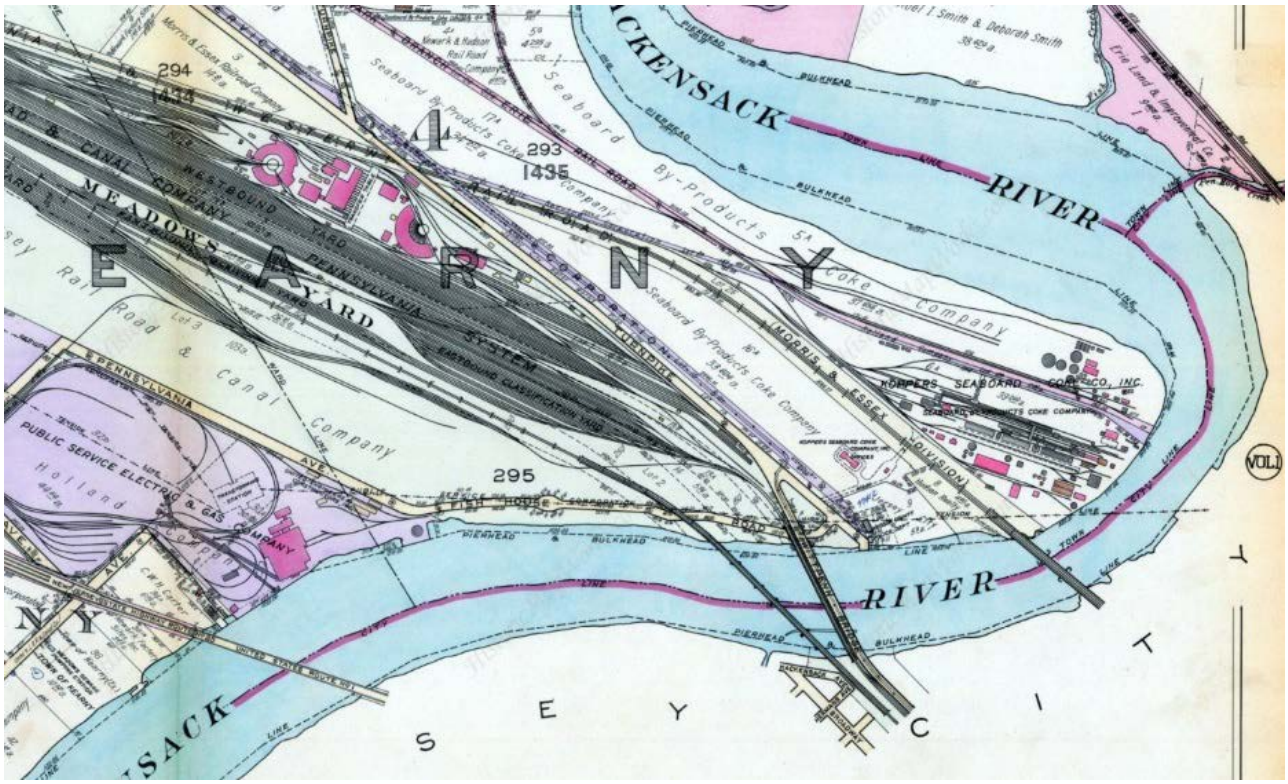
HISTORIC CONTEXT NARRATIVE



INDUSTRY, ROADWAYS, AND RIVER CROSSINGS ALONG THE LOWER HACKENSACK RIVER

PREPARED FOR:

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and

The New Jersey Department of Transportation
1035 Parkway Avenue
Trenton, NJ 08625

September 2022

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ASSOCIATES

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September 14, 2022

Cover photograph: 1934 G.M. Hopkins, *Atlas of Hudson County, New Jersey*, showing the many river crossings and industries along the Lower Hackensack River at that time.

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1.0 INTRODUCTION

This historic context document has been prepared by Richard Grubb & Associates, Inc. (RGA) on behalf of the New Jersey Department of Transportation (NJDOT) and the Jacobs Engineering Group Inc. The publication is an outgrowth of NJDOT's plans to replace the Wittpenn Bridge with a new, vertical lift structure. In 2010, the Federal Highway Administration and the New Jersey Historic Preservation Office (NJHPO) executed a Memorandum of Agreement (MOA) to mitigate the effects of replacing the Route 7 (2) Wittpenn Bridge in Jersey City and Kearny, Hudson County, New Jersey. In 2019, this MOA was amended to include Stipulation #9, which requires the NJDOT to carry out additional research "to inform a historical context narrative focused on industrial development along the banks of the Hackensack River in the vicinity of the Wittpenn Bridge and the relationship between industrial development and the evolution of river crossings within the Hackensack River Lift Bridges Historic District over time." Additionally, the MOA specified that the historic context is to include a description of "extant features of former river crossings, including the extant swing bridge pier and related roadbed on the west bank of the Hackensack River, and extant historic industrial properties in the vicinity of the Wittpenn Bridge" (FHWA and NJHPO 2019). Additional components of the project include measures such as the preparation of Historic American Engineering Record documentation of the Wittpenn Bridge and interpretive displays. All documentation will be placed on file with the NJDOT and the NJHPO in Trenton.

2.0 HISTORIC CONTEXT FOR THE DEVELOPMENT OF TRANSPORTATION AND INDUSTRY IN THE LOWER HACKENSACK RIVER

This historic context documents the development of transportation networks and industry in the vicinity of the Hackensack River Lift Bridges Historic District (SHPO Opinion 5/3/2002), with special focus on the Route 7 (2) Wittpenn Bridge over the Hackensack River (1930 Wittpenn Bridge) (Figure 1).[1] As such, the Hackensack River Lift Bridges Historic District serves as the Study Area, though the following historic context seeks to put developments within the Study Area into the wider context of transportation and industrial developments along the Hackensack River from the seventeenth century through to the present.

Historically, the Hackensack River was established as the original boundary between Essex and Bergen counties in 1693, but in 1710 that boundary was shifted west to the Passaic River. Thereafter, both sides of the Hackensack River in the vicinity of the Study Area were within Bergen County for the next 130 years. In 1840, both sides of the Lower Hackensack River were incorporated into the new Hudson County (Snyder 1969: 82, 145).

The west side of the Hackensack River, currently the Town of Kearny, was originally the southern end of the large and sprawling New Barbadoes Township, established in 1693. In 1826, Lodi Township was formed from the southern end of New Barbadoes Township, setting off a string of geographic partitions. When Hudson County was formed in 1840, the portion of Lodi Township located in the new county was established as Harrison Township. In 1867, Kearny Township was established, occupying the northern and eastern portions of Harrison Township; Kearny became Kearny Town in 1899, the final step in the political organization history of the west side of the Study Area (Snyder 1969: 80, 82, 147).

The east side of the Hackensack River is now part of Jersey City. It was originally part of Bergen Township, which was established in 1661 by Peter Stuyvesant, Governor of the Dutch New Netherland Colony. After nearly two centuries, Bergen Township was divided in half in 1843 when the northern half was established as North Bergen Township. Most of the land on the east bank of the Lower Hackensack River was in North Bergen Township; this area was incorporated as Hudson in 1852 and then was annexed to Jersey City in 1870. Bergen Township, which after 1843 included Bayonne and the land north to the New Jersey Railroad line, was partitioned in 1863, but the two smaller municipalities were annexed to Jersey City in 1870 and 1873 (Snyder 1969: 145-146). The land on the eastern bank of the Lower Hackensack River has been part of Jersey City since 1873.

2.1 Transportation Routes of the Seventeenth through Nineteenth Centuries

Hudson County's transportation network is a palimpsest of a variety of transportation types and modes that were overlaid onto its topography as the centuries progressed. The earliest transportation routes were the south-flowing Hackensack and Passaic rivers, which were used by settlers in the seventeenth century. The marshes and cedar swamps along the rivers complicated land improvement, retarding transportation and population growth (Van Winkle 1924:86-87). In the early eighteenth century, the earliest roads were laid out, depending upon ferries to convey travelers over the rivers until bridges with moveable spans were constructed. An important improved road authorized by the legislature in 1790 connected Newark with Paulus Hook and soon became known as the Newark Turnpike. Wood draw bridges were built to carry the Newark Turnpike over the Hackensack and Passaic rivers while allowing for shipping to pass underneath. Maritime traffic along the Hackensack and Passaic rivers connected upriver industries with the ports of New York and Elizabeth. A generation later,

1 The 1930 vertical lift highway bridge over the Hackensack River and its 2021 replacement are both named after former Jersey City mayor H. Otto Wittpenn. For the purposes of clarity, the original Wittpenn Bridge will be described as "1930 Wittpenn Bridge," with its replacement the "2021 Wittpenn Bridge."

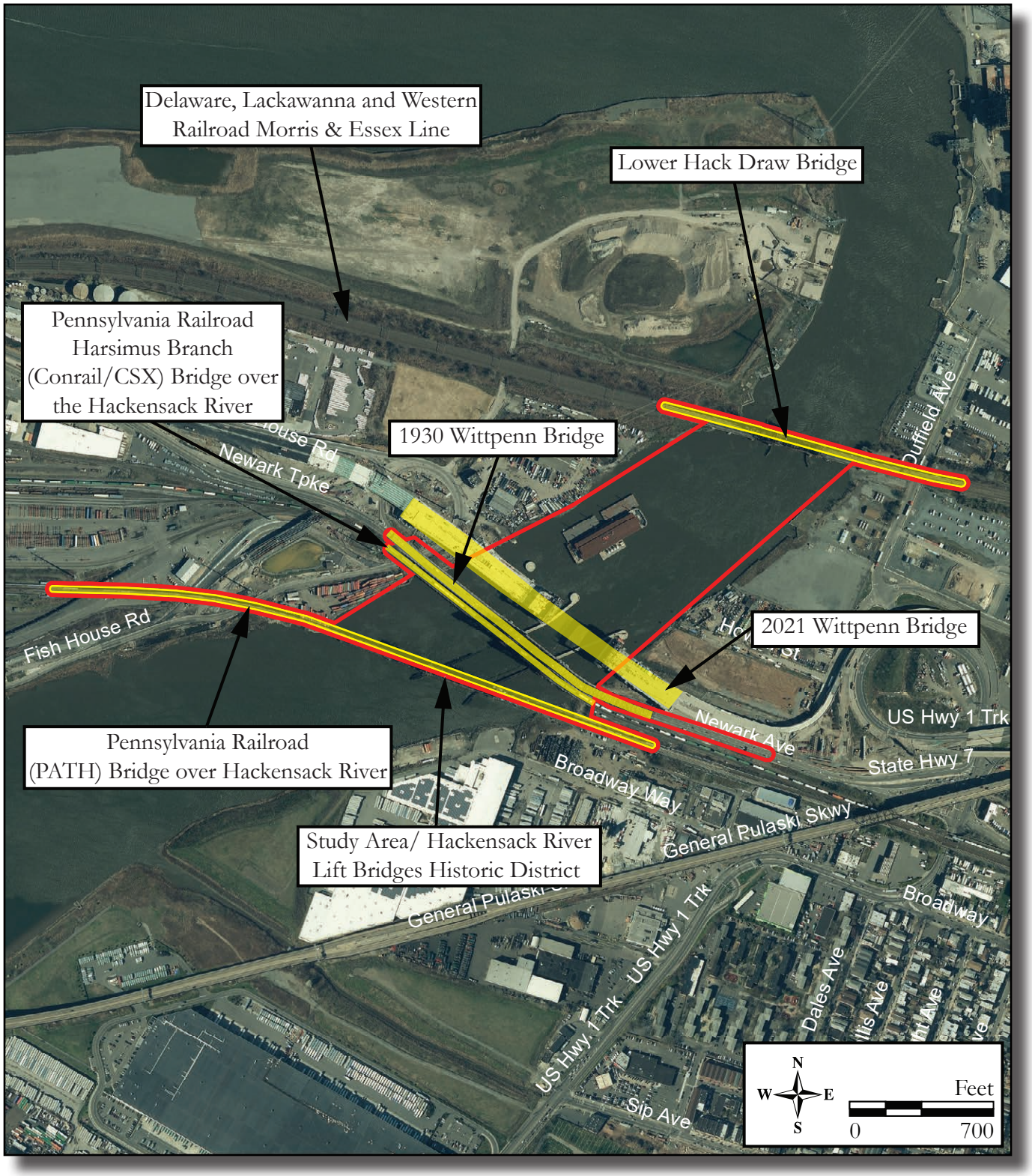

Figure 1: Lower Hackensack River Study Area.

the Morris Canal and railroads were built across the meadows in the early nineteenth century, running east to west, parallel to the earlier roads. Increased use of the rivers as shipping corridors in the nineteenth century resulted in the construction of swing-span bridges in the late nineteenth century to balance the needs of land and water transportation.

Seventeenth-Century Transportation

In the seventeenth century, the land in today's Hudson County was part of the Dutch colony of New Netherland. The north-south running Passaic, Hackensack, and Hudson rivers created two long peninsulas (Figure 2; Bowles 1776). The eastern peninsula, which was called Bergen Neck, was bounded by the Hudson River to the east and the Hackensack River to the west, reaching south to today's Bayonne. Bergen Neck was purchased from the Native Americans in 1630, but the initial Dutch settlements were abandoned in 1643. Settlement resumed after the Native people ceded claims to the Bergen Neck in 1658 (Wright 1988:18-19) and accelerated after the Dutch ceded control of New Netherland to the English in 1664. The western peninsula, New Barbadoes Neck, was located between the Passaic and the Hackensack rivers. William Sandford purchased this peninsula in 1668 on behalf of his uncle, Nathaniel Kingsland of the island of Barbados. The tract initially included 5,300 acres of upland and 10,000 acres of meadow and extended from the southern tip of the peninsula north for seven miles. Sandford and Kingsland partitioned the tract in 1671, and thereafter farmsteads were established on the peninsula (Wright 1988:20-21).

During the seventeenth century, the rivers were the primary means of transportation for residents of the two peninsulas. Individual farmsteads included a wharf along the river where a sloop would be moored (Olsen 2008: 29). Early trading posts were established along the rivers, and some traders remained in their boats while the transactions took place. Native Americans brought corn, tobacco, and wampum; early settlers brought produce, wheat, salt hay, timber, beaver and otter furs, and the skins of elk, bear, and deer. One of the early trading posts was Achter Col, borrowing the Dutch name for the Hackensack River, which was located in what is today the Borough of Bogota, almost ten miles north of the Study Area. The Dutch West India Company, which maintained a trade monopoly, banned the trade of alcohol to the Native Americans in 1665 (Olsen 2008: 9-10, 15-16). Bergen County had very few roads in the seventeenth century other than trails created by Native Americans, with one exception being the road from Bergen to Communipaw, built in 1660 and running north-south down Bergen Neck (Olsen 2008: 13, 29). In a move which underscores the reliance on water transportation, the Town of Newark arranged for two boat owners to settle there in 1669 who would rent out their boats to the general public (Olsen 2008: 14).

Eighteenth-Century Transportation

The pace of road construction accelerated throughout the eighteenth century. Boats of various types maintained an irregular schedule, and travel by water sometimes was dangerous or even perilous. As a result, the growing population gradually pressed for more roads to be built. The second road in Bergen County was Queen Anne's Road, laid out in 1702 along the Hackensack River to connect Little Ferry to Teaneck (Olsen 2008: 29). The earliest road across in the Lower Hackensack River area was constructed to help deliver copper from a mine in Kearny to the rivers for transport to Europe. Arent Schuyler purchased a parcel of land spanning the New Barbados Neck in 1710, and after he settled there, a copper mine was discovered circa 1712 (Wright 1988:36). Schuyler shipped the copper ore to the Netherlands in wooden casks for several years until he was required to ship to England, and by 1731 he had shipped 1,400 tons of copper ore to England (Wright 1988:36). When Schuyler died, his son, John Schuyler, inherited his farmstead and the copper mine. The son had multiple employees who worked in the copper mine and worked to improve the meadows (Wright 1988:36-37).

In the era prior to the construction of bridges, destinations called "landings" emerged along the banks of rivers. Landings were accessible by roads and superseded the trading posts of the seventeenth century. Local produce collected at landings to be traded in New York City included livestock, wheat, buckwheat, corn, flax, watermelons, tobacco, and miscellaneous other products such as lumber, firewood, and hay. During the eighteenth century, landings grew in importance as mills and stores were built and ferry services materialized (Olsen 2008: 29-30).

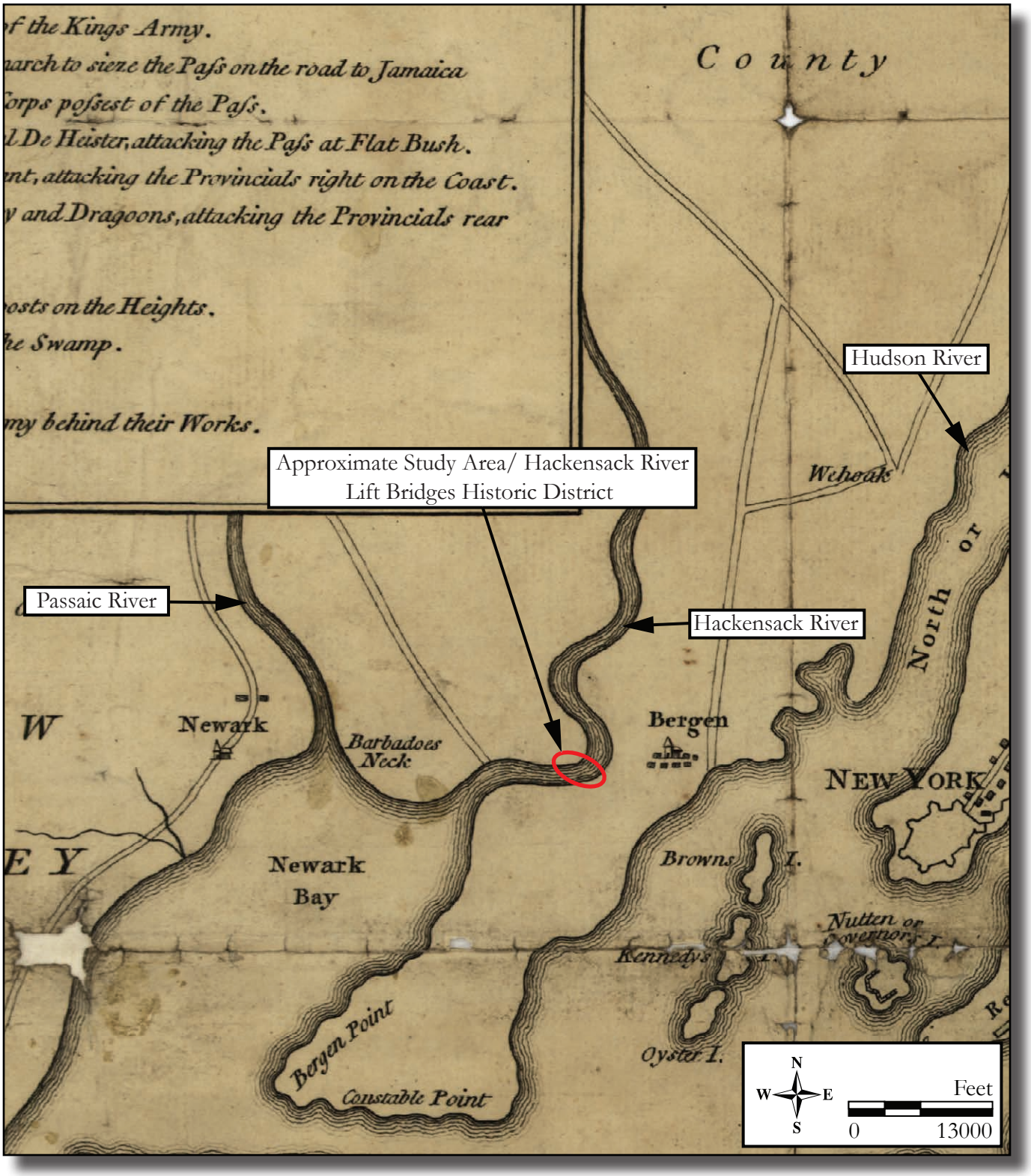

Figure 2: Detail of Bowles 1776, *Plan of the attack on the provincial army on Long Island, August 27th 1776* showing New Barbadoes and Bergen necks.

The first two bridges over the Hackensack were constructed during the colonial period, well north of the Study Area. The first, later known as the Old Bridge, was built at Demarest Landing (today's New Milford) circa 1730. The bridge included a moveable element to accommodate the passage of boats, and it survived for half a century. The second bridge, built in 1744 two miles south of the Old Bridge, was called the New Bridge and was located north of Hackensack. The New Bridge was a strategic location during the American Revolution (Olsen 2008: 30-31).

Two roads crossed the Lower Hackensack River in the late eighteenth century, with ferries carrying people and goods across the river between Kearny and Jersey City (Figure 3; Hills 1781). The first was laid out during John Schuyler's ownership in the mid-eighteenth century, although the date of the road's first construction has not been ascertained by historians. Schuyler's road was initially a causeway through the meadows, leading southeast across the New Barbadoes Neck to deliver copper ore to the Hackensack River for shipment to England; today's Belleville Turnpike follows a portion of the route of the causeway (Modica 2016:3). It is possible that the causeway was initially laid to help deliver a steam engine, received from England by Schuyler in 1753, to pump water out of the copper mine (Wright 1988: 37). On the east side of the Hackensack, the road ran through the meadows and then north to Bergen.

A second road was laid through the meadows by the mid-eighteenth century, connecting Newark and Jersey City. This road across the meadows was improved as a plank road by an act of the Newark Town Assembly in 1765 (Urquart 1913: 230). Running south of John Schuyler's causeway, near the current roadbed of U.S. Route 1/9 Truck Bypass, the Newark Plank Road crossed the Passaic and Hackensack rivers by ferries maintained by the property owners. Heading east from the Hackensack River, the road continued to the center of Bergen Neck, then turned north to enter the village of Bergen from the south. Travelers could reach New York City by taking a road east from Bergen to Paulus Hook, then taking a ferry across the Hudson River (Hills 1778).

Increasing population density and more roads prompted the growth of ferries to accommodate travelers. One of the early ferries was Brown's Ferry at the Hackensack River crossing of the Newark Plank Road. The land on the east bank of the Hackensack River was in dispute at the time the plank road was laid out, and Thomas Brown opened his ferry business after winning the lawsuit. Brown's ferry managed to thrive for three decades as one of two primary points of crossing along the land route connecting Philadelphia and New York City (Winfield 1874: 272). By the time of the American Revolution, the ferry scows were in poor condition; the Continental Congress appropriated money for new scows along with funds to extend ropes across the river. The ferry continued in service after the Revolution, although service was periodically suspended, and the scows were irregularly maintained (Winfield 1874: 273). John Douw established a ferry at the east end of the Schuyler causeway to carry travelers across the Hackensack River. The ferry began operation circa 1763 and continued in operation until 1794. Douw built a tavern on the west side of the Hackensack at the end of the causeway to entertain people who were waiting for their ferry trip (Winfield 1874: 273). A third ferry dating to the 1760s was in Little Ferry at the mouth of Overpeck Creek, which connected Ridgefield on the east bank of the Hackensack to the town of Little Ferry on the west bank (Olsen 2008: 31).

Difficulty of travel and increased use of the two existing roads across New Barbadoes Neck prompted the New Jersey Legislature to authorize a four-rod (66-foot-wide) road between Newark Court House and the ferry at Paulus Hook in 1790 (Modica 2016:8; Lane 1939: 123). The act authorizing the road also called for the erection of bridges across the Hackensack and Passaic rivers and granted exclusive rights to the commissioners of the road to build bridges in this area (Shaw 1884: 1038-1039). The road, initially called the Causeway, used gravel over three layers of logs. By 1795, the first bridge over the Hackensack River between Kearny and Jersey City was built along this road's alignment (Figure 4; Moore and Jones 1802). Josiah Nottage, a Boston engineer, served as superintendent of the bridge and its sister bridge over the Passaic River (Lane 1939: 123-124; Olsen 2008: 33). Each drawbridge had a 24-foot-wide opening for shipping vessels. The Hackensack River drawbridge was 980 feet in length and was constructed of wood, with stone piers and abutments (Modica 2016:8; Lane 1939: 123; Winfield 1874: 273).

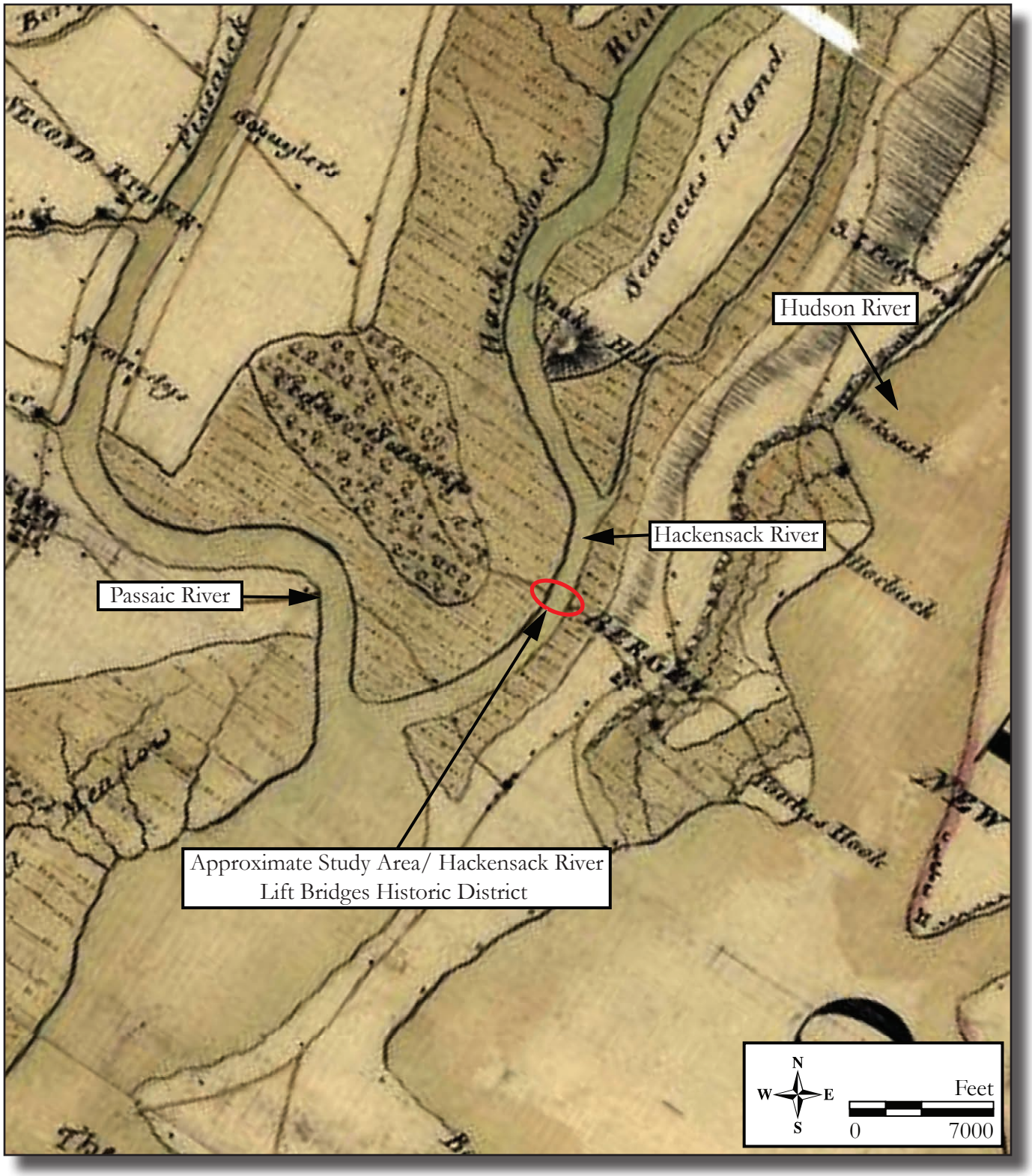

Figure 3: Detail of 1781 John Hills, *A sketch of the northern parts of New Jersey.*
The road running through the Cedar Swamp to Bergen was Schuyler's Causeway, and the road across the lower portion of the peninsula was the 1765 road from Newark to Bergen, later the Newark Plank Road.

Figure 4: Detail of the 1802 S.S. Moore and T.W. Jones, *Road from Philadelphia to New York*. The drawbridge over the Hackensack River, built in 1795, is shown.

Nineteenth-Century Transportation

In the early nineteenth century, several new means of transportation emerged in New Jersey which proved to be improvements over the existing causeway, road, and ferry system. The turnpike, canal, railroad, and plank road each promised to provide a more smooth and comfortable ride than had been possible in a stagecoach. As such, the transportation network crisscrossing the Bergen Neck and New Barbados Neck developed rapidly in the nineteenth century.

The creation of turnpike companies to offer better-maintained roads was increasingly commonplace throughout the nation in the early nineteenth century. The New Jersey Legislature chartered the Newark Turnpike Company in 1804 to maintain a road from Paulus Hook to Newark, reusing much of the alignment which had been authorized in 1790. The road also used the two draw bridges that had been built in 1795 over the Hackensack and Passaic rivers. New Jersey's Governor authorized the State to acquire 250 shares of the Newark Turnpike Company to enact the 1804 law. The Newark Turnpike represents the only publicly funded turnpike in New Jersey, and it operated as a toll road after opening (KSK Architects, Planners, Historians, Inc. 2011: 44-45; Shaw 1884:1040). The turnpike company was later taken over by the Passaic and Hackensack Bridge Company, which already owned the franchise on the bridges themselves, but kept the Newark Turnpike name (Shaw 1884: 1039-1040). Thus the "Newark Turnpike Company" held the monopoly over river crossings in the Lower Hackensack in the early nineteenth century. The Newark Turnpike followed the approximate alignment of today's Route 7/Newark Turnpike within the Study Area, experienced heavy use in the early nineteenth century, and was frequently improved (Modica 2016: 3). In 1865, when one of the Newark Turnpike bridges over the Hackensack was 70 years old, it was in good working order:

> The turnpike bridge is 330 feet north of the [New Jersey Railroad] bridge, on the west side of the river, and is controlled also by the New Jersey Railroad Company. It crosses obliquely, so that the east end is but a few feet from the railroad bridge. There is not sufficient room between these bridges to work a vessel. It is a wooden bridge, with a slide-draw 99 feet 5 inches in length, over all, and takes one minute and a half to run off. The opening is 38 feet in width; the whole extension through this draw 100 feet, which includes the piers, upon which rests the Jersey City Water Works; this draw, or opening, is near the west shore; the opening is well planked up, and the whole structure is in good order (Bridge Committee 1865:7).

The railroad era began in the 1830s when this new mode of transportation started to sweep the nation. A variety of types of transportation ran on the rails, each with the same advantage over earlier transportation methods: a smooth ride on a predictable schedule that was cleaner than stagecoaches and eventually faster too. In 1830, the Delaware & Raritan Canal Company (D&RCC) and the Camden & Amboy Railroad (C&ARR) were chartered as private corporations seeking to facilitate and control long distance freight transportation in New Jersey between Philadelphia and New York City. Northern New Jersey business interests, especially in Newark and Paterson, wanted to get involved in the railroad business. On January 21, 1831, the Paterson & Hudson River Railroad (P&HRRR) was chartered to build a railroad from Paterson to the Hudson River opposite New York City (Cunningham 1997: 49; Lucas 1944: 316). In February of 1831, the D&RCC and the C&ARR (Joint Companies) joined forces and secured a temporary monopoly on rail traffic between New York and Philadelphia (Freeman 1953: 103-105). The Joint Companies offered stock to the State of New Jersey in exchange for a permanently sanctioned monopoly (Freeman 1953:108).

The New Jersey Railroad (NJRR), chartered in 1832 to connect Jersey City with New Brunswick, laid its track across the Kearny meadows in 1833. Because the Newark Turnpike Company had a monopoly on bridges over the Passaic and the Hackensack rivers, the railroad company laid its track across the Hackensack and Passaic turnpike drawbridges. In November 1833, the New York-based *Spectator* reported that a one-half-mile section of Bergen Hill had been prepared for rail traffic. An embankment in the meadowlands had been constructed between the Passaic and Hackensack rivers. The railroad intended to carve a cut through the Bergen ridge, but until it was completed, the ridge would be traversed "by a suitable increase of propelling power, such as the addition of a horse or

two to a car" to scale the heights between the Hackensack River and the Hudson River (*The Spectator* 1833). This temporary track over the ridge was laid by September 1834 and was traversed by horse-drawn cars. While the bridges over the Hackensack and Passaic rivers were vital links for the NJRR, the completion of the Bergen Cut would be a watershed moment for the railroad and result in an exponential increase in rail traffic over the rivers.

In 1838, the New Jersey Railroad completed the Bergen Cut through Bergen Hill, which facilitated rail service from the Hudson waterfront to Philadelphia (Richard Grubb and Associates, Inc., 2002: 6-13). It was built as a cooperative effort between the NJRR and the P&HRRR between 1832 and 1838. On June 7, 1832, the NJRR met with Robert L. and Edwin A. Stevens of the Hoboken Ferry Company and the committee of the P&HRRR to discuss a route that would cross Bergen Hill and agreed to share the proposed passage through the hill (Baer 2015a). The NJRR surveyed a route that took advantage of meandering streams and erosion within the rock. In December of 1832, contractors for the NJRR began work on the Bergen Cut (Douglass 1841; Cunningham 1997). In January of 1833, William Gibbs McNeill, engineer of the P&HRRR, reported on the costs to date for work on Bergen Hill, including the "purchase of mining tool and experiment on Bergen ridge and the Hackensack marshes" at an expense of $2,199.63 (Lucas 1944: 101). McNeill also reported that negotiations continued as to how the costs would be divided between the P&HRRR the NJRR (Lucas 1944: 103-109). The final report, printed in the February 1833 issue of the *American Railroad Journal*, detailed the proposed arrangement between the two railroad companies. This arrangement stipulated that the NJRR would be responsible for the construction of the road through Bergen Hill, though P&HRRR would shoulder two-fifths of the cost at an expense of $55,171.86 as well as two-fifths of the maintenance costs (Lucas 1944: 104, 115-116). As a result, the portion of the road that travelled through Bergen Hill was "to be common property of the two Companies, with equal privileges in all respects" (Lucas 1944: 104; citing Dickerson 1833: 147). Notably, the expenses incurred by the P&HRRR far exceeded the original estimates and overages the P&HRRR were responsible for amounted to $166,490.17 (Lucas 1944: 148).

In October of 1834, the NJRR and P&HRRR made an agreement that detailed the rights that each would have with respect to the Bergen Cut. The NJRR would build two tracks and grant trackage rights to P&HRRR for the route between the west side of Bergen Hill and the Hudson River in Jersey City (Freeman 1953: 114). Specifically, the NJRR would "lay two tracks from the junction of the Paterson road to Jersey City at a grade not exceeding 40 feet to the mile as soon as could be conveniently done and when completed the two roads should travel on the south track going to Jersey City and in returning, the north track" (Lucas 1944: 132-133). In addition to this, the NJRR was also beholden to "lay down two tracks on any branch road which they might make to any ferry landing and allow the Paterson road to use it" (Lucas 1944: 133). The latter concession gave the P&HRRR access not only to the cut but also to the rail lines as they approached the Hudson River. Several other stipulations outlined scheduling minutia, the right-of-way for passenger cars, and the speed of trains. After the agreement was settled, the P&HRRR agreed to pay tolls as follows: "For every passenger that shall enter upon the New Jersey road, six cents, and for every ton of merchandise, twelve cents. Empty cars and motive power were free of toll" (Lucas 1944: 133).

The Bergen Cut was finally completed on January 9, 1838. The cut comprised a one-mile-long excavation ranging from 20 to 40 feet deep. It established a grade of 26 feet per mile and followed an S-shaped curve along an existing streambed in two sharp reverse curves (Freeman 1953: 123; Baer 2015b). An article reporting on the progress of the NJRR appeared in the Centinel of Freedom in 1838, describing the feat as "Herculean" and noting that as a result of the continuous and convenient rail line it completed, "no public means of locomotion is likely to combine celerity and safety as to supersede Rail Roads" (Centinel of Freedom 1838). The NJRR opened the Bergen Cut to locomotive traffic on January 22, 1838, when the first train traveled from Jersey City westward to Newark (Freeman 1953: 123). The completion of the Bergen Cut represented not only the first direct rail access between the east and west sides of Bergen Hill via steam locomotive but also an important link in the first rail line between Philadelphia and New York; the circuit was completed as the NJRR connected with the Camden and Amboy Railroad (C&ARR) at New Brunswick (Cunningham 1997: 61; Alexander 1947:

18-19). With the introduction of the steam locomotives traveling through the Bergen Cut, the need for teams of horses to pull horse cars on the rails over the ridge was removed virtually overnight. Without the inconvenience of a combination horse-and-steam system, the NJRR was able to divert more resources to other projects to attract more passengers, such as improved stations, lower fares, and heated cars (Freeman 1953: 124-125). The completion of the Bergen Cut hastened the reliance on rail transportation and shipping.

Steamboat shipping companies and the railroads locked horns in 1843 in an early rate war as a result of the increasing dominance of the rail transportation across the Hackensack and Passaic rivers. After complaints from Bergen and Passaic counties, the state legislature directed the P&HRRR to enlarge its Passaic River drawbridge, allowing for steamboats to pass more readily through the channel. When the new drawbridge was completed in 1843, steamboat operators reduced their fares to 31 cents, or half that of the railroad (62 cents). The railroad responded by cutting its rate to 25 cents, but after the river froze, the railroad restored its rate of 62 cents (Olsen 2008: 68).

To break the Newark Turnpike Company's monopoly on bridges over the Lower Hackensack, the NJRR purchased a controlling interest in the turnpike. In 1846, a Hudson County Grand Jury found that the use of the bridge for both the Newark Turnpike and the NJRR was a "public wrong" which disregarded the safety of travelers on the turnpike (Newark Daily Advertiser, 14 Nov 1846: 2). As a result, the NJRR was ordered to and did build an independent structure south of the turnpike bridge (Figures 5 and 6; U.S. Coast Survey 1845; Walling 1859). The NJRR bridge over the Hackensack River was described in 1865:

> The New Jersey Railroad Bridge, crossing the Hackensack River, is a wooden bridge, in good condition. It has a half pivot draw, with one opening of 40 feet in width, which is near the west end of the bridge; the outer or swinging end of the draw is supported by iron rods reaching to the top of a pair of shears, and are elevated upon the bridge and on the east side of the draw. This draw works very heavy and slow, owing to its peculiar construction, it requiring 3.5 minutes to turn it off. The whole length of the projection or wings of this bridge is 180 feet; the opening is well planked up and is true to the current (Bridge Committee 1865: 7).

The NJRR became part of the railroad system of the United Canal and Railroad Company of New Jersey in 1867 and four years later was leased by the Pennsylvania Railroad. The railroad bridge remained in use until 1911 (Richard Grubb and Associates, Inc. 2002: 6-13, 6-16; Modica 2016: 3).

Canals also became an important component of the transportation network in the Study Area. In most parts of the nation, canals preceded railroads, but the Morris Canal didn't pass across the Hackensack River until after the New Jersey Railroad was built (See Figure 5). The canal had been chartered on the final day of 1824 to connect the Delaware River to the Passaic River; that section was completed in 1831. While the original canal was under construction, the canal company received the authority to extend the canal's path to the Hudson River. This additional work was completed in 1836 (Winfield 1874:366). The Morris Canal played a key role in delivering coal from eastern Pennsylvania to the greater New York area (Figure 7; Desobry 1827). The canal crossed the Passaic River near its southern confluence, then crossed the Kearny meadowlands and the Hackensack River, before jogging south around the Bergen Ridge on its way to Bayonne, then north to its terminus at Paulus Hook, just across the Hudson River from the southern end of Manhattan. The canal teams would be ferried across the Hackensack, but after the Newark Plank Road drawbridge crossed the Hackensack in 1852, horse teams could tow canal boats across the river (Lane 1939: 164-165; Olsen 2008: 138). Operators of canal boats who were interviewed in their old age in the early twentieth century reported that they often used steamboats to pull their canal boats after they reached Newark in order to avoid the Hackensack and Passaic crossings (Olsen 2008: 138-139).

The 1850s represented the height of the plank road movement (Lane 1939: 162-166). As canals and railroads displaced earlier roads, rural areas without access to those forms of transportation looked to plank roads as a suitable means of improving their transportation routes. The idea behind plank roads

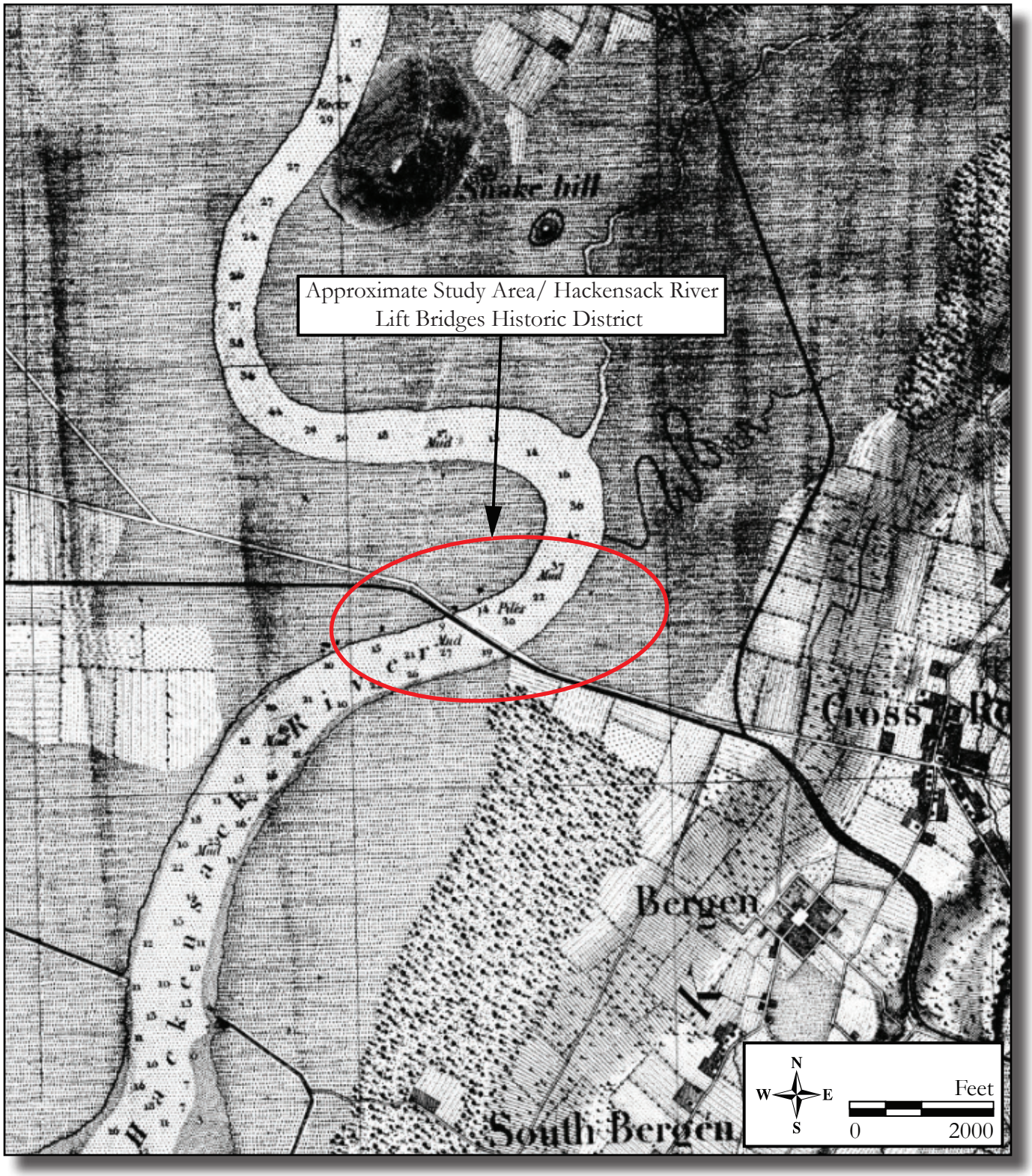

Figure 5: Detail of 1845 U.S Coast and Geodesic Survey, *New-York Bay and Harbor and the Environs.* U.S. Coast and Geodesic Survey. Acc. No. 602ns. On file at the Library of Congress, Washington, D.C.

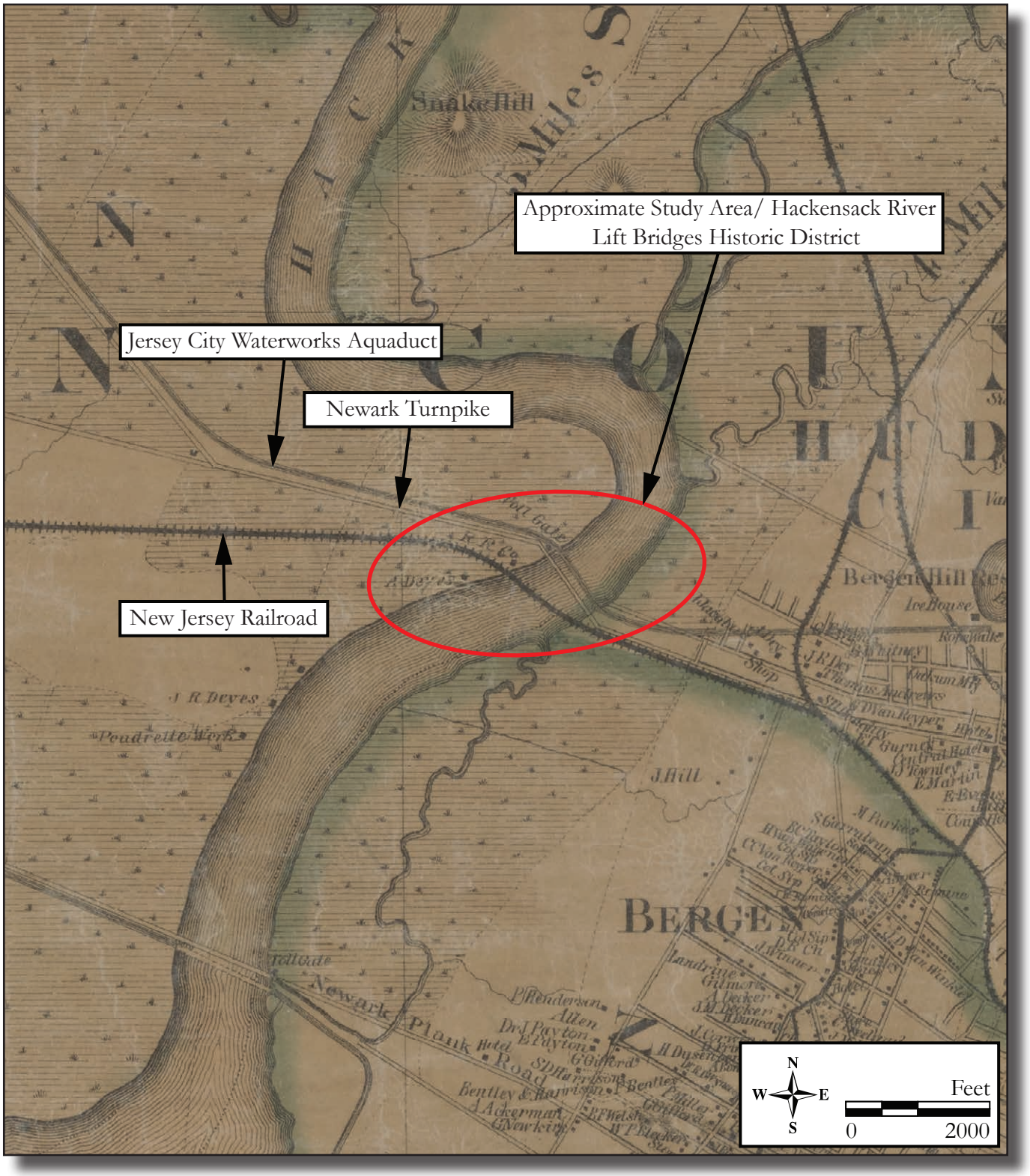

Figure 6: Detail of 1855 Walling, *Map of New York Bay, Harbor and its Environs* (Courtesy of the New York Public Library Digital Collections). The separate vehicle and railroad bridges over the Hackensack River are depicted here, as well as a number of buildings on the west side of the crossing. The aqueduct for the Jersey City Water Works crosses the river just north of the vehicle bridge.

Figure 7: Detail of circa 1827 Prosper Desobry, *Line of the Morris Canal, New Jersey, 1827* (Courtesy of the New York Public Library Digital Collections).

was that planks provided a smoother ride at a lower cost than other forms of land transportation; in cases where the land had poor drainage, replacing the planks in that location was fairly easy. The first plank road company in New Jersey was authorized in 1849 to connect Newark with the Hudson waterfront (Lane 1939: 164). The New Jersey Railroad opposed the legislation, as it would violate the railroad's monopoly of bridges over the Hackensack River, but legislators who had complaints against the railroads were able to pass the bill. The plank road company built a bridge over the Hackensack River in 1852 and over the Passaic River in 1855 (Lane 1939: 164). With the completion of the two bridges, the plank road soon became the most heavily travelled road in the entire state (Lane 1939: 164-165). Difficulty in maintaining the planks on the road resulted in its surface being paved within a few decades. The Hackensack River Newark Plank Road bridge was described in 1865:

> The plank road bridge, crossing the Hackensack river in Hudson county… is a wooden structure, the bridge being in ordinary condition, it has a pivot or turn-table draw with one opening, which is located in deep water. The extreme length of the entire pier is 165 feet in length, parallel with the river; the condition of the opening is very bad, indeed. On the north side of the bridge, that end of the pier is quite open and dangerous to vessels coming in contact with it. On the outside of the opening to the west there are no fenders or wing for protection to the bridge or to vessels, but loose piles, one of which is broken off and covered with water during a part of the tide. On the south or lower side of the bridge the extreme end of the centre pier is nearly square. A vessel approaching from the south, the tide being strong and striking this corner, would be liable to great damage. To the east and from the end of the centre pier are loose piles, for what purpose your committee are not informed, but presume them to be placed there to close the east opening, as they extend to the bridge beyond where the opening would be. The general condition of the west opening is bad, and requires immediate attention; the want of proper lights is much needed (Bridge Committee 1865: 7).

The third quarter of the nineteenth century represented a tremendous expansion of railroads connecting New Jersey's interior with the Hudson River waterfront (Figure 8; McDowell 1879). Several railroad companies laid track across the meadowlands and passed through the Bergen Cut. The Paterson & Ramapo Railroad (P&RRR) laid its track across the Hackensack in 1849, a mile upriver of the crossings in East Kearny. Three years later (1852), the P&RRR and the Paterson and Hudson River Railroad (P&HRRR) were absorbed into the New York & Erie Railroad (NY&ERR or Erie Railroad), which sought its own connection to the Hudson River waterfront (Lucas 1944: 243). As a result, the Erie Railroad created the first direct all-rail route between the Great Lakes and New York Harbor by way of the Bergen Cut (Hungerford 1946: 132-133; Lucas 1944: 244).

An ongoing problem was that the Erie Railroad used a wider gauge with wider cars than the other railroads, which required the retrofitting of the tracks through the Bergen Cut to create the necessary clearance between cars. In the fall of 1853, the 1834 agreement between the NJRR and P&HRRR (now absorbed into the Erie Railroad) was revised with respect to the financing and access to the Bergen Cut (Freeman 1953: 141). The Erie Railroad agreed to pay the same rates as had the P&HRRR; however, the Erie Railroad was allowed to increase the gauge of the tracks through the Bergen Cut to accommodate the wider Erie cars by laying of a third rail (Freeman 1953: 141; Lucas 1944: 262). Even though the cut was widened in 1852, the opening provided minimal clearance for the wide Erie cars. The narrow cut, coupled with human error associated with switching between gauges, resulted in delays and slow traffic through the cut, as well as derailments and accidents.

The improvement of the Bergen Cut did not completely resolve the problem with the Erie Railroad. Increased rail traffic through the cut continued to be complicated by the size of the Erie cars. After considering various options, the Erie Railroad began the construction of a tunnel through the Bergen Hill in 1856 under the oversight of engineer James P. Kirkwood. The tunnel, completed in 1861, came to be known as the Long Dock Tunnel, also known as the Bergen Hill Tunnel. It provided an eastbound and a westbound track. The Erie Railroad then laid new track through the meadowlands to access the tunnel more directly (Winfield 1874: 369). The Long Dock Tunnel was an important

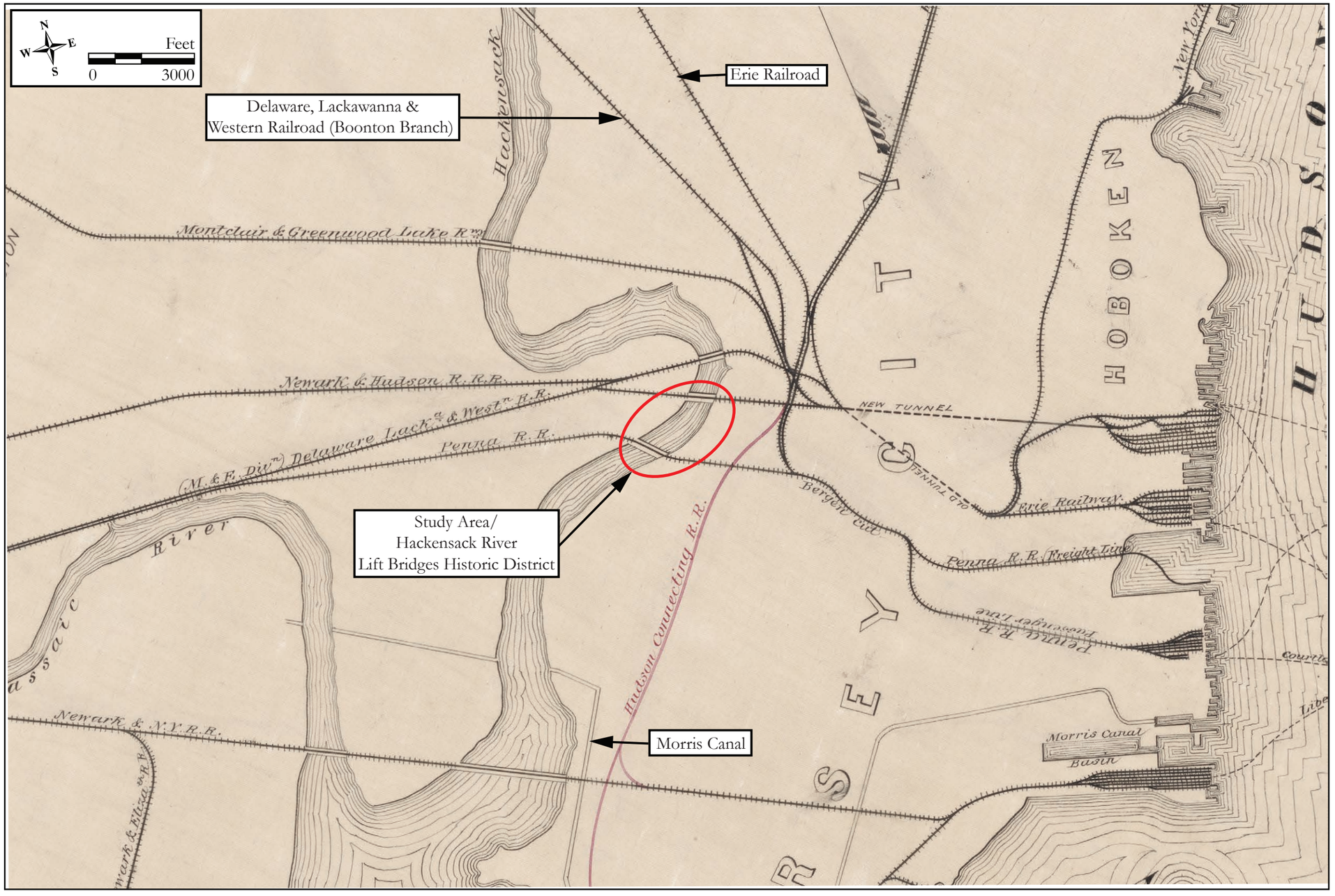

Figure 8: Detail of circa 1879 F.H. McDowell, *Outline map of the rail roads terminating on the west shore of the Hudson, opposite New York* (Courtesy of the New York Public Library Digital Collections). This railroad-focused map shows numerous railroad lines that traversed the Kearny Meadows, passing through or over Bergen Hill, and terminating at the Hudson River where passengers and cargo embarked on the final leg of the trip to New York City by water

boost for the Erie Railroad, which prided itself on comfortable and punctual commutes. However, an incident in 1896 illustrated an ongoing problem with the tunnel. An engine broke down in the tunnel in November, effectively blocking one track. Commuters who ventured off the train to inquire about why it stopped were greeted with a cloud of smoke, soot, and grime that forced them back onto the train (*Passaic Daily News*, 28 November 1896:4). The Erie Railroad was already working on a solution to the tunnel and announced its plans to create its own cut for commuter trains, leaving the tunnel for freight alone. The cut would be laid through Bergen Hill on a higher grade than the tunnel, which would create the opportunity to add two-level commuter stations on either end (Paterson News, 9 December 1896:6). The Erie Railroad Cut would not materialize for a decade, however.

The Delaware, Lackawanna, & Western Railroad (DL&WRR) extended its Morris and Essex line through the meadowlands in 1862 in order to access the Erie Railroad's Long Dock Tunnel (Taber 1977: 59). The DL&WRR crossed the Hackensack River at Kearny Point, near the north end of what is today the Hackensack River Lift Bridge Historic District, via a bridge built by the Hoboken and Newark Railroad in 1862. Fifteen years later, in 1877, the DL&WRR built a new bridge across the river to carry the Morris and Essex across the Hackensack and access the Bergen Tunnel, its own cut through the palisades (see "New Tunnel" on Figure 8). The railroad replaced the latter bridge in 1902 with a double-track swing bridge that lay 12 feet above mean high water (Taber 1980: 22). The original 1862 bridge north of the DL&WRR was incorporated into the Erie Railroad's Newark Branch sometime after 1877, and the bridge was abandoned by 1910 and removed the following year (Figure 9; Hopkins 1909; USACE 1912: 7).

The third railroad bridge at this crossing in the late 1870s was that of the New Jersey Railroad, which was leased by the Pennsylvania Railroad in 1870 (Winfield 1874: 368). The next bridge to the south was used by the Newark Plank Road, which ran immediately north of and parallel with the Morris Canal. The southernmost railroad bridge was built for the New York and Newark Railroad in 1864; this railroad became part of the Central New Jersey Railroad in 1869 (Winfield 1874: 369).

The railroad bridges at Kearny Point were built generally parallel to each other. In the late nineteenth century, these were all swing-span bridges. The bridges were constructed with a rotating span that pivoted in the center over a pivot pier. The rotating spans of these bridges had to be opened in tandem to allow shipping vessels to pass, which was increasingly important as the century progressed. Boats could pass through the opened bridge on either side of the pivot pier, but the time involved in opening all the spans (and the proximity of some spans) complicated river transportation. Opening a swing-span bridge was a complicated procedure given the technology of the time, and, on occasion, the span would get stuck in a partially opened position. River barges were also becoming larger, which added a further layer of complexity, because the river channels flanking the pivot pier were narrowing as sediment continued to settle in them.

The Kearny meadowlands became the location of a large rail yard in the 1870s. Because of congestion along the Hudson River, the Pennsylvania Railroad began constructing its Meadows Yard in 1872 (Mordecai 1883: 30; RGA, Inc. 2017). It became that railroad's primary terminal and classification yard for its freight. Rail infrastructure in the Meadows Yard included a roundhouse, turntable, lumberyards, storage sheds, blacksmith shops, and erecting shops. The former New Jersey Railroad bridge, now operated by the Pennsylvania Railroad, was enlarged to accommodate four tracks (instead of the original two) to carry the freight traffic eastward.

In 1867, the NJRR was consolidated with the combined C&ARR and D&RCC to form the United New Jersey Railroad and Canal Company (UNJRR&C Co.). The new company then established a joint operating agreement with the Pennsylvania Railroad and began making extensive improvements to its terminal facilities in Jersey City, including filling in part of Harsimus Cove, constructing a new freight rail yard, and blasting out a dedicated rail link from the east end of the Bergen Cut to the Cove. Finally, in 1871, the Pennsylvania Railroad leased the UNJRR&C Co. outright and achieved its long-sought-after outlet to the Hudson River through the Bergen Cut (Burgess and Kennedy 1949: 240).

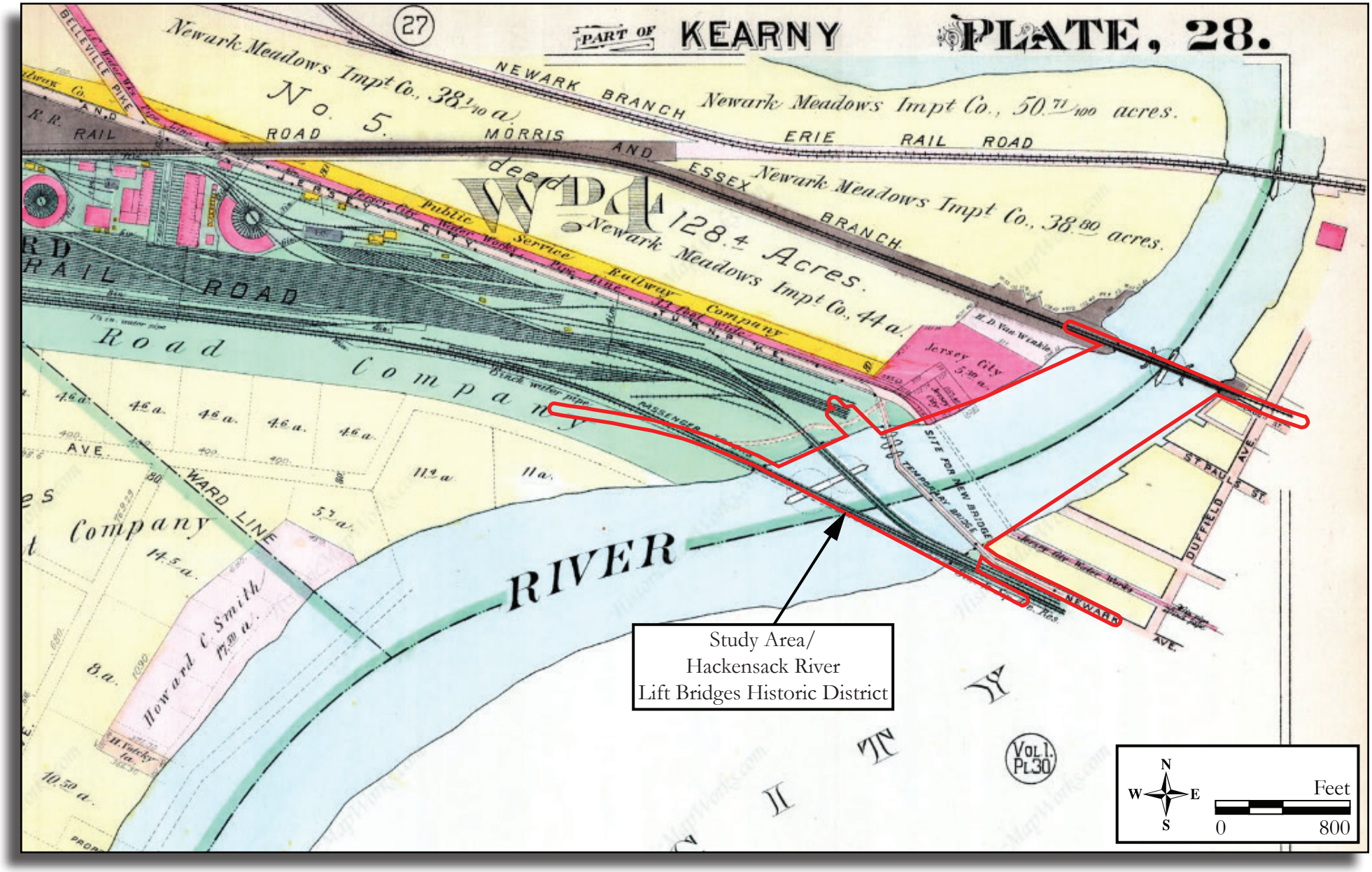

Figure 9: Detail of 1909 G.M. Hopkins, *Atlas of Hudson County, Volume 2, Plate 28, Part of Kearny*.
Note the Erie Railroad. Newark Branch is using the old DL&WRR Morris & Essex/Hoboken and Newark Railroad bridge (Built 1862).
The Newark Turnpike is using a temporary bridge, the new one to be completed in 1911.

The Second Bergen Cut was completed by the Pennsylvania Railroad between 1874 and 1882. The project began with widening the eastern terminus of the Bergen Cut to accommodate the route of the Harsimus Branch toward a new alignment in Jersey City. In 1875, the Pennsylvania Railroad's annual report noted that the "new railway to connect with the Harsimus Cove property has been opened for use through a portion of Bergen Hill from its connection with the Main Line" (Pennsylvania Railroad [PRR] Annual Report 1875: 46). Thus, the northeastern-most section of the present-day Bergen Cut—still in active use by the Port Authority Trans Hudson Corporation (PATH) rapid transit system—was first constructed specifically for the Harsimus Branch. The remainder of the widening of the Bergen Cut took place in the late 1870s and early 1880s. The project eliminated several sharp curves in the original cut and provided sufficient clearance to build a four-track main line through the cut (PRR Annual Report 1878; PRR Annual Report 1881). The straightening project was undertaken by the team of Bernard M. and John F. Shanley of Newark, long-time Pennsylvania Railroad contractors (Messer and Roberts 2002: 187; New York Times [NYT] 1911: 13). The newly straightened Bergen Cut, also known as "Shanley's Cut," opened in March of 1882. It measured approximately a mile long, ran at an average depth of 25 feet, and cost over $500,000 (NYT 1882: 5). By straightening the line, the railroad obliterated most of the original 1830s Bergen Cut (Messer and Roberts 2002; Pennsylvania Railroad 1878; 1881).

In 1875, the Pennsylvania Railroad completed its freight terminal at Harsimus Cove on the Hudson River in Jersey City, which caused a swell in freight traffic. The single bridge across the Hackensack River could no longer handle the burgeoning flow of freight traffic. In the mid-1880s, the Pennsylvania Railroad built a new bridge over the Hackensack River for the sole purpose of carrying freight to Harsimus Cove Yard. The new swing-span bridge was constructed between its passenger bridge to the south and the Newark Turnpike Bridge to the north. The freight bridge was rebuilt by 1894 (Taber 1980: 181).

Two swing spans were built over the Hackensack River between 1880 and 1887. The Pennsylvania Railroad aligned the swing-span openings of its freight and passenger bridges to form one continuous channel. The freight bridge had two openings of 61 and 60 feet and cleared the water by a mere 5.5 feet (USACE 1926: 9). The Pennsylvania Railroad replaced its passenger bridge in 1905 with a new swing-span structure six feet above the mean high water mark with 56- and 58-foot channel openings (NYT 1905). In 1911, the Pennsylvania Railroad electrified its passenger line which connected with Newark and continued to Jersey City, where it shared the tracks with the Hudson & Manhattan Railway under the Hudson River to New York City (Engineering Record: 1911a: 666).

As the nineteenth century neared its close, two important studies emphasized the importance of the Hackensack River. The U.S. Army Corps of Engineers (USACE) had been granted authority over the navigable waters of the nation in 1824. In 1889, the USACE completed a study of the Hackensack River. The study noted that a quarter of a million tons of goods were transported down the river annually, with a total value of over a million dollars. The report mentioned that the lower portion of the Hackensack River was sufficiently wide and deep, but that the unimproved meadows would become increasingly valuable as time passed (USACE 1889). The second study was completed for the New Jersey geological survey by a consulting engineer named Cornelius C. Vermuele. His 1897 report documented the southern portion of the Hackensack River. Vermuele pointed out that although the river's navigable status fostered its use for water transportation, the meadows on either bank retarded its best use. He recommended "improving" the meadows for industrial use, specifically "bringing down of the cities to the water front, so that these waterways can be utilized" (Vermuele 1897: 304). Vermuele also commented on the bridges. He believed that the bridges needed to be elevated at least high enough that tugs and barges could pass below without having to open the bridges, which would greatly reduce the number of bridge openings (Vermuele 1897: 310).

Nineteenth-Century Industry

As the nineteenth century progressed, industrialization in Hudson County transformed the landscape of the meadowlands. The transportation improvements described in the previous section were essential to the industrialization of Jersey City and Kearny, as they brought raw materials to the area

that fed the nascent industrial concerns. This section examines local products of the area, how these products were shipped to market, and the spread of industry in Hudson County.

From colonial days, the Hackensack River was a thoroughfare for delivery of agricultural products from Bergen (later Hudson) County to Manhattan markets. Supplying the construction and population boom in Manhattan, two primary exports were wheat and logs. A growing number of mills in Bergen County made it possible to process these exports locally and increase local capital. Grist mills ground wheat into flour locally before it was shipped to New York, and sawmills prepared lumber locally for shipping. The latter type of mill had an unintended consequence: by mechanizing the process of producing lumber, the forests in Bergen County were mostly depleted by the mid-nineteenth century, which handicapped that industry. By 1850, the county had 47 feed or sawmills, 11 textile mills, and two foundries. The foundries produced iron products for export and provided skilled employment to residents of Bergen County (Fogarty 1985:31-32).

In the vicinity of the Study Area, the land on Kearny Point continued to be used for agricultural purposes (See Figures 5 and 6; U.S. Coast Survey 1845; Walling 1859). An 1859 map of Kearny Point identifies a "Poudrette Work," suggesting that one of the earliest industrial uses of the land was for the processing of the fertilizer "poudrette" (French for "powder") (see Figure 6; Walling 1859). This fertilizer was made by processing, deodorizing, and drying human waste collected from cesspools and privies in urban centers to be sold to local farms (McNeur 2014: 120-121). By 1850, water transportation increased the profitability of farms in the Hackensack Valley with farmers raising over 50,000 bushels of rye, corn, and wheat for market, along with oats and hay (Olsen 2008: 54-55). Manure, agricultural lime, and phosphates were traded at the landings for produce; these types of fertilizers aided in the increased production of the early nineteenth century (Olsen 2008: 55). Another means of accommodating the increased agricultural output was the emergence of a type of grist mill called a "tidal mill." The name is based on its power source; during high tide, water would fill a reservoir, and during the day the mill would draw down the water as it operated. Farmers brought grain to one side of the mill, and, after processing, the ground flour could be emptied on the other side of the mill into vessels bound for New York City. The Van Buskirk mill in New Milford was a prominent example of a tidal mill (Olsen 2008:55).

New types of agricultural exports emerged in Bergen County in the nineteenth century. The larger export was strawberries. The soil of Bergen County produced strawberries with a particular flavor that was preferred in Manhattan, and, by the 1850s, the county was shipping 10-15 million baskets of strawberries to New York City. In 1858, the Bergen Turnpike Company recorded the volume of strawberries delivered by road and by ship over the same 12-hour period. The turnpike study reported 170 wagons with 221,000 baskets using the turnpike and 283 wagons traveling by ship. Initially shipped by river, strawberries shifted to daily "berry trains" that delivered fresh produce to the Hudson waterfront (Fogarty 1985: 31; Olsen 2008:54).

Another important late-nineteenth-century export from Bergen County was brick. In 1847, Elizabeth Sutliff Dufler, a free Black woman, purchased 10 acres of land that had outstanding clay deposits near Little Ferry along the Hackensack. Dufler began selling clay to potteries in Newark and Jersey City and maintained a very profitable operation (Olsen 2008: 59). In the final decades of the nineteenth century, at least ten brick yards operated along the banks of the Hackensack. The Mehrof Brothers established a brickyard near Little Ferry after the Civil War and eventually became the second largest brick company in the nation. By 1882, the company shipped over two million bricks per year on its private fleet of schooners. Interestingly, the houses in the vicinity of the brick yards were frame, not brick, which affirms that the brick were produced for export and not for local use (Mitchell 1983:18). In the early 1980s, the only vestige of the brick industry at Little Ferry was a series of small lakes where the clay was excavated (Mitchell 1983:18-19; Olsen 2008: 59).

Special barges were built to deliver brick to markets and to return with coal. Because of the weight of brick, rail transportation was avoided when possible. Instead, bricks were delivered to market on ships called "brick schooners" (Mitchell 1983:18). The USACE estimated in 1889 that 250,000 tons

of products were shipped down the Hackensack River annually, with a market value of $1 million; it appears that most of this shipping was brick (Modica 2016:6). Around the time of the USACE study, a new type of barge was introduced to address the difficulties brick schooners faced while navigating the turns in the Hackensack River. The new type of barge was called a "nutcracker barge" which comprised two smaller barges hinged in the center to allow the craft to bend. This was particularly important in cases where two bridges were built next to each other, which placed extra limitations on navigation (Mitchell 1983:44-45).

One of the earliest types of industry in the vicinity of today's Kearny was a japanning factory in Harrison in the early 1840s. "Japanning" was a process of adding lacquer to metal surfaces to create a decorative, enameled effect (a process now called toleware). Most japanning involved the creation of a glossy black background overlaid with decorative or picturesque scenes, often in relief. One of the early japanning factories was established in Harrison in the early 1840s, taking advantage of the markets in both Newark and New York City (Doherty 1986:56).

The Hackensack River was at once vital for commercial transportation and presented enormous challenges due to the marshy land that bordered it. Even in the late nineteenth century, most of the banks of the Hackensack River were meadows, particularly in the southern part of the river. Kearny's meadows were crisscrossed by railroads and turnpikes but saw little development even by 1873 (Figure 10; Hopkins 1873). Where industries did border the river, they were upriver in Lodi, Harrington, and New Barbadoes townships. Brick yards were located in Lodi and New Barbadoes townships. Across the river, a varnish factory was located in Englewood Township, and a chair factory was located in Harrington Township (Walker 1876). The chair factory was operated by the Collignon Brothers and produced wooden folding deck chairs that were marketed in New York City (Fogarty 1985:65). Buildings along the river were generally industrial or manufacturing concerns, not residential settlements. The land-use pattern continued into the twentieth century.

2.2 Transportation and Industry in the Twentieth Century

Pre-World War I

The hegemony of rail transportation in New Jersey at the turn of the twentieth century faced an increasingly formidable foe as the century progressed: the automobile. The automobile was initially expensive, and the poor state of roads complicated the use of cars as a form of transportation. By 1910, however, the "Good Roads" movement had been initiated, which accelerated the retirement of horse-drawn coaches, drays, and wagons (KSK Architects Planners Historians, Inc. 2011). State-wide counties and municipalities were improving road surfaces, bridges, and drainage to accommodate bicycles, cars, and trucks. Recognizing their new competition, railroads continued to upgrade their networks to remain competitive and retain their dominance. During the first decades of the twentieth century, manufacturing in the Study Area was developing quickly and the transportation network saw an array of updates to the bridges, roadways, and railroads that traversed the meadowlands.

An accident in 1901 greeted the new century. River traffic along the Hackensack had the right-of-way, although the railroads and travelers along the road system consistently pressed to restrict bridge openings to specific times each day. In March 1901, the DL&WRR drawbridge opened to accommodate the passing of a lumber schooner. While the bridge was closing, a steel roller in the pivot became displaced and locked the bridge five feet short of closing. It took an hour for workers to diagnose the problem and then make the needed repairs, resulting in trains stacking on both banks. The DL&WRR was able to lock the bridge in place for several weeks while workers investigated why the failure happened, effectively stopping river traffic during that period (Olsen 2008: 145). Meanwhile, the Erie Railroad claimed that 70 percent of its rail delays were caused by bridge openings. A typical delay in 1910 resulted when a schooner passing through the open Erie Railroad drawbridge sailed too far to one side and became stuck in the seabed. While workers tried various methods to free the schooner, 14 trains carrying 7,000 commuters were forced to stack on either side of the river (Olsen 2008: 145).

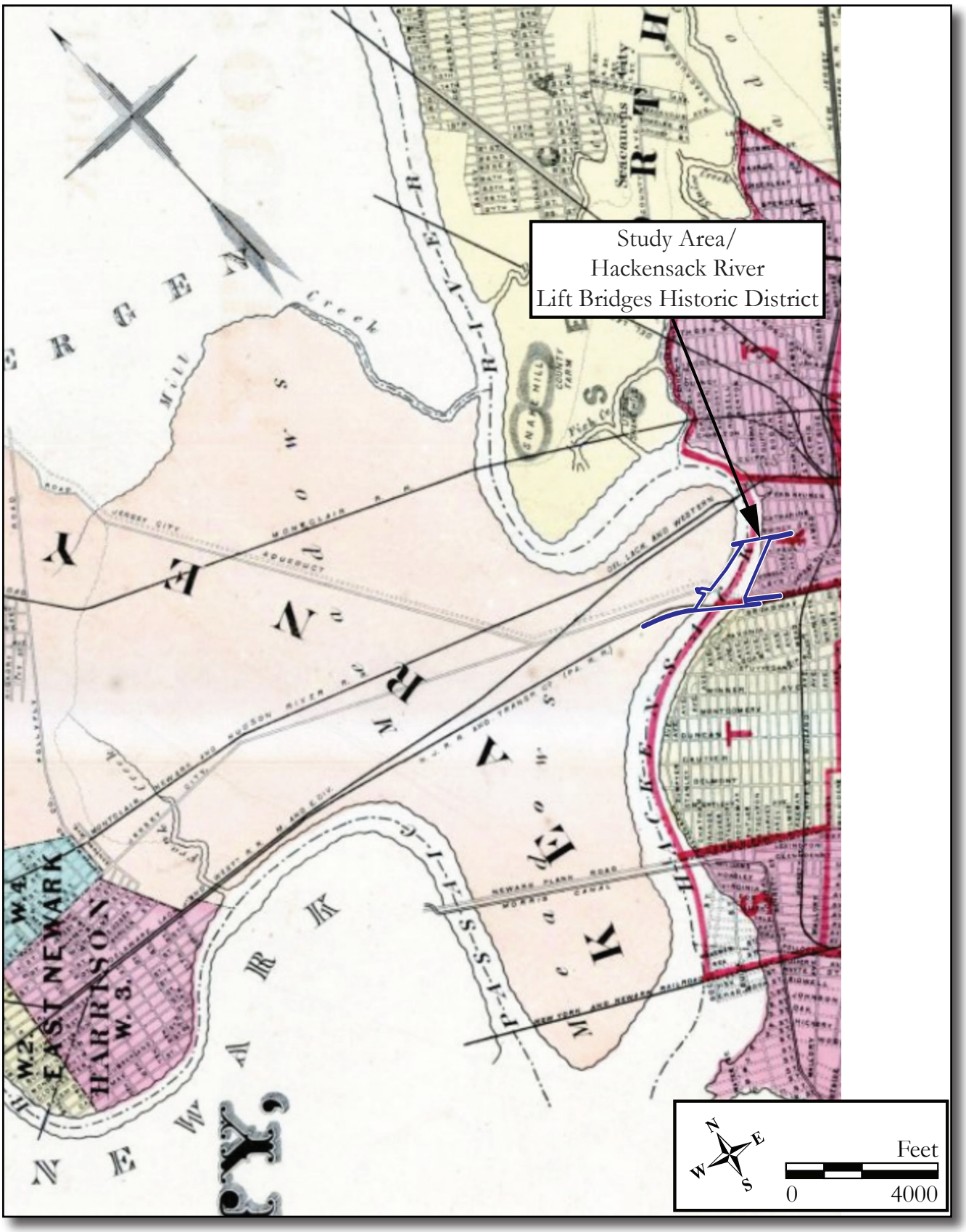

Figure 10: Detail of 1873 G.M. Hopkins, *Atlas of Hudson County, New Jersey, from Actual Surveys, Outline and Index Map.*

The Newark Turnpike had been rebuilt several times over the course of the nineteenth century to address the ruts, washouts, and otherwise near-continuous deterioration of the roadway due to high traffic and storm damage. In 1911, Hudson County completed a new Newark Turnpike Bridge which would carry the roadway, two trolley tracks, and two sidewalks on its 40-foot width. The bridge was a steel through-truss bridge, 893.6 feet long (including approaches), with a 225-foot swing-span and three 184-foot fixed spans (Engineering Record 1911:720). The bridge had channel clearance of 80 feet on either side of its pivot pier and sat 8.9 feet above the water in the closed position (USACE 1926: 9). The steel bridge superstructure was supported by concrete piers and abutments. A contemporary observer concluded that "there are no remarkable features in the design" but the method of constructing the river piers was notable (Engineering Record 1911:720;). The piers were "built in the dry in floating caissons" and plunged deep into the river mud, 40 feet below the river bed (Engineering Record 1911:720). The bridge was designed by Alexander S. Hamill, Hudson County Engineer, and was the predecessor to the 1930 Wittpenn Bridge.

The increase in maritime activity and the use of larger ships with deeper drafts, mostly north of Jersey City, prompted the Army Corps of Engineers to initiate the first dredging project of the Hackensack River authorized by the Rivers and Harbors Act of 1912. The existing navigable depth of the Hackensack River from the head of Newark Bay to the Central Railroad's Newark & New York Railroad Bridge was about eight feet and then increased to approximately 12 feet north of the bridge (USACE 1918: 317). The dredging project called for an increase of navigable depth to 20 feet, with a 300-foot-wide channel at Newark Bay. From Newark Bay, the Army Corps of Engineers project called for dredging and maintaining a consistent 12-foot-deep, 200-foot-wide channel from Newark Bay to Little Ferry, a distance of 13 miles. North of this, a 150-foot channel would be dredged to 12 feet. The Army Corps of Engineers completed the dredging project on November 14, 1914, and reported favorably that larger boats were being used and were less dependent on tides (USACE 1918: 318).

The dredging project could not have come at a better time. War broke out in Europe in July 1914. Even though the United States proclaimed its neutrality, American industry still provided the Allies with needed goods to aid the war effort. American entry into the hostilities in 1917 stimulated the need for more wartime production. Industries seeking to capitalize on supplying American troops with the necessary material sought new building sites and looked to the undeveloped meadows along the Hackensack River.

In the early twentieth century, the land south of the railroads at Kearny Point between the Hackensack and Passaic rivers was quickly being filled, drained, and stabilized to pave the way for new industries. Referred to as "Newark Meadows" in a contemporary news article, Kearny Point was seen as especially advantageous, as "from any part of this property manufactured products may be loaded for direct carriage by steam or rail to any part of the world" (Evening Star 1910). The Newark Meadows Improvement Company began the filling and drainage project in 1906 and thereafter courted industrial and manufacturing companies to establish themselves on the land. Just prior to the country's entry into World War I, the U.S. Department of Commerce's Census of Manufactures illustrates the diversity and multiplicity of industries which had sprung up in and around Kearny Point in the first decades of the twentieth century (U.S. Department of Commerce [DOC] 1914: 908-909). As a national publication, the Census of Manufacturers only provided thumbnail sketches of most cities in the nation, but nonetheless provides a snapshot of the types of production underway along the Hackensack and nearby. The key industries in Kearny were oilcloth and linoleum production, chemicals, slaughtering, and meat packing. Harrison's main industries were foundry and machine shop products and electrical machinery, apparatus, and supplies. Hackensack's factories produced silk goods and wallpaper (DOC 1914: 908-909). These entries provide an overview of the types of products manufactured on the properties bordering the Lower Hackensack River and hint at the shift toward heavy industry that would come with wartime production.

World War I

Effects of the First World War were felt in northeastern New Jersey as early as 1914, three years prior to the entry of the United States on the side of the European Allies. At that time, Germany was the primary producer of chemicals in the world, including textile dyes and chemicals used to make TNT

(benzene and toluene). Once England had blockaded German ports, the supply of these chemicals to the United States ended. American firms began to investigate ways to expand chemical production in the United States. The City of Newark recognized the potential and preemptively began to prepare its waterfront along Newark Bay in 1915. It reclaimed hundreds of acres of meadowland to establish docks, slips, warehouses, and bulkheads (Modica 2016:14).

Newark quickly developed into a chemical processing center. One of the initial facilities was the Martin Dennis Company of Newark, which constructed a large chemical plant to produce potassium dichromate and sodium bichromate, which were used as a tanning agent for the production of military boots. The White Tar Company built a plant on the property south of the Martin Dennis Company where it refined crude naphthalene, which was used in moth repellants, disinfectants, and deodorizers and was also used to prevent the lice-borne "trench fever." The Texas Oil Company established an oil refinery on Newark Bay (Modica 2016: 14).

A major new plant was built in 1916 in Newark to produce coke, a dense fuel produced by burning coal in a process called "coking" which was used in domestic settings as a smokeless fuel and in industrial concerns. The H. Koppers Company, based in Chicago, used technology and processes invented by Heinrich Kopper (1872-1941). Kopper had returned to Germany for a brief visit in 1914, but the outbreak of hostilities extended his stay there. His holdings in the United States were seized and auctioned in November 1914. His company continued to operate, and in 1916, it built the Seaboard By-Product Coke Company plant in Kearny along the DL&WRR line. As coke was a by-product of burning coal, larger coal barges were introduced to supply the plant. Coke could be sold for multiple industrial uses including the production of ammonia, benzol, and toluol which were components of TNT. The company laid a pipeline below the Hackensack River that provided coke gas to the Marion gas works that distributed it for residential heating (Modica 2016:16).

Although the nation was only briefly involved in World War I, the "Great War" played a seminal role in the history of railroads both in Kearny and New Jersey as a whole. Because the nation was not prepared for war when the United States declared war on Germany on April 6, 1917, the larger planning, necessary to maintain the flow of goods, had not been undertaken. Increased British and French demand for American goods before the United States entered the war had resulted in massive confusion along the Hudson River waterfront. Jersey City warehouses were full of goods awaiting transshipment to ships headed to Europe. Increased demand with American entry into the war meant that rail cars arrived at the Hudson waterfront faster than they could be unloaded, leaving rolling stock standing as storage containers in the rail yards. The reduced rolling stock meant that the railroads did not have sufficient cars to deliver the usual loads of coal for homes and industry. As the situation neared a crisis at the end of 1917, railroad executives gathered in Washington, D.C., to meet with the Department of War. The executives looked to the War Department for recommendations to resolve the log jam of cars in various northeastern cities, particularly Jersey City (*Asbury Park Evening Press*, 24 November 1917:4). Initial efforts by the railroads did not resolve the problem quickly enough, and President Woodrow Wilson nationalized the railroads on December 26, 1917. He appointed Secretary of the Treasury (and his son-in-law), William G. McAdoo, to serve as Director General of the new United States Railroad Administration. McAdoo and his staff reviewed train and trolley lines and consolidated routes to eliminate competing lines of service to streamline rail service. The consolidation was initially confusing for commuters but soon began to bring order to the overall rail system. New rolling stock was ordered, and by the time the Railway Administration Act passed in the spring of 1918 to affirm Wilson's actions, the railroad emergency had been resolved (Doherty 1986: 68).

Another impact of World War I was the 1917 construction of the Federal Shipbuilding Company facility in eastern Kearny, which was the largest business to operate in the meadowlands (Olsen 2008: 155). The company, a subsidiary of U.S. Steel, developed a 160-acre property between the Newark Plank Road Bridge and the Central Railroad's Bridge. The company won a contract to build 30 steel freighters for the Emergency Fleet Corporation, which was responsible for enhancing the merchant marine. Federal completed its first ship in October 1918, a 9,600-ton steel vessel. Two other vessels

were launched before the end of 1918 and the remaining 27 ships in 1919, representing five percent of new merchant tonnage that year (Smith 1920:274-279). During the 1920s, the company specialized in installing diesel engines to replace old steam-powered engines (Olsen 2008: 155). The shipyard remained in operation, thereafter building additional merchant shipping, cruisers, troop transports, and destroyers for the U.S. Navy, in addition to repairing damaged ships. During 1943, the company was completing a vessel every week (Olsen 2008: 156). The U.S. Navy purchased the shipyard in 1948 and used it as a yard for scrapping obsolete ships, including aircraft carriers, battleships, cruisers, and submarines, until 1964 (Cichowski 1975:13; Olsen 2008: 160).

Throughout the remainder of World War I, the railroads and the Hackensack River were heavily used. Railroads brought carloads of coal, ore, and steel to the Newark/Jersey City region. Military training camps also sent waves of railroad cars full of soldiers to ports of departure along the Atlantic coast for shipping to Europe, and the New York Harbor was one of the most important. Shipping on the Hackensack River also increased, from 795,563 tons of goods in 1915 to 1,417,262 tons in 1917 and then to 1,841,548 tons in 1918. The value of these shipped goods also increased, from $3.7 million in 1916 to $10.9 million in 1919. Approximately half of the shipped tonnage was coal, with the two largest sources of demand being the Seaboard By-Product Coke Company and Marion Gas Works. Seaboard's coke was the second-most important shipped commodity, representing one-tenth of all goods shipped (190,535 tons valued at $1.3 million) (Modica 2016:12, citing USACE 1922:20).

Transportation Improvements 1919-1928

After the end of World War I, the return of vast numbers of soldiers, the completion of multiple military contracts, and the overabundance of products contributed to an economic depression with high unemployment. The Seaboard By-Product Coke Company reduced its output of coke, resulting in a drastic reduction of demand for coal; the total tonnage of coal shipped on the Hackensack River was halved between 1919 and 1920 (Modica 2016: 17). Despite this temporary economic slump, the primary commodity shipped to Kearny was coal, which was converted into the largest commodity shipped out, which was coke. Sale of coke produced a stable income throughout the decade following World War I for the Koppers Company, which expanded its operations across the nation and into related industries (Modica 2016: 15).

Economic prosperity returned in 1921 and continued mostly uninterrupted until 1929. Tonnage shipped on the Hackensack River resumed pre-war totals of 1.5 million tons a year (Modica 2016: 17; citing USACE 1922:46). More than half of that tonnage was coal sent to the Seaboard By-Product Coke Company. Seaboard required 3,000 tons of a specific type of coal (bituminous coal) every day, and the coal needed to be drawn from a uniform quality in order to produce an even supply of gas. The design of the furnaces required them to remain at an even temperature in order to prevent damage (Modica 2016: 17; citing USACE 1926: 18). To maintain an even supply of coal, Seaboard depended on barges and rail. Railroads sometimes assessed higher rates for delivery, which Seaboard constantly opposed, and Seaboard occasionally filed lawsuits against the railroads. Seaboard preferred coal from Virginia, Kentucky, and West Virginia, partially due to the slightly different properties of coal from that region and partially because coal barges charged a more consistent amount for shipping. Seaboard coordinated with the coal companies to deliver coal efficiently, such as only loading 1,450 tons of coal in an individual barge and enforcing the 16-foot draft for barges, which represented the parameters of the Hackensack River. Seaboard also began to use ocean-going steamers for additional coal delivery, as steamers were faster than barges but charged higher tonnage rates. Seaboard constructed an 800-foot wharf on the Hackensack just north of the DL&WRR bridge to dock coal barges and steamers (Modica 2016: 18; citing USACE 1926: 19). The availability of coal was also critical to the success of the Harrison Gas Works and the Kearny Station, both opened in 1926 to produce gas for residential use (Olsen 2008: 142).

A disastrous maritime accident in 1922 played a major role in the history of Hackensack River bridges. Just after eight o'clock on the morning of June 22, 1922, a collier named the *Glendaruel* from Norfolk, Virginia, was proceeding north up the Hackensack to deliver half a ton of coal to Seaboard. The ship was reported at the time to have been the largest vessel to pass below the Hackensack River bridges

and had made the passage safely on one earlier occasion. On this particular day, however, the ship was drawing 19 feet of draft, which was the maximum limit under ideal circumstances, but the tide was low that morning. A tug guided the *Glendaruel* through an opening of the Central Railroad's Newark & New York Railroad Bridge and then reached the Lincoln Highway Bridge (built 1906). The swing span of the Lincoln Highway Bridge opened without issue, providing the ship 78 feet of horizontal clearance. However, the crew noticed that the ship was headed off course as it approached the bridge. A last-minute attempt to slow the ship failed, and it hit a fender protecting the swing span. The ship then hit the draw span of the Lincoln Highway Bridge, knocking it off the pivot pier and into the Hackensack River. The 200-foot-long swing span, which weighed 900 tons, buckled and crashed onto the broken fender that had been hit by the ship. The *Glendaruel* continued through the bridge opening and proceeded nearly 1,000 feet before running aground (*Hackensack Record*, 22 June 1922:1; Modica 2016:18).

The accident had short-term and long-term consequences. The state highway department had opened discussions to assume responsibility for the Lincoln Highway Bridge prior to the accident, taking it out of the hands of Hudson County. The state highway department re-routed traffic north to the Newark Turnpike Bridge and then constructed a temporary bridge with a trolley line for the Lincoln Highway. Congress almost immediately allocated funds for dredging the Hackensack River (through the Rivers and Harbors Act of 1922) from a point at the Central Railroad Newark & New York Railroad Bridge north to 1.6 miles past the Lincoln Highway Bridge. The goal of the congressional appropriation was to deepen the riverbed from 20 feet to 30 feet. Insurance companies realized the complications of navigating the Hackensack, particularly when Hudson County sued the owners of the *Glendaruel* and refused to insure self-propelled ships along the Hackensack until navigation conditions improved (Modica 2016:19).

Nearly two million tons of goods moved along the Hackensack River in 1923, the most since 1919. The total value of those commodities—$15.5 million—set a record (USACE 1926: 10). In 1924, total commerce on the Hackensack River eclipsed 2.3 million tons, and the value of shipped goods rose to $26.4 million, a 70-percent increase. As in previous years, most of that commerce began and ended at the Seaboard By-Product Coke Company. Across the river from Seaboard, the Public Service Marion electric generating facility imported 115,000 tons of coal, which it received by barge from South Amboy. Combined, Seaboard and Public Service imported all the coal transported on the river. Other river-borne products included sand, gravel and crushed stone, chemicals and fertilizer, petroleum products, and lumber (USACE 1926: 2, 11 and 18).

In 1923, while the new Lincoln Highway Bridge was being designed, the New Jersey State Highway Commission investigated the efficiency of the state's various bridges along the Lincoln Highway. The route of the Lincoln Highway had been planned to provide an improved and efficient roadway for motorists from California to New York City. The commission calculated the value of time drivers spent waiting at the route's various swing bridges and drawbridges in the state. The greatest loss in value took place at the Passaic River, where the bridge was opened 6,717 times in the previous 12 months, forcing drivers to invest 21,486 hours waiting to cross the bridge. Hackensack River bridges represented less loss of time; the swing bridge there opened 3,579 times, resulting in an investment of 7,160 hours by automobile drivers. The most openings of any month occurred in April 1923 when the Hackensack River bridges were opened 385 times for vessels to pass through. The study noted that 78 percent of openings were the result of a need to allow a ship requiring up to 40 feet clearance. Altogether, nearly 17,000 drivers passed over these two bridges in the previous year while driving through the area along the Lincoln Highway (Monmouth Inquirer, 6 December 1923:2). For years, the railroad companies operating in northern New Jersey urged the War Department to allow the bridges to remain closed during rush hours. Ship and barge operators opposed these proposed closures, pointing out that rush hour closings were impractical, since only during high tide, which varied from day to day, could they navigate the upper reaches of the Passaic and Hackensack rivers (NYT 1926a).

In 1924, new hearings regarding Hackensack River bridges resulted in a directive to upgrade all bridges over the river. The Army Corps of Engineers held hearings in the summer of 1924 as it investigated whether the bridges needed to be cited as obstructions to navigation. One of the early

public comments was given by a representative from Seaboard who described the Hackensack River bridges as too narrow and obsolete (Modica 2016:20). Other speakers, including one from the New Jersey Chamber of Commerce, decried the low clearance of the bridges. A representative from Federal Shipbuilding said he would support any plan that would make it possible for higher clearances, pointing out that then his company could produce larger ships (Modica 2016:20). The DL&WRR announced that it planned to rebuild its Hackensack River Bridge in August 1924 to accommodate larger locomotives. The rush hour openings were especially onerous and a great source of ire among its passengers (Newark Evening News 1924). During the previous year, the railroad's trains had been stopped nearly 3,000 times for bridge openings, and the DL&WRR intended to elevate and improve the bridge. The Pennsylvania Railroad followed course soon thereafter. On October 30, 1924, John W. Weeks, the Secretary of War, ordered the DL&WRR to replace its bridge within three years with a minimum clearance of 35 feet and a 150-foot-wide channel. The following spring, Weeks directed the Pennsylvania Railroad to similarly improve its Hackensack River bridges (Modica 2016: 20).

In 1926, a committee comprised of railroad executives, commuters and local municipalities filed a petition with the War Department urging for the closing of the drawbridges over the Hackensack River, Passaic River, and Newark Bay during morning and afternoon rush hours. The committee included six railroads, the North Jersey Transit Commission, the State Highway Commission, and the Hudson County Board of Chosen Freeholders. The purpose was to allow for the unobstructed passage of some 350,000 railroad and vehicular commuters. If the measure passed, ships would have to wait up to 12 hours for the next high tide (NYT 1926b; NYT 1926c). The City of Newark, firmly supportive of the proposal in an effort to develop a port for deep-sea ships, claimed that the measure would save thousands of dollars a year in freight charges and lower the price of foodstuffs. Not only did the committee want to alleviate the "daily chaos" in commuter train service but also future traffic problems posed by the opening of the Holland Tunnel (NYT 1926a).

The War Department decided against the committee's proposal. Instead, they ordered that the bridges over the Hackensack and Passaic rivers have a minimum 35-foot vertical clearance over mean high water. Since the first River and Harbor Act was enacted in 1852, the War Department had assumed jurisdiction over the nation's navigable waterways and had, at various times, dredged the rivers, bays, and channels around the Port of New York to allow for the safe and free passage of vessels. The Hackensack River was included in a federal navigation project in 1912, as noted above, and was subsequently modified between 1922 and 1927. The Rivers and Harbors Act of 1927 called for dredging a channel in the Hackensack River 30 feet deep and 400 feet wide from the upper end of Newark Bay to the Central Railroad of New Jersey Bridge (U.S. Board of Engineers for Rivers and Harbors 1955: 60).

A "larger, higher, and stronger" bridge was built in 1927 to carry the Lincoln Highway over the Hackensack River. The bridge was designed to minimize openings by elevating the deck to allow most ships to pass without opening the bridge but still be able to open for larger shipping. Its bridge over the Hackensack River was planned for a location near the former Morris Canal, along the alignment of the Newark Plank Road. The total cost of the bridge was slightly over a million dollars and was a double-leaf bascule bridge that featured two lifting leaves. The 1927 bridge was designed by the Strauss Bascule Bridge Company of Chicago, fabricated by the American Bridge Company, and built by contractors Stillman-Delehanty-Ferris Company of Jersey City. Near the end of 1928, however, the east leaf separated and fell into the Hackensack. A later study determined that frequent openings of the bridge contributed to metal fatigue and thus failure after being in use less than two years (Engineering News-Record 1928:180-182).

While improvements to river, roadway, and railroad transportation were being made in the late 1920s, several important industries were established on Kearny Point. One important concern was the Edison Battery Company, which built its complex in eastern Kearny on the east side of the Belleville Turnpike. The renowned inventor Thomas A. Edison investigated ways of producing efficient batteries throughout the early decades of the twentieth century (McDonald 2007). Edison introduced a lightweight alkaline car battery that was used for electric cars and trucks. His "Type A"

battery used potassium hydrate, lithium electrolyte, and a nickel and iron electrode and was placed on the market in 1910. He established several battery-related companies, including the Edison Storage Battery Company, which opened a plant in West Orange, New Jersey, in 1910. In 1916, the company purchased the land in eastern Kearny, extending from the Belleville Turnpike to the Hackensack River. The property remained vacant until 1927 when a factory complex was constructed. The buildings were designed with Art Deco style touches that lent a degree of modernity, including a laboratory, a battery manufacturing building, a service and maintenance building, and a boiler house. The largest building was the battery manufacturing building, where batteries were manufactured, packed, and shipped. The Edison Storage Battery Company was merged into the overall company operating as Thomas A. Edison, Inc., in 1932. The Koppers Gas & Coke Company purchased the property in the mid-twentieth century and operated its Tar Products Division there. The Tantanex Chemical Corp. operated out of the buildings from 1959 to 1962, producing dye carriers. The Standard Chlorine and Standard Naphthalene companies then operated out of the Edison buildings until vacating the property in 1993, leaving the buildings vacant (McDonald 2007).

The Vertical Lift Bridges over the Hackensack River

The earlier swing bridges over the Hackensack River were replaced by vertical lift bridges that were constructed in 1928-1930. The new bridges are shown in the 1934 G.M. Hopkins, *Atlas of Hudson County, New Jersey* (Figure 11).

The earliest known vertical lift bridge was constructed in 1872 to carry roads over canals in New York State (none of these early vertical lift bridges survived) (Hool and Kinne 1943: 158). The bridge type remained rather rare in the nation for the following two decades. In 1892, John A.L. Waddell designed the South Halstead Street Bridge in Chicago, which is considered to have been the first vertical lift bridge "of any size and importance" in the United States (Hool and Kinne 1943:158). The bridge featured towers and sheaves that elevated a 130-foot span to an open height of 155 feet (Richard Grubb and Associates, Inc. 2002). Waddell's vertical lift bridge included several improvements over the vertical lift bridges of the 1870s, and he received a patent in 1895 for his design of the "Waddell-type" bridge. The design was complicated and expensive, and the lower cost of bascule bridges meant that the Waddell-type lift bridges were not built again for ten years. Waddell entered into partnership with John L. Harrington in 1907. Harrington was a civil and mechanical engineer who worked with Waddell to improve the design of his vertical lift bridge and make it a more competitive design. Waddell and Harrington parted ways, after which, each entered into other partnerships. Between 1917 and 1919, Waddell partnered with N. Everett Waddell as Waddell & Son, and in 1920, he moved from Kansas City to New York, practicing independently until 1927 when he formed a partnership with Shortridge Hardesty as Waddell & Hardesty (1927-1945). In addition to consulting on the Pennsylvania Railroad passenger and freight bridges over the Hackensack River, Waddell & Hardesty designed the Newark Bay Bridge between Elizabethport and Bayonne for the Central Railroad of New Jersey (demolished in 1980), which featured two pairs of parallel double-track vertical lift spans (Plowden 1974: 188). During Waddell's 50-year career, he designed the Goethals Bridge and Outerbridge Crossing over the Arthur Kill in addition to bridges in Canada, Mexico, Europe, and New Zealand (Petroski 1995; NYT 1938). Harrington became a principal in the firm Ash, Howard, Needle and Tammen in 1928 (Richard Grubb and Associates, Inc. 2002). Waddell and Harrington both assisted with the design of the four Hackensack River bridges built in 1928 to 1930.

By the late 1920s, the refinement of the vertical lift bridge design into an economical type to build and operate had made it the preferred bridge to span long crossings. This was especially true along the Hackensack River, an integral waterway within the burgeoning Port of New York. Twenty-three bridges, mostly of the swing-span type built in the previous century, crossed the Hackensack and Passaic rivers, carrying the state's far-reaching railroad network to a vast terminal complex along the Hudson River. But the complex goods-handling system in New Jersey, operated by many private, independently owned railroad companies, precluded the development of a unified shipping network.

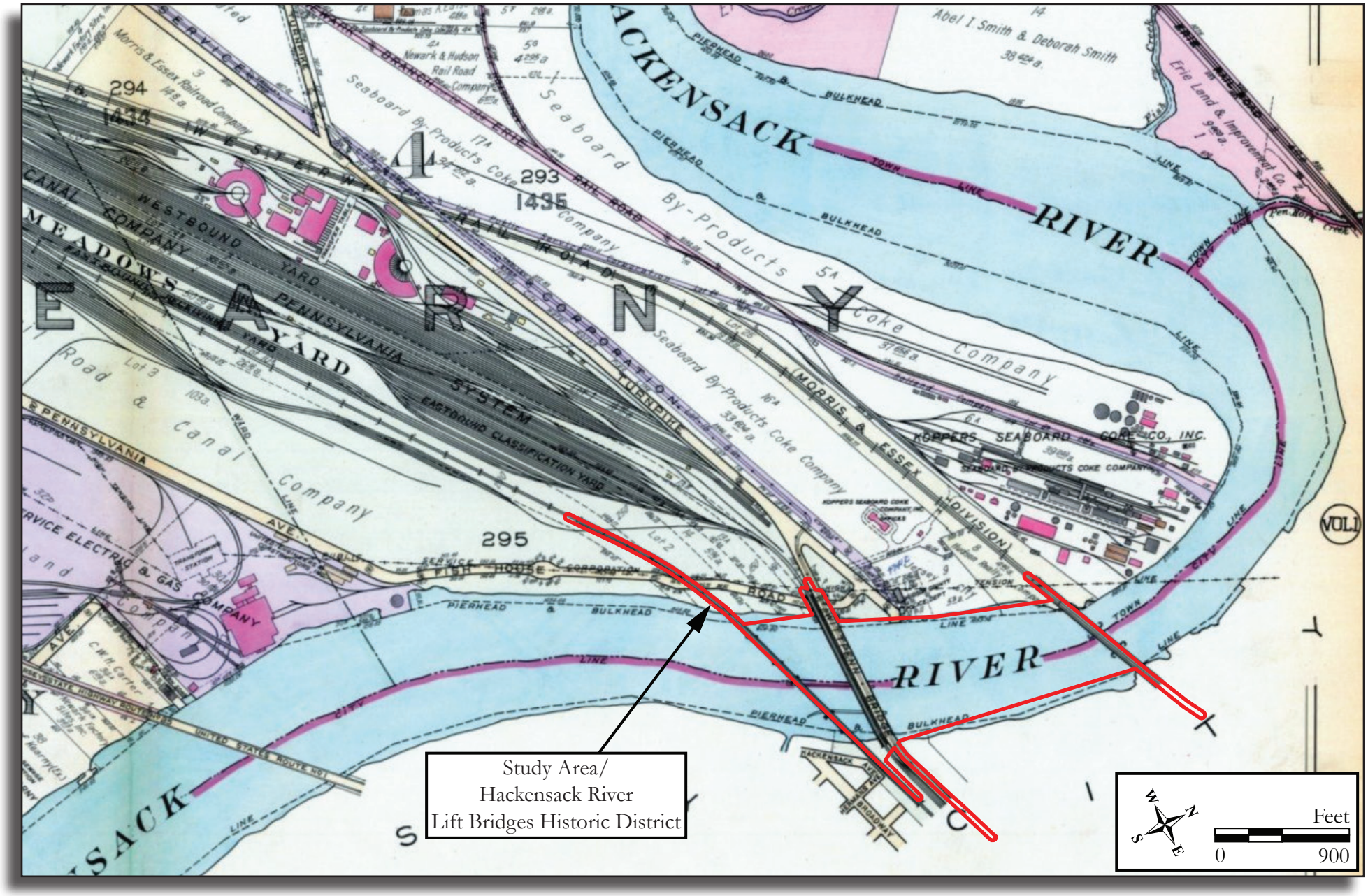

Figure 11: 1934 G.M. Hopkins, *Atlas of Hudson County, New Jersey.*
This was one of the first maps showing the new bridges over the Hackensack built in the 1920s.

The first of the four bridges built in the Hackensack River Lift Bridges Historic District was the DL&WRR Bridge, today also known as the Lower Hack Draw Bridge, completed in 1928. In 1930, the State of New Jersey constructed the Wittpenn Bridge, a vertical lift bridge designed to carry vehicular traffic over the Hackensack River. The 1930 Wittpenn Bridge was constructed concurrently with the vertical lift bridge that the Pennsylvania Railroad constructed for its freight rail line, the Harsimus Branch Bridge. The two bridges share long concrete piers on their western ends. Also completed in 1930 was the Pennsylvania Railroad's PATH Bridge which served the Pennsylvania Railroad's passenger rail line. The 1930 Wittpenn Bridge, the Harsimus Branch Bridge, and the PATH Bridge were together known as the "Triple Hack Bridges."

The firm Ash, Howard, Needles and Tammen was responsible for the design of the lift span on the 1930 Wittpenn Bridge. Several of the principal members of the firm began their careers under the tutelage of Waddell. In the case of the Triple Hack Bridges, the firm Waddell and Hardesty served as consulting engineers.

During bridge construction along this section of the Hackensack River, the ship channel was shifted from the west to the east side of the river, widened, and dredged to a navigable depth. While piers were dug for the new bridges, fill taken from the bottom of the river to deepen and widen the channel was added to Jersey City's western shore, thereby adding several hundred acres of shoreline. Unusually deep piers were required for all the bridges. Pneumatic caissons (essentially, bottomless steel boxes that are pressurized to keep water from rising) to set the piers were sunk between 110-122 feet below mean high water through 60 feet of soft muck and rock. The river was closed to navigation from November 2 to November 6, 1930, and during this period, the spans over the old navigation channel were closed and the old bridges were removed (Engineering News-Record 1930; Railway Age 1931).

The 1930 Wittpenn Bridge (NJ Route 7 Bridge) over the Hackensack River was a vertical lift bridge with several approach spans, carrying the Newark Turnpike (subsequently NJ Route 10 and NJ Route 7) over the Hackensack River. The 1930 Wittpenn Bridge replaced the existing 1911 swing-bridge just north of this location. The bridge shared its westernmost eight piers with the Pennsylvania Railroad Harsimus Brach (Conrail/CSX) Bridge over the Hackensack (Harsimus Branch Bridge). In concert with the concurrent replacement of two Pennsylvania Railroad bridges to the south of the 1930 Wittpenn Bridge, the series of three vertical lift bridges provided a new means of safe navigation for large vessels on the Hackensack River. The bridge was named in honor of H. Otto Wittpenn, who was mayor of Jersey City from 1908 to 1913 and served as a member of the State Highway Commission between 1929 and 1931. The 1930 Wittpenn Bridge was made of steel and was constructed on reinforced concrete piers. According to the New Jersey Historic Bridge Survey, the vertical lift span was a "skewed Parker truss," while the approach spans comprise "two camelback (Pratt) thru trusses, one modified thru Pratt truss span acting as a continuous span with its neighbors, a fixed tower truss span of modified Pratt form whose top chords rises from portal to tower face, a Pratt lift span with flat top chord, another fixed tower span and five deck girder spans forming the west approach" (A.G. Lichtenstein 1994). The 1930 Wittpenn Bridge was demolished in 2022.

The Pennsylvania Railroad Harsimus Branch (Conrail/CSX) Bridge over the Hackensack River (Harsimus Branch Bridge) is a vertical lift bridge which carries two tracks of freight rail traffic over the Hackensack River, between Kearny Town and Jersey City. This rail line once connected northern New Jersey with the former Pennsylvania Railroad's terminals on the east side of Jersey City via the Bergen Cut. The swing-bridge it replaced had been constructed between 1880 and 1887 by the Pennsylvania Railroad early in its campaign to improve freight movements into Jersey City. Completed in 1930, the lift bridge was constructed in coordination with the Pennsylvania Railroad's adjacent sister bridge carrying the passenger main line to Jersey City (today known as the Pennsylvania Railroad [PATH] Bridge over the Hackensack) and the 1930 Wittpenn Bridge. This bridge comprises the following spans: one through girder and four deck plate steel girder western approach spans, two Pratt truss tower spans, a Parker truss lift span, one deck plate steel girder, and a six-span concrete-encased steel viaduct at the eastern approach. The bridge is made of steel, measures 1,188 feet long and rests on reinforced concrete piers. While completed as part of the post-World War I directive to improve

clearance along the Hackensack, the bridge rests only 13 feet above mean high water due to the low elevation of the adjacent Pennsylvania Railroad's Meadows Yard (now part of the Kearny Intermodal Facility). Since its opening, the lift span has been controlled by a bridge operator stationed in the adjoining Pennsylvania Railroad passenger bridge to the south. Today, the Harsimus Branch Bridge continues to carry freight traffic and is now owned by Conrail Shared Assets Corporation, controlled jointly by Norfolk Southern Corporation and CSX.

The Pennsylvania Railroad (PATH) Bridge over the Hackensack River (PATH Bridge) is a vertical lift bridge that carries two tracks of passenger rail traffic over the Hackensack River between Kearny Town and Jersey City, New Jersey. The PATH Bridge is the sister bridge to the Pennsylvania Harsimus Branch (Conrail/CSX) Bridge over the Hackensack River. As with the Harsimus Branch Bridge, the PATH Bridge was also part of the building campaign associated with navigation clearance that came in the late 1920s and was one component of a wider network of transportation corridors intended to allow for the free flow of traffic on the region's roadways, railroads, and waterways. This bridge is 2,950 feet long including approaches and comprises a three-span concrete viaduct, a through girder span, five deck plate steel girder spans and a deck truss span at the western approach, two Pratt truss tower spans, a Parker truss lift span, and eight deck plate girders, one through girder, and a three-span concrete viaduct at the eastern approach. The lift span is 331 feet long with a 40-foot vertical clearance over mean high water in the closed position and 135 feet when opened. Horizontal clearance between the fenders is 158 feet.

2.3 Transportation and Industry 1930-1970

During the Great Depression, the Pennsylvania Railroad completed a massive electrification project. Some portions of its route had been electrified as early as 1903, but the process accelerated in the 1930s and was completed in 1938. The project benefited freight service as much as passenger service. It involved installing catenary poles, guy wires, and associated electric lines along the designated routes, including the rail lines running over the Harsimus Branch Bridge and the PATH Bridge. The electrification program also spurred the design and construction of new electric freight locomotives powerful enough to pull the heavy loads (Alexander 1947: 213-214). Electric freight service between New York, Philadelphia, Baltimore, and Washington was inaugurated on May 20, 1935, allowing freight to move faster and more efficiently, allowing railroad overnight and third-day delivery for the first time. In 1938, the Pennsylvania Railroad electrified the last of the principal lines, including portions of the Meadows Yard and Waverly Yard (PRR Annual Report 1937: 5). The Pennsylvania Railroad electrification project represented the largest capital improvement program undertaken by a railroad up until that date. This comprehensive and irreversible step towards electrification called for the transition of America's largest railroad to a new form of motive power and effectively heralded the end of America's "Age of Steam" (Bezilla 1980: 143-145).

With the help of the roadway and railroad lift bridges described above, industry in Kearny continued to thrive into the 1940s and 1950s. In 1940, the Kearny Chamber of Commerce produced a promotional map of the city, which featured six major industries on the East Kearny peninsula, with many acres of land still available for industrial development (Figure 12; Krasner 2000:56). The Koppers Seaboard Coke and Byproducts Company occupied the land north of the Pennsylvania Railroad's Meadows Yard, with its western parcel used for its Tar Products Division and the eastern parcel devoted to coke production and byproducts processing. A large industrial complex was located south of the railroad. Businesses such as Western Electric, Tomkins Terminal, Federal Shipbuilding, Coca-Cola, and the Public Service Co. took advantage of the Kearny Peninsula waterfront (Krasner 2000: 56).

During the 1950s, more than four million tons of goods were shipped along the Hackensack River annually. When Owens Corning built its Kearny plant in the meadows circa 1960, it represented the end of industrial expansion in eastern Kearny. Industrial instability began during the 1960s, resulting in the closure and consolidation of businesses, followed by recognition of the environmental toll that heavy industry had wrought on Kearny Point. The former White Tar complex was sold to the

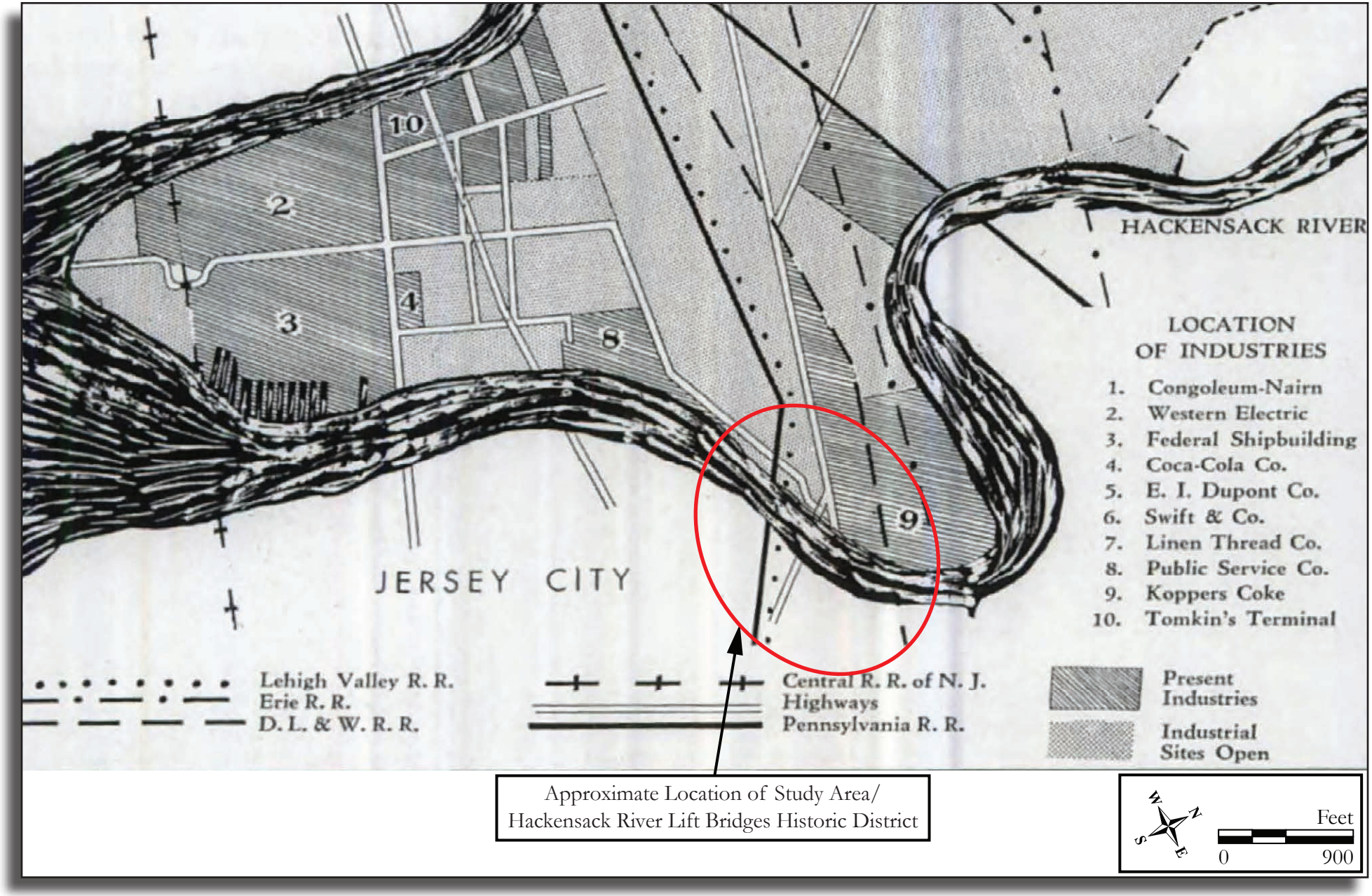

Figure 12: Detail of 1940 Kearny Chamber of Commerce Map of Industry in the City
(Reproduced in Krasner 2000: 56). Note: Pennsylvania Railroad Harsimus (Freight) Line labeled as "Lehigh Railroad."

Standard Chlorine Chemical Company in 1962; it ended the production of naphthalene and instead produced mothballs and drain cleaners (*Hackensack Record*, 5 July 1985: C-4). The U.S. Army Corps of Engineers estimated traffic along the Hackensack in 1970 to have been 5.6 million tons, including one million tons of coal; 800,000 tons of sand, gravel, and stone; 400,000 tons of gasoline and heating oil; and smaller amounts of newsprint, scrap metals, crude tar oil, and chemicals (Olsen 2008: 165). In the 1970s, the volume of shipping dipped below three million tons per year (Modica 2016: 33). The Federal Shipbuilding yards, then under the control of the U.S. Navy, were sold to River Terminal Development Company, a firm that initially scrapped warships using the gantry cranes with 92-foot booms, then shipping out the harvested steel using the existing rail system (Olsen 2008: 161). The Koppers Company shuttered the Seaboard By-Product Coke facility, and most buildings on the White Tar site were demolished in 1975 (Central New Jersey Home News, 19 March 1976:7). Then, in 1979, the former Martin Dennis complex was demolished. In 1983, the *New York Daily News* moved its printing operations to a building on the Federal Shipbuilding campus, the first in a series of leases of buildings that gradually shifted the River Terminal Development Company into the manager of an industrial park rather than a scrapper of warships (*Hackensack Record*, 3 February 1983: D-4). Contamination of the Standard Chlorine site was identified in 1985; by that time, the company only had 40 employees (*Hackensack Record*, 5 July 1985: C-4). Shipping fell below two million tons during the 1990s, and during that decade the former White Tar site was abandoned (Modica 2016: 33). Standard Chemical gradually scaled back operations, and ongoing setbacks caused it to abandon its buildings in 1993; the site was then added to the Superfund list in 2003 (Morristown Daily Record, 1 May 2003: A7).

The history of railroads in Kearny since World War II has been a similar story of declining demand. The Hudson & Manhattan Railroad, which then leased the Pennsylvania Railroad's passenger bridge, went into receivership in 1954 (Modica 2016: 38). The Pennsylvania Railroad continued commuter service over its bridge until 1961. The following year, the Port Authority of New York and New Jersey acquired the bridge and began to operate PATH service to Manhattan. Increasing use of container shipping reduced the need for freight lines, and in 1968, the two largest railroads in the nation—the Pennsylvania Railroad and the New York Central—merged to form the Penn Central Railroad (Modica 2016: 33). Merging their operations did not bring the new railroad company to prosperity, and it filed for bankruptcy in 1970—the largest bankruptcy in the nation up to that time. A new railroad emerged from the ashes of Penn Central, which was Conrail (1976); it assumed the Penn Central's freight operations and the use of the Harsimus Branch freight bridge. In 1998, Conrail was absorbed by the Norfolk Southern and CSX Corporation (Modica 2016: 33).

Other railroads suffered similar fates. The DL&WRR merged with the Erie Railroad in 1960, forming the Erie-Lackawanna Railroad. Like Penn Central, this new railroad merger failed, and it filed for bankruptcy in 1972. In 1983, New Jersey Transit began to run its Morristown Line over the Hackensack River Bridge (Modica 2016: 33).

3.0 EXTANT FEATURES

The lower portion of the Hackensack River has been a major transportation center for nearly three centuries. The layers of roads, railroads, and the Morris Canal created a network of manmade transportation routes aligned east-west across the Hackensack River, which flows south. These routes attracted heavy industrial concerns in the early twentieth century, some of which survive today. This section details the extant features of former river crossings, including the "extant swing bridge pier and related roadbed on the west bank of the Hackensack River" and "extant historic industrial properties in the vicinity of the Wittpenn Bridge" (FHWA and NJHPO 2019). Late nineteenth- and twentieth-century transportation-related resources in the Study Area are identified on Figure 13, and extant historic industrial properties near the Wittpenn Bridge are identified in Figure 14. In the following discussion, resources are discussed from north to south. Photo locations are detailed in Figures 15a and 15b.

3.1 Bridges

Multiple bridges historically carried roads and railroads over the Lower Hackensack River. Several historic bridges remain in use, and limited vestiges of other bridges survive. These transportation resources are mostly located within the Hackensack River Vertical Lift Bridges Historic District (SHPO Opinion: 5/3/2002). The district includes four vertical lift bridges built in the years 1928 to 1930 that are collectively eligible under Criteria A and C in the areas of Transportation and Engineering. The district represents largely unaltered, operable, and increasingly rare examples of historically and technologically significant bridge types. Its period of significance is 1928 to 1930. The following discussion reviews extant bridges or vestiges of earlier bridges.

The Hoboken and Newark Railroad's 1862 bridge formerly spanned the Hackensack River north of the Hackensack River Lift Bridge Historic District (see Figures 8 and 11). This bridge effectively extended the Delaware, Lackawanna& Western Railroad's Morris and Essex line eastward and allowed that railroad to access the Erie Railroad's Long Dock Tunnel. This 1862 bridge was under the control of the Erie Railroad's Newark Branch after 1877, was abandoned in 1910, and was removed circa 1911 (Taber 1977; USACE 1912). No vestiges of the railroad bridge are known to survive, based on an examination of aerial photographs (NETR 1987 to 2017).

The 1911 Newark Turnpike Bridge crossed the Hackensack north of the 1930 Wittpenn Bridge (see Figure 13, Notation 3a). The Newark Turnpike Road leading to this crossing on the west side of the river dates to the mid-eighteenth century, and it originally used a ferry to cross the Hackensack. The road was designated as the Newark Turnpike in the 1790s, and in 1795, the initial turnpike drawbridge was built. The drawbridge was eventually rebuilt in 1911 as a swing bridge. The 1911 bridge was built perpendicular to the river, and its distance north of the 1930 Wittpenn Bridge is wider on the west bank (300 feet) than it is on the east bank (50 feet). The bridge was mostly demolished circa 1930.

A portion of the 1911 Newark Turnpike Bridge, including part of the west abutment, a portion of the roadbed, and a section of parapet wall, survives on the west bank of the Hackensack River (Plates 1, 2 and 3). The bridge would have been originally 40 feet wide, but the remaining abutment is only 24 feet wide, its south side having been demolished. The remainder of the abutment is encapsulated on its south side by steel sheeting (see Plate 1), although its reinforced concrete composition is still evident on its east and north faces. The upper level of the abutment represents the roadbed level, which steps down 8.5 feet to a lower level that juts out into the river. Fixed iron safety ladders, project down from the roadbed to the lower level, and from the lower level to the river. The remaining 24-foot-wide roadbed is bordered on its north side by a paneled concrete parapet wall with concrete posts, approximately 80 feet in length. The parapet wall has a center-pitched, precast, reinforced concrete coping, and each

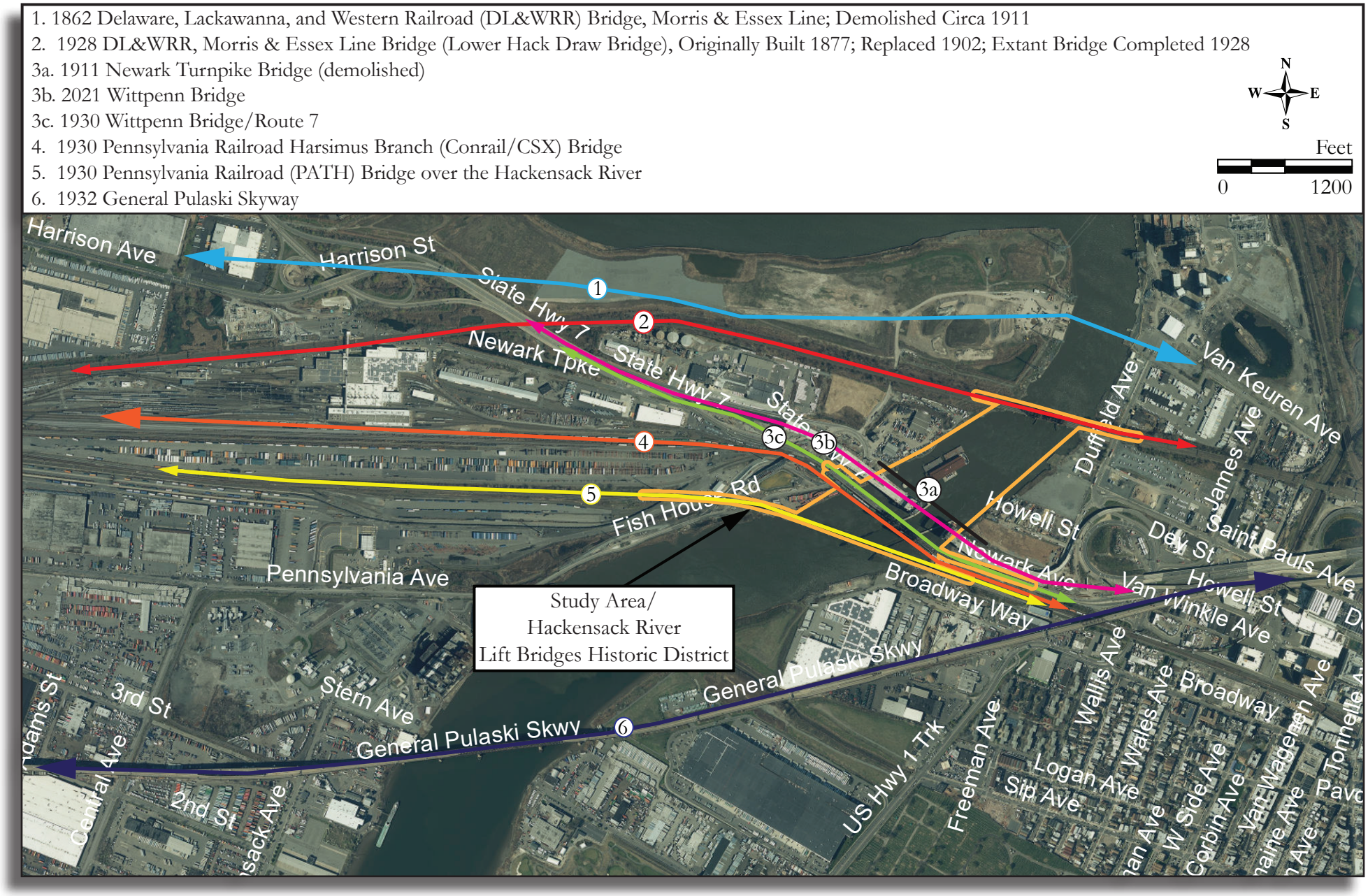

Figure 13: Railroads and Vehicular Bridges in the vicinity of the Study Area from the late nineteenth through the mid-twentieth century.

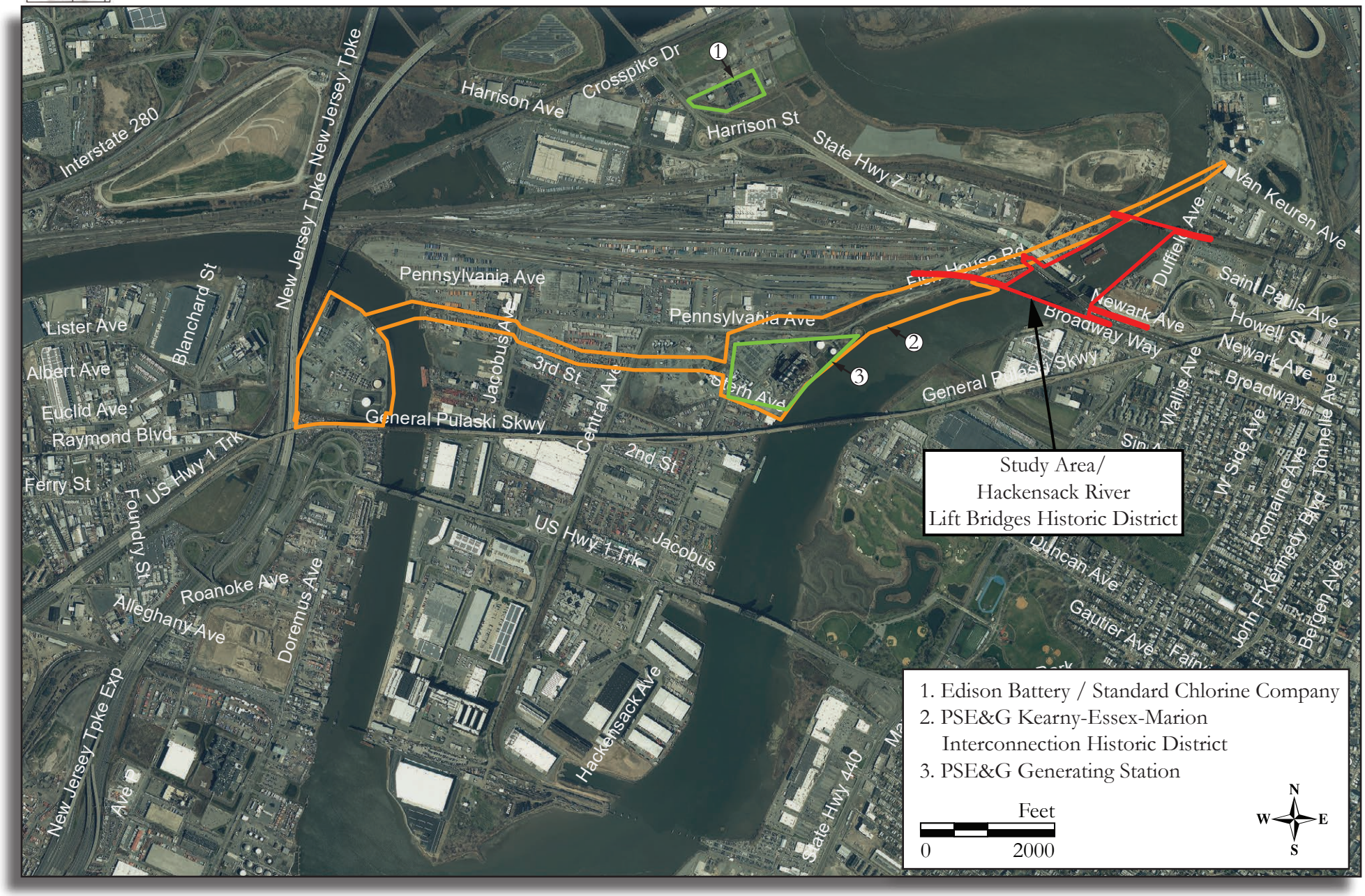

Figure 14: Extant Historic Industrial Properties in the vicinity of the Study Area/Hackensack River Lift Bridges Historic District (NJGIS Digital Orthographic Imagery, 2020).

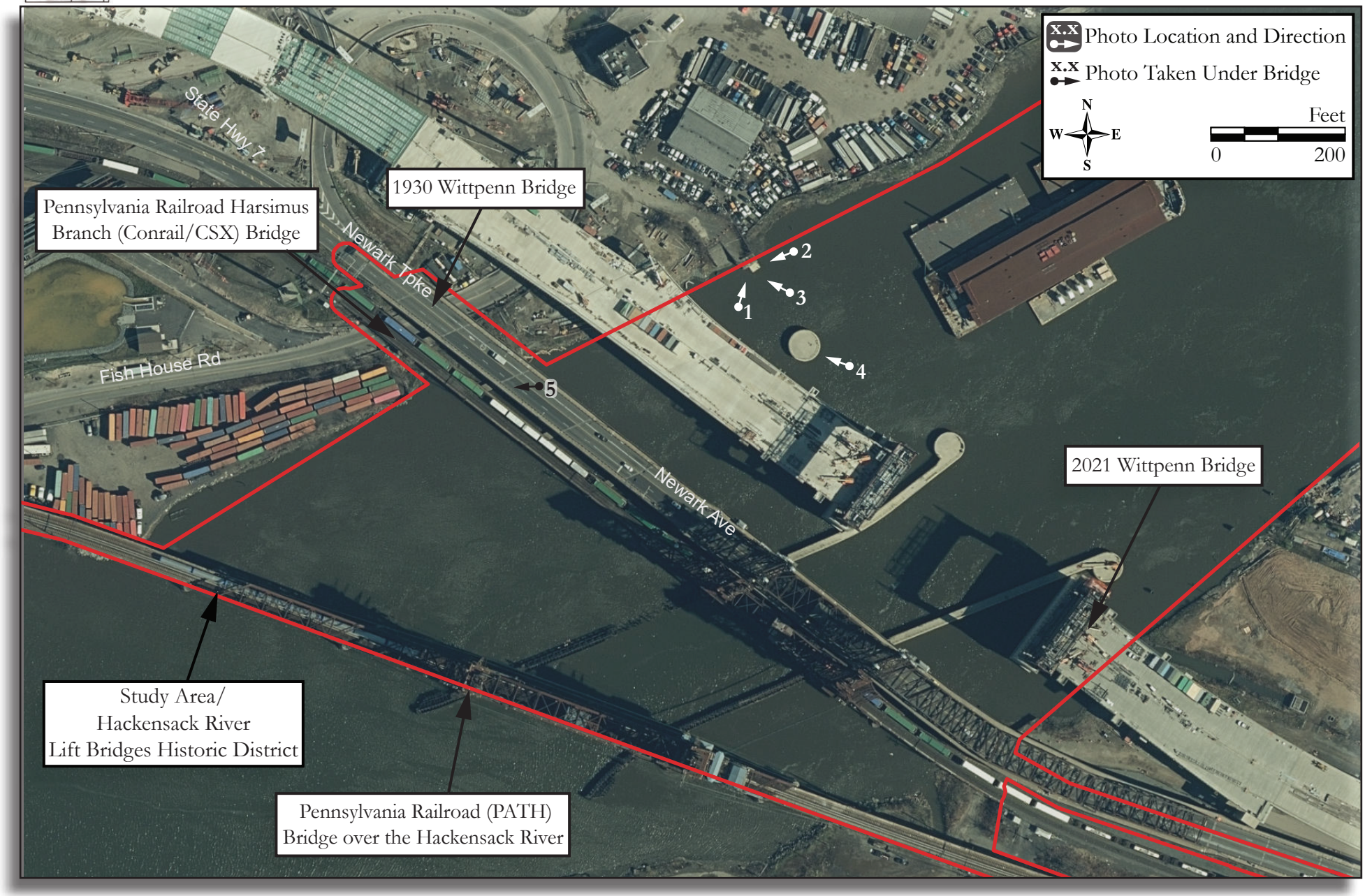

Figure 15a: Photo locations for Plates 1-5
(NJGIS Digital Orthographic Imagery, 2020)

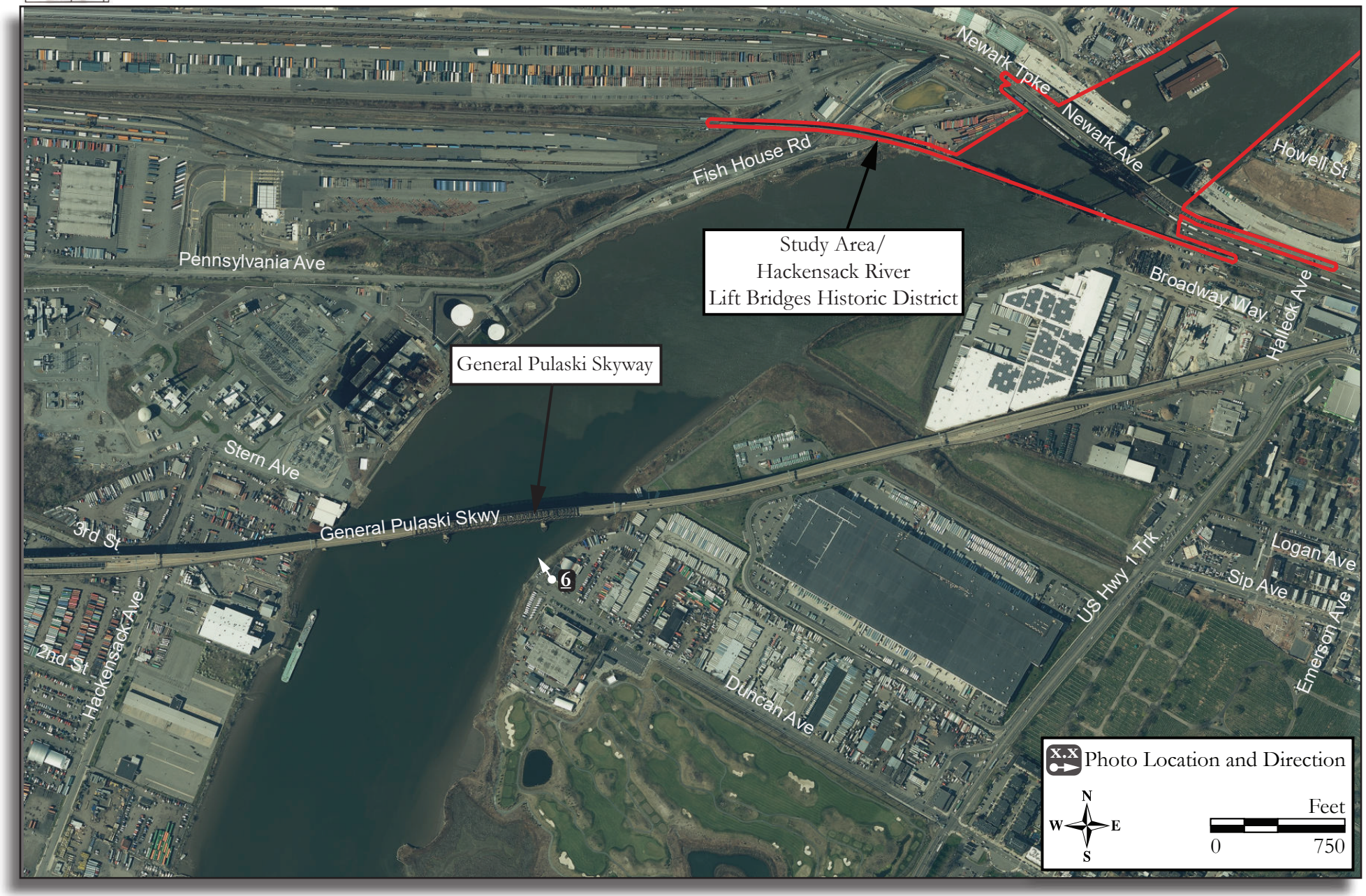

Figure 15b: Photo Location for Plate 6
(NJGIS Digital Orthographic Imagery, 2020).

Figure 16: The Lower Hack Draw Bridge over the Hackensack River, also known as the Delaware, Lackawanna and Western Railroad Bridge, in 1979, facing south
(Boucher 1979; Photograph NJ-42-1 from HAER NJ-42, Erie & Lackawanna Railroad Bridge [Delaware, Lackawanna & Western Railroad Bridge]; Courtesy of the Library of Congress).

Figure 17: 2022 Oblique aerial view of the 1928 Delaware, Lackawanna & Western Railroad (DL&WRR), Morris & Essex Line Bridge, also known as the Lower Hack Draw Bridge over the Hackensack River.
Note remnants of the 1902 iteration of the bridge (Google Images, 2022).

post cap is beveled. The parapet wall on the south side of the roadbed is missing and a section of parapet appears to have been placed across the roadbed. Modern safety features, including chain link fences, metal railings, and steel guard rails, have been installed on the lower level and roadbed level of the abutment. Immediately north of the abutment is a wood sill retaining wall of unknown origin.

The pivot pier of the 1911 Newark Turnpike Bridge is no longer extant in the Hackensack River. A concrete pylon with an energy absorption bumper system, part of the pier protection system for Pier 2W of the 2021 Wittpenn Bridge, has been constructed in the approximate location of the former pier (Plate 4). Although the MOA called for documentation of the extant pivot pier associated with the 1911 Turnpike Bridge, no elements of the pier are observable today.

The 2021 Wittpenn Bridge was built in the early twenty-first century between the locations of the 1911 and 1930 bridges on this road (see Figure 13, Notation 3b). Construction of the new bridge began in 2011, and it opened in 2021 although some project tasks are still being completed at the time of this report. It is a vertical lift bridge with an orthotropic deck, a new approach to bridge design in which a structural steel deck is lighter in weight and still is able to distribute the load of vehicles.

The 1930 Wittpenn Bridge formerly carried NJ Route 7 across the Hackensack (see Figure 13, Notation 3c and Figure 18). When it opened in 1930, it was built immediately adjacent to today's Conrail/CSX Bridge (i.e., the Pennsylvania Railroad Harsimus Branch Bridge). Both the 1930 and 2021 Wittpenn Bridge were designed as vertical lift bridges and named for Jersey City's former mayor H. Otto Wittpenn (Richard Grubb and Associates, Inc. 2002). It is eligible for listing in the NRHP (SHPO Opinion: 2/6/2001). In the riverbed below the bridge are remnants of two reinforced concrete columns or pipes of uncertain derivation but with an early or mid-twentieth-century appearance (Plate 5). As noted above, an early twentieth-century temporary bridge spanned the Hackensack River in this approximate location while the 1911 Newark Turnpike Bridge was being constructed (See Figure 9). Additionally, the Jersey City Water Works had a 33-foot right-of-way which spanned the Hackensack River just north of the 1911 bridge. It is unknown whether the concrete columns are associated with either the temporary bridge or the water works.

The Pennsylvania Railroad Harsimus Branch (Conrail/CSX) Bridge is the third freight bridge in this location (Figure 19). The Pennsylvania Railroad constructed the first bridge here for its Harsimus Branch circa 1885 and then re-built it in 1892-1894. The current bridge was constructed in 1930 and has a length of 1,188 feet. It is a vertical lift bridge that carries two freight tracks over the Hackensack. The bridge has a complicated design, with a Parker truss lift span flanked by Pratt truss towers and deck plate steel girders connecting to the approaches, plus one through-girder span to the west (Bulger 2019). The bridge is eligible for listing in the NRHP (SHPO Opinion: 5/2/2002). No remnants of the 1885 or 1894 Harsimus Branch bridges were identified

The Pennsylvania Railroad (PATH) Bridge over the Hackensack River (Port Authority Trans-Hudson) is the fourth bridge in this location (Figure 20). The New Jersey Railroad built the first bridge here in 1846, aligned with the Bergen Cut. After the Pennsylvania Railroad leased the line in 1870, it rebuilt the bridge here in the 1880s. That bridge was then replaced in 1905, before the current bridge was built in 1929-1930. The PATH bridge carries two tracks for passenger trains across the Hackensack. The bridge is a vertical lift bridge, 2,950 feet long (including the approaches) and consists of a three-span concrete viaduct, a through girder span, five deck plate steel girder spans, and a deck truss span at the western approach, a Parker truss lift span flanked by Pratt truss towers, and an eastern approach that includes eight deck plate girders, one through girder, and a three-span concrete viaduct (Richard Grubb and Associates, Inc. 2002). The current bridge is eligible for listing in the NRHP (SHPO Opinion: 5/2/2002) and is a contributing resource in the Pennsylvania Railroad New York to Philadelphia Historic District [Northeast Corridor] (SHPO Opinion: 1/13/2015).

Southerly of the Pennsylvania Railroad (PATH) Bridge over the Hackensack, the long-span portion of the General Pulaski Skyway spans the Hackensack River. The Pulaski Skyway is an elevated superhighway running east-west, carrying U.S. Routes 1 and 9 between Newark and Jersey City (see

Plate 1: West abutment for the 1911 Newark Turnpike Bridge, predecessor of the 1930 Wittpenn Bridge.

Photo view: Northwest

Photographer: Richard Adamczyk, via

Date: February 8, 2022

Plate 2: West abutment for the 1911 Newark Turnpike Bridge, predecessor of the 1930 Wittpenn Bridge.

Photo view: Southwest

Photographer: Richard Adamczyk

Date: February 8, 2022

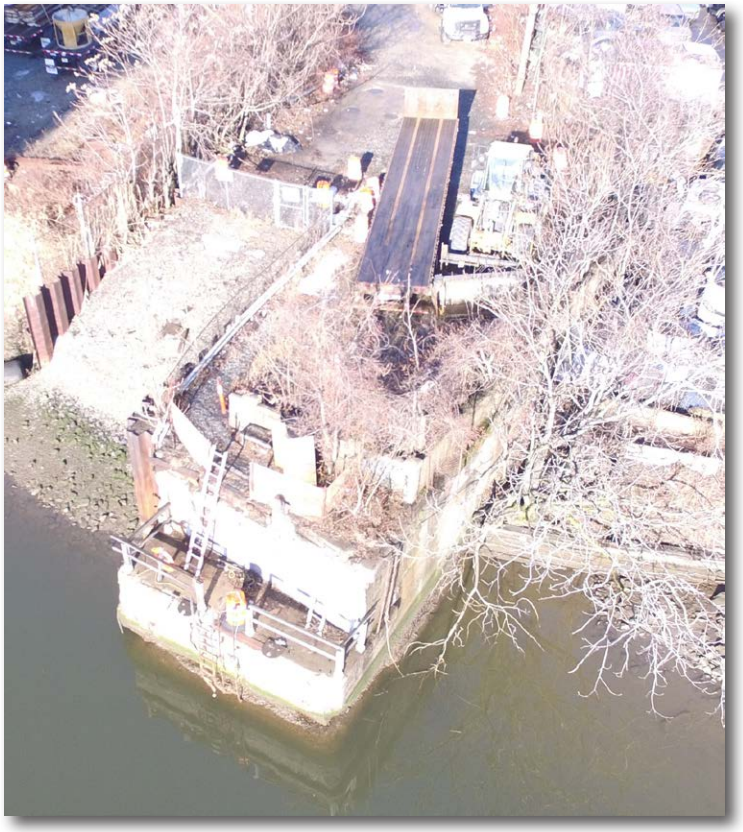

Plate 3: West abutment for the 1911 Newark Turnpike Bridge, predecessor of the 1930 Wittpenn Bridge.

Photo view: Oblique, southwest

Photographer: Richard Adamczyk

Date: February 8, 2022

Plate 4: Concrete and steel plate pylon, which is part of the Pier Protection System for the 2021 Wittpenn Bridge, in the approximate location as the pivot pier (once associated with the 1911 Newark Turnpike Bridge).

Photo view: Oblique, southwest.

Photographer: Richard Adamczyk

Date: February 8, 2022

Plate 5: Unidentified architectural concrete columns or piers located beneath the 1930 Wittpenn Bridge.

Photo view: Southwest

Photographer: Seth Hinshaw

Date: February 8, 2022

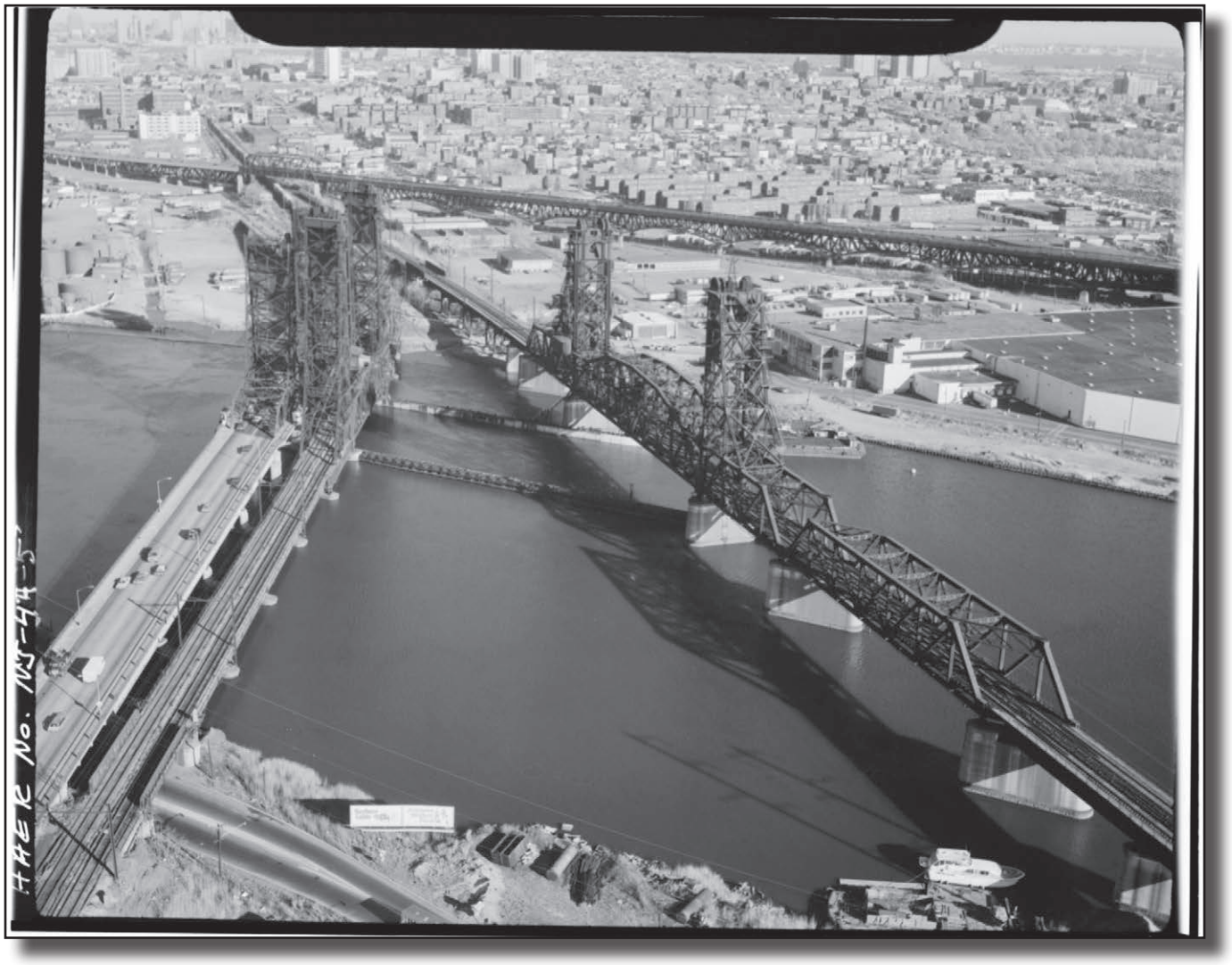

Figure 18: Bridges connecting Kearny and Jersey City, view southeast. The 1930 Wittpenn Bridge is on the left, with Pennsylvania Railroad Harsimus Branch Bridge immediately on its right.
To the far right is the Pennsylvania Railroad PATH Bridge. In the background is the Pulaski Skyway (Boucher 1978; Photograph NJ-44-5 from HAER NJ-44, PATH Transit System Bridge Looking Southeast; Courtesy of the Library of Congress).

Figure 19: Bridges connecting Kearny and Jersey City, view southeast. The 1930 Wittpenn Bridge is on the left, with Pennsylvania Railroad Harsimus Branch Bridge immediately on its right.
To the far right is the Pennsylvania Railroad PATH Bridge. In the background is the Pulaski Skyway (Boucher 1978; Photograph NJ-44-6 from HAER NJ-44, PATH Transit System Bridge Looking Southeast; Courtesy of the Library of Congress).

Figure 20: Bridges connecting Kearny and Jersey City, view northwest.
To the left is the Pennsylvania Railroad (PATH) Bridge over the Hackensack, also known as the PATH Bridge, in the center is the Pennsylvania Railroad Harsimus Branch Bridge, and the 1930 Wittpenn Bridge is on the far right
(Boucher 1978; Photograph NJ-43-1 from HAER NJ-43, Conrail Bridge from the South; Courtesy of the Library of Congress).

Figure 13, Notation 6). As the first high-speed, limited-access highway in the country, the 13.2-mile Route 1 Extension, completed between 1923 and 1932, was "America's First Superhighway." One important section, the Pulaski Skyway, represented a 3.5-mile-long section of the highway which rose up above the Jersey meadowlands and crossed the Passaic and Hackensack rivers via two continuous cantilever through-truss bridges (McCahon and Johnston 2005). The Pulaski Skyway was first completed in 1932, rehabilitated in the twenty-first century, and remains a major transportation route in northeastern New Jersey. The Pulaski Skyway was listed in the NRHP as the U.S. Route 1 Extension [Pulaski Skyway] on August 12, 2005, and listed in the New Jersey Register of Historic Places (NJR) on June 13, 2005. It is a contributing resource to the U.S. Routes 1 & 9 Historic District (SHPO Opinion: 3/7/1996).

3.2 Industry

The eastern part of Kearny has been a transportation and industrial center for over a century. The Pennsylvania Railroad's Meadows Yard occupies a large area along the railroad tracks that divides a small industrial area to the north from a much larger industrial zone to the south, once called the "Newark Meadows." Pennsylvania Avenue is the general division line between the rail yards to the north and the industrial zone to the south. A variety of important industries were located in the eastern part of Kearny in the early twentieth century through to the present, as has been detailed above. The following is a description of those properties in close proximity to the 1930 Wittpenn Bridge and have been recognized as eligible for the National Register [NR] by the NJHPO (See Figure 14).

North of the Meadows Yard rail yard, the Edison Battery Company Property/Standard Chlorine Chemical Company operated out of buildings on the northeast side of NJ Route 7 (SHPO Opinion 4/8/2008; See Figure 14, Notation 1). The White Tar Company also operated at this site in the early twentieth century, in these buildings and a building just north of the Edison Battery complex, though the two were merged when the Koppers Seaboard Coke and Byproducts Company purchased both in the 1940s and established their Tar Products Division (McDonald 2007). The Edison Battery Company Site is eligible for the NR under Criterion A for its association with Thomas A. Edison and the invention of the battery and Criterion C as an example of Art Deco architectural design as applied to an industrial setting (McDonald 2007).

The Public Service Electric and Gas Company (PSE&G) Kearny Generating Station is located on the western bank of the Hackensack River, south of Pennsylvania Avenue and immediately north of the Pulaski Skyway. When the building opened in 1925, it was the largest electric generating station in New Jersey (SHPO Opinion 5/3/2002). The largest of the extant buildings associated with this property is the powerhouse, which features Palladian windows on the southern façade and large arched windows on the east façade (Richard Grubb and Associates, Inc. 2002; Plate 6). The generating station is eligible for the NR under Criteria A and C for its association with the technological innovations of PSE&G and architecture (Guzzo 2002). Originally using coal to produce electricity, it currently uses natural gas. It is a contributing resource in the PSE&G Kearny-Essex-Marion Interconnection Historic District (SHPO Opinion: 12/30/2013). The historic district is eligible under Criterion A in the areas of Engineering, Industry, and Commerce and under Criterion C as a significant and distinguishable entity. The Interconnection represents the utility's first successful application of high-tension wires at 132,000 volts over steel lattice towers, connecting three generating stations to supply electricity to Newark and Jersey City (Hayden 2013).

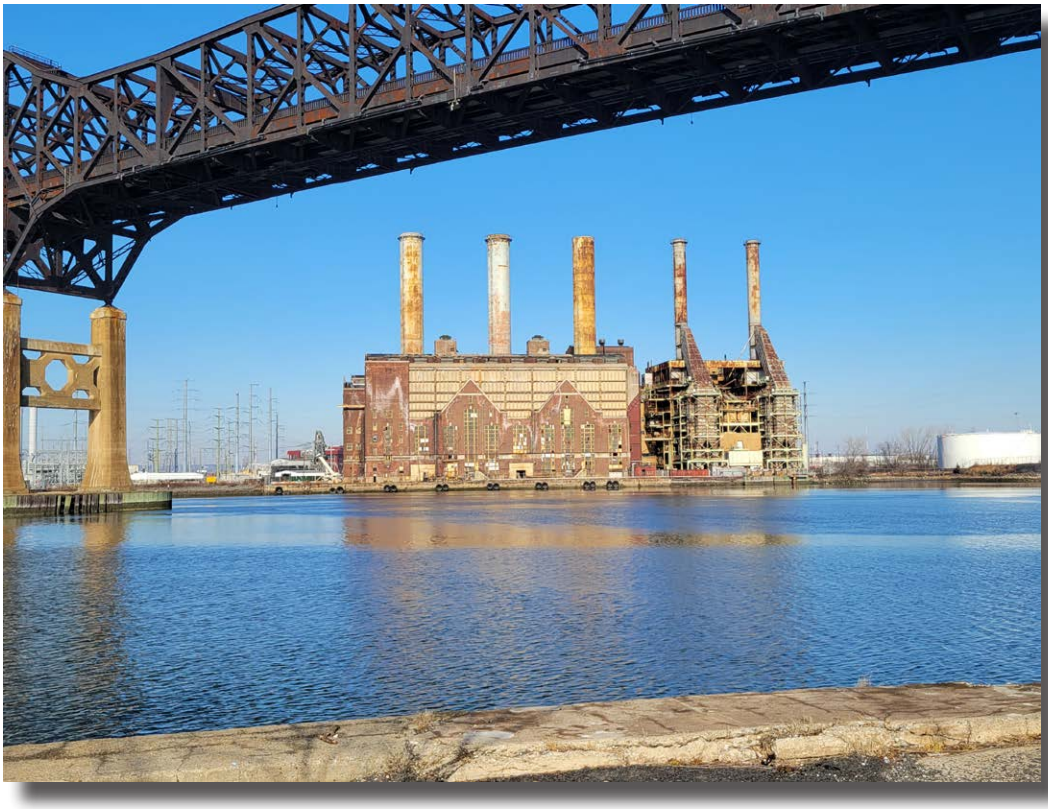

Plate 6: PSE&G Generating Station.

Photo view: Northwest

Photographer: Seth Hinshaw

Date: February 8, 2022

4.0 CONCLUSION

The lower segment of the Hackensack River has historically been a crossroads where various transportation systems accommodated goods and travelers moving towards the New York City markets. The earliest transportation system was shipping, which historically delivered produce and finished goods to market and returned with goods from other locations. The earliest roads and associated ferries emerged in the late colonial period; ongoing changes in road construction technology resulted in these roads being improved over the centuries, first by becoming turnpikes with bridges. The current Newark-Jersey City Turnpike traces its history back to these colonial roads. Railroads were laid through the meadowlands in the mid- to late nineteenth century, taking advantages of either the Bergen Cut or tunnels through Jersey City to reach the Hudson terminus for each rail line. Beginning in the 1790s, bridges over the Hackensack were drawbridges designed to open to accommodate shipping; the bridges were replaced over time, often with swing bridges. After World War I, the decision was made to improve the bridges in the lower Hackensack River area between Kearny and Jersey City, and in the late 1920s, new vertical lift bridges replaced the earlier swing bridges in order to accommodate larger ships. A set of four vertical lift bridges between Kearny and Jersey City running generally parallel to each other within a half-mile corridor comprise the Hackensack River Vertical Lift Bridges Historic District (SHPO Opinion: 5/3/2002). In October 2021, a modern 2021 Wittpenn Bridge with a higher clearance and wider lanes replaced the 1930 Wittpenn Bridge, which was demolished over the course of 2022. This report demonstrates that the Lower Hackensack River and its crossings in East Kearny have been vital to the development of industry and commerce in the area and these transportation avenues have evolved to meet the demands of changing markets, innovations in transportation technology, and industrial and manufacturing developments.

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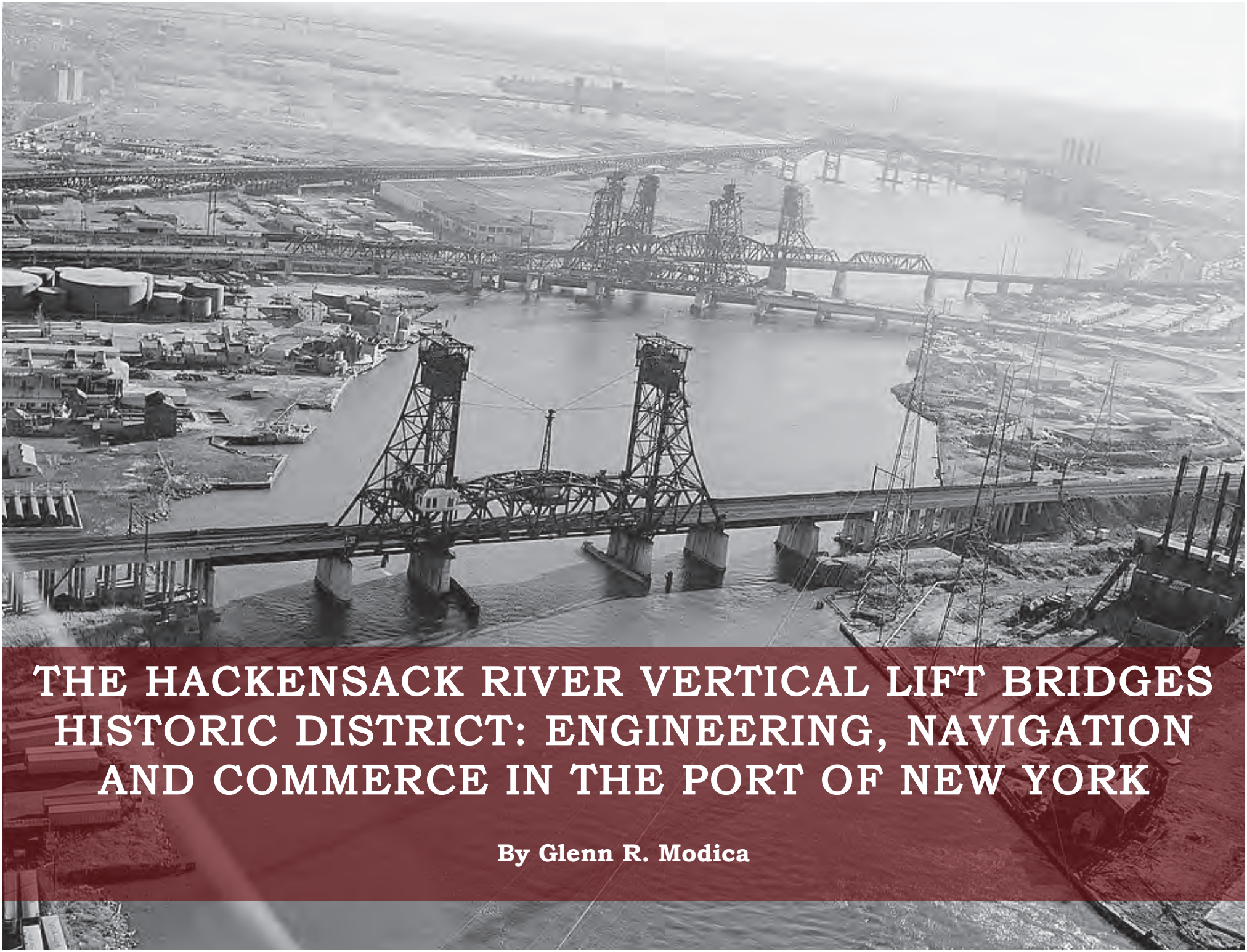


THE HACKENSACK RIVER VERTICAL LIFT BRIDGES HISTORIC DISTRICT: ENGINEERING, NAVIGATION AND COMMERCE IN THE PORT OF NEW YORK

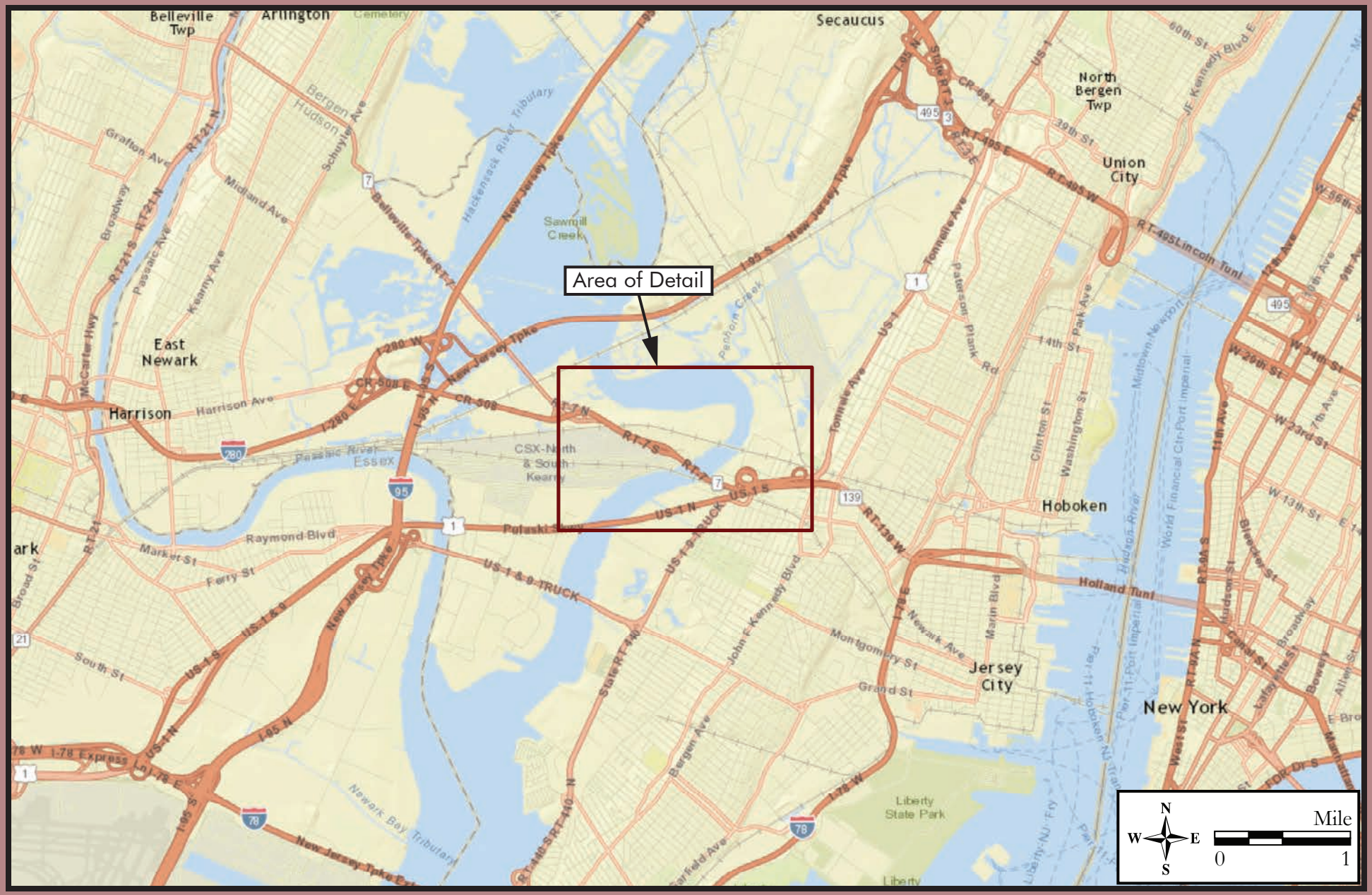
By Glenn R. Modica

On the cover: The Hackensack River Vertical Lift Bridges Historic District. From the foreground they include the Delaware, Lackawanna & Western Railroad Bridge, NJ Route 7 (Wittpenn) Bridge, Pennsylvania Railroad Harsimus Branch freight bridge, and Pennsylvania Railroad Hudson & Manhattan Railroad passenger bridge. The Pulaski Skyway is in the distance (Boucher, HAER-Erie & Lackawanna Railroad Bridge).

PREFACE

The Hackensack River Vertical Lift Bridges Historic District is a historic resource unique to New Jersey. Four consecutive vertical lift bridges spanning the Hackensack River between Jersey City and Kearny comprise the district. From north to south the bridges include the Lower Hack Bridge, formerly the Delaware, Lackawanna & Western Railroad bridge and now operated by NJ Transit; the NJ Route 7-Wittpenn Bridge operated by the New Jersey Department of Transportation (NJDOT); the Pennsylvania Railroad Harsimus Branch freight bridge (now CSX/Norfolk Southern Railroad); and the Pennsylvania Railroad's passenger bridge (now PATH). The latter three bridges, collectively known as the Triple Hack Bridges, were completed in 1930, while the Lower Hack Bridge was completed in 1928. The Wittpenn Bridge and the Pennsylvania Railroad's Harsimus Branch bridge were built concurrently and share common piers at the western approach. John Alexander Low Waddell, the foremost bridge engineer of the early twentieth century, consulted on the design of the lift spans for the railroad bridges. The firm of Harrington, Howard and Ash, a successor firm to Waddell, designed the Wittpenn Bridge.

This publication has been prepared by RGA, Inc. on behalf of the NJDOT and the Jacobs Engineering Group Inc. The publication is an outgrowth of NJDOT's plans to replace the Wittpenn Bridge with a new, vertical lift structure. In 2010, the NJDOT executed a Memorandum of Agreement to mitigate the effects of replacing the Wittpenn Bridge. Additional components of the project include Historic American Engineering Record documentation of the bridge and interpretive displays. All documentation will be placed on file with the NJDOT and the New Jersey Historic Preservation Office in Trenton.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North Bergen Twp
Union City
East Newark
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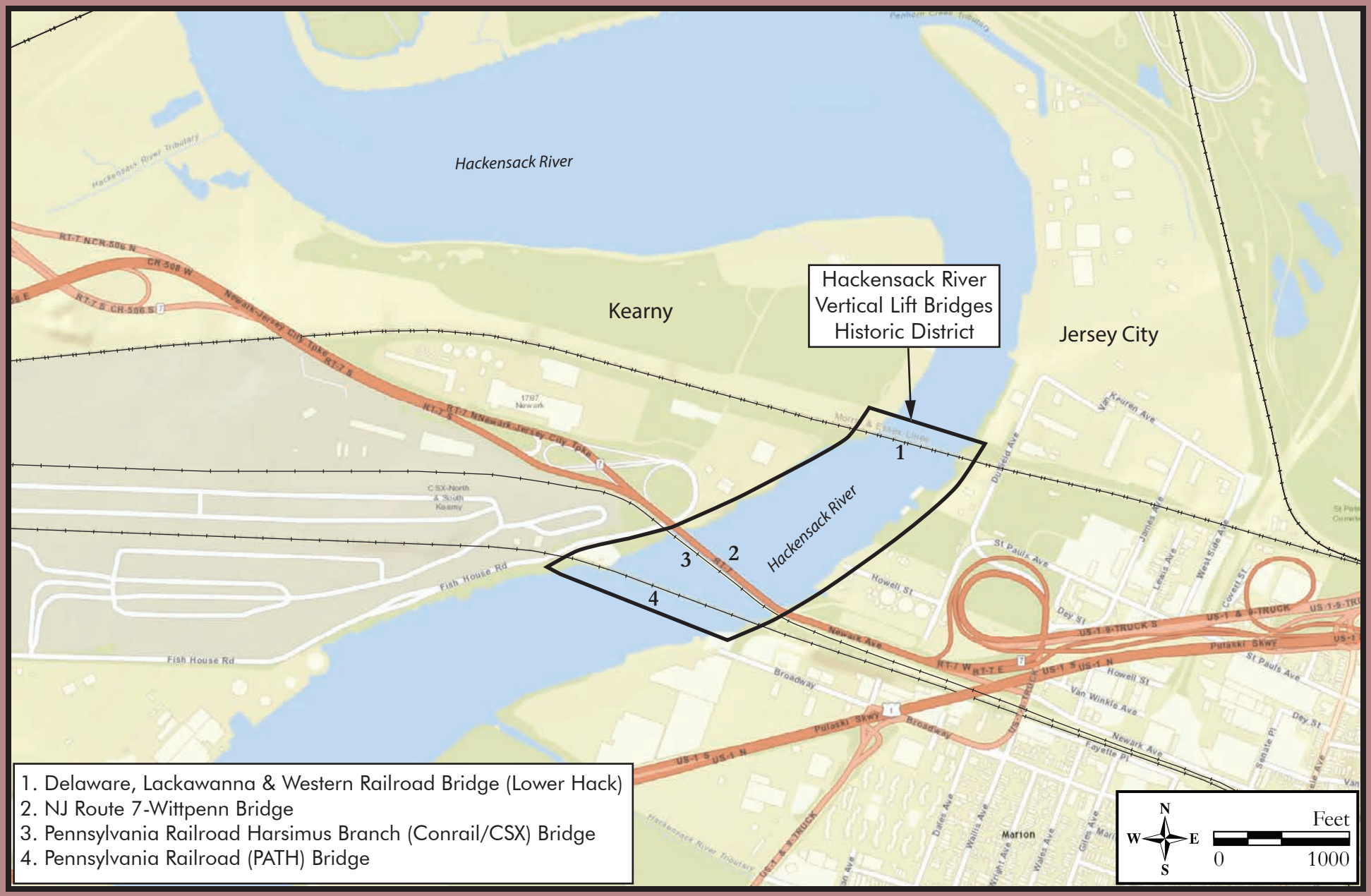


1. Delaware, Lackawanna & Western Railroad Bridge (Lower Hack)
2. NJ Route 7-Wittpenn Bridge
3. Pennsylvania Railroad Harsimus Branch (Conrail/CSX) Bridge
4. Pennsylvania Railroad (PATH) Bridge

CONTENTS

INTRODUCTION

Maritime commerce on the Hackensack River after World War I brimmed with activity. Schooners, scows and barges loaded with brick, stone and building materials steered downriver, while sailing vessels from Maine, Nova Scotia and the south brought lumber upriver as far as the head of navigation in New Milford, Bergen County.[1] Gasoline and oil products carried on barges plied the river along with package and miscellaneous goods conveyed on steam lighters.[2] Most of all, there was coal. Tons of it. Coal-laden barges guided by tugs moved slowly up the Hackensack River to make daily deliveries to the Seaboard By-Product Coke Company in Kearny or across the river to Public Service's Marion gas plant in Jersey City.

Navigating the Hackensack River was rife with difficulty. Natural impediments included shifting shoals and shallow water, but manmade obstacles posed the greatest challenge. A series of swing-span bridges hung low over the channel, making navigation treacherous even for the experienced pilot. Most vessels had to be towed up and down the Hackensack River by tugboat. Smaller craft were towed singly while two to four tugboats moving with the tide guided larger barges and scows.[3]

A ship bound for the Hackensack River from New York Harbor bore about west at Constable Hook to enter the Kill Van Kull, a tidal estuary about 3.5 miles long separating Staten Island from Bayonne and the New Jersey mainland. A rocky reef at the western end of the Kill Van Kull projected from Bergen Point at the southern tip of Bayonne. The Bergen Point Lighthouse (also called Kills Light), first erected in the mid-nineteenth century, warned mariners of hazardous conditions.[4] When abreast of the Bergen Point Light, vessels hauled around the lighthouse leaving it 250 yards on the starboard side. After passing the lighthouse, the pilot turned sharply north to enter the deepest part of the channel in Newark Bay and began the careful journey upstream.[5]

The first in the succession of bridges belonged to the Central Railroad of New Jersey. Nearly two miles long, the Central Railroad's bridge linked Elizabeth and Bayonne across Newark Bay with a double-track, Scherzer rolling lift bascule span and timber trestle approaches.[6] A pilot would have to steer easterly to maneuver through the draw of the bridge, which was built at a diagonal to the river.

Beyond the bridge, ships headed through a natural deepwater channel up the middle of Newark Bay, keeping the Passaic Lighthouse at the edge of the channel to port.[7] The course continued up the middle of the channel and through the Upper Bay Bridge, a double-track swing bridge shared by the Lehigh Valley Railroad and the Pennsylvania Railroad.[8] Ships approaching Kearny Point and the confluence of the Passaic and Hackensack rivers would keep to port as they passed the Elbow Beacon which shined a fixed white light marking the shallows of the broad river flats. Bearing north by northeast up the Hackensack River and past a craggy spit of land on the Jersey City side known as Droyer's Point, vessels passed through the swing span of the Central Railroad's Newark & New York Railroad bridge and then the Communipaw Avenue bridge, a vehicular swing-span bridge also known as the Newark Plank Road bridge and later the Lincoln Highway bridge.

Thus began the most challenging stretch of the Hackensack River. Ahead lay three closely spaced bridges – two railroad and one vehicular – that crossed the waterway at different angles and required careful navigation through each span. In succession from south to north, they included the Pennsylvania Railroad's passenger and freight bridges followed by the Newark Turnpike Bridge operated by Hudson County. Another 1,500 feet north at the bend in the river lay another railroad bridge, this one operated by the Delaware, Lackawanna & Western Railroad. Just beyond the DL&W's bridge lay the Seaboard By-Product Coke Company and Public Service's Marion gas plant, the two largest contributors to Hackensack River traffic.

Traditionally, a ship has the foremost right of passage over all other modes of transportation. All drawbridges had to open upon three blasts of a ship's whistle or horn. A reply of three blasts from the bridge tender meant the movable span was ready to be opened. Two long blasts indicated a delay in opening. The bridge had to open safely provided no train was approaching within five minutes of the bridge. During the morning and evening rush hour, the bridges did not have to remain open for more than ten minutes.[9]

The heavy and constant volume of traffic, across the bridges and over the river, stirred continual conflict between the railroads and shippers. Bridge operators often forced vessels to wait by refusing to open a bridge, usually during the morning or evening rush hour when trains passed over these bridges every five minutes. The right of passage through the swing bridges became a source of contention with the rise of industry along the Hackensack River toward the end of World War I. Industrial, maritime and civic interests argued that the Hackensack River swing-span bridges – in particular the four bridges south of the Seaboard By-Product Coke facility – posed a hazard to a ship's right to unimpeded navigation and acted as barrier to economic development along the river.

1. USACE 1912, 7.
2. USACE 1926, 11.
3. USACE 1926, 8 and 11.
4. Harrison and Jones, 56.
5. USACE 1922, 6.
6. Berhart, 45.
7. Harrison and Jones, 56.
8. Greenberg and Fischer, 151.
9. United States Army Corps of Engineers 1915, 30-31.

The Bergen Point Light located at the western end of Kill van Kull at the entrance to Newark Bay warned mariners of the rocky reef that projected from the end of Bayonne (Foghorn Publishing).

ORIGIN OF THE BRIDGES

Before there were bridges, ferries carried passengers back and forth across the Hackensack River between Jersey City and Kearny. John Douw established the first ferry across the Hackensack River around 1759. The road to the ferry utilized a causeway built across the Kearny meadows several years earlier by John Schuyler to reach his copper mine. This road generally follows today's Belleville Turnpike. The road in Jersey City leading to the ferry followed a route just north of today's Newark Turnpike. Douw operated a tavern on the west side of the Hackensack River to shelter travelers and entertain guests.[1]

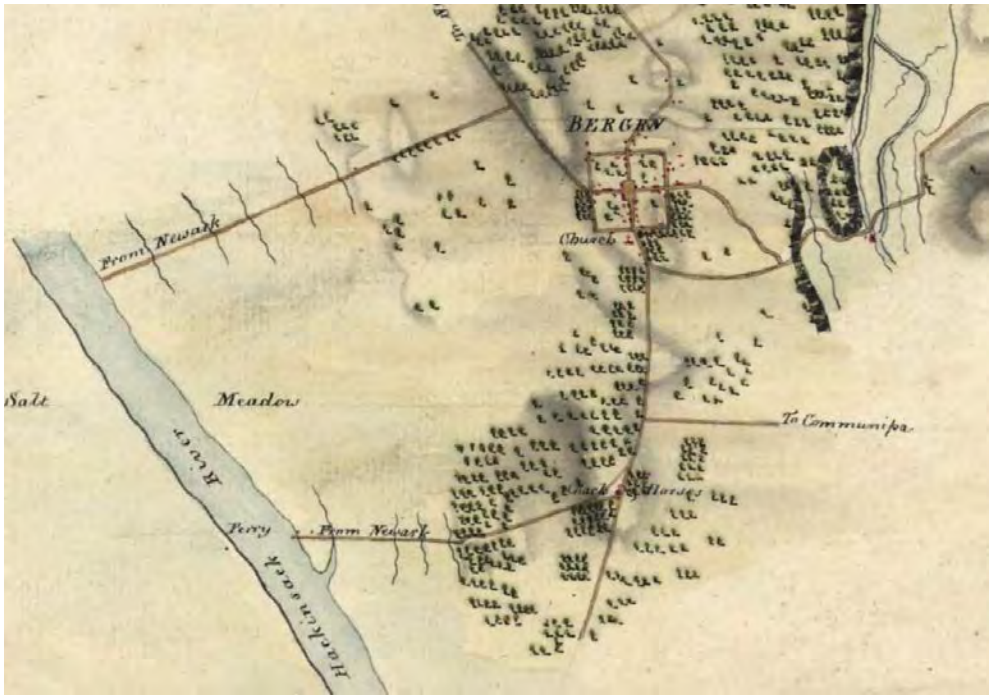
To improve connections between Philadelphia and New York, the New Jersey State Legislature in 1790 authorized construction of a four-rod road (66 feet) between Newark Court House and the ferry at Powles (Paulus) Hook in Jersey City. Draw bridges to be built over the Hackensack and Passaic rivers had to have at least a 24-foot opening to permit unimpeded navigation.[2] The first bridge over the Hackensack River to Jersey City, completed by the summer of 1795, was a wooden drawbridge, 980 feet in length, with piers and abutments built of stone quarried from nearby Snake Hill.[3] The new bridge quickly put Douw's Ferry out of business.

Further transportation improvements occurred in 1804 when the New Jersey Legislature chartered the Newark Turnpike Company. Using the same route laid out in 1790, the Newark Turnpike Company operated a toll road from Paulus Hook at Warren Street, along Newark Avenue and then over the Hackensack River bridge to connect with the Belleville Turnpike in the meadows.[4] The Hackensack and Passaic River Bridge Company acquired from the Newark Turnpike Company the franchise and use of the bridges.[5]

The Newark Turnpike was rebuilt several times over the course of the nineteenth century to address the ruts, washouts and otherwise near continuous deterioration of the roadway due to high traffic and storm damage. In 1911, Hudson County completed a new bridge with a 225-foot swing-span and three fixed spans. The bridge had channel clearance of 80 feet and sat nine feet above the water in the closed position. The bridge was designed by Alexander S. Hamill, Hudson County Engineer. A contemporary observer unimpressed with the new structure concluded "there are no remarkable features in the design."[6]

The New Jersey Railroad and Transportation Company, the third railroad incorporated in the state, became the first to reach Jersey City when it laid its tracks across the

1. Winfield, 273; Robinson, 9.
2. Lane, 123.
3. Brydon, 186.
4. Eaton, 78.
5. Shaw, 1040.
6. "Open Caisson Foundations of the Newark Turnpike Bridge;" USACE 1926, 9.



During the Colonial era, ferries crossed the Hackensack River from Jersey City near present-day Communipaw Avenue (bottom) and Newark Avenue (top) (Hills).

meadows in 1834. By 1838, the railroad had cut through the traprock in Bergen Hill to reach the Hudson River waterfront. The following year, the New Jersey Railroad connected with the Camden and Amboy Railroad at New Brunswick to provide the first direct rail service between New York and Philadelphia.[7]

To cross the Hackensack River, the New Jersey Railroad set its sights on jointly using the Newark Turnpike bridge. The New Jersey Railroad acquired a majority of the Hackensack and Passaic River Bridge Company's stock and built a bridge adjacent to the south side of the turnpike bridge. In 1846, after the Grand Jury of Hudson County objected to the joint use of the bridge, the railroad erected an independent structure south of the turnpike bridge dedicated solely to railroad use.[8]

In 1867, the New Jersey Railroad was absorbed by the United Canal and Railroad Company of New Jersey, which was then leased in 1871 by the Pennsylvania Railroad for a term of 999 years. After the Pennsylvania Railroad completed its freight terminal at Harsimus Cove on the Hudson River in Jersey City, the single bridge across the

7. Lane, 312
8. Ibid.

The Newark Turnpike bridge (near bottom of map), built in 1795, became the first crossing of the Hackensack River into Jersey City (Moore and Jones).

When the New Jersey Railroad completed its line to Jersey City in 1836 it shared the Newark Turnpike bridge over the Hackensack River (Spielman and Brush 1882 reprinted from L.F. Douglass).

Hackensack River could no longer handle the burgeoning flow of freight traffic. In the mid-1880s, the Pennsylvania Railroad built a new bridge over the Hackensack River for the sole purpose of carrying freight to Harsimus Cove Yard. The new swing-span bridge was constructed between its passenger bridge to the south and the Newark Turnpike bridge to the north.[9] The freight bridge was rebuilt by 1894.[10]

The Pennsylvania Railroad aligned the swing-span openings of its freight and passenger bridges to form one continuous channel. The freight bridge had two openings of 61 and 60 feet and cleared the water by a mere 5.5 feet.[11] The Pennsylvania Railroad replaced its passenger bridge in 1905 with a new swing-span structure six feet above mean high water with 56- and 58-foot channel openings.[12]

The Morris & Essex Division of the Delaware, Lackawanna & Western Railroad originally crossed the Hackensack River north of its current location via a bridge completed in 1862 by the Hoboken and Newark Railroad.[13] The DL&W built a new bridge across the river in 1877 to directly access its own cut through the Palisades, called the Bergen Tunnel, for its main line and Boonton branch. The DL&W replaced the bridge in

9. Cook et al; Fowler.
10. Taber 1980, 181.
11. USACE 1926, 9.
12. "New P.R.R. Bridge Blownup by Dynamite," *New York Times*, 27 March 1905.
13. Taber 1977, 59.

1902 with a double-track swing bridge that lay 12 feet above mean high water.[14] The original 1862 bridge north of the DL&W was abandoned by 1910 and removed the following year.[15]

The four bridges at the north end of Kearny and Jersey City belonging to the Pennsylvania Railroad, Hudson County, and the Delaware, Lackawanna & Western Railroad were all swing-span bridges. In a swing-span, the movable span rotates around a central pivot. When fully opened the swing-span bridge provided two channels of navigation. Until the close of the nineteenth century, swing-span bridges dominated bridge construction where wide channels needed to be crossed. The swing-span had its drawbacks. They were slow to open and close. If the operating machinery failed they either didn't open at all or refused to close. Wide barges especially had great difficulty navigating between the mid-channel pivot pier and the river piers. The bridges sat so low to the water that they had to be opened for all but the smallest of vessels.

14. Taber 1980, 22.
15. USACE 1912, 7.

THE HACKENSACK RIVER

The Hackensack River begins a 50-mile journey from its headwaters near Haverstraw in Rockland County, New York. The river meanders south crossing the state line into Bergen County, New Jersey where it widens just below Little Ferry at the mouth of Overpeck Creek. It flows through salt meadows before finally merging with the Passaic River at the southern end of Kearny and emptying into Newark Bay. The Hackensack River formed some 15,000 years ago when the retreating Wisconsin Glacier scoured and compressed bedrock to form what paleontologists call Glacial Lake Hackensack. What rose up out of the lake bed became the Hackensack River watershed.[1]

The Hackensack River's head of navigation lay some twenty miles upstream from Newark Bay in New Milford, Bergen County.[2] Throughout the nineteenth century most maritime vessels on the Hackensack River carried goods to and from the upper reaches of the river—to New Milford, Little Falls and especially Hackensack. The lower portion of the Hackensack River, in the vicinity of Jersey City and Kearny, was bordered by vast low-lying meadows that remained largely undeveloped through the nineteenth century. Farmers built docks along the upper Hackensack River and its major tributary, Overpeck Creek, to float agricultural products downstream to markets in Jersey City and New York. The Town of Hackensack emerged in the nineteenth century as the most important industrial and shipping center along the river.[3] Shipped downriver from its wharves lining the waterfront were bricks, agricultural produce, and flour. Goods sent upriver included mainly coal and lumber.[4] The steady increase in maritime commerce led to the first request for federal government action to improve navigation on the river.

Topographical map showing the five closely spaced bridges near Kearny Point (center of map) at the bend in the Hackensack River. The northernmost bridge, shown here associated with the Paterson & Newark Railroad, was removed during World War I (Bien and Vermeule).

The improvement of waterways rested with state governments or private corporations until 1824. In that watershed year, the Supreme Court's decision in Gibbons v. Ogden conferred upon Congress the power to regulate interstate commerce, including commerce over the nation's waterways.[5] In 1824, Congress passed the first Rivers and Harbors Act that appropriated funds to remove obstructions from the Mississippi and Ohio rivers. The Rivers and Harbors Act conferred upon the Army Corps of Engineers, part of the Department of War, jurisdiction over the nation's navigable waterways.[6] Appropriations for the Rivers and Harbors Act remained slim until after the Civil War. Late nineteenth century industrial growth fostered a vast increase in maritime traffic and led to the passage of more legislation and appropriation of more funds to facilitate navigation along the nation's waterways.

The first federal legislation involving the Hackensack River came with the passage of the Rivers and Harbors Act of 1852. Although Congress appropriated $10,000 to remove a sandbar near the convergence of the Passaic and Hackensack rivers, there is no record of the project being carried out.[7]

The Army Corps of Engineers completed its first survey of the Hackensack River in 1889. The survey covered the upper reaches of the river from Little Ferry to Hackensack, at the time an area with the greatest population, the most industry, and most maritime traffic. The Army Corps estimated that goods shipped along this section of the river amounted to 250,000 tons valued at $1 million per year. Despite the Army Corps' recommendation to widen and improve the channel at an estimated cost of $60,000, Congress did not adopt the project.[8]

1. "The Hackensack River: A True Comeback Story."
2. USACE 1922, 8.
3. Federal Writers' Project, 259.
4. USCAE 1889, 842-4; Olsen, 15.
5. Holmes, 3.
6. Hull and Hull, 13.
7. Klawonn, 249.
8. USCAE 1926, 6.

This 1914 coastal survey shows the recently dredged channel in Newark Bay and the depths of the Hackensack River (Coast and Geodetic Survey).

In its report, the Army Corps of Engineers gave passing reference to the lower section of the Hackensack River, stating it had "ample width and depth." The Army Corps saw no immediate need to improve the lower section of the river but predicted that a future need may arise as the Hackensack River "runs through salt meadows as yet entirely unimproved, but destined within the next twenty years to become very valuable."[9]

Observers routinely regarded the meadows as a "wasteland" and "worthless," an unpleasant, unhealthy, and unproductive place that ought to be "improved" out of existence as rapidly as possible. Civic boosters, business leaders, and public officials had long cast an acquisitive eye toward the meadows. Countless plans and ideas had been brought forth to "reclaim" the meadows for industrial, commercial and residential use.[10]

In his comprehensive report on the meadows published in 1897, Cornelius Clarkson Vermeule, consulting engineer to New Jersey's geological survey, remarked that the Hackensack River "throughout almost its entire navigable course, is cut off from neighboring populous upland by broad belts of tide-marsh, which make it entirely inaccessible, rendering almost useless its otherwise excellent facilities for manufacturing and internal commerce."[11] Vermeule recommended filling the meadows for commercial use and "bringing down of the cities to the water front, so that these waterways can be utilized."[12] Vermeule observed another impediment to future growth: the bridges with their low draws crossing the river. Vermeule recommended that "with the improvement of navigation on the Hackensack, some considerable relief to navigation and railroad traffic would be afforded if the numerous railroad and high-way bridges were raised high enough to admit tugs and barges passing under."[13]

9. USCAE 1889, 842-4.
10. "The New System of Reclaiming Lands, "*Frank Leslie's Illustrated Newspaper*, 16 November 1867, 36–37 after Marshall.
11. Vermeule, 304.
12. Ibid.
13. Ibid, 310.

The increase in maritime activity and the use of larger ships with deeper drafts, mostly north of Jersey City, prompted the Army Corps of Engineers to initiate the first dredging project of the Hackensack River authorized by the Rivers and Harbors Act of 1912. The existing navigable depth of the Hackensack River from the head of Newark Bay to the Central Railroad's Newark & New York Railroad bridge was about eight feet and then increased to approximately 12 feet north of the bridge.[14]

The Army Corps of Engineers project called for dredging and maintaining a consistent 12-foot deep, 200-foot wide channel from Newark Bay to Little Ferry, a distance of 13 miles. North of Little Ferry, the river would be dredged from its existing five- to six-foot depth to a depth of 12 feet with a 150-foot wide channel. Newark Bay was also dredged with a 20-foot deep, 300 feet wide channel.[15] The project was estimated to cost $171,018.10 plus $6,000 for annual maintenance.[16] The Army Corps of Engineers completed the dredging project on November 14, 1914 and reported favorably that larger boats are being used and are less dependent on tides.[17]

The dredging project could not have come at a better time. War broke out in Europe in July 1914. Even though the United States proclaimed its neutrality, American industry still provided the Allies with needed goods to aid the war effort. American entry into the hostilities in 1917 stimulated the need to produce more wartime goods. Industries seeking to capitalize on supplying American troops with the necessary war materiel sought new building sites and looked to the undeveloped meadows along the Hackensack River.

14. USACE 1918, 317.
15. USACE 1922, 13.
16. United States War Department, 317.
17. Ibid, 318.

WAR OF CHEMICALS

On the eve of the First World War, the Hackensack River between Kearny and Jersey City still remained largely in its natural state. The Newark Meadows Improvement Company owned most of the land in the Kearny meadows. Along the eastern edge of the river was one industry – the New Jersey Zinc Company/National Metallurgical Company just below the Newark Plank Road bridge. The company had a river pier and a railroad siding leading to the Central Railroad's Newark & New York Railroad. The former recreational use of the river was evidenced by the presence of the Eureka Yacht Club and Passaic River Yacht Club north of the Plank Road bridge. Jersey City's four miles of Hackensack River frontage remained mostly "unreclaimed," except for Lincoln Park (originally West Side Park), a recreation pier, and Public Service's Marion gas works.[1]

After the United States entered the First World War in April 1917, existing industries shifted from producing domestic products to churning out military goods. The war precipitated a building boom as industry sought out available sites on which to erect new facilities. The undeveloped meadows bordering Newark Bay and the Hackensack River offered plenty of opportunities. New railroad sidings could connect with any of the railroads that crossed the meadows in order to deliver goods for transshipment from the Jersey City waterfront. More importantly, the Hackensack River provided a strategic location to send and receive river borne goods.

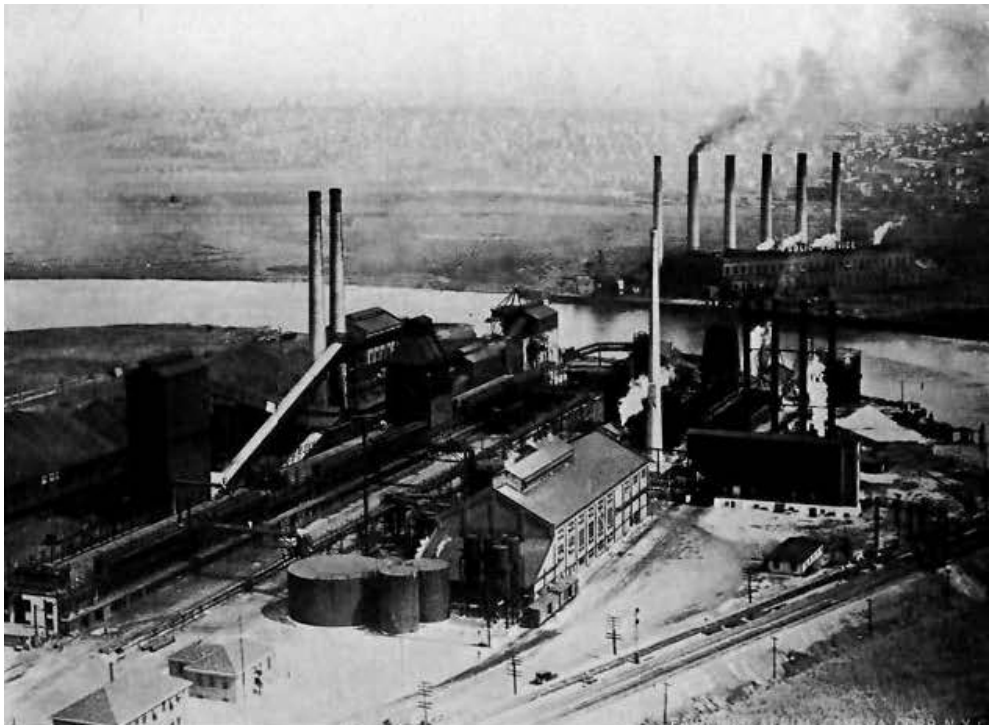
The First World War immediately stimulated development of Port Newark. The City of Newark began developing its waterfront along Newark Bay in 1915. Using its own money, the city built one mile of bulkhead, warehouses, slips and docks on thousands of acres of reclaimed meadows to attract industry and create a first-class port. During the war, the city leased 113 acres to the Submarine Boat Corporation to establish a shipyard.[2] By the close of the war the Submarine Boat Corporation had become the second largest shipyard in the country. The Texas Oil company also established a refinery at the edge of Newark Bay.[3]

The largest operation to establish a facility in the meadows was the Federal Shipbuilding Company. A subsidiary of U.S. Steel, Federal Shipbuilding began developing in 1917 a 160-acre site on the west side of the Hackensack River in Kearny, between the Plank Road bridge and the Central Railroad's Newark & New York Railroad bridge. Federal Shipbuilding developed the facility to construct ocean-going cargo vessels to carry war materiel and supplies to the European front. The first keel was laid at the yard on November 14, 1917, and the first vessel, the *Liberty*, was launched on June 19, 1918, five months before the end of the war.[4]

1. Hopkins 1908 and 1909.
2. USACE 1922, 22.
3. Ibid, 29.
4. "Yard of the Federal Shipbuilding Company."

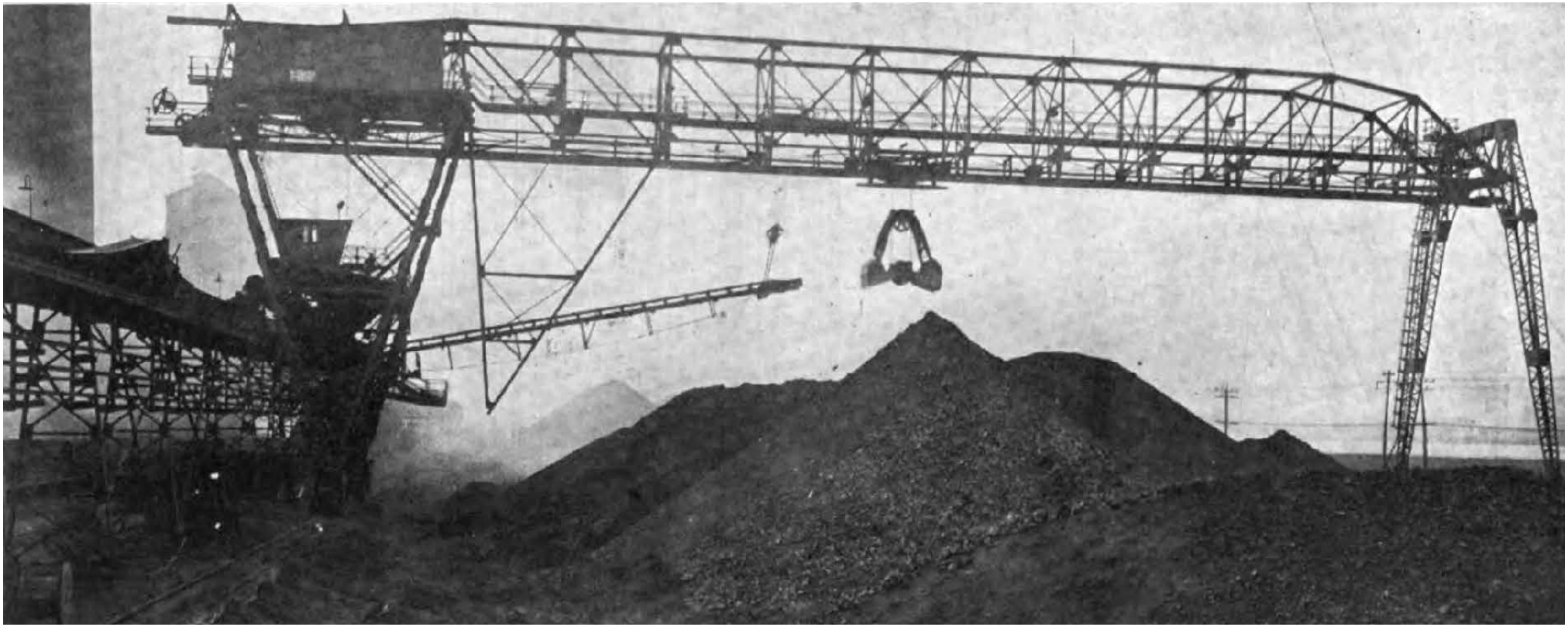
Prior to the First World War, Germany led the world in chemical production. It not only manufactured more dyes for textiles but also produced the most benzene and toluene, chemicals used to make explosives such as TNT. When war broke out in 1914 that supply stopped and the First World War proved to be a war of chemicals. In 1916, three chemical-producing companies took up sites adjacent to each other in Kearny at the bend in the Hackensack River north of the Delaware, Lackawanna & Western bridge. Even though the United States still proclaimed its neutrality, the chemical industries provided direct aid to the Allies.[5]

The Martin Dennis Company of Newark built a new facility to manufacture sodium bichromate and potassium dichromate, chemicals used in the preparation of "Tanolin," a leather tanning agent in high demand to cure military boots. The White Tar Company developed a long narrow parcel directly south of the Martin Dennis Company and constructed several buildings on the site to refine crude naphthalene to produce moth repellents, disinfectants, and deodorizers. These products helped prevent "trench fever," a debilitating disease caused by lice.[6]



Aerial view of the Seaboard By-Product Coke Company. The tracks of the Delaware, Lackawanna & Western Railroad are at bottom right (The Koppers Company).

5. Cannadine, 253.
6. AKRF, Appendix B:2-11.



Coal yard of the Seaboard By-Product Coke Company ("Plant of the Seaboard By-Product Coke Company").

In April 1916, the H. Koppers Company began construction of a new coke producing facility on thirty-five acres between the White Tar Company and the Delaware, Lackawanna & Western bridge. The new facility, called the Seaboard By-Product Coke Company, began operations the following year. The gas released from burning coal produces a byproduct gas called coke. Coke gas, more efficient than coal, has great industrial uses and was distributed to fuel the furnaces of nearby industries turning out goods for the war effort.[7]

German-born Heinrich Koppers (1872-1941), an engineer by trade, developed an economical method of recovering the byproduct chemicals of the coking process. Building on his patented designs for coke ovens, Koppers established the firm of Heinrich Koppers AG in 1901 in Essen, Germany. Koppers immigrated to the United States and built coke ovens for U.S. Steel in Joliet, Illinois by 1907. In 1912, he established the H. Koppers Company in Chicago.[8]

The H. Koppers Company caught the acquisitive eye of American millionaire, Andrew Mellon. Andrew Mellon (1855-1937), a native of Pittsburgh, had made his money in banking but amassed his fortune by owning an interest in a broad spectrum of industries. Mellon's holdings included Gulf Oil, the Aluminum Company of America (Alcoa), the Standard Steel Car Company, makers of railroad cars, and Carborundum, manufacturers of industrial abrasives. Mellon also owned a stake in the New York Shipbuilding Company, located along the Delaware River in Camden, New Jersey, though he sold his shares in the company in 1916. Along with Henry Ford and John D. Rockefeller, Andrew Mellon was one of the richest men in the United States.[9]

In June 1914, Heinrich Koppers left for Germany intending to return after a few months. After war broke out in Europe on July 28, Koppers was classified as an enemy alien and unable to return to the United States.[10] The federal government seized Koppers property, including his shares in his own company.[11] In November 1914, Andrew Mellon, H.W. Croft and Hamilton Stewart purchased 80 percent of the Koppers Company stock to acquire a controlling interest in the firm. Mellon relocated the company's headquarters the following year to the familiar steel territory of his hometown, Pittsburgh.[12] In 1916 the Koppers Company established the Seaboard By-Product Coke Company in Kearny.

In October 1918, the federal Office of Alien Property Custodian sold Heinrich Kopper's remaining shares in the company at public auction. One group of bidders participated,

7. "Placing Foundations for Coke Plant Near New York," 688.
8. BJHP, Box 30, Folder 2, Stanley N. Brown to Burton Jesse Hendrick, 30 September 1941.
9. Cannadine, 257.
10. BJHP, Box 30, Folder 2, "BJH Notes," 27 August 1941.
11. Cannadine, 253.
12. BJHP, Box 30, Folder 2, Stanley N. Brown to Burton Jesse Hendrick, 30 September 1941.

a group headed by Andrew Mellon, who modified the name to the Koppers Company. After the war, Heinrich Koppers was allowed to return to America. He visited Mellon in Pittsburgh in 1921 to discuss re-entering the company he created. Mellon refused, writing "I could see no reason for giving the proposition favorable consideration."[13]

The First World War had created unprecedented demand for coke. Coke byproducts valuable to the war effort included ammonia, benzol, and tuluol, all used to manufacture explosives such as TNT. At the beginning of the war, the United States had not one facility to recover the aforementioned byproducts. From 1916 to 1918, Koppers put into operation a coke plant once every 60 days and a benzol and toluol plant every six weeks.[14] The Koppers Company benefitted handsomely from the war, including a $7 million contract from U.S. Steel.[15]

The signing of the armistice in November 1918 ended hostilities and curtailed the demand for chemicals. Despite this the Seaboard By-Product Coke Company flourished during peacetime. Coke had a very practical and widespread domestic use. Coke was used for heating. The Seaboard By-Product Coke Company was ideally situated directly across the Hackensack River from Public Service's Marion gas works in Jersey City. Seaboard had laid a gas pipeline beneath the Hackensack River to connect the two facilities. The gas that Seaboard produced went directly to the Public Service, which in turn distributed the gas to homes and businesses throughout northern New Jersey's most urbanized areas.[16] Reflecting on the decision to establish the Seaboard By-Product Coke Company, Andrew Mellon wrote in 1919: "The Seaboard plant has been built with the idea of disposing of the coke locally for domestic purposes on the theory that in the long run that market would be a very steady and profitable one in connection with the advantage of the Seaboard location for disposal of the various by-products."[17]

With a buyer of their product near at hand, the Seaboard facility flourished after the war. Their demand for coal filled the Hackensack River with larger and heavier barges laden with incoming coal and outgoing coke. The success of Seaboard prompted expansion into new markets as "the ultimate success of the merchant coke plants at St. Paul and Jersey City [Kearny] in marketing coke for domestic uses encouraged the management to build more similar plants in other cities and selling the gas to public utilities."[18] By the 1920s, the Koppers Company had become one of the nation's largest operators of coal mines, coke plants, tar distilling plants, wood preserving plants, and blast furnaces. In addition to distributing gas and electricity, the company produced fertilizers, road materials, creosote oil, and paint.[19]

Mellon and his partners transformed the company from a builder of ovens to a national conglomerate that had a great influence over the national economy. More than any other American company, the Koppers Company had both greatly benefitted from the war and played an instrumental role in winning it. Of all the industries along the banks of the Hackensack River, the Seaboard By-Product Coke Company created the most maritime commerce and stood to benefit the most from improved navigation along the river.

13. Cannadine, 254.
14. BJHP, Box 30, Folder 2, "The Koppers Company," typed manuscript, undated but appears to be *circa* 1930.
15. Cannadine, 253.
16. "Placing Foundations for Coke Plant Near New York," 688.
17. BJHP, Box 35, Folder 1, Andrew W. Mellon to J.L. Replogle, 29 December 1919.
18. BJHP, Box 30, Folder 2, "The Koppers Company."
19. Ibid.

The exigencies of war placed great strains on the nation's railroads. Nowhere was that more evident than in the Port of New York. Unprecedented demand for raw materials and manufactured products meant that carloads of coal, ore, steel and war materiel from the west stalled at the freight terminals along the Hudson River and could not be unloaded fast enough onto awaiting barges, car floats and lighters. Trains backed up for hundreds of miles. The breakdown of railroad freight handling prompted the federal government to nationalize the railroads and take them under control.[1]

In an effort to improve the regional transportation network and bolster commerce in and around the Port of New York, the states of New York and New Jersey created the New York, New Jersey Port and Harbor Development Commission in 1917. The Commission's findings, issued in 1920 in a 500-page *Comprehensive Report*, took aim at the complicated and inefficient railroad freight handling system that terminated in Jersey City.[2] To alleviate the problem, the Commission proposed to divert rail traffic before it reached the west side of the Hudson River. The Commission proposed belt line railroads to divert freight traffic around the busiest and most congested areas of northern New Jersey. Trains would be redirected to one of several shared freight and waterfront terminals that would centralize the transfer of inbound and outbound freight between railroads and ships.[3]

The proposed belt lines and rail terminals were intended to alleviate congestion across the region's waterways, particularly the Hackensack River. The Commission noted that "an unnecessary number of bridges cross the [Hackensack] river." The three consecutive bridges across the Hackensack River – the Pennsylvania Railroad's freight and passenger bridges and the Newark Turnpike bridge – drew particular attention. The Commission stated bluntly "they are so close together as to render navigation hazardous." The Commission proposed "they could and should be combined in a single structure."[4]

While railroads struggled during the Great War, maritime commerce thrived. In 1914, the amount of goods shipped on the Hackensack River totaled 460,303 tons. That number rose to 795,563 tons in 1915, and to 696,391 tons in 1916. In 1917, when the United States entered the conflict, the amount of tonnage carried on the river more than doubled to 1,417,262 tons and rose again the following year to 1,841,548 tons. Even during the first year of peacetime in 1919, commerce continued to rise, eclipsing two million tons. The value of all articles carried on the Hackensack River tripled, from $3.7 million in 1916 to $10.9 million in 1919.[5]

Nearly half of all the tonnage carried along the river in 1919 – one million tons – was coal. The $4.7 million worth of coal represented almost half the value of all goods shipped on the river.[6] Nearly all of the coal went to the Seaboard By-Product Coke Company. Most of the remaining coal went to the Public Service's Marion gas works, which consumed about 300,000 tons a year.[7] The second most valuable product shipped on the Hackensack River was coke, the coke produced by Seaboard: 190,535 tons valued at $1.3 million.[8] Seaboard's impact on the commerce of the Hackensack River was so great that it single-handedly contributed to half the commerce brought up and down the Hackensack River.

A nationwide economic downturn in 1920 cut in half the total tonnage carried on the Hackensack River from the year before, to one million tons.[9] The Army Corps of Engineers, then considering another dredging project of the river, attributed the decline "due mainly to the fact that a large manufacturing plant used considerably less coal in 1920 than in the preceding year."[10] Though not mentioned by name, the "manufacturing plant" was most certainly Seaboard. The economic recovery that began in 1921 signaled prosperity that would last the rest of the decade. Total yearly tonnage on the Hackensack River rebounded to 1.5 million tons, with Seaboard accounting for more than half of that amount from its imports of coal and exports of coke.[11]

As much as Seaboard contributed to the economic vitality of the Hackensack River, so too did it depend on the river and the safe operation of its coal barges heading upriver. Every day, Seaboard required 3,000 tons of bituminous coal. Not just any coal would do. Seaboard required high-grade coal of uniform quality to produce an even supply gas. A constant flow of coal was needed to keep the coke furnaces in continuous use, otherwise a reduction in temperature could cause the furnace lining to contract and become damaged.[12]

To ensure a steady supply of coal, the company could import coal either by rail or barge. The facility had direct rail connections to the Erie Railroad and the Delaware, Lackawanna & Western Railroad. Seaboard's relationship with the railroads was at

1. Churella, 702.
2. The Commission's most far-reaching recommendation led to the creation of the Port of New York Authority in 1921. The Port Authority began as a planning agency charged with carrying out the 1920 *Comprehensive Plan*. But railroad executives proved to be intractable. After several years and little to show for its efforts, the Port Authority turned its attention to improving vehicular traffic through the region and made its imprint on the landscape by building interstate bridges.
3. New York, New Jersey Port and Harbor Development Commission.
4. Ibid., 369.
5. USACE 1926.
6. USACE 1922, 20.
7. Ibid., 30.
8. Ibid., 20.
9. USACE 1921, 361,
10. Ibid., 360.
11. USACE 1922, 46.
12. USACE 1926,18.

times acrimonious. On several occasions, Seaboard disputed the coal rates charged by the railroads, claiming they were being overcharged based on the distance hauled. The contentious relationship took the form of several lawsuits against the railroads. In some instances, Seaboard joined Public Service as plaintiffs against the railroads.[13]

Rather than rely solely on the railroads, Seaboard preferred to import its coal by barge. The company built an 800-foot wharf just above the Delaware, Lackawanna & Western Railroad bridge. Seaboard imported nearly all its coal from Virginia, West Virginia and Kentucky. Seaboard claimed the coal from these southern fields was of better quality than the coal mined in western Pennsylvania. Not to mention that "greater difficulties and uncertainties attend the transportation and constant supply of Pennsylvania coal" via the railroad.[14]

Coal was loaded onto rail cars and sent to Hampton Roads Harbor in Norfolk, Virginia where it was loaded onto ocean-going barges. Coal barges leaving Norfolk could be loaded to only partial capacity due to the limited depth of the Hackensack River. Coal barges were limited to 1,450 tons and a 16-foot draft, just enough to move upstream at high tide. Overloaded barges that attempted to navigate upriver or barges moving upstream at ebb tide frequently grounded in the river between the Central Railroad's Newark & New York bridge and the Lincoln Highway/ Communipaw Avenue bridge to the north.[15] In many instances, a barge arriving in New York Harbor during inclement weather could not navigate upstream at all. Instead, a barge had to drop anchor and incur demurrage charges due to the delay in unloading.[16]

In 1922, the *Glendaruel*, a steamer loaded with coal making a delivery to the Seaboard By-Product Coke Company crashed into the Lincoln Highway bridge. A temporary bridge was erected within a few months ("Steamer Runs into Open Drawbridge and Wrecks it").

Seaboard had at its disposal larger and faster ocean-going steamers. They could carry greater tonnage but they also had deeper drafts and could not be loaded to full capacity. Even a partially loaded steamer would save Seaboard twenty cents a ton over using barges.[17] An especial advantage of steamers is that they could navigate through inclement weather, thus avoiding costly demurrage charges. After World War I, Seaboard came to increasingly rely on steamers to speed the flow of coal to its facility and lower costs.

On the morning of June 22, 1922, the *Glendaruel*, a collier from Norfolk, Virginia was heading up the Hackensack River to deliver coal to Seaboard. The *Glendaruel*, said to be the largest ship that ever went on the Hackensack River, had made the same trip only the week before.[18] Carrying about 1,000 tons of coal with a gross weight of 2,063 tons, the collier was drawing nineteen feet of draft, the maximum limit under ideal circumstances. The tide that morning was low. The *Glendaruel* headed up the Hackensack River under her own power though a tug was at the stern to help guide the ship through the channel. By some accounts there may have been a "peculiar current" that day, one that sweeps from the southeast and "fools all the pilots."[19]

After passing through the opening of the Central Railroad's Newark & New York Railroad bridge, the *Glendaruel* continued north through the channel to pass through the next bridge carrying the Lincoln Highway over the river. The swing-span of the Lincoln Highway bridge fully opened, giving the *Glendaruel* seventy-eight feet to maneuver. As the ship neared the bridge, the crew realized they were off course. They cast out a mud hook anchor to slow down but to no avail. The ship rammed into the wooden fender built to protect the swing-span, splitting the fender like kindling. The *Glendaruel* then squarely hit the draw span, knocking it off its pivot pier and pushing it upriver. The force of impact broke the supporting girders and buckled the 200-foot long swing-span, dropping the 900-ton structure on top of the wrecked fender.[20] Nobody was seriously injured, and the boat sustained only minor damage on its bow. The *Glendaruel* ran aground and had to wait for the incoming tide before completing its journey.[21]

All vehicular traffic had to be diverted a mile north to the Newark Turnpike bridge. The State Highway Department had been in discussions with Hudson and Essex counties to assume control of the Lincoln Highway bridge for some time before the collision.[22] The State Highway Department agreed to take control of the crossing and build a new Lincoln Highway bridge that would be "much larger, higher and stronger" than its mangled predecessor. In the meantime, the State Highway Department erected a temporary bridge with trolley tracks that opened in November 1922.[23]

13. Interstate Commerce Commission 1922, 317-334.
14. USACE 1926, 18.
15. USACE 1922, 30 and46.
16. USCAE 1926,19.
17. Ibid., 20.
18. "Suggest Sand Bar Caused Span Wreck, *Newark Evening News*, [illegible date] July 1922.
19. "Coal Steamer Crashes Head-On Into Draw Span, *Jersey Journal* [Jersey City], 22 June 1922; "Marine Casualties."
20. "Steamer Wrecks Drawbridge on Traffic Artery."
21. "Coal Steamer Crashes Head-On Into Draw Span;" "Marine Casualties."
22. "Steamer Wrecks Drawbridge on Traffic Artery."
23. "Highway Board Plans An Entire New Structure," *Jersey Journal*, 29 June 1922; "Bridge Reopening to End Congestion on Newark Pike," *Jersey Journal*, 14 November 1922.

The matter of the *Glendaruel* went to trial in district court and then was appealed to the Circuit Court of Appeals. When the case was finally decided in 1928, Charlton B. Hibbard, the owner of the *Glendaruel*, had to pay $115,000 in damages to Hudson and Essex counties, then the owners of the bridge, which had to turn the money over to the State Highway Department.[24]

The collision reverberated back to Hackensack River industries. Due to the difficulties in navigating the Hackensack River, insurance underwriters would no longer insure large self-propelled vessels – like the *Glendaruel* – for damages caused to bridges and other fixed objects in the river. The risk of navigating in the section of the Hackensack River between Kearny and Jersey City was considered so hazardous that the underwriters threatened to refuse insurance to all vessels if navigation conditions in the river did not improve.[25]

The collision of the *Glendaruel* facilitated Congress to approve a new dredging project in the Hackensack River as part of the Rivers and Harbors Act of 1922, which was adopted on September 22. The legislation called for dredging the Hackensack River from the Central Railroad's Newark & New York Railroad bridge to a point 4,800 feet above the Lincoln Highway bridge, a distance of 1.6 miles. The project called for creating a 300-foot wide channel and deepening the existing 20-foot channel to 30 feet.[26]

The *Glendaruel* incident brought to the fore the dangers of navigating the Hackensack River, especially the hazards posed by the succession of low-lying swing-span bridges. Most importantly, the collision directly affected the Seaboard By-Product Coke Company, the river's most important and influential industry. The rise in maritime commerce on the Hackensack River punctuated by the *Glendaruel* event prompted the federal government to not only deepen the river channel but also to require the replacement of the swing-span bridges.

24. "In Re Hibbard et al."
25. USACE 1926, 10.
26. Ibid., 8.

WAR DEPARTMENT ORDERS

All signs in 1923 pointed towards increased maritime activity on the Hackensack River. The Public Service Corporation began construction that year on a site in Kearny north of the Lincoln Highway bridge where they would build the largest electrical generating facility in the world. Public Service embarked on major upgrades to its infrastructure to bring reliable electricity to all parts of northern New Jersey.[1] Public Service anticipated its new Kearny facility would initially need 360,000 tons of coal a year, about 1,000 tons every day. Public Service planned to bring coal from western Pennsylvania via the Pennsylvania Railroad to South Amboy where it would be loaded onto barges and shipped up the Hackensack River.[2]

Nearly two million tons of goods moved along the Hackensack River in 1923, the most since 1919. The total value of those commodities – $15.5 million – set a record.[3] In 1924, total commerce on the Hackensack River eclipsed 2.3 million tons, and the value of shipped goods rose to $26.4 million, a 70 percent increase. As in previous years, most of that commerce began and ended at one facility: Seaboard By-Product Coke Company. Across the river from Seaboard, the Public Service Marion facility imported 115,000 tons of coal, which it received by barge from South Amboy. Combined, Seaboard and Public Service imported all the coal transported on the river. Other river borne products included sand, gravel, and crushed stone; chemicals and fertilizer; petroleum products; and lumber.[4]

An idea of the volume of river traffic on the Hackensack River can be gleaned from the number of bridge openings. In 1924, the Central Railroad's Newark & New York Railroad bridge over the Hackensack River opened 12,266 times, about 34 times a day. The majority of openings were for tugs and barges, with schooners plying the river to a lesser extent.[5] The Central Railroad bridge's vertical clearance of 25 feet was higher than the five successive bridges leading to Seaboard. Though not all ships would have continued to Seaboard, the number of openings suggests that the bridges in the upper part of the Hackensack River had to open for all but the smallest of craft.

During the summer of 1924, Colonel H.C. Newcomer of the Army Corps of Engineers held hearings on the Hackensack River bridges at the Army Building on Whitehall Street in lower Manhattan. The Army Corps was considering citing the bridges as obstructions to navigation, due to their low clearance above the water and narrow draw openings.[6] The hearings took place largely at the behest of Seaboard officials who wanted unimpeded service to their docks.[7]

Colonel Newcomer opened the meeting to comments. The first to speak was a representative from Seaboard who highlighted the growth of the company's business and derided the bridges as obsolete due to their narrow width and as relics of a bygone era. Speakers representing Jersey City, Newark and the New Jersey Board of Commerce and Navigation all urged for larger bridges that would provide a minimum clearance of 35 to 40 feet to allow nearly all tugs to pass unimpeded. A representative from Federal Shipbuilding voiced his support of any plan that would improve navigation and allow the company to build larger ships.[8]

The Delaware, Lackawanna & Western Railroad announced its intention to replace its bridge over the Hackensack River. Nearly 3,000 of its trains were delayed annually by bridge openings due to deliveries and shipments to Seaboard. The rush hour openings were especially onerous and a great source of ire among its passengers.[9] The railroads had other vested interests in upgrading their bridges. Heavier locomotives pulling trains carrying more cargo and passengers necessitated new bridges. The Delaware, Lackawanna & Western Railroad requested five years in which to complete its new bridge rather than the three usually dictated by the War Department. The Pennsylvania Railroad also signaled its intention to replace its passenger and freight bridges, though they still requested time to conduct appropriate surveys and develop plans.[10]

On October 30, 1924, Secretary of War John W. Weeks officially ordered the Delaware, Lackawanna & Western Railroad to replace its bridge over the Hackensack River. The railroad was required to reconstruct its bridge within four years in order to provide a 150-foot wide channel and a vertical clearance of no less than 35 feet.[11] On April 28, 1925, Secretary Weeks signed the order notifying the Pennsylvania Railroad and Hudson County to replace their Hackensack River bridges within four years. The Army Corps would dredge a new shipping channel on the east side of the river, and the bridges had to provide a continuous 150-foot wide channel through all three draws.

How much influence, if any, did Andrew Mellon have over the decision to replace the bridges is not directly known. As part owner of the Koppers Company, Mellon had a vested interest in seeing its subsidiary – Seaboard By-Product Coke – remain successful. In 1921, Mellon had been appointed Secretary of the Treasury by newly elected President Warren G. Harding, a Republican. Mellon remained Secretary of the Treasury through the Republican administrations of Calvin Coolidge (1923-27) and Herbert Hoover (1928-1932). As Secretary of Treasury, Mellon was prohibited from using the office for personal financial gain.[12] This was in accordance with the

1. Coniff and Conniff, 303.
2. USACE 1926, 20.
3. Ibid., 10.
4. Ibid., 2, 11 and 18.
5. Ibid.,11-12.
6. "Railroads Plan New Hackensack River Bridges," *Newark Evening News*, 20 August 1924.
7. "Rail and River Men Tilt Over Bridges," *Newark Evening News*, 21[?] August 1924.
8. "Railroads Plan…"
9. "Rail and River Men…"
10. "Railroads Plan…"
11. USACE 1926, 9.
12. Cannadine, 382.

1789 statute that established the Treasury Department and stipulated that no person employed in the department "shall directly or indirectly be concerned or interested in carrying on the business of trade or commerce." Before taking office Mellon resigned from the Board of Directors of the many companies in which he had a financial interest, including Koppers and Seaboard.[13] Opponents in Washington had long suspected that Mellon continued to maintain direct involvement with his companies. Mellon later claimed, while he was under federal investigation in the early 1930s for tax fraud, that he no longer kept in touch with his companies "as completely as if I had died at the time."[14] Evidence suggests otherwise.

Mellon's diary entries record a litany of meetings and conversations with the affairs of his companies. According to one biographer, Mellon's insistence that he had withdrawn from his businesses "as if I had died" was a "brazen lie."[15] Mellon not only stayed directly involved in his companies' operations but also used his position to influence favorable legislation.

In 1921, Mellon corresponded with his brother Richard about a coal property that the Koppers Company should consider acquiring. The following year he alerted Henry Rust, president of Koppers, of the operations of a competing coke by-product company near Washington, D.C.[16] Mellon convinced Secretary of State Charles Evans Hughes to award a contract to build a bridge over the Yellow River in China to McClintic-Marshall, a Mellon company. He influenced legislation for higher tariffs to benefit Alcoa, and for lower prices on imported raw materials that favored Carborundum. In 1922, the House Committee on Rivers and Harbors, a congressional body that approves expenditures for maritime improvements, rejected appropriating funds for a project that would benefit Gulf Oil. Mellon sought the assistance of Congressman John Morin, a Republican from Pennsylvania representing Pittsburgh. Mellon wrote to George S. Davison, president of Gulf Oil, that Morin promised to assist Mellon and "through the influence of Mr. Morin with Chairman [S. Wallace] Dempsey, they are going to reopen the matter and we are doing everything to have it reported favorably."[17]

Andrew Mellon and Secretary of War John W. Weeks formed part of President Harding's first cabinet. Mellon's correspondence with Weeks suggests an amicable relationship built upon an exchange of favors. In 1922, Mellon agreed to donate funds to build a memorial at William and Mary College, a memorial to which Weeks evidently had solicited Mellon's financial assistance. Mellon wrote Weeks that he would be "very glad to join in furnishing" the memorial and that "it will give me pleasure to participate."[18] Mellon's largesse to Weeks' requests also occurred a little more than one month after Weeks signed the orders to replace the Delaware, Lackawanna & Western Railroad

Andrew Mellon sat for this photo right after he became Secretary of the Treasury in 1921. One of the richest men in America, Mellon owned a controlling interest in the Seaboard By-Product Coke Company, a subsidiary of the Koppers Company (Library of Congress).

13. Ibid., 274.
14. Ibid., 297.
15. Ibid., 365.
16. Ibid., 296.
17. BJHP, Box 35, Folder 2, Andrew W. Mellon to George S. Davison, 1 March 1922; Cannadine 2006, 297.
18. BJH Papers, Box 35, Folder 2, Andrew W. Mellon to John W. Weeks, 5 January 1922.

bridge over the Hackensack River. On December 11, 1924, Mellon wrote to Weeks: "In response to your letter of the 9th instant I take pleasure in enclosing herewith check for $1,000, contribution to the Women's Division, National Amateur Athletic Federation of America. Sincerely yours, A.W. Mellon."[19]

With his position of power and influence in Washington, it is tempting to conclude that Mellon played a role in influencing the replacement of the four Hackensack River bridges to benefit his own Koppers Company. Yet no evidence was found directly connecting Mellon with the bridge replacement projects. Mellon's potential involvement notwithstanding, the Seaboard By-Product Coke Company generated most of the maritime traffic on the Hackensack River, and the company's location clearly presented a pressing need to improve navigation to and from the facility.

Even as the railroads drew up plans for new bridges spanning the Hackensack River, they took up another battle against Seaboard. In March 1926, six railroads joined the North Jersey Transit Commission, the State Highway Commission, and the Hudson County Board of Chosen Freeholders, to file an application with War Department. They wanted to keep closed during the morning and evening rush hours some two dozen drawbridges over the Hackensack River, the Passaic River and Newark Bay to allow for the unobstructed passage of some 350,00 railroad and vehicular commuters. If the measure passed, ships would have to wait up to 12 hours for the next high tide. The City of Newark, joined by neighboring municipalities and shipping and manufacturing interests opposed the measure, stating that maritime traffic was of such import that denying free right of passage would harm industry.[20]

A week before the public meeting, the North Jersey Transit Commission distributed flyers on trains bound for Manhattan urging commuters to contact the Secretary of War and their state senators to support the bridge closure and help "overcome the serious and vexatious delays."[21] The Army Corps of Engineers heard pubic testimony in May 1925 but denied the request to keep the bridges closed.

The delays continued. Train passengers had only to look out the window to see the cause: a barge or steamer laden with coal heading upstream to Seaboard. One such passenger was Mark M. Jones, an economist who commuted from East Orange to New York City by way of the Delaware, Lackawanna & Western Railroad. Jones, evidently an acquaintance of H.D. Rust, president of Seaboard, wrote to Rust in the fall of 1927 about the many passenger complaints he overheard: "I have wondered if you realize the extent to which your company is being credited with the responsibility of these delays." Jones asked Rust if there was anything Seaboard could do to change the schedule of its barges on the river to reduce the delays.[22]

On behalf of H.D. Rust, Seaboard vice-president Donald MacArthur replied, "We realize very keenly the extent to which our Company has been credited with the responsibility of delays of various trains crossing the Hackensack River."[23] MacArthur recounted how five years earlier "we went into the matter at great length with the Government and the Railroads" leading to the War Department's orders to replace the bridges. Regarding the previous year's hearings to close the bridges during rush hour, MacArthur emphasized that the Army Corps of Engineers was "entirely unprejudiced" in rendering a "unbiased opinion" in favor of Seaboard to maintain the right of passage to maritime vessels. "In the meantime," MacArthur continued, "we have been instrumental in getting the channel in the river deepened, and within a year or so all of the bridges crossing the Hackensack River will be replaced by modern bridges so that navigation will be accomplished much more easily than at present."[24]

19. BJH Papers, Box 34, Folder 5, Andrew W. Mellon to John W. Weeks, 11 December 1924.
20. "Petitioning the War Department," *New York Times*, 27 March 1926; "Newark Will Fight Closing of Bridges," *New York Times*, 30 March 1926.
21. "Wants Bridges Closed, " *New York Times*, 5 May 1926.
22. KCR, Box 10116, "Koppers Files, Correspondence 1927-1967," Mark M. Jones to H.D. Rust 23 September 1927.
23. Ibid.
24. KCR, Box 10116, "Koppers Files, Correspondence 1927-1967," Donald MacArthur to Mark M. Jones, 26 October 1927.

J.A.L. WADDELL

The War Department required replacement of the four consecutive swing-span bridges just below Seaboard with vertical lift bridges. Small vertical lift bridges had been constructed over canals in the United States and Europe during the nineteenth century. The first vertical lift bridges in America were built in 1872 by Squire Whipple over New York State's canal system, but the modern vertical lift bridge was largely an invention of J.A.L Waddell.[1]

John Alexander Low (J.A.L.) Waddell (1854-1938) was born in Ontario, Canada and received a Civil Engineering degree from Rensselaer Polytechnic Institute in 1875. He taught civil engineering at the University of Tokyo and upon returning to the United States Waddell joined the Phoenix Bridge Company. Waddell started his own practice in Kansas City in 1887 and soon made a name for himself for his design of vertical lift bridges.[2]

Waddell's design for Chicago's South Halstead Street Bridge over the Chicago River, completed in 1895, is recognized as the first vertical lift bridge "of any size and importance" built in the United States. The South Halstead Street Bridge had a 130-foot lift span with a 155-foot vertical clearance in the open position. The overhead trusses between the sheaves at the top of each tower leg became known as the "Waddell-type" vertical lift. Waddell received a patent for this design in 1895.[3]

The primary identifying feature of Waddell's vertical lift design was the pair of steel towers at each end of the lift span. The tower spans are topped with steel wheels called sheaves around which steel cables pass. Counterweights, which balance the weight of the lift span, are attached to cables near the top of the tower spans and at the bottom to the lift span. To raise the lift span, electric motors turn reduction gears connected to drums that pull the operating cables connected to the lift span and towers. Guided by rollers at each corner, the lift span remains horizontal as it is raised upward to allow river traffic to pass below. Although a lift span can weigh over 1,000 tons, the nearly equal weight of the counterweights allows for small 150-300 horsepower electric motors.[4]

For more than a decade, the South Halstead Street Bridge remained the nation's only lift bridge, as bascule and swing-spans still dominated movable bridge construction. Mechanical flaws in the South Halstead Street Bridge along with high construction costs gave the vertical lift a reputation as too expensive to build, maintain and operate.

John Alexander Low Waddell, the foremost vertical lift bridge engineer of the early twentieth century, designed the Pennsylvania Railroad's freight and passenger bridges and the DL&W's bridge (Waddell 1921).

1. Hoole and Kinne,158.
2. Nyman.
3. Hoole and Kinne, 158.
4. Koglin, 90-99.

Waddell practiced independently until 1899 when he partnered with Ira G. Hendrick to form the firm of Waddell & Hendrick (1899-1907). Waddell then teamed with John Lyle Harrington as Waddell & Harrington (1907-1915). Harrington, a skilled civil and mechanical engineer, refined Waddell's patented lift design into a practical type less expensive to construct and operate.[5] Before their partnership dissolved in 1915, Waddell & Harrington designed about 30 vertical lift spans for highway and railroad crossings. Harrington went on to found his own firm – Harrington, Howard & Ash – which designed the Wittpenn Bridge.[6]

Between 1915-1920 Waddell partnered with his son, N. Everett Waddell, as Waddell & Son. In 1920, Waddell moved from Kansas City to New York City where he established an independent practice to capitalize on the region's need for ever-expanding infrastructure. In 1924, the Port of New York Authority selected the experienced Waddell to instill public confidence by designing the fledgling agency's first bridges: the Outerbridge Crossing and Goethals Bridge, both cantilever structures spanning the Arthur Kill between Staten Island and New Jersey. Vertical lift bridges were his forte, and he designed the Central Railroad's Newark & New York Railroad double vertical lift bridge across Newark Bay, completed in 1926, followed by the Delaware, Lackawanna & Western Railroad's Hackensack River (Lower Hack) bridge, completed 1928.[7]

Waddell practiced independently until 1927 when he formed a partnership with Shortridge Hardesty as Waddell & Hardesty (1927-1945). It was during this partnership that the Pennsylvania Railroad hired Waddell & Hardesty to design its passenger and freight lift bridges. Around the same time, the firm also prepared plans for the joint Lehigh Valley Railroad/Pennsylvania Railroad bridge over Newark Bay, which would be completed in 1930.[8]

J.A.L. Waddell's passed away on March 3, 1938 at the age of 84. During Waddell's 50-year career, he designed approximately 90 vertical lift bridges not only in the United States but also in Canada, Mexico, Europe and New Zealand. His firm retained the Waddell & Hardesty name until it changed to Hardesty & Hanover in 1945.[9] The firm remains in operation today as one of the most respected engineering firms involved in the design of movable bridges.

By the 1920s, Waddell's refinement of the vertical lift bridge into an economical type to build and operate made it the preferred bridge to span long crossings. Vertical lifts had the advantage over swing-spans by opening and closing faster, thus reducing delays carrying passenger and freight. A vertical lift also had the ability to be partially opened for small vessels, furthering reducing operating time. Unlike a swing-span, a vertical lift did not need a central pier that blocked the navigation channel and diverted currents. Where circumstances dictated, vertical lift bridges could be built next to each other to allow for a continuous navigation channel.

5. A.G. Lichtenstein & Associates, 63.
6. Nyman.
7. Ibid.
8. Ibid.
9. Ibid.; Petroski, 193-201.

DELAWARE, LACKAWANNA & WESTERN RAILROAD (LOWER HACK) BRIDGE

The Delaware, Lackawanna & Western Railroad selected J.A.L. Waddell, then practicing independently, to draw up plans for the company's new vertical lift bridge across the Hackensack River. The proposed bridge would carry three tracks instead of the previous two. The channel opening of 150 feet would well exceed the 69 and 73 feet between the piers of the swing-span. The 35-foot vertical clearance when closed greatly exceeded the 12 feet of the existing bridge. The Delaware, Lackawanna & Western constructed the new bridge about 65 feet south of the existing bridge, which had to be kept in operation during construction.[1]

Construction began in March 1927. The greater height of the bridge above the waterway required the railroad to elevate more than a mile of track on the east and west sides of the river. The railroad laid its tracks atop high earthen embankments on both sides of the river to carry the tracks up to the level of the bridge. The earthen embankment approaches had a combined length of 6,100 feet (4,700 on the west and 1,400 on the east) that required 500,000 cubic yards of fill. The embankment reached a height of 48 feet at the west end and 42 feet at the east. The west approach has a natural slope, but a 300-foot long retaining wall was required on the south side of the Jersey City approach to prevent the fill from sliding into Meadow Street.[2]

Construction of the new DL&W vertical lift bridge is underway in this circa 1927 photograph. At right are the DL&W's swing span bridge and the Seaboard By-Product Coke Company (Taber).

Undated photograph of the Delaware, Lackawanna & Western Railroad's swing span bridge over the Hackensack River, built in 1902 (Taber).

With the new structure only 65 feet downstream of the existing bridge the Delaware, Lackawanna & Western had difficulty constructing the vertical lift span. When the old swing-span was fully opened it was long enough to potentially "foul" or hit the new lift span. To avoid this, the railroad erected about two-thirds of the lift span from the east tower on falsework. The remaining one-third of the bridge was erected on a barge and floated to the site and raised into position. The lift span was completed in the open position at a point high enough to allow the end of the swing-span to open below it. The bridge was put in operation on Sunday, October 21, 1928 and cost more than $3 million. After completion, the old bridge was removed though the ashlar abutments of the old structure are still visible along Duffield Avenue in Jersey City.[3]

The new bridge design includes a riveted Parker truss lift span that was 200 feet long and weighed 1,100 tons. The two Pratt truss tower spans with front vertical columns and rear inclined columns, each 153 feet tall, support concrete counterweights. Power for lifting the bridge is supplied by electric motors in the two-story operator's house on the east tower span, which also contains an auxiliary gas motor. The span can be lifted to its maximum height of 135 feet in about 90 seconds.[4]

1. "D.L. & W. Completes Three-Track Lift-Span Bridge."
2. Ibid.
3. Ibid.
4. DeLeuw, Cather & Company.

The DL&W's Hackensack River Bridge, known as the Lower Hack, in 1979 (Boucher, HAER-Erie & Lackawanna Railroad Bridge).

There are three fixed steel deck girder river spans (one on the east and two on the west), each supported on three column bents. An 11-span reinforced concrete slab Kearny Viaduct forms the western portion of the west approach span. The bridge rests on concrete piers with timber piles and has an overall length of 1,309 feet and a width of 45 feet.

G.J. Ray, Chief Engineer of the DL&W, supervised construction. M. Hirschthal, the DL&W's Concrete Engineer, designed the concrete approaches. The American Bridge Company fabricated all the steelwork, the Foundation Company built the river piers and H.F. Curtis constructed the approach viaducts.[5]

5. "D.L. & W. Completes Three-Track Lift-Span Bridge."

PENNSYLVANIA RAILROAD BRIDGES

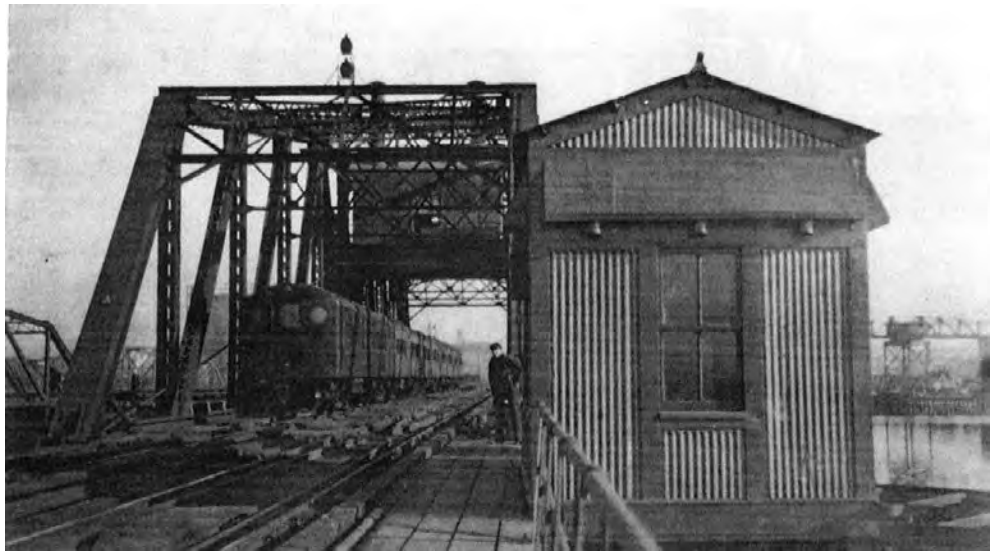
The Pennsylvania Railroad selected Waddell & Hardesty to design its freight and passenger bridges. Construction began on both bridges simultaneously at the end of 1928. The first eastbound train passed over the new passenger bridge on November 2, 1930. The freight bridge opened two days later. Both the passenger and freight bridges took less than 22 months to complete and cost $9 million combined.[1]

The Pennsylvania Railroad shifted the alignment of its new passenger bridge about 80 feet south of the existing swing-span bridge. The eastern approach consists of a three-span concrete viaduct, a through girder span, five deck plate steel girder spans, and a deck truss span. Eight deck plate girders, a through girder and a three span concrete viaduct form the eastern approach. The vertical lift is a 331-foot Parker truss lift span that provides a clear channel of 166 feet. The lift span is flanked by two Pratt truss tower spans supporting the back legs of the lift towers. The bridge rests on a concrete substructure and measures 2,950 feet long.

The Pennsylvania Railroad's existing freight bridge had less than a nine-foot clearance above mean high water. The Army Corps of Engineers generally required that all new bridges had to have a minimum 35-foot vertical clearance above the navigation channel. Raising the level of the freight bridge to the required height would have necessitated raising the railroad tracks approaching the bridge for some two miles. In the Kearny meadows just beyond the western end of the bridge lay Meadows Yard, one of the Pennsylvania Railroad's most important freight yards on the east coast. Raising the elevation of the bridge and its approach tracks would require a commensurate change in grade of the yard, a prospect that would totally disrupt the goods handling system for much of the port region. In this instance, the Army Corps granted the railroad an exception and specified that the freight bridge only needed to be raised a little more than four feet to achieve a relatively low 13-foot clearance.[2]

The Pennsylvania Railroad built its new freight bridge north of its existing bridge in order to keep the railroad line open while constructing the new bridge. The freight bridge is comprised of one through girder and four deck plate steel girder western approach spans, two Pratt truss tower spans, a 206-foot long Parker truss lift span, and one deck plate steel girder and a six span concrete viaduct at the eastern approach. The bridge is 1,188 feet long, rests on reinforced concrete piers, and provides a 158-foot wide channel.[3]

Power to operate both lift spans came from four sources of power: two independent 650-volt D.C. motors, a connection with a 4,150-volt circuit to Public Service, and gasoline engines located in the machinery house on each of the lift spans. The freight bridge could be raised or lowered between two and three minutes, while the passenger



The Pennsylvania Railroad's passenger bridge in 1919, looking east, with Hudson & Manhattan Railroad train crossing the bridge. The swing span of the Pennsylvania Railroad freight bridge is visible at left (Interstate Commerce Commission, Railroad Valuation Records).

The Pennsylvania Railroad's freight bridge, completed in 1894, looking west in 1919 (Interstate Commerce Commission, Railroad Valuation Records).

1. "Two Heavy Spans Floated Into Place to Complete Hackensack River Bridges;" "Special Features Used in New Lift-Span Bridges."
2. USACE 1926, 9.
3. "Special Features Used in New Lift-Span Bridges."

span was slightly faster. Instead of an operator for each bridge, one operator housed in the east tower of the passenger bridge controlled the opening and closing of both bridges.[4]

The Pennsylvania Railroad personnel in charge of constructing both bridges included A.C. Watson, Chief Engineer of the New York District, T.W. Pinard, Engineer of Bridges and Buildings, and J.J. Vail, Construction Engineer. Bethlehem Steel erected the superstructure for the passenger bridge, and the Phoenix Bridge Company built the superstructure of the freight bridge.[5]

While the freight and passenger bridges were designed and built concurrently, each possesses unique qualities. To account for the different angles (or skew) at which they cross the river, the bridges are about 140 feet apart on the east shore in Jersey City and about 500 feet apart on the west side in Kearny. The freight bridge crosses the Hackensack River at a more perpendicular angle to the river than the passenger bridge, which crosses at a more acute angle. Since the freight bridge covers a shorter distance across the channel its lift span is 125 shorter than the passenger lift span. Another difference lies in the tower spans. The tower spans in the passenger bridge are integral components of the flanking fixed truss spans. The towers in the freight bridge, on the other hand, are independent of the flanking deck girder spans and are supported on deep box girders placed outside the flanking deck girder spans.[6]

4. Ibid.
5. "Two Heavy Spans Floated Into Place to Complete Hackensack River Bridges."
6. "Special Features Used in New Lift-Span Bridges."

Top: The Pennsylvania Railroad's passenger bridge in 1948. The Port Authority of New York & New Jersey began running PATH trains over the bridge in 1962 (Boucher, HAER-PATH Transit System Bridge).
Bottom: The Pennsylvania Railroad's Harsimus Branch freight bridge in 1984. Conrail took control of the bridge and the Pennsylvania Railroad's freight operations in 1976 (Boucher, HAER-Conrail Bridge).

NJ ROUTE 7-WITTPENN BRIDGE

The NJ Route 7-Wittpenn Bridge was dedicated on November 5, 1930 amid a heavy downpour. In attendance was Henry Otto Wittpenn, a former Jersey City mayor and now a member of the State Highway Department. Wittpenn died in 1931, and the State Highway Department named the bridge in his honor the following year.[1] The opening was celebrated by a half hour of whistles from a fleet of tugboats and other vessels, some of which had helped carry the draw span into place. The Wittpenn Bridge was completed in less than two years at a cost of $3 million.

The NJ Route 7-Wittpenn Bridge over the Hackensack River was one of six new bridges planned in the 1920s by the State Highway Department to improve highway connections in and around Newark and Jersey City. The New Jersey State Highway Department included the Newark Turnpike as part of Route 10 (later renumbered Route 7) in the state highway system in 1927. Route 10 started in Jersey City, crossed the new bridge over the Hackensack River, headed through Kearny, Harrison, Newark, Bloomfield, the Oranges, and terminated in Dover, Morris County.[2] Another bridge included in the long-range plan was a proposed high-level viaduct carrying Route 25 spanning the Passaic and Hackensack rivers. Later dubbed the Pulaski Skyway, the bridge soared 135 feet above the river and was an engineering marvel when it was completed in 1933.[3]

In 1927, the New Jersey State Highway Department received proposals to design the lift span of the Wittpenn Bridge from three engineering firms: Harrington, Howard & Ash; Waddell & Hardesty; and the Strauss Engineering Corporation.[4] Harrington, Howard & Ash, a New York-based engineering firm, was chosen to design the bridge superstructure.[5] All principals of the firm – John Lyle Harrington, Ernest E. Howard and Louis R. Ash – began their careers under the tutelage of J.A.L. Waddell. The trio established their own firm in 1915. Between 1915 and 1928, they designed 45 vertical lift bridges, 13 bascule bridges, and six rolling bascule bridges. During the Depression, the firm received many New Deal projects for both railroad and highway bridges. The firm became Ash, Howard, Needles and Tammen in 1928 and was renamed Howard, Needles, Tammen & Bergendoff in 1941.[6] The firm, now known by its initials HNTB, survives today as one of the nation's largest transportation engineering concerns.

Supervising the work at the State Highway Department were William H. Hudson, Assistant Construction Engineer; Sigvald Johnannesson Engineer of Design; and O.C. Whitman, Resident Engineer. Johnannesson, a graduate of the University of Copenhagen, is best known for his design of the Pulaski Skyway. The Foundation Company of New York and Charles Kavanaugh were hired to pour the foundations. The Stroebel Steel Construction Company of Chicago built the superstructure. The job of dismantling the old Newark Turnpike bridge rested with Merritt-Chapman & Scott Corporation.[7]

The War Department approved plans for the new Route 10 bridge in June 1928.[8] The new structure would be sited south of the existing bridge and would eliminate the dangerous S-curve at the Jersey City approach. Construction began at the end of 1928 when caissons for the piers were sunk. Construction continued without incident until May 1929 when a worker on a floating concrete mixer was killed when the pontoon sank. The concrete was being used in construction of the bridge abutments.[9] In order to provide level footing on which to lay the bridge piers, caissons were submerged below the water so that the workers, called sandhogs, could dig out the underlying rock and mud. While 75 feet underwater and 250 feet from the shore, an exploded

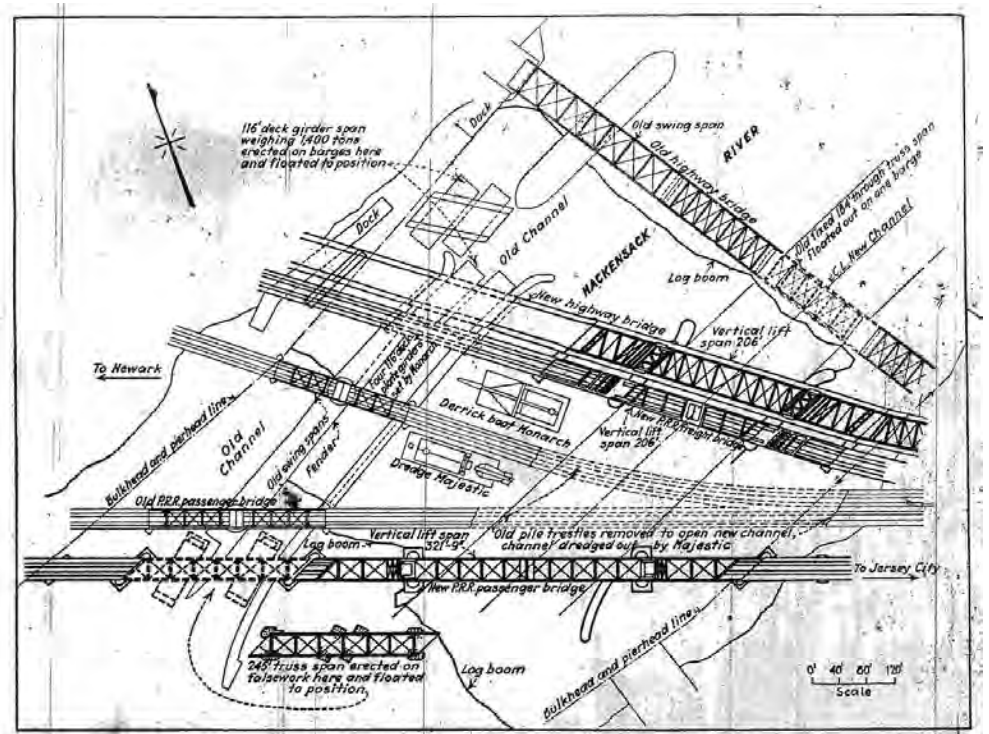


FIG. 2—LAYOUT OF HACKENSACK RIVER BRIDGES

Layout of the Hackensack River Bridges showing the sequence of construction ("Two Heavy Spans Floated into Place").

1. "Moore Signs Milk and Other Bills," *Trenton Times*, 3 May 1932.
2. New Jersey State Highway Department.
3. "Hackensack River Bridge Approved," *Trenton Times,* 9 June 1928.
4. "New Bridge Ordered for Hackensack," *Newark News,* 26 September 1927.
5. "Plans Ordered for New Span on Hackensack," *Newark News,* 18 October 1927.
6. A.G. Lichtenstein & Associates, Inc., 63.
7. "Two Heavy Spans Floated Into Place to Complete Hackensack River Bridges."
8. "New Turnpike Bridge is O.K'D," *Jersey Journal*, 11 June 1928.
9. "Divers Seek Body of Man in River," *Newark News,* 10 May 1929.

1931 aerial view of the completed Hackensack River lift bridges. The Seaboard By-Product Coke facility is at left and across the river is Public Service's Marion facility (New York Public Library 2015).

air pressure line caused additional deaths when an onrush of mud and water into the caisson claimed six lives and injured ten others.[10]

At 2,169 feet long, the Wittpenn Bridge has deck plate girder approach spans on concrete piers, two fixed camelback through truss spans, and a modified fixed Pratt through truss. The vertical lift span is a 209-foot long skewed Parker truss. Each tower is 160 feet tall and consists of a Pratt truss with front vertical columns and rear inclined columns. The 63-foot wide bridge was first built with two lines of streetcar tracks and two sidewalks on the outer edges of the bridge. The trolley tracks were removed in the 1950s.

The State Highway Department selected an alignment south of the old Newark Turnpike bridge, while the Pennsylvania Railroad shifted its new freight bridge north. Due to the proximity of the two bridges, the Pennsylvania Railroad and the State Highway Department agreed that the most economical method of construction would be to build one set of piers to support both structures. Construction of the freight bridge and the Wittpenn Bridge involved a novel solution in which the westernmost eight piers, including all the river piers and the west abutment, are shared by both bridges.[11] By having one set of piers instead of two, impediments to river navigation – caused by the 100-foot distance between the existing bridge's piers – would be removed.

As part of the bridge building project, the Army Corps of Engineers shifted the navigation channel from the west side of the river to a newly dredged 160-foot wide channel on the east side. To maintain a continuous navigation channel, the adjacent Pennsylvania Railroad freight bridge and Wittpenn Bridge were both built at the same 39 degree angle to the river so that their lift spans would align.[12] Navigation on the Hackensack River was halted for almost six days in 1930 – from Sunday, November 2 at 3:30 am to Thursday, November 6 at 11 pm – to shift the channel. By this time, the two Pennsylvania Railroad bridges and the Wittpenn Bridge were fully constructed with important exceptions. All three bridges were left with openings over the old west channel to keep the river clear for navigation. To allow for dredging of the new east channel, none of the lift spans would be inserted until the Army Corps completed its work.

The first task in dredging the channel and shifting rail and vehicular traffic to the new bridges involved inserting new spans into the opening over the old channel. The Pennsylvania Railroad's 245-foot through truss for the passenger bridge was erected on falsework in the river. At high tide at 5:30 in the morning of November 2, 1930, two barges maneuvered by four tugs floated the passenger lift span, weighing 813 tons, into its final position. The first New York bound passenger train passed over the new bridge later that morning.[13]

Around noon the same day, four deck plate girder spans, with a total length of 116 feet, were set in place into the freight bridge by a floating derrick. The spans had been erected off site and brought out on flat cars on the old freight bridge and unloaded by the derrick. The freight bridge went into service on November 4, 1930.[14]

The Wittpenn Bridge in 2005 in the open position (Elliott 2005).

10. "Neglect is Charged in Caisson Blast," *New York Times*, 31 May 1929.
11. "Two Heavy Spans Floated Into Place to Complete Hackensack River Bridges."
12. "Two Heavy Spans Floated Into Place to Complete Hackensack River Bridges."
13. Ibid.; "Special Features Used in New Lift-Span Bridges."
14. Ibid.

The fixed truss spans of the old Newark Turnpike bridge and the trestle from the Pennsylvania Railroad's two swing-span bridges were removed so that the Corps could freely dredge the channel. A 116-foot long deck girder span for the Wittpenn Bridge, erected in the river on two barges, was inserted into its final position simultaneously with the Pennsylvania Railroad's passenger bridge. The 184-foot through truss span of the old highway bridge was removed from the eastern channel on November 5 and floated out on a barge at high tide. The remainder of the bridges were dismantled, taken away, and sold for scrap.[15]

The new, modern bridges that crossed the Hackensack River were a functional success. Even so, they were generally considered unattractive. Many critics of the 1920s and 1930s argued that classical conceptions of beauty and historically-inspired designs were outdated and ill-suited to modern requirements and materials. Others criticized the vertical lift bridges carrying America's expanding rail and road network as a blight on the landscape, an "eyesore" and "ungainly."[16] In "Esthetic Design of Steel Structure" Aymar Embury wrote that "it is indisputable that of all of the types of bridges in common use, the lift span is the ugliest."[17] J.A.L Waddell countered that "some of them undoubtedly are ugly, but others, at least to an engineer's eye, are fine looking, being bold, massive, and evidently well-fitted for their purpose."[18]

Functional efficiency was Waddell's chief concern. He believed modern considerations of aesthetics would have to adapt to advances in engineering and materials. But Waddell also acknowledged the importance of harmony in setting, symmetry in design, the elimination of unnecessary ornament (any ornamentation should serve to emphasize function), and bridge elements that define their functions. According to Waddell, a bridge "must be fitted for the work it is to do, that it should express the truth, and that imitations and falsities are vicious and outside the realm of rational esthetics."[19]

15. Ibid.
16. Hoole and Kinne.
17. Embury, 263.
18. Waddell 1924, 215.
19. Waddell 1928, 636.

EPILOGUE

The economic malaise wrought by the Great Depression brought a precipitous decline to maritime traffic on the Hackensack River. Even during ramped up industrial production during World War II, total tonnage carried along the river remained stagnant. Maritime commerce revived during the 1950s as consistently more than four million tons moved along the river. But by the 1970s goods shipped amounted to less than three million tons then dropped below two million tons in the 1990s.[1]

The industries that precipitated construction of the Hackensack River bridges declined, were abandoned, and then demolished. The Navy took control of Federal Shipbuilding at the end of World War II and operated the yard until 1964. By the 1970s the facility had been shut down.[2] The property was recently converted by River Terminal Development into a warehouse and distribution center but the facility has no maritime use. The Diamond Shamrock Site (formerly Martin Dennis) continued as a chromate chemical manufacturing facility until it closed in the 1970s. The facility was demolished in 1979. At the Standard Chlorine site (formerly White Tar), naphthalene and naphthalene by-products were produced until the complex shut down in the 1990s. The Seaboard By-Product Coke Company continued to receive bimonthly shipments of liquid asphalt, sand and gravel into the 1970s until the Koppers Company shuttered the facility and leveled the buildings.[3]

The railroads fared little better. In 1954, the Hudson & Manhattan Railroad operating over the Pennsylvania Railroad's passenger bridge went into receivership. The Pennsylvania Railroad ceased running passenger service over the bridge in 1961. In 1962, the Port Authority of New York and New Jersey acquired the trackage and the passenger bridge and began operating the Port Authority Trans Hudson (PATH) service between Jersey City and Manhattan. In 1968, the Pennsylvania Railroad and the New York Central, the two largest railroads in the country, merged to form the Penn Central Railroad. Just two years later, the Penn Central filed for bankruptcy, the nation's largest bankruptcy up to that time.[4] In 1976, Conrail assumed control of the former Pennsylvania Railroad's freight operations and the Harsimus Branch freight bridge. The Norfolk Southern Corporation and the CSX Corporation acquired Conrail in 1998.

The declining Delaware, Lackawanna & Western Railroad merged with the Erie Railroad in 1960 to form the Erie-Lackawanna Railroad. The Erie-Lackawanna went bankrupt in 1972. New Jersey Transit took over commuter operations in 1983 and continues to operate the Hackensack River bridge as part of its Morristown Line.[5]

1. United States Board of Engineers for Rivers and Harbors 1951-2000.
2. Olsen 1999, 69.
3. AKRF 2008, B:2-11.
4. Coxey and Kranefeld 2007.
5. DeLeuw, Cather and Company 1991, 42.

The Wittpenn Bridge, operated by the New Jersey Department of Transportation, has remained a vital part of the region's transportation infrastructure. Yet the narrow lane widths and other physical deficiencies render the bridge substandard and functionally obsolete. The Wittpenn Bridge will be replaced by a new vertical lift bridge located on a new alignment immediately north of the existing bridge. The new vertical lift bridge will increase the vertical clearance over mean high water from 35 to 70 feet in the closed position and retain the 135-foot clearance in the open position. The replacement for the Wittpenn Bridge will be a modern structure, representing the pinnacle of vertical lift engineering in the same way the Hackensack River Vertical Lift Bridges Historic District embodies the engineering prowess of its era.

Circa 1970s aerial view of the Triple Hack Bridges. From left to right: Pennsylvania Railroad (PATH) Bridge, Pennsylvania Railroad Harsimus Branch (Conrail/CSX) Bridge and the NJ Route 7-Wittpenn Bridge (New Jersey Department of Transportation).

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KCR: Koppers Company Records
USACE: United States Army Corps of Engineers

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