inc., Trenton, NJ

Vice President and stockholder of firm providing archaeological and historical research, survey, excavation, evaluation, report preparation and public outreach services in the Northeastern United States. Responsible for:

- Project management, budgeting and scheduling
- Technical and synthetic writing
- Proposal preparation, contract negotiation and management
- Hiring and supervision of personnel
- Supervision of research, fieldwork, analysis and report preparation
- Development of public outreach initiatives
- Design and Oversight of internship program
- Company safety policy as Company Safety Officer, including oversight of HAZWOPER certification

2012-Present Vice President for Government Affairs, American Cultural Resources Association

2010-2012 President, Register of Professional Archaeologists

2004-2005 President, American Cultural Resources Association

1995-present Consultant Archaeological Reviewer for Township of Evesham, New Jersey, Planning and Zoning boards

2010-present Adjunct Professor
Rutgers University
Teaching in Cultural Heritage and Preservation Studies (CHAPS)

2006-present Adjunct Professor
Drew University, New Jersey
Teaching in Historic Preservation Certificate Program, School of Continuing Education

2008-present Adjunct Professor
Rider University, New Jersey
Teaching World History and developing archaeology program, Department of History, Introduction to Historical Archaeology, Department of Continuing Education

1986-1988 Director
Oxford Archaeological Unit, Oxford, England
Principal in charge of non-profit organization undertaking archaeological projects.

1975-1986 County Archaeologist for counties of Somerset (1979-86) and Shropshire (1975-79), England

1974-1988 Adult Education Tutor
Universities of Birmingham and Bristol, England, and Department of External Studies, University of Oxford, England

SPECIAL SKILLS AND INTERESTS

- 18th -century military sites
- archaeology and standing buildings
- urban archaeology
- archaeological education and public outreach
- Cultural Resource and Heritage Management
- National Historic Preservation Policy
- Master planning for historic sites
- National Register of Historic Places Nominations

SELECTED PUBLICATIONS

"On the Brink (Dorp): The Archaeology and Landscape of the Fortified New-Netherland Village of Bergen, Jersey City, New Jersey." *Bulletin of the Archaeological Society of New Jersey* forthcoming 2014

"Historical Archaeology in Trenton: A Thirty-Year Retrospective (with Richard W. Hunter). In Historical Archaeology in the Delaware Valley 1600-1850, edited by Richard Veit and David Orr. University of Tennessee Press, 2014:323-374.

Peer reviewer for *Antiquity* Magazine (UK) 2008-

Review of Martin Carver; "Making Archaeology Happen: Design versus Dogma". *Historical Archaeology* 46(4) 2012: 185-187.

"Steel Away: the Trenton Steel Works and the Struggle for American Manufacturing Independence" (with Richard W. Hunter). In Footprints of Industry: Papers from the 300th Anniversary Conference at Coalbrookdale, 3-7 June 2009. British Archaeological Reports, British Series 523 [2010]: 69-88.

Review of Paul Everill: "The Invisible Diggers: a study of British Commercial Archeology". *Antiquity 84 (2010): 256-257.*

'"Wilkes and Liberty"-Anglo-American Colonial Politics at the Old Barracks, Trenton, New Jersey.' Bulletin of the Archaeological Society of New Jersey 63 2008: 76-80.

"The Historical Geography and Archaeology of the Revolutionary War in New Jersey." In *New Jersey in the American Revolution*, edited by Barbara J. Mitnick, pp.165-193. Rutgers University Press [2005] (with Richard W. Hunter).

Ancient Ways: Native Americans in South Trenton, 10,000 B.C. to A.D. 1700. New Jersey Department of Transportation and Federal Highway Administration [2005] (24-page booklet).

A Tale of Two Houses: The Lambert Douglas House and the Rosey Hill Mansion, 1700-1850. New Jersey Department of Transportation and Federal Highway Administration [2005] (24-page booklet).

"Archaeological Data Recovery Investigations at the Derewal Prehistoric Site, Hunterdon County, New Jersey." *Bulletin of the Archaeological Society of New Jersey,* No. 54, 12-42, 1999, co-authored with Donald Thieme, William Liebeknecht and Joseph Schuldenrein.

"The Savich Farm Site: An Archaeological Survey for Phase I of the Long-Term Management Plan." *Bulletin of the Archaeological Society of New Jersey,* No. 52, 35-50, 1997.

"We've Got Thousands of These Here Too! Significance Assessment and Farm Archaeology in New Jersey." Paper presented at the Middle Atlantic Archaeology Conference, Ocean City, Maryland, March 1996. Published in *Bulletin of the Archaeological Society of New Jersey,* No. 52, 35-50, 1997.

"Pretty Village to Urban Place: 18th Century Trenton and Its Archaeology." *New Jersey History,* Volume 14, Numbers 3-4, 32-52, Fall/Winter 1996, co-authored with Richard W. Hunter.

"Contracting Archaeology? Cultural Resource Management in New Jersey, U.S.A." *The Field Archaeologist* (Journal of the Institute of Field Archaeologists) 12, 194-200, March 1990, co-authored with Richard W. Hunter.

PRESENTATIONS

Frequent presenter at local, regional and national meetings and conferences. Numerous presentations to local societies and community groups.

PROFESSIONAL AFFILIATIONS

Friends of the New Jersey State Museum (Trustee 2002-2011)
Friends of the New Jersey State Museum (Vice President 2009-2011)
American Cultural Resources Association (Board member 2003-2008, 2012-2015)
New Jersey Council for the Humanities Speakers' Bureau Member since 1998
Registered Professional Archaeologist since 1999
Fellow of the Society of Antiquaries of London
Institute of Field Archaeologists (UK: Charter Member)
Society for Historical Archaeology
Society for American Archaeology
Archaeological Society of New Jersey: elected Fellow 2011

CERTIFICATIONS

Current 40-hour HAZWOPER and 8-hour HAZWOPER Supervisory certification
HAZWOPER Confined Space Entry Certification

ELECTED AND INVITED POSITIONS

Register of Professional Archaeologists (President, 2010-2012)
American Cultural Resources Association (President, 2004-2005)
American Cultural Resources Association (Vice President for Government Relations 2012-present)
Association of County Archaeological Officers, UK (Chair 1984-1986)
White House Preserve America Summit, New Orleans 2007, Panel Member
New Jersey Historical Commission Grants Review Panel Member 2002-2005

PATRICK HARSHBARGER
Principal Historian/Architectural Historian, M.A., M.P.A.

EDUCATION

M.A., History, Hagley Fellow, University of Delaware, Newark, Delaware, 1990

- Major Fields of Study: History of Technology (focus on built environment, structural engineering and architecture); American Colonial History
- Minor Fields of Study: American Labor History; European Industrialization

Museum Studies Certificate, University of Delaware, Newark, Delaware, 1990

M.P.A., Public Administration, Florida International University, Miami, Florida, 1988

B.A. *magna cum laude*, American History, Brown University, Providence, Rhode Island, 1984

EXPERIENCE

2010-present Principal Historian/Architectural Historian
Hunter Research, Inc., Trenton, New Jersey

Technical and day-to-day managerial responsibilities for historical and archival research in support or historic architecture and archaeology. Participation in:

- Section 106 and state preservation law compliance review
- historical architectural survey, evaluation and recording of buildings and structures
- historical research
- preservation planning
- public outreach
- historical exhibits and signage
- interpretive planning and development
- report preparation
- proposal preparation

1996-present National Editor, *Society for Industrial Archeology Newsletter*
(www.sia-web.org/siapubs/publications.html)

Full editorial responsibilities inclusive of identifying and providing assistance to contributing authors and photographers, copy editing and oversight of graphic design and production on a quarterly basis.

1991-2010 Senior Historian/Preservation Planner
TranSystems Corp. (formerly Lichtenstein Consulting Engineers)
Langhorne, Pennsylvania and Paramus, New Jersey

Served as one of two staff historians to a national engineering and transportation consulting firm specializing in historic bridges and roads, as well as general cultural resources management services (Sections 106 and 4f), to a client base consisting mainly of local, state and federal transportation agencies.

1990 Historian, National Park Service
Historic American Engineering Record, Boston, Massachusetts

1989 Architectural Historian Intern
Bucks County Conservancy, Doylestown, Pennsylvania

1984-1986 Deputy Director
Slater Mill Historic Site, Pawtucket, Rhode Island

CONTINUING EDUCATION AND CERTIFICATIONS

Secretary of the Interior's Professional Qualifications Standards for Historians (36 CFR Part 61)
Secretary of the Interior's Professional Qualifications Standards for Architectural Historians (36 CFR Part 61)
National Register Nomination Preparation, New Jersey Historic Preservation Office and National Register of Historic Places Joint Workshop, Trenton, New Jersey, 2011
Iron and Steel Preservation Workshop Certificate, Lansing Community College, Lansing, Michigan, 2010, 2012
Section 106 Training Certificate, Ohio Department of Transportation, Columbus, Ohio, 2010
HAZWOPER 24-hr. Training
Section 106 Training Workshop, Pennsylvania Department of Transportation, Allentown, Pennsylvania, 2009
Museum Studies Certificate, University of Delaware, Newark, Delaware, 1990
Hagley Fellow in the History of Industry and Technology/Museum Studies, Hagley Museum & Library, Wilmington, Delaware, 1988-1991

PROFESSIONAL AFFILIATIONS

Association for Industrial Archaeology (U.K.)
Association for Preservation Technology International
National Railway Historical Society
National Society for the Preservation of Covered Bridges
National Trust for Historic Preservation
Newlin Foundation, Board of Directors
Society for Commercial Archeology
Society for the History of Technology
Society for Industrial Archeology
Society for the Preservation of Old Mills
Vernacular Architecture Forum

SELECTED PUBLICATIONS

Co-author with Richard W. Hunter. *Sartori to Sacred Heart: Early Catholic Trenton.* Sacred Heart Parish, Trenton, New Jersey, 2014.

New Jersey Department of Transportation's Fernwood Service Station, Serving New Jersey's Highways Since 1922. New Jersey Department of Transportation, Trenton, New Jersey. 2014.

"Two Pioneering American Roadways." *Proceedings of the Institution of Civil Engineers – Engineering History and Heritage*. London, England, May 2010.

Editor. *Abstracts of American Truss Bridge Patents, 1817-1900*. Society for Industrial Archeology, Houghton, Michigan, 2009.

Robert John Prowse, New Hampshire State Bridge Engineer. New Hampshire State Historic Preservation Monograph Series. Concord, New Hampshire, 2009.

Co-author. *National Guidelines for Historic Bridge Rehabilitation and Replacement*. Washington, D.C.: American Association of State Highway and Transportation Officials, 2008.

Editor and Co-author. *Delaware's Historic Bridges: Survey and Evaluation of Historic Bridges with Historic Contexts for Highways and Railroads*. 2nd Edition Revised. Dover, Delaware: Delaware Department of Transportation, 2000.

"The Providence School Board Reform Movement, 1898-1924." *Rhode Island History*, Volume 44, Number 2 (May 1985).

Appendix C

Hunter Research, Inc.

The Catenary Structures at the Intermodal Ferry Transportation Center, South Amboy, Middlesex County, New Jersey

2002

HUNTER RESEARCH

THE CATENARY STRUCTURES AT THE INTERMODAL FERRY TRANSPORTATION CENTER SOUTH AMBOY, MIDDLESEX COUNTY NEW JERSEY

WITH A NOTE ON CAMDEN AND AMBOY RAILROAD STONE SLEEPERS

Historic Context, Description and Recommendations

Prepared for:

Potomac-Hudson Environmental, Inc.
110 S. Broadway Street
P.O. Box 7
South Amboy, NJ 08879

Prepared by:

Ian Burrow, Ph.D., RPA
Principal Investigator

DECEMBER 2002

Hunter Research, Inc. Historical Resource Consultants 120 West State Street, Trenton, NJ 08608-1185 609/695-0122 609/695-0147 Fax
e-mail address: hri@hunterresearch.com www.hunterresearch.com

THE CATENARY STRUCTURES AT THE INTERMODAL FERRY TRANSPORTATION CENTER, SOUTH AMBOY, MIDDLESEX COUNTY, NEW JERSEY

A. INTRODUCTION

This report has been undertaken to establish the historic context and significance of the surviving catenary[1] structures along the alignment of the former Camden and Amboy branch of the Pennsylvania Railroad at the Intermodal Ferry Transportation Center at South Amboy. This work forms part of the review of the project under Section 106 of the National Historic Preservation Act of 1966 (as amended). The report includes recommendations for treatment of the catenary structures as part of the Intermodal Ferry Transportation Center. Stone sleepers from the earliest phase of the Camden and Amboy Railroad in the 1830's are also briefly discussed.

B. HISTORIC CONTEXT OF OVERHEAD CATENARY ELECTRIFICATION ON THE PENNSYLVANIA RAILROAD

1. Historical Summary

The remaining elements of the catenary system at South Amboy are part of the last stage of the electrification program of the Pennsylvania Railroad (PRR) in 1938-39. The PRR was a leader in railroad electrification, eventually having over 2600 miles of track treated in this way. Electricity, however, never became a dominant power source for American railroads. In 1938 only 1.2% of the total U.S. track was electrified, and after World War II the diesel-electric locomotive came to dominate, eclipsing both steam and electric power (Bezilla 1980:1; Nesladek 1996).

Electrification of railroads in the U.S. began with the first successful installation in Richmond, Virginia in 1888. In the 1890's electrification of suburban lines and urban trolleys proceeded very rapidly, but the technology remained inadequate to provide power for the longer distances and heavier trains on the major railroads (Bezilla 1980:4).

The Pennsylvania Railroad's involvement with electrification began in 1895 with the installation of a direct current system on 7.2 miles of line from Burlington to Mount Holly. This system was not totally successful, but by the early 1900's it was becoming apparent that electric traction was becoming both feasible and necessary. The immediate stimulus for the PRR was the need to take trains under the Hudson River into the new station in Manhattan from New Jersey in order to compete with the New York Central Railroad, which had direct access into the City from the north. Steam trains could not operate in the tunnels, and the City of New York was in any case proposing to ban all steam locomotives from Manhattan because of their effect on air quality. The Baltimore and Ohio Railroad had earlier demonstrated that it was possible to carry D.C. electricity through tunnels on a third rail, and this system was therefore adopted for the Hudson tunnels (Nesladek 1996:16).

[1] Catenary "the curve assumed by a cord of uniform density and cross section that is perfectly flexible but not capable of being stretched and that hangs freely from two fixed points" (Webster's Ninth New Collegiate Dictionary).

The development of the overhead catenary system was a result of the adoption of alternating current (A.C.), which could transmit power over long distances without the numerous substations needed by D.C. systems. The PRR first adopted this new system on its suburban Philadelphia to Paoli line in 1914-15. It was so successful, both economically and in terms of public enthusiasm for the much cleaner trains, that electrification using catenaries had been extended to all the suburban passenger lines around Philadelphia by 1924.

In 1925 the PRR announced plans to electrify the Washington D.C. to New York mainline corridor, a massive and costly undertaking that required extensive infrastructure changes and also resulted in the replacement of the old semaphore signals with position light systems mounted on bridge structures between catenary poles. The work was completed in several stages, and it was not until 1935 that the first electric passenger train made the complete run between the two cities (Nesladek 1996:19-21).

The final major phase of electrification on the PRR involved conversion of the freight lines extending eastward to New Jersey and New York from the Enola Yards opposite Harrisburg in 1937-38. Plans to extend the catenary system to Pittsburgh, the subject of studies in 1936 and 1941, were never implemented because of the outbreak of World War II, the worsening economic condition of the PRR after 1945, and the greater flexibility and ease of introduction of diesel-electric traction (Nesladek 1996:21-22).

At South Amboy, electrification was introduced in two stages. The New York and Long Branch Railroad line (now the North Jersey Coast Line operated by New Jersey Transit) was electrified in 1935 as far south as South Amboy (John Burlage, West Jersey Chapter, National Railroad Historical Society, personal communication 11/5/02). This line does not connect to the former Camden and Amboy line, where catenaries were not erected until 1938 (Nesladek 1996:21). Numerous tracks on the Amboy branch are listed as electrified on a PRR New York region timetable dated October 28th 1956, but no map or diagram showing the tracks has been located (John Burlage, West Jersey Chapter, National Railroad Historical Society, personal communication 11/5/02). The timetable does however confirm that electric operation was continuing at the South Amboy yards into the late 1950's.

2. Catenary Structures

The purpose of the catenary (defined as an overhead system for distributing current, together with the whole assemblage of supporting poles, braces, overhead wires and related gear) is to enable electric locomotives to obtain continuous power from a wire suspended over the tracks, via a pantograph structure mounted on the locomotive. The power cable (termed the Trolley or Contact Wire) needs to run at a generally consistent height above the ground. In the later phases of the electrification the wire was maintained at about 22 feet above the rail. Changes in elevation down to about 15'8"could be accommodated, for example to bring the wire through tunnels lower than the main catenary, but these had to be gradual to ensure that the pantograph did not disengage.

The basic principle and method of construction of catenaries remained essentially the same throughout the main PRR construction period of 1914 to 1939 (Nesladek 1996 22-27). Vertical poles, initially of tubular steel, but in the1930's replaced by cheaper 14-inch square beams of H-section, were used as the primary support structures.

These H-section poles were between 70 and 110 feet high, set into concrete pedestals about four feet square and five feet high. These were normally finished with two coats of aluminum paint.

The poles were typically placed in pairs, one on each side of the tracks. The pairs were spaced at about 300 foot intervals on straight track alignments on the Philadelphia-Paoli alignment, reduced to 270 feet on the New York to Washington D.C. corridor. These poles carried both the transmission lines, which provided the main power and were typically placed on the tops of the poles, and the support structures for the Trolley/Contact wire. The transmission lines carried current at 44,000 volts, which was stepped down at transformer stations to 11,000 (later 12,000) volts for use on the actual catenary system.

The space over the tracks between each pair of poles was bridged by either a wire or steel beam structure termed a Cross Catenary or Body Span. From this bridging structure an arrangement of longitudinal and bracing wires carried the Trolley/Contact wire. The primary suspension wire, called the Messenger, was suspended in a true catenary arc from the bridging structure (thus giving the whole system its name). Below this was suspended a second wire, the Auxiliary Messenger, which provided extra flexibility to the structure and could carry additional current for the Trolley/Contact wire. The Trolley/Contact wire was suspended immediately below the Auxiliary and was attached to it by clips. Figure 1 shows the structure as installed on the New York to Philadelphia line in the early 1930's.

Deviations from this basic design were needed for special circumstances such as curves and switches, as well as for existing bridges and tunnels. Catenaries were also used to support other railroad infrastructure, particularly signal systems.

On freight lines, such as the Amboy Branch at South Amboy, the Auxiliary Messenger was often omitted because it was not needed for the lower speeds attained by freight trains. Freight tracks also more often used single poles, termed bracket arms, rather than pairs of poles. These had braced horizontal beams extending out over tracks on one or both sides of the pole.

C. THE SOUTH AMBOY CATENARY

The surviving catenary structures at the project site were inspected on December 10th 2002. Field survey was confined to the Camden and Amboy line and did not examine the New York and Long Branch Railroad of New Jersey alignment (the current New Jersey Transit coast line).

A total of 30 support structures are present within the Area of Potential Effect along the CARR alignment. These are identified on the map (Figure 2) as C1 through 26. All but one of them is of steel, the remaining one being of wood. The total includes a large lighting tower (C17: Plate 1) that is not truly a part of the catenary system, and four pairs of poles (C8a and b, C10a and b, C12a and b and C15a and b).

Inspection of the poles and remaining wiring confirm that the structures that remain today are those of the PRR installation of 1937-8. Changes and modifications have been made to some of the poles, particularly poles C1 through C6 at the western end of the APE, which have each been heightened with steel sections to carry wiring towards the single track that connects the CARR with the NJT tracks just east of the bridge (Plate 2).

While much of the catenary wiring has been removed, a section between poles C10a/b and C15a/b is largely intact and shows the complexity of these systems on multiple tracks and on curves. Much of the wiring seems to have ended at C15a/b, with a single line continuing to C20. A separate line must have once run as far as C26, but no wiring remains on poles C21-C26 which served this siding. It appears that electrification was never carried further east towards the thawing sheds and coal docks, nor into the area where the proposed ferry terminal is to be constructed. Both compound (three wire) and simple (two wire) catenary wiring was apparently used

The catenary poles that form the main structural element of the system are chiefly 14" square H-section steel beams placed on a concrete slab mat and encased in a concrete pedestal in typical PRR construction (Plate 3; Nesladek 1996:24). A few of the lower poles are of smaller dimension H-section steel.

The catenary structures are of four types:

Portal Bridges (C10a/b; C15a/b). In these cases the two poles are connected by a braced horizontal beam (Plate 4). This type of structure was often used to support signaling systems but there is no evidence for this at South Amboy.

Cross Catenaries or Body Span Structures (C8a/b; C12a/b). These are typical of mainline catenaries. The two poles are connected by wires, from which the longitudinal messenger, auxiliary messenger and contact/trolley wires are suspended. These and the Portal Bridge structures are concentrated on and each side of the bridge where the electrified tracks had to converge.

Bracket Arm Bridge Structures (C1-C5; C7; C13; C20; C21; C23). Typical of freight installations, these consist of a single pole supporting a T-shaped bracket arm spanning one track (Plate 5).

Single poles (C6; C9; C11; C13; C18; C19; C22; C24-C26). These served as braces for larger poles, or as tension supports for wires on curving section of track. The precise function of the westernmost row of single poles (C24-26) is not clear.

D. EVALUATION AND RECOMMENDATION

The catenary at the intermodal ferry site appears to be typical of the PRR freight line electrical installation of 1937-8 as described by Nesladek (1996), with some later modifications. The system has been abandoned for many years and most of the wires have been removed. There has been loss of integrity but the system is still comprehensible if the basic principles are understood.

The demolition of the bridge will remove one of the portal structures (C10a/b) and one single pole (C11), but the other poles are unaffected by the project and will remain.

This consultant was asked to make recommendations about the desirability of preserving all or part of this catenary system and which elements might merit preservation and interpretive treatment.

It is recommended that the Portal Bridge C15a/b be retained in place. It is in the best location to function as an entrance feature to the ferry terminal and should not require moving. One or two of the Bracket Arm poles (perhaps C20 and C21) could also be used in association with the portal since these are representative of freight electrifi-

cation systems on the PRR. These could perhaps be moved and placed forward (i.e. east) of the Portal bridge, one on each side and with the bracket arms either extending out into the roadway or to each side. Other arrangements could certainly be devised, but this is relatively simple and uses the catenaries in a way that marks the entrance to the terminal and memorializes the electrification history of the site.

The structures should be inspected to ensure that they are structurally sound. Those that are moved should be reset on a concrete slab mat and encased in a concrete pedestal to match the existing PRR construction. Original surface finish of aluminum paint could be restored. Interpretive information should be provided on one of the structures.

E. CAMDEN AND AMBOY RAILROAD STONE SLEEPERS

Re-examination of the shoreline area adjacent to the site of the Explosives Pier on December 10th 2002 identified at least 19 of the large sub-rectangular stone blocks used as sleepers for the earliest phase of the Camden and Amboy Railroad track in the 1830's. These blocks each have flat settings and drilled holes for mounting the iron plates to which the rails themselves were attached. These sleepers are not in situ and should be used as interpretive and landscape features for the new terminal.

REFERENCES

Bezilla, Michael
1980 *Electric Traction on the Pennsylvania Railroad 1895-1968.* Pennsylvania University Press.

Nezladek, Mike
1996 Overhead Catenary of the PRR. The Keystone, 29(4), Winter 1996:15-49,

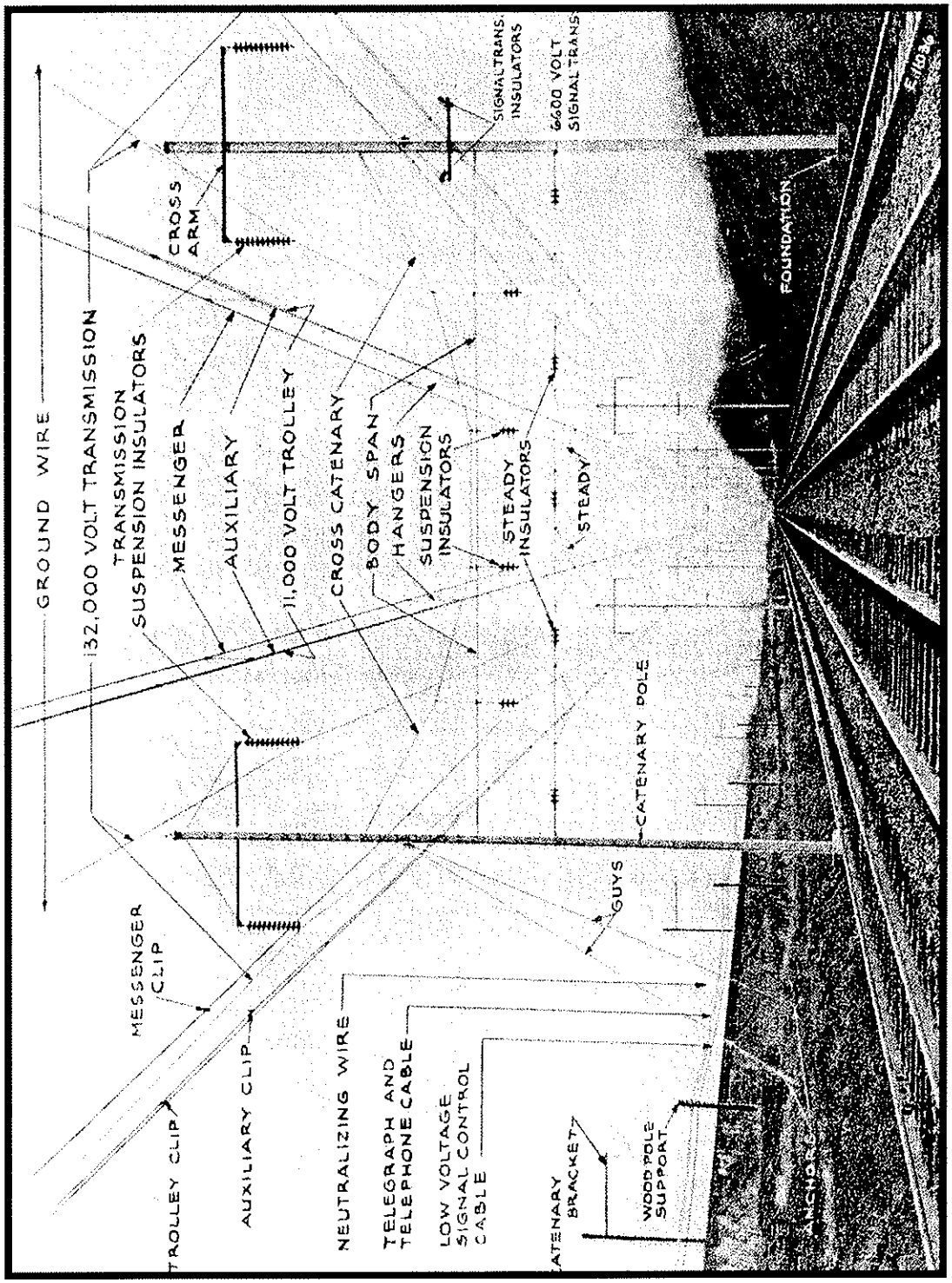


Figure 1. Typical catenary structure used on the New York to Philadelphia line in the 1930's. Source: Nesladek 1996:26.

Plate 1. Lighting tower (C17). View facing southeast (Photographer: Ian Burrow, December 2002). [Hunter Research Inc. Negative 02081/1:08].

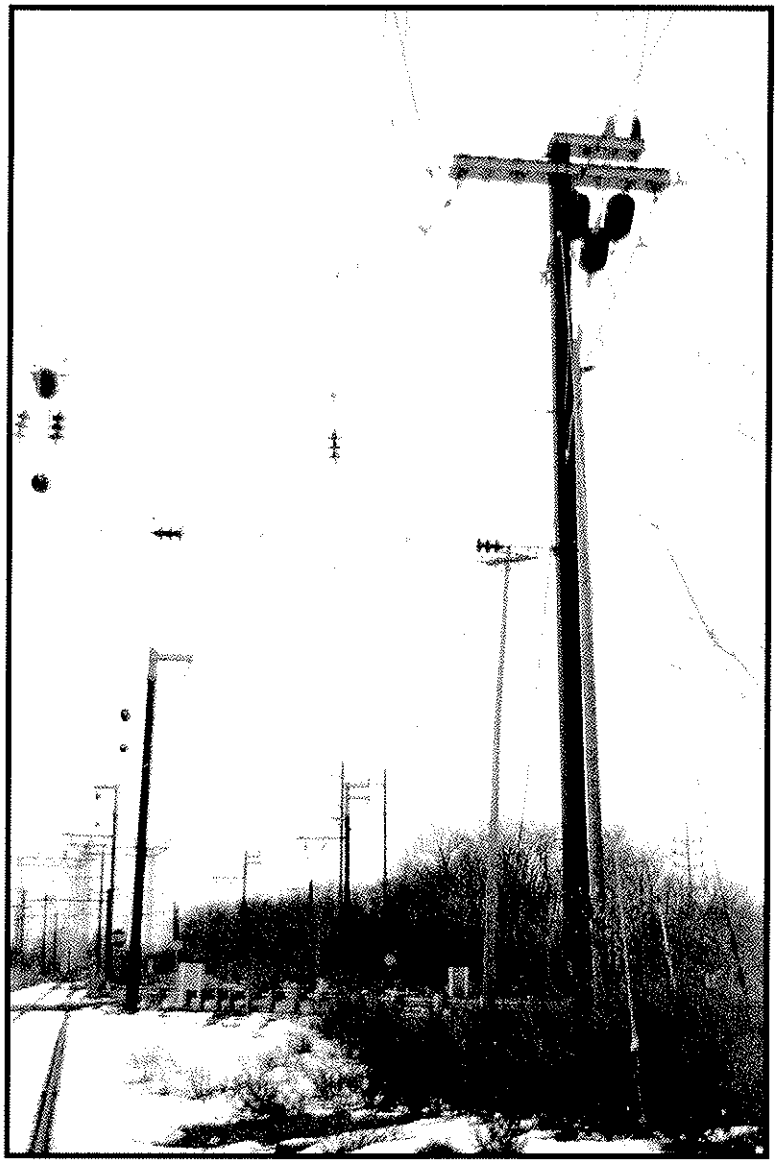


Plate 2. Catenary pole C8a. View facing northwest with poles C5 and C6 in the background. These originally single poles have had transmission structures added at the top. (Photographer: Ian Burrow, December 2002). [Hunter Research Inc. Negative 02081/1:22].

Plate 3. The base of Portal Bridge Catenary C10a from the southeast, showing concrete slab mat and concrete pedestal typical of Pennsylvania Railroad construction (Photographer: Ian Burrow, December 2002). [Hunter Research Inc. Negative 02081/D1:03].

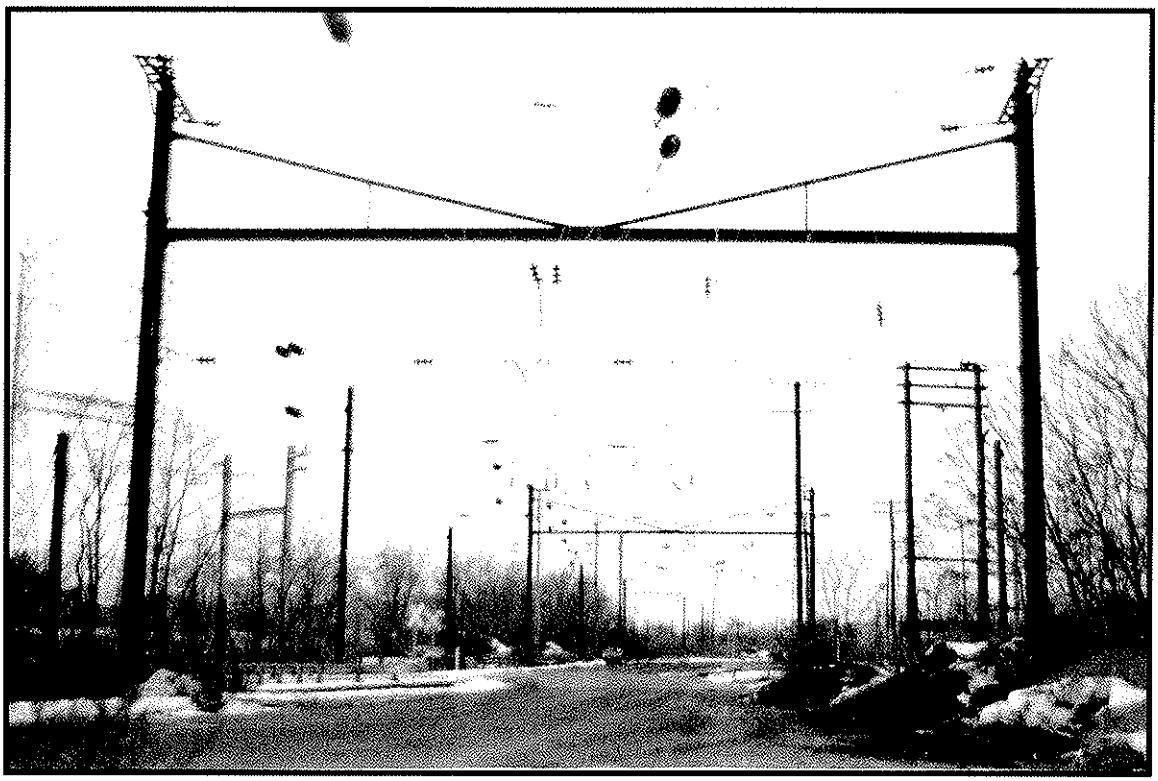
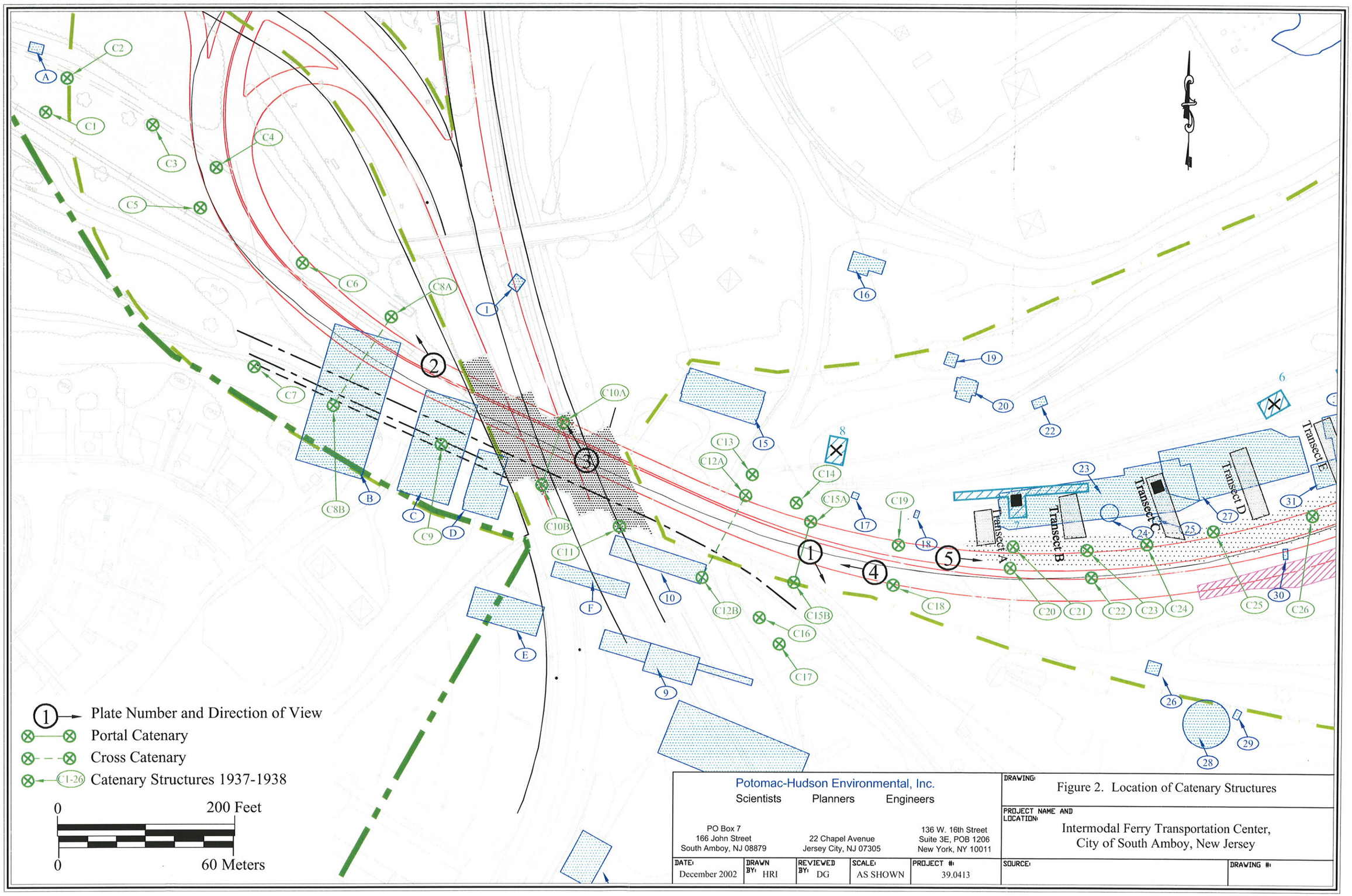


Plate 4. Portal Bridge Catenary C15a-b in foreground with C10a-b in background. View facing northwest (Photographer: Ian Burrow, December 2002). [Hunter Research Inc. Negative 02081/1:13].

Plate 5. Bracket Arm Catenary Structures C20 and C21. View facing northeast (Photographer: Ian Burrow, December 2002). [Hunter Research Inc. Negative 02081/1:10].



Potomac-Hudson Environmental, Inc.
Scientists Planners Engineers

PO Box 7
166 John Street
South Amboy, NJ 08879

22 Chapel Avenue
Jersey City, NJ 07305

136 W. 16th Street
Suite 3E, POB 1206
New York, NY 10011

DATE:	DRAWN BY:	REVIEWED BY:	SCALE:	PROJECT #:
December 2002	HRI	DG	AS SHOWN	39.0413

DRAWING:
Figure 2. Location of Catenary Structures

PROJECT NAME AND LOCATION:
Intermodal Ferry Transportation Center,
City of South Amboy, New Jersey

SOURCE:

DRAWING #:

Appendix D

Geo-Graf, Inc.

Geophysical Investigation Report, South Amboy Regional Intermodal Transportation Center, South Amboy, New Jersey

2001

GEO-GRAF

GEOTECHNICAL ENGINEERING

GEOPHYSICAL INVESTIGATION REPORT
SOUTH AMBOY REGIONAL INTERMODAL TRANSPORTATION CENTER
SOUTH AMBOY, NEW JERSEY
23 JULY 2001

Prepared for:

Hunter Research, Inc.
120 West State Street
Trenton, NJ 08608-1185

Project Manager:
Mr. Ian Burrows

Prepared by:

Geo-Graf, Inc.
511 Beechwood Drive
Kennett Square, PA 19348

Project Manager:
Mr. Jamieson Graf
Project Number: 062701

Geo-Graf, Inc. Disclaimer

Services and resulting interpretations provided by Geo-Graf, Inc., shall be performed with our best professional efforts. Depth of GPR, EM, RF and magnetic signal penetration is dependent upon the electrical properties of the material(s) probed and interpretations are opinions based on inference from acquired GPR, EM, RF, magnetic and/or other data. Thus, Geo-Graf, Inc., does not guarantee the desired penetration depth, accuracy or correctness of interpretations. Geo-Graf, Inc., will not accept liability or responsibility for any losses, damages or expenses which may be incurred or sustained by any services or interpretations performed by Geo-Graf, Inc., or others.

Summary:

This report contains the findings of a nonintrusive geophysical investigation performed by Geo-Graf, Inc. (GGI) on June 27, 29, and July 12, 2001, at the South Amboy Regional Intermodal Transportation Center, South Amboy, NJ, in accordance with the GGI Geotechnical Engineering Proposal No. 1281.

Thirteen sampling areas, totaling approximately 1 acre, were created by Hunter within the 25 acre site. These transects, denoted *A* through *M*, were investigated by GGI utilizing GPR, EM, and magnetic nonintrusive geophysical delineation techniques in an attempt to delineate buried concrete building foundations and other subsurface anomalies of a historical nature.

A total of fifty-seven magnetic targets representing buried iron containing objects and twenty-four EM targets associated with subsurface metallic targets or conductive subsoils were delineated within the accessible search areas.

Fifteen subsurface anomalies were delineated by GPR within the investigated transects. Two of the anomalous areas contained strong, definable foundation-like GPR data signatures which have a high probability of being associated with intact buried foundations. Eleven anomalous areas were indicative of disturbed subsoils which could contain fractured concrete or building foundation remnants. Two areas were delineated by GPR which could contain deeper, isolated objects that could be of historical significance.

Detected anomalies are presented on the accompanying color GGI Subsurface Anomaly Maps (***SAMs***).

Utilities were also detected through the course of the GPR data analysis. Several of the more significant utilities were included on the ***SAMs*** for reference. Note, additional utilities exist within the investigated areas and are not shown on the ***SAMs***.

Scope of Work:

Perform a nonintrusive geophysical subsurface investigation within the accessible specified search areas in an attempt to delineate subsurface building foundations, or remnants, and other underground anomalies of a historic nature. The nonintrusive delineation techniques to be utilized will include collection and interpretation of data from ground penetrating radar (GPR), electromagnetics (EM), and magnetic geophysical instruments. Collected site data will be reviewed and correlated with findings presented on a color GGI Subsurface Anomaly Map (***SAM***).

Specified Search Area:

Thirteen sampling areas, denoted *Transect A* through *Transect M*, within the 25 acre site were specified for investigation. The approximate size of the investigated sections of each transect are represented below.

Table 1: Transect Areas

Transect	Approx. Size (ft^2)
A	1,550
B	1,300
C	2,400
D	2,250
E	2,500
F	2,400
G	3,000
H	4,500
I	4,300
J	11,500
K	5,300
L	4,000
M	3,500
TOTAL:	**48,500**

Site Background:

The abandoned 25 acre project site known as the South Amboy Regional Intermodal Transportation Center contained active rail and shipping depots reportedly dating to the mid 1800's. Site redevelopment proposals include a possible recreational harbor and marina. As part of a continuing archaeological and historical site assessment conducted by Hunter Research, Inc (HRI), GGI was retained to perform a nonintrusive geophysical investigation within thirteen sampling areas, totaling approximately 1 acre.

Field Investigation:

On June 27 (two-crews), 29, and July 12, 2001 (single crews), GGI performed a nonintrusive geophysical investigation as directed by Mr. George Cress, Project Manager- HRI.

Each transect sampling area was brush-cut and surveyed by HRI. To facilitate documentation of site findings and GPR data collection, GGI created a reference grid with 10' spacings within each transect.

Investigative Procedure:

GGI initially investigated the accessible sections of each transect utilizing EM and magnetics in an attempt to locate subsurface metallic anomalies. Detected anomalies were field-marked in green paint and documented by GGI. GPR profiles were subsequently completed at 5' intervals in both the north-south and east-west grid directions in an attempt to delineate and identify subsurface metallic and nonmetallic targets and anomalies. GPR data was collected utilizing two different frequency antenna systems: a 550 *MHz* and a 120 *MHz* system.

Geophysical Instrumentation:

The following is a list and brief description of the geophysical equipment utilized for this investigation.

- GPR - Ground Penetrating Radar - A Geophysical Survey Systems, Inc. Subsurface Interface Radar (SIR) System 2000 ground penetrating radar unit. Profiles collected on site are digitally recorded for subsequent data analyzation and post-processing at the GGI office. GPR is capable of delineating metallic and nonmetallic: USTs, drums, utilities, pipeline leaks, voids, bed rock layers, product plumes, rebar and rebar spacings, concrete floor thicknesses, grave sites and other subsurface anomalies.

  In addition, various computer processing techniques are used at the GGI office in order to improve the image resolution for GPR interpretation and for the generation of a representative color GPR data printout.

Different GPR antenna systems were utilized for the investigation: a 550 *MHz* and a 120 *MHz* antenna system. The use of the different antennae is based on the following. The higher the antenna frequency, the greater the GPR image resolution (ability to detect smaller targets) but at the "cost" of signal penetration depth. The lower the antenna frequency, the deeper the signal penetration but at the "cost" of GPR image resolution. A total of 357 GPR profiles were recorded at the site.

- EM - Electromagnetics - An Aqua-Tronics Tracer, model A-6. Capable of locating and delineating metallic masses. Operates by inducing and measuring the returning electric field on subsurface metallic targets. Utilized to delineate USTs, drum piles, subsurface concrete pads, utilities and metallic debris.

- Magnetics - A Dunham and Morrow, model DML 2000 Magnetic Locator (Vertical Field Gradiometer). Capable of detecting small and large ferrous (iron) containing targets. Operates by measuring the remnant vertical magnetic fields from ferrous-containing compounds. Utilized to detect buried drums, fill lids, manhole lids, valves, utilities, rebar and iron-containing debris.

Findings:

A total of 13 transects (*A* through *M*) were brush-cut and surveyed by HRI. Each transect was investigated by GGI utilizing EM, magnetic, and GPR nonintrusive geophysical delineation techniques. Findings are shown on the accompanying GGI ***SAM***s and tabulated below.

EM Detected Anomaly:

Subsurface anomalies detected by EM represent larger buried metallic objects or conductive subsoils (fly ash, coke, etc.). The target boundaries as shown on the ***SAMs*** approximate the size and shape of the buried anomaly. Some of the detected anomalies extend beyond the target area represented on the ***SAMs***.

Magnetic Detected Anomaly:

Magnetic anomalies represent the strongest peaks within the vertical magnetic field emanating from a buried iron containing target. Thus, the actual size and shape of the target may extend beyond the target boundary shown on the ***SAMs***.

GPR Detected Anomaly:
Three categories of subsurface anomalies were delineated within the search areas.

- T-1

Strong, definable foundation-like GPR data signatures were detected. GGI anticipates that these anomalies have the highest probability of containing intact buried building foundations. Estimated target depth based on GPR data estimates is 1' to 3' below grade. Complete delineation of the size and shape of the probable foundation was limited due to the accessibility of the search area. The possibility exists that the detected anomaly extends beyond the target area boundary shown on the ***SAMs***.

- T-2

Disturbed subsoil GPR data signatures were detected. These target areas could contain broken-up or fractured building foundation remnants. Estimated target depth based on GPR data estimates is 1' to 3' below grade. Complete delineation of the size and shape of the anomalous area was limited due to the accessibility of the search area. The possibility exists that the detected anomaly extends beyond the target area boundary shown on the ***SAMs***.

- T-3

These anomalies are deeper, isolated buried targets. Although they do not represent foundation-like GPR data signatures, these targets could represent objects of a historical nature. Depth to the top of the targets based on GPR data estimates is 3' to 5' below grade.

- Subsurface Utilities

Several larger subsurface utilities were delineated within the course of the GPR data analysis. These utilities are shown on the ***SAM***. Note, additional smaller utilities were also detected within the investigated areas but were not shown on the drawings.

Figures 1 and 2 are representative GPR data profiles from Transects *C* and *D,* respectively.

Table 2: Findings Summary

Transect	Magnetic Targets	EM Targets	GPR T-1	GPR T-2	GPR T-3	GPR Utilities
A	6	0	0	1, 10'x20'	0	2
B	7	2	0	1, 20'x50'	1, 5'x10'	0
C	10	1	1, 20'x35'	0	1, 10'x10'	0
D	3	2	0	2, 20'x35'	0	0
E	4	1	0	2, 20'x50' & 20'x30'	0	0
F	1	2	1, 20'x'20'	0	0	0
G	3	3	0	1, 20'x110'	0	0
H	3	1	0	1, 40'x110'	0	0
I	6	3	0	1, 30'x80'	0	0
J	8	2	0	2, 110'x50' & 50'x50'	0	2
K	3	3	0	0	0	0
L	2	2	0	0	0	0
M	1	2	0	0	0	0
Totals:	**57**	**24**	**2**	**11**	**2**	**4**

Note: GPR target sizes are approximate.

With any geophysical investigation, it must be stressed that careful ground-truthing precede any excavation or intrusive testing in proximity to any anomalies/targets indicated in this report. GGI always recommends careful ground-truthing to verify all investigative findings. Also note, the absence of detected geophysical data signals does not preclude the possibility that targets exist.

Respectfully submitted,

Fred L Graf

Fred L. Graf, P.E., President

Jamieson Graf, Project Manager

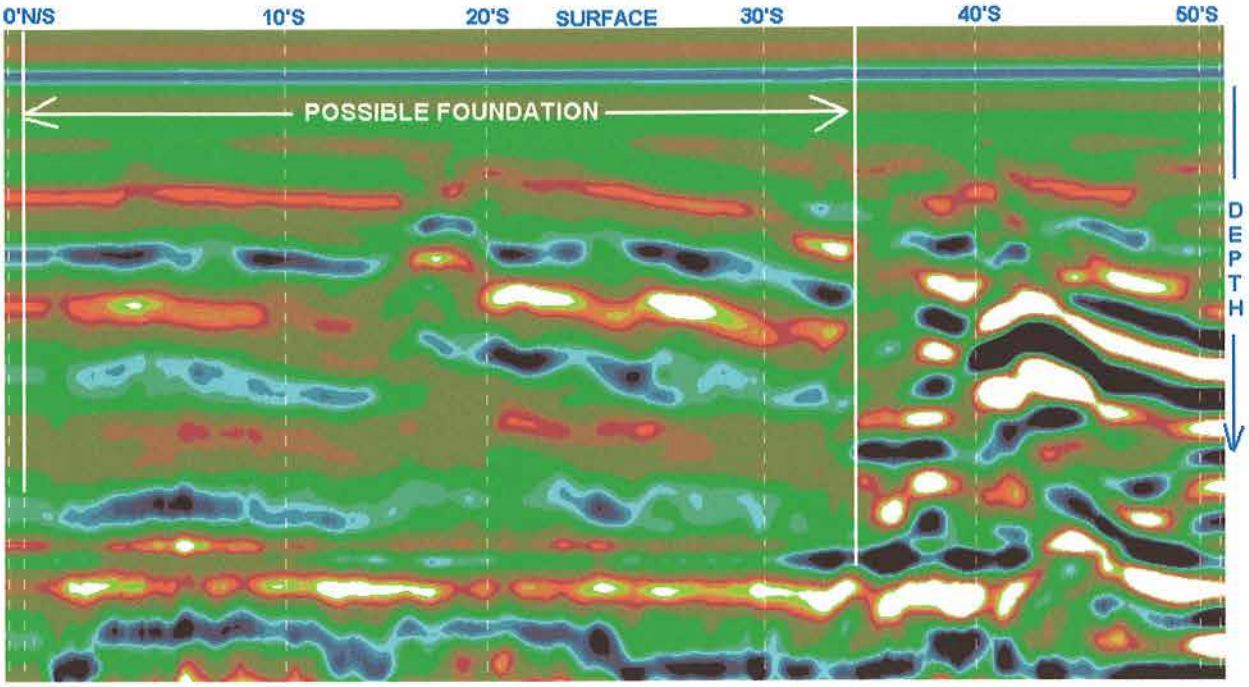


Figure 1 - GPR Data Profile - *T-1*
GPR data profile within Transect *C*. The profile is at 5' W extending from 0' to 50' S. Shown is the GPR foundation-like data signatures extending from 0' to approximately 35' S. 120 MHz GPR antenna system

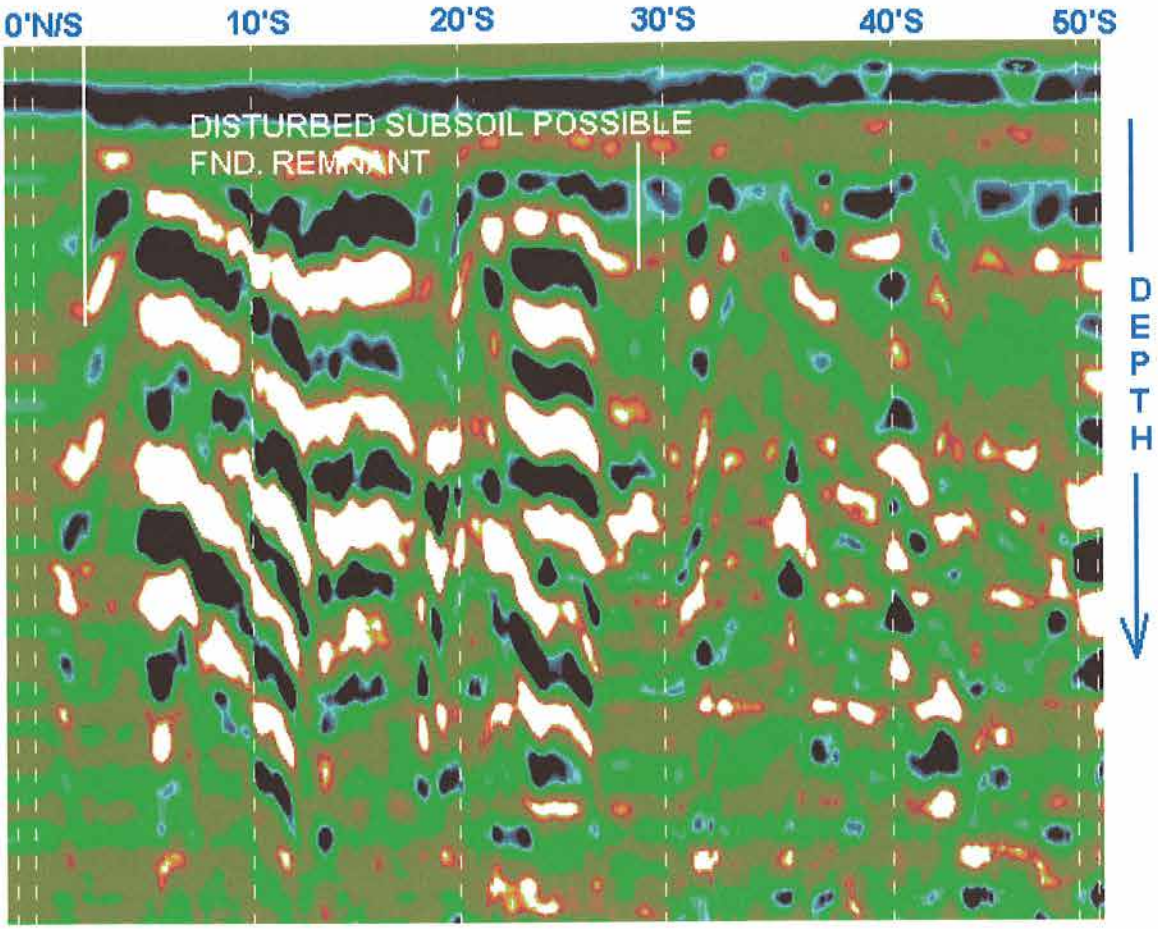


Figure 2- GPR Data Profile - *T-2*
GPR data profile within Transect *D*. The profile is at 10' W extending from 0' to 50' S. Shown in this profile is GPR disturbed subsoil data signatures which could be associated with a fractured building foundation or building remnants. 550 MHz GPR antenna systems.

Figure 3 - Site Photo

Figure 4 - Site Photo

Appendix E

MEMORANDUM OF AGREEMENT

Final

AMENDED
MEMORANDUM OF AGREEMENT
BETWEEN THE FEDERAL HIGHWAY ADMINISTRATION AND THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER REGARDING THE INTERMODAL FERRY TRANSPORTATION CENTER CITY OF SOUTH AMBOY, MIDDLESEX COUNTY, NEW JERSEY

WHEREAS, the City of South Amboy proposes to construct a ferry facility [including access roadway, parking, terminal and in-water improvements] to accommodate up to three ferry vessels in South Amboy, Middlesex County using funds provided by the Federal Highway Administration (FHWA) via the New Jersey Department of Transportation (NJDOT); and

WHEREAS, the FHWA, the New Jersey State Historic Preservation Office (SHPO), the Advisory Council on Historic Preservation (Council), and the NJDOT executed a Programmatic Agreement in November of 1996 which stipulates how FHWA's Section 106 responsibilities for NJDOT-administered federal aid projects will be satisfied; and

WHEREAS, in accordance with that agreement, the NJDOT has consulted with the SHPO in order to determine the area of potential effect (APE), to identify significant National Register eligible and listed properties, and to assess the effects of the project on both eligible and listed properties within the APE pursuant to the requirements of 36 CFR Part 800, the regulations implementing Section 106 of the National Historic Preservation Act of 1966 as amended (16 U.S.C.470f); and

WHEREAS, background and field research have indicated that physical remains of the Camden and Amboy [ca. 1831 - 1871] and Pennsylvania [ca. 1871- 1965] Railroads persist within and beyond the APE, but the integrity of the physical remains in the APE is low; and

WHEREAS, the historic significance of the property within the APE relates primarily to it being the location of nationally significant events, the feeling or sense of place conveyed by the few physical remains, and the setting of the former rail yard and piers; and

WHEREAS, previous consultation on other projects resulted in an initial June 26, 1975 opinion (and several reiterations of that opinion in the context of federally funded

roadway and other projects) that the Camden and Amboy Railroad (Main Line) Historic District is eligible for listing in the National Register of Historic Places; and

WHEREAS, previous consultation has also indicated that the period of significance for the Camden & Amboy Railroad (Main Line) Historic District spans the tenures of both railroad companies, and that understanding the relationships between the various archeological remains and evaluating their significance is a complex process requiring extensive background research; and

WHEREAS, consultation for other projects affecting the Camden & Amboy Railroad (Main Line) Historic District has focused on identifying and protecting contributing resources and features of the historic district; introducing historically compatible new bridges, stations, and structures; and adequately mitigating the adverse effects resulting from new construction or removal of original features; and

WHEREAS, Hunter Research has compiled an inventory of visible railroad remains within the APE [*The Catenary Structures at the Intermodal Ferry Transportation Center, South Amboy, Middlesex County, New Jersey with a note on Camden and Amboy Railroad Stone Sleepers, Historic Context, Description and Recommendations;* Ian Burrow, December 2002] documenting the overall integrity of the Camden and Amboy Railroad yards at this location is low, as only catenary structures and displaced stone sleepers, and two coal thawing sheds and associated infrastructure remain intact within the APE of the project; and

WHEREAS, the FHWA has determined in consultation with the SHPO and others that the construction of this project as proposed will have an adverse effect on the Camden & Amboy Railroad (Main Line) Historic District due to the alteration and/or removal of the catenary structures and stone sleepers; and

WHEREAS, the NJDOT and FHWA have considered alternatives to avoid or minimize the adverse effects and have found that they are not feasible; and

WHEREAS, a Camden and Amboy corridor management study entitled *Camden and Amboy Railroad Historic Districts Study, Volume 1 and Volume 2* identified appropriate mitigation strategies and additional opportunities which were considered by the project sponsors in developing a mitigation program to offset the adverse effects of the proposed construction; and

WHEREAS, consultation for the Southern New Jersey Light Rail Transit System (SNJLRTS) has involved extensively researched consideration of appropriate standard design features for new construction within the Camden and Amboy Railroad (Main Line) Historic District; and

WHEREAS; it is desirable to utilize a single design vocabulary for all projects within the historic district; and

WHEREAS, two public meetings were held on February 8, 2001 and June 27, 2001 in the City of South Amboy to describe the project and the environmental studies which had been conducted to the public, and to allow the public to ask questions and provide comments on the work conducted to date; and

WHEREAS, questions and comments at that meeting related primarily to traffic engineering issues; and

WHEREAS, the FHWA, SHPO, NJDOT and City of South Amboy, have consulted to develop a plan to mitigate the adverse effects; and

WHEREAS, NJDOT on behalf of the FHWA invited the City of South Amboy to concur in the MOA and they have agreed; and

WHEREAS, the NJDOT has participated in the consultation, has been invited to concur in the MOA, and has agreed; and

WHEREAS, the Advisory Council was notified of the adverse effect and invited to participate in the consultation process via letter dated March 21, 2002 and has declined to participate in the consultation process; and

WHEREAS, for the purposes of construction the project was broken into four project phases: the Main Street Bridge, Radford Ferry Road Phase I, Radford Ferry Road Phase II and the Intermodal Facility; and

WHEREAS, the Main Street Bridge project was completed in Spring of 2007, and the construction of the Radford Ferry Road Phase I project [initiated in April of 2007] was completed in May 2009; and

WHEREAS, the design for the remaining phases of the project was subsequently revised as the result of the NJDEP Waterfront Development Permitting process –the location of the waterfront walkway was moved landward of the wetland transition area and the ferry dock and access locations were changed, thus both the dredging of material and the containment area for the dredged materials were eliminated from the project; and

WHEREAS, the effect of the revised design continues to be adverse; and

WHEREAS, this agreement supersedes the previous Memorandum of Agreement [executed on 7/25/03];

NOW, THEREFORE, the FHWA and the SHPO agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

The FHWA will ensure that the following measures are carried out:

The City of South Amboy, using the services of a consultant and prior to the initiation of construction, shall implement the following stipulations.

I. Archeological Monitoring

A. Preconstruction Notice – The City of South Amboy shall ensure that all construction inspectors and contractors are informed about the need for identification, evaluation and protection of historic properties pursuant to Section 106 of the National Historic Preservation Act; and that they are informed of all stipulations in this MOA which may restrict or constrain construction activities. The City shall develop an archeological monitoring/data recovery procedure, which provides for notification and coordination with NJDOT, SHPO and FHWA should historic resources and/or features be uncovered during construction. The procedure shall provide for immediate cessation of construction activities in any areas where undocumented remains are uncovered, notification of qualified archeologists to collect initial information about the resources identified and convene a consultation meeting; and implementation of any data collection/mitigation procedures which might, through consultation, be determined appropriate. FHWA, NJDOT and SHPO staff shall be available for on-site consultation in no more than two days of notification of the need for consultation. The procedure shall be submitted to the SHPO, NJDOT and FHWA for review and comment prior to advertising the construction contract; the revised procedure shall be included in the construction bid package and shall be an item of discussion during the preconstruction conference. SHPO staff will be invited to participate in the preconstruction conference.

B. Monitoring – A professionally qualified archeological monitor shall be present on-site and shall inspect all excavations/earthmoving operations that may result in subsurface disturbance. Two types of monitoring may be anticipated, and

provisions for both types shall be included in the procedures developed as Task A above.

1. Observational monitoring - which entails visual examination of work in progress and the rapid documentation of features or artifacts through photography, survey, and written notes.
2. Documentary monitoring – requires discontinuation of construction related work for a longer period of time to investigate and document [sufficiently to meet any requirements for archeological mitigation] archeological features which are significant or potentially significant.

II. Photographic Documentation

Documentary photos of the overall rail site and specific perspectives that illustrate the surviving catenary system, remaining pier/wharf pilings, and former locomotive shop area in relation to the surviving coal thawing sheds will be taken for inclusion in the final report. Any railroad artifacts that will not be used in the gateway or as landscape features will be photographically documented in their original setting prior to removal.

III. Field Verification of Pier/Wharf Locations

The City of South Amboy will ensure that field verification of the locations of the various piers and wharves in the area of direct impact, as documented in historic maps, will be undertaken. The locations of key pilings will be recorded using global positioning system (GPS) technology, and ancillary pilings will be mapped using relational techniques. Archival photographs of the pilings will be taken to supplement the mapping effort. Visible hardware will be photographed only if it has the ability to assist in the dating or other interpretation of the pier/wharf features. No artifacts will be retained. The goal of this effort is to verify the locations and construction sequences of the various pier/wharf features that appear on historic maps. Such information will contribute to an understanding of how the rail facility developed and functioned.

IV. Design Considerations - Site Design

A Landscape Architect with a demonstrated interest in historic preservation will be added to the project design team to assist with the development of the site. The goal of this individual's involvement will be to ensure that, to the degree possible, all pertinent features, of the facility will be compatible with the historic architecture and engineering characteristics, features, and setting of the Camden and Amboy Railroad (Main Line) Historic District. The design shall be responsive to the standards, guidelines, and recommended approaches for new construction affecting historic properties as set forth in the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. Historic compatibility considerations shall include design, location, size, scale, materials, color, workmanship, and visual impacts. Design

features such as fencing, lighting, handrails, signage, etc. selected for the SNJLRTS shall be considered for use in the current project. Specific tasks to be accomplished with the involvement of the Landscape Architect include

A. Developing a site plan and on-site interpretive materials or displays that utilize and interpret in situ historic railroad artifacts and landscape features. The plan should minimize the visual impacts of the new construction on the remaining landscape features of the historic rail facility and propose interpretive elements that are consistent with similar materials being developed by NJ Transit and NJDOT for use within the Camden & Amboy Railroad (Main Line) Historic District When removal of artifacts is unavoidable, the materials will be offered for relocation as described in Section V.

B. Developing a "gateway" to the intermodal transportation facility that preserves in place two types of catenary structures--a Portal Bridge [C15a/b] and one or more Bracket Arm Bridge Structures [C20 or C21].

The overall site plan and design details for the gateway; and specifications [including plans as needed] for the removal of the railroad features will be submitted to the SHPO for review as soon as possible, but at least prior to advertisement of Phase III of the project, to determine if proposed designs are compatible with historic properties. Any design compatibility issues raised by the SHPO will be addressed and resolved through consultation among the City, SHPO, NJDOT, and FHWA prior to the advertisement of the job and/or prior to the initiation of any actions which may compromise the integrity of the railroad features.

V. Artifacts

The City shall ensure that all artifacts recovered during fieldwork and not used for on-site interpretation are offered to the NJ State Museum, NJ Transportation Museum and other appropriate local or railroad focused facilities as identified in consultation with the SHPO. Potential recipients will be provided with a notice of the availability of any artifacts [for 30 days]. The City will work with interested recipients to reasonably accommodate any requests for artifacts, and will distribute those artifacts which it is feasible to move. All artifacts may be disposed of after 60 days if no bona fide recipients have been identified

VI. Reporting

The City shall ensure that appropriate reporting of the research conducted for the project is completed. The following will be accomplished:

A. Additional Research – Historical research completed to date has been sufficient to satisfy the identification and assessment components of the Section 106 process. Additional research will be conducted as partial mitigation for the adverse effects to the Camden and Amboy Railroad (Main Line) Historic District. This research will address materials in the collections

of the Pennsylvania State Archives, Hagley Museum, New Jersey State Library/Archives, New Jersey Historical Society and other repositories that may be identified as the result of the review of *The Camden and Amboy Railroad and Transportation Company, A Bibliography [1947]*. Research will be undertaken in order to collect information from primary and secondary sources pertinent to the understanding of the development of the South Amboy rail facility in the years between 1831 and 1911. This research will place the facility within regional economic and transportation contexts. The region is roughly defined as the area between the Ports of New York and New Jersey to the north and Philadelphia to the south. No more than 20 person-days shall be expended on this effort.

B. Technical Report - The results of all historical and archeological research conducted for this project will be presented in an analytical and narrative report, which conforms to professional reporting standards as described in the New Jersey Register of Historic Places Act Rules [N.J.A.C. 7:4]. The narrative section of the report will place the facility in the overall context of the Camden and Amboy and Pennsylvania Railroad operations, and also present the specific history and development of the South Amboy facilities. The report shall specifically address the development and functioning of the rail-maritime connection, and the evolution of the physical configuration and operations of the South Amboy facility. Photographic documentation of the various site elements as compiled for interim survey/management reports and as described in Task II above will also be included in the technical report. Copies of the report will be provided to no more than five institutions, that will be identified in consultation with the SHPO. Institutions my request either a CD or hard copy.

C. Non-technical Report – A non-technical, descriptive summary of information about the history of the rail facility within the context of the Camden and Amboy and Pennsylvania rail systems compiled during the current investigations will be prepared in a format suitable for posting on a web site. The information will be initially posted on the City of South Amboy's Web site and maintained on the web site for a minimum of one year after its posting. If any other organization shows an interest in hosting the information on their web site, the City will supply a digital copy of the report for posting. The technical report prepared in response to Task VI.B may also be posted as a companion document to the non-technical report.

ADMINISTRATIVE CONDITIONS

I. Professional Qualifications

The City and NJDOT, on behalf of FHWA, will ensure that all work is carried out by/under the direct supervision of a person or persons meeting at a minimum the *Secretary of the Interior's Professional Qualifications Standards for Archaeology, History and/or Architectural History [48 FR 44738-44739]* as appropriate.

II. Dispute Resolutions

At any time during the implementation of the measures stipulated in this MOA, should an objection to any such measure or its manner of implementation be raised, FHWA will notify all signatories to the agreement, take the objection into account, and consult as needed to resolve the objection.

Disputes regarding the completion of the terms of this agreement as necessary shall be resolved by the signatories. If the signatories cannot agree regarding a dispute, the FHWA shall then initiate appropriate actions in accordance with the provisions of 36 CFR 800.6(b) and 800.7 as appropriate.

Modification, amendment, or termination of this agreement as necessary shall be accomplished by the signatories in the same manner as the original agreement.

III. Design Changes

If any changes to the Intermodal Ferry Transportation Center project design occur which have the potential to affect historic properties, the City of South Amboy shall notify the NJDOT. NJDOT, with the assistance of the FHWA, shall consult with the SHPO in accordance with the provisions of 36 CFR Part 800. For any such changes, the City shall submit a plan sheet or design sketch showing the proposed change; a written description of why the change is needed; and a description of alternatives considered to achieve the same goals. If formal consultation is initiated the SHPO shall provide written comments to the City, FHWA, NJDOT [Bureau of Environmental Services and Local Aid] within five working days of receipt of documents. Review comments shall evaluate the change for its potential to affect historic properties and its conformance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties.*

IV. Project Completion

A. **Project Completion** - All work required to complete the tasks enumerated in Stipulations I through IV will be completed within two years of the receipt of the NJDEP permit(s) for the construction of Phase III. Should an alternate schedule be required, that schedule will be established and provided to all consulting parties prior to the initiation of construction of Phase III. Work required as part of Stipulation VI will be accomplished according to a schedule developed during negotiations for the cultural resources work.

B. **Documentation of Satisfaction of Stipulations** - The City shall submit a short narrative report with appropriate illustrations to all consulting parties demonstrating satisfaction of any mitigation requirements which will not be included in the archeological reports within 90 days of completion of construction or according to an alternate schedule negotiated immediately after the pre-construction meeting.

V. Review of Implementation

This agreement shall become null and void if construction is not initiated within ten years from the date of execution unless the signatories agree in writing to an extension. If, after ten years without action the FHWA chooses to continue with the undertaking, it shall re-initiate its review in accordance with the provisions of 36 CFR Part 800.

Execution of this Memorandum of Agreement and implementation of its terms evidence that FHWA has afforded the Council an opportunity to comment on the Intermodal Ferry Transportation Center project and its effects on historic properties, and that the FHWA has taken in to account the effects of the project on historic properties.

FEDERAL HIGHWAY ADMINISTRATION

By: _____ Date: 12/22/2009

For Dennis L. Merida, P.E.
Division Administrator, NJ Division Office

NEW JERSEY STATE HISTORIC PRESERVATION OFFICE

By: _____ Date: 12/15/2009

Daniel D. Saunders
Deputy State Historic Preservation Officer

Concur:

NEW JERSEY STATE DEPARTMENT OF TRANSPORTATION

By: _____ Date: 12-14-09

Michael Russo.
Director, Local Aid and Economic Development

CITY OF SOUTH AMBOY

By: _____ Date: 12/10/09

John T. O'Leary
Mayor

Appendix F

Documentation of Wooden Trestle Structure

November 15, 2012

11/15/12 S. Amboy RFR 1B

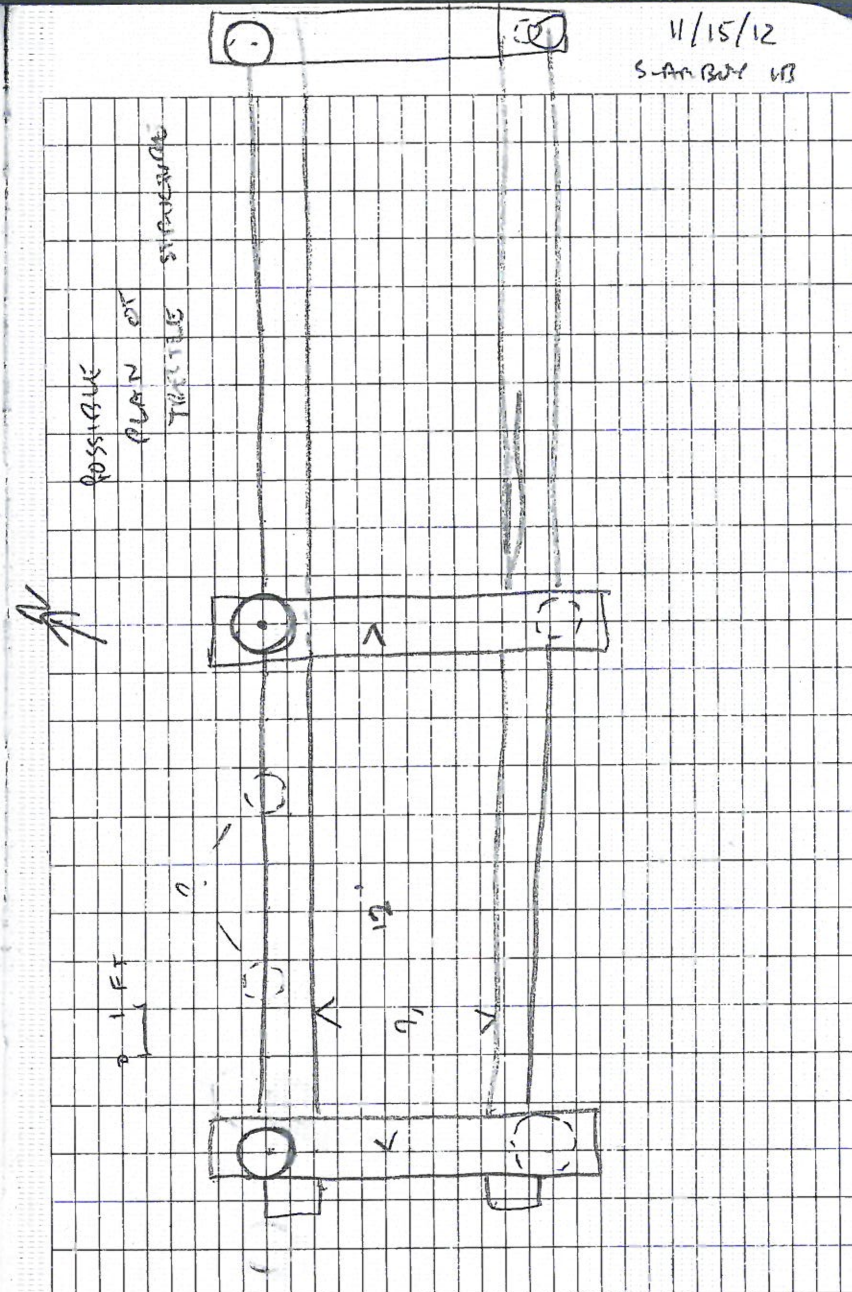
Notched, 100' and spiked logs
observed & west of 50+100
centerline. Tapered ends, so
support posts

Some lumake, others square
notched

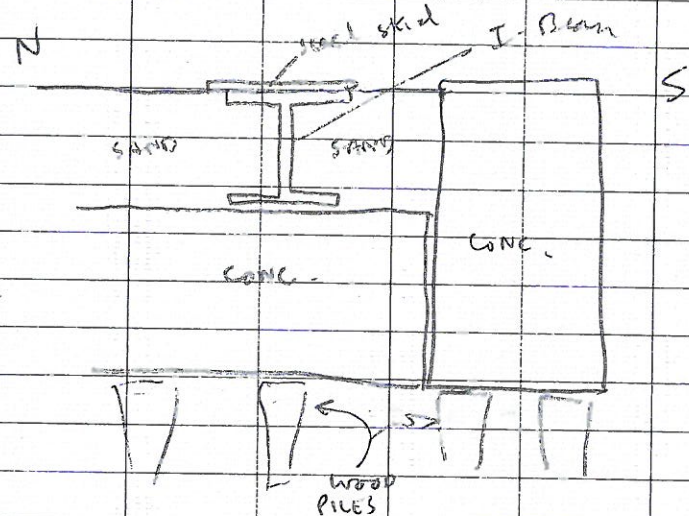
Longest observed piece 26' long
Most posts about 9', though tops
rotted. Probably part of trestle 47
(present 1942)

By mid day structure 11/14 A broke
up and work started on S part of
11/14 B. Very massive conds.

11/15/12
S-Amboy 1B



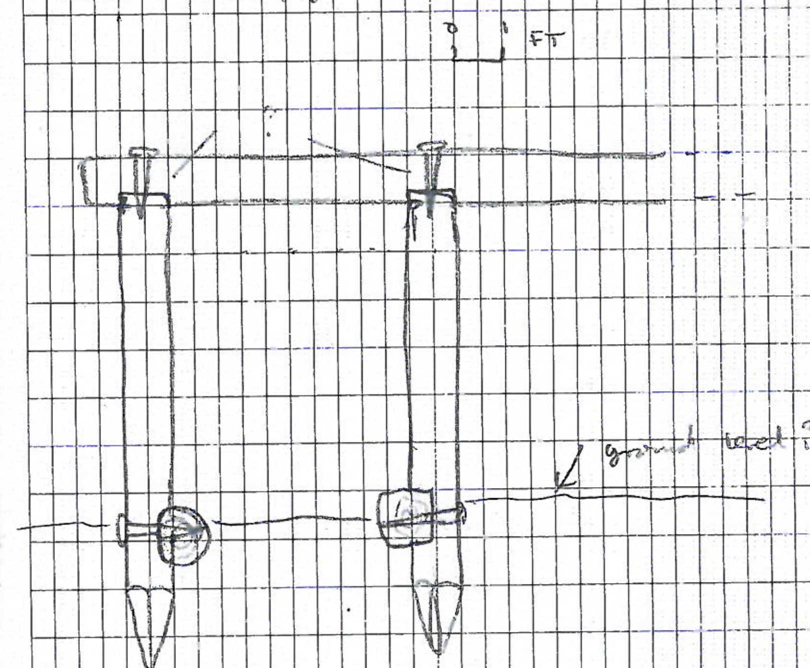
Interior of 11/4/B is clean sand down to base of I beam.



15' long 12" x 12" Beam with rectangular mortise hole - used horizontal aligned N-S in water [illegible]

Loose timbers (placed in sand fill of wharf), then poured concrete block with recesses for rail plates? bulkhead at end of trestle

Possible Configuration of timber trestle



Sand fill ends at 50+00 with darker soil to east - corresponds with end of timber and cement [illegible]

1pm grading and filling with bulldozer!

Appendix G

NEW JERSEY HISTORIC PRESERVATION OFFICE BIBLIOGRAPHIC ABSTRACT

APPENDIX G

New Jersey Historic Preservation Office
Bibliographic Abstract

HUNTER RESEARCH, INC.

Location:	City of South Amboy, Middlesex County, NJ
Drainage Basin:	Raritan Bay
U.S.G.S. Quadrangle:	South Amboy, N.J.-N.Y.
Project:	Cultural Resource Investigations: Intermodal Ferry Transportation Center, City of South Amboy, Middlesex County, New Jersey, Intermodal Ferry Transportation Center, City of South Amboy, Middlesex County, New Jersey
Level of Survey:	II
Cultural Resources:	Camden and Amboy Railroad Historic District