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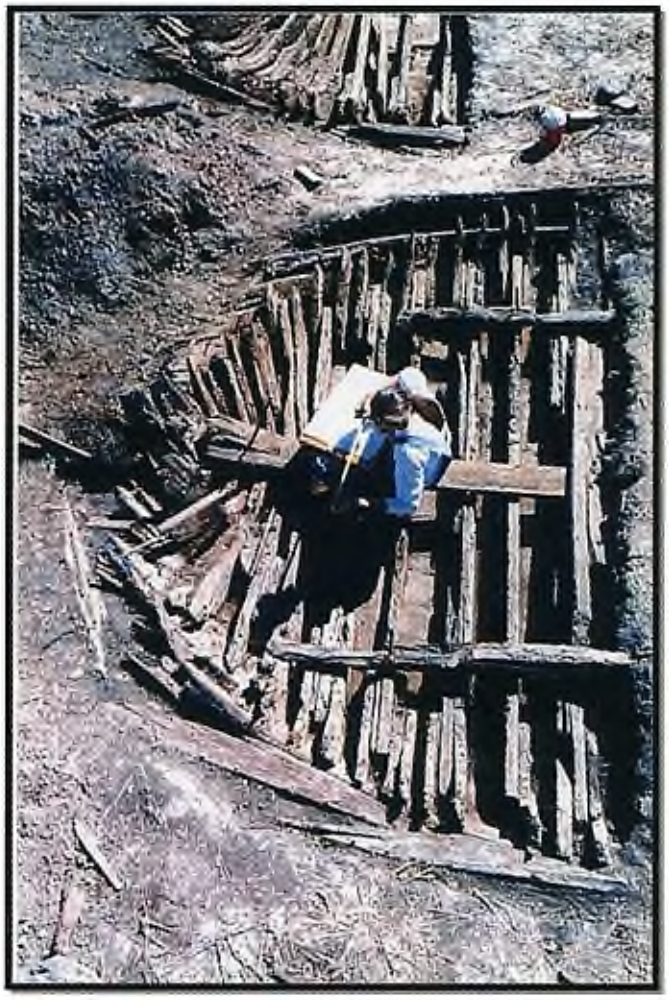

Fever River Research
Springfield, Illinois

1998

CANAL BOATS ALONG THE ILLINOIS AND MICHIGAN CANAL: A STUDY IN ARCHAEOLOGICAL VARIABILITY

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for
The Illinois Department of Natural Resources
Springfield, Illinois

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ABSTRACT

During the late summer of 1996, an unusually extreme thunderstorm deposited over 15" of rainfall on Chicago's southwestern suburbs within a 24-hour period of time. A result of this torrential downpour was the destruction of a dam across the Du Page River at Channahon which supplied a large section of the Illinois and Michigan Canal with water. The unexpected result of the dewatering of this stretch of canal was the exposure of 7 canal boat hulls within a section of canal known as the Morris Wide Water. Opened for navigation in the summer of 1848, the Illinois and Michigan Canal connected the southern tip of Lake Michigan (and the port city of Chicago) with the upper Illinois River valley and greatly influenced the settlement of the northern quarter of the state of Illinois. Although canal boats were once a common site along the canal, with hundreds of boats plying the waters between Chicago and LaSalle, little is known today about canal boat construction techniques in Illinois. Archaeological investigations at the Morris Wide Water have resulted in the detailed documentation of seven canal boats and have contributed to our understanding of these nineteenth century maritime resources.

Introduction

During the late summer of 1996, an unusually extreme thunderstorm deposited over 15" of rainfall on Chicago's southwestern suburbs within a 24-hour period of time. A result of this torrential downpour was the destruction of a dam across the Du Page River at Channahon which supplied a large section of the Illinois and Michigan Canal with water. The unexpected result of the canal de-watering was the exposure of 7 canal boat hulls within a section of canal known as the Morris Wide Water (Figures 1 and 2). With the unexpected discovery of the canal boats, the Illinois Department of Natural Resources (IDNR) quickly recognized the archaeological potential of these maritime resources, as well as their accessibility to looting and vandalism. With this in mind, the IDNR initiated a plan of study and contracted with Fever River Research to document these resources and assess their potential National Register of Historic Places eligibility. As the IDNR and Fever River Research were to discover, these boats had great appeal to the general public, and over the course of the project hundreds of people (both young and old) visited the site to view the boats and the excavations.

Archaeological investigations at the Morris Wide Water were initiated by Fever River Research for the IDNR during the late fall and early winter of 1996. At that time, we began mapping the surface remains of these structures.[1] Unfortunately, late fall rains resulted in the canal bed taking on water and inundating two of the boats prior to our completing this task. Prior to the water receding, the weather turned cold and the snow began to fly. It was not until the next summer (1997) that we were able to conclude this work. Our goal was to map the surface remains of the seven canal boats, expose a representative bow and stern section for more detailed mapping purposes, assess the integrity of the boats under investigation, and determine the extent of the boats' contents (if any). As the work progressed, we learned about the great variability between the boat framing techniques. We eventually opened up a bow, midsection, and stern on two of the boats (Boats 5 and 6), as well as the partial midsections of two other boats (Boats 1 and 7). Additionally, we relocated the remains of the *City of Pekin* near Channahon, and documented the mid-section chine detail of this vessel.[2]

[1] The remains of the seven canal boats within the Morris Wide Water have been assigned Illinois Archaeological Survey site number 11GR205.

[2] The chine is that area where the sides and bottom of a boat come together. The remains of the *City of Pekin* were located along the north bank of the Illinois and Michigan Canal slightly down river of the U. S. Route 6 bridge on the northwest edge of Channahon. Except for a short section of the boat's midsection, little remains intact of this structure. Both the bow and stern of the vessel have disappeared. At the time of our investigations, a large section of the boat had washed ashore and/or been dragged ashore, along the opposite bank. This boat offers little opportunity for further archaeological investigations.

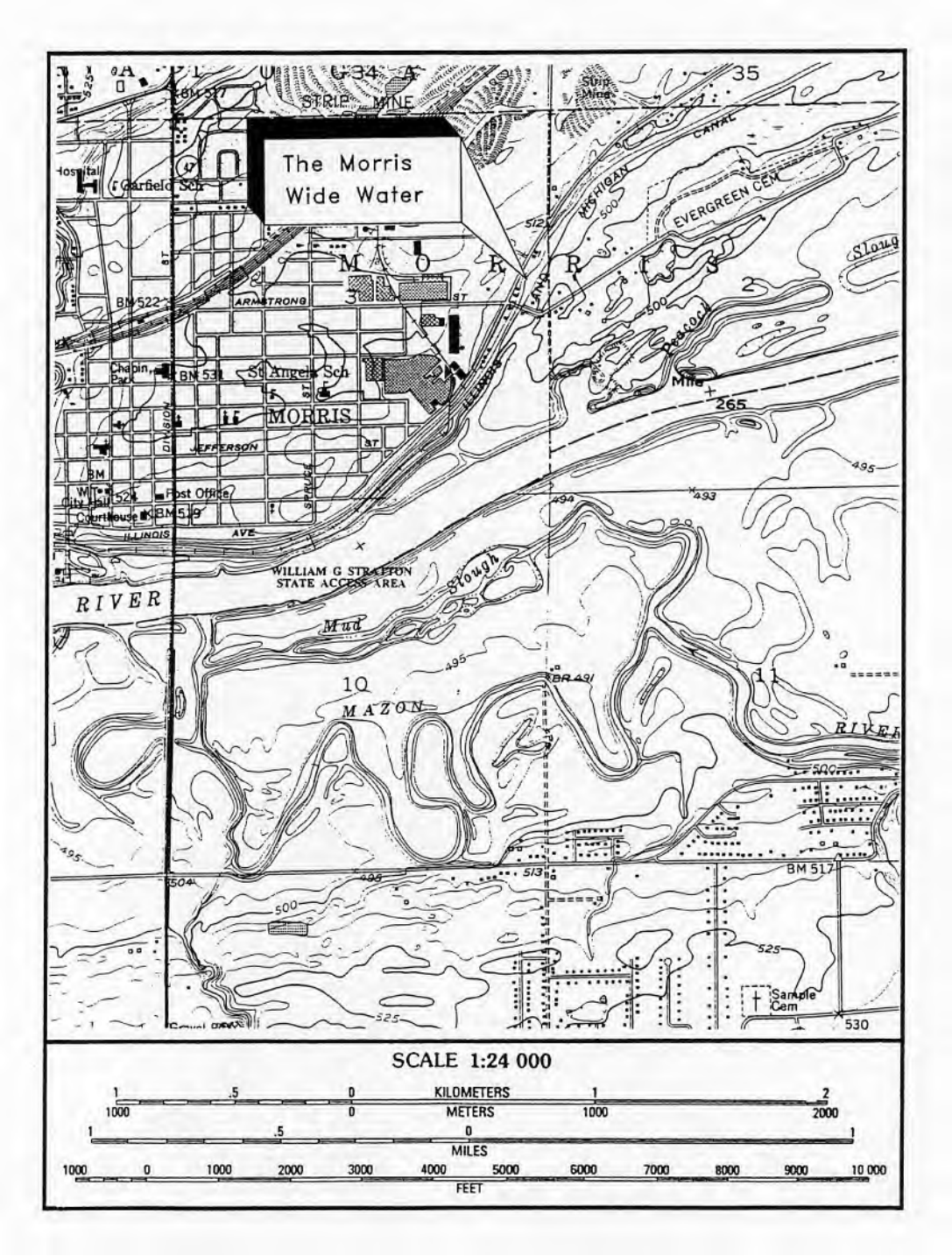

Figure 1. Location of the Morris Wide Water in relationship to the Illinois and Michigan Canal, Armstrong Street and the City of Morris, Illinois.

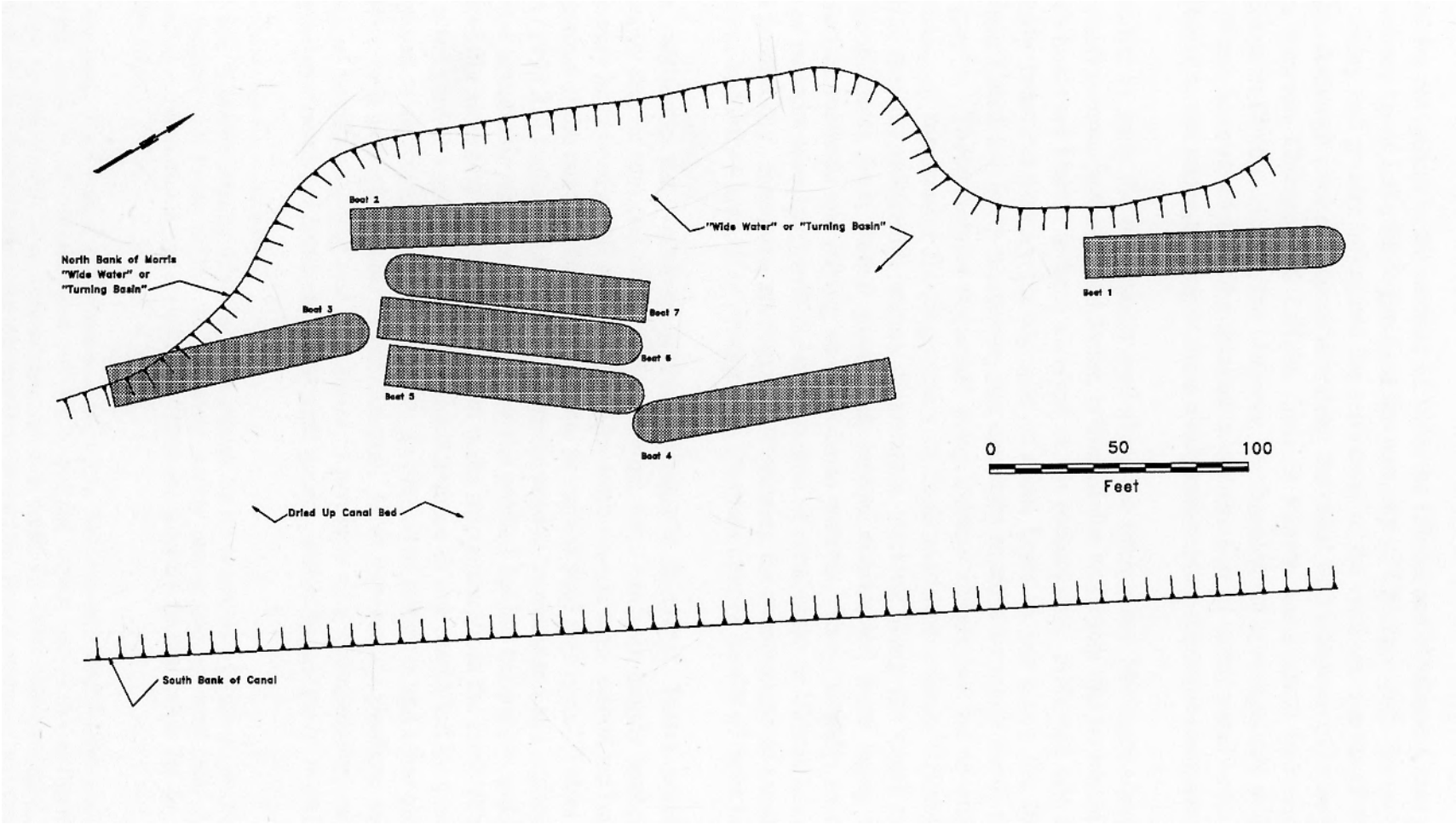

Figure 2. The remains of seven canal boat hulls were exposed at the Morris Wide Water during the low water of 1996. This map illustrates the location of these boats within the turning basin.

Opened for navigation in the summer of 1848, the Illinois and Michigan Canal connected the southern tip of Lake Michigan (and the port city of Chicago) with the upper Illinois River valley and greatly influenced the settlement of the northern quarter of the state of Illinois. Although once a common site along the canal with hundreds of boats plying the waters between Chicago and LaSalle, little is known about canal boat construction techniques in Illinois, or even the Midwest. Archaeological investigations at the Morris Wide Water have resulted in the detailed documentation of seven canal boats and have contributed to our understanding of these nineteenth-century maritime resources.

Our ability to study the canal boats used along the Illinois and Michigan Canal, as with most canal systems in the United States, is limited due to the fact that no whole examples of such boats are known to have survived to the present day. Although late nineteenth and early twentieth century photographs of canal boats in use along the Illinois and Michigan Canal are fairly numerous, one can only squeeze so much detail from these photographs. These pictures document many exterior details but fail to elucidate the complexity of the interior framing system of these maritime vessels.[3] Similarly, it is doubtful that the nineteenth-century shipwrights working along the canal constructed their canal boats from formal plans, but instead constructed them using traditional construction methods and relying on a few basic patterns. Unfortunately, no blueprints, plans or patterns associated with the construction of canal boats in Illinois have survived to the present day. Similarly, photographs illustrating the construction of canal boats are unknown, and only a handful of photographs illustrate interior details of these boats.[4]

When discussing the workforce within Michigan's shipyards, Peters notes that the nationality and/or ethnicity of the shipyards work force has been largely unexplored, and "there may have been subtle differences in the ways vessels were assembled based on the background of the naval architect or designer or various yard managers" (Peters 1993:20). Peters (1993:21) further noted that "shipwrecks need to be evaluated as a separate form of evidence about shipyards as they represent the product behind the people and processes. By carefully analyzing the remains, we can make inferences about the kinds of equipment used at the yard at a given time, such as the difference in saw marks left by a circular saw as opposed to an up-and-down muley saw. Evolution of fasteners and other shipbuilding materials such as steel can also be documented. *Most importantly, perhaps we can start looking at wrecks as being one of a series of products of a manufacturer, and that the manufacturer produced products of variable quality, either by design or necessity. How these products relate to each other in terms of similarities in construction or in the evolution of design needs to be evaluated* (italics added)."

Our ability to understand the details of Midwestern canal boat construction was greatly increased by the de-watering of the Morris Wide Water, and the "rediscovery" of the multiple submerged

[3] This lack of interior framing detail has been pointed out by several individuals, particularly maritime model builders (c.f. Lowe 1975). Unfortunately interior photographs of canal boat frames under construction (such as that in Paget-Tomlinson 1993) are unknown by this author for the Illinois and Michigan Canal.

[4] This dilemma is not unique to the canals of Illinois or the Midwest. Historically, one of the most significant canals in the United States was the Erie Canal, which opened for navigation in 1825. Discussing the preservation of canal boats along the Erie Canal, the Canal Museum (Canal Boat Primer 1981:3) notes "It is hard to believe that the canalboats of the Erie Canal System… would vanish from the scene with barely a trace remaining."

canal boats at this location (Figure 3).[5] Many years ago, Cleland and Stone (1967), as well as Noble (1991), advocated the use of archaeology for the study of canal systems. Although previous archaeological research in Illinois has been undertaken on canal locks along the Illinois and Michigan Canal (cf. Noble 1986), nothing has been undertaken on the study of canal boats in the state. Similarly, little professional archaeological work has been conducted on canal boat remains in the Midwest, or within the Great Lakes states (cf. Halsey n.d.). In many instances where archaeology is used to study canal boat construction, the percentage of the boat that the archaeologist is able to inspect is fairly small, often lending itself poorly to a good understanding of the resource (cf. Noble 1992). Not only were we fortunate that the bottom foot of a canal boat's hull was laid open with minimal amount of overburden (exposing the boat's hull from bow to stern), but we had multiple boats to work with.

[5] The canal boats at the Morris Wide Water were first discovered in June 1978 by Mr. David Carr, then site superintendent of the Illinois and Michigan Canal State Trail (which was then under the direction of the Illinois Department of Conservation). The discovery of the canal boats was made at that time when an unusually severe storm caused a portion of the canal bank to break, de-watering a section of the canal bed and adjacent turning basin (IHPA 1978:10). To everyone's surprise, the hulls of what was interpreted at that time as five boats were noted in the turning basin. Although aerial photographs were taken, the basin refilled immediately and no further work was done on the boats. At that time, discussions floated around the Illinois Department of Conservation about conducting archaeological investigations on the boats. Unfortunately, the plans "to send an archeological team to measure, photograph, and otherwise document the hulks" never materialized (IHPA 1978:10). The senior author of this report discovered the 1978 aerial photographs of the canal boats in the Illinois Historic Preservation Agency's site files in 1987, and at that time, became intrigued by the unique character and research potential of these underwater resources. In late 1996, surprised to learn that these boats had once again resurfaced, the senior author was elated to be able to conduct research on these boats. This time around, with the aid of Dr. Harold Hassen and the Illinois Department of Natural Resources, a detailed strategy was initiated to study the canal boats and collect data on the design, construction, and use of these nineteenth-century vessels.

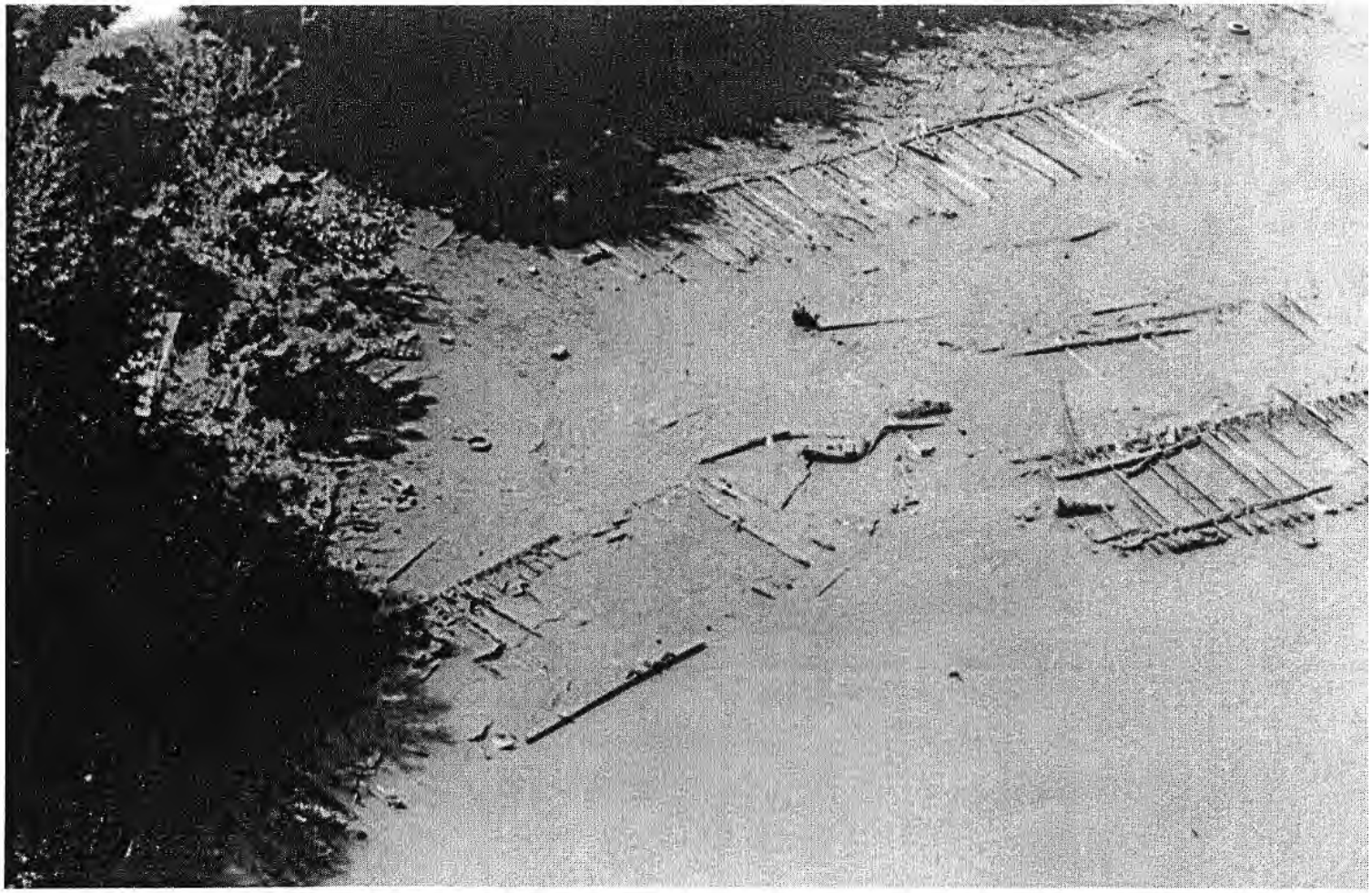

Figure 3. Canal boats at the Morris Wide Water as exposed in June 1978. The canal boats at the Morris Wide Water were first discovered in June 1978 by David Carr, site superintendent of the Illinois and Michigan Canal State Trail. At that time, another unusually strong storm caused a portion of the canal bank to break, de-watering a section of the canal bed and adjacent turning basin. Although aerial photographs were taken, the basin refilled immediately and no further work was done to document the boats at that time (IDNR site files, Springfield).

The Illinois and Michigan Canal

Transportation corridors have always played a significant role in the settlement of Illinois during both the prehistoric and historic periods. Early travel between Lake Michigan and the Upper Illinois River Valley (which eventually opened into the Mississippi River and the Gulf of Mexico) required a short, but difficult portage across a low lying area located at the head of the Chicago River. Additionally, the shallow and rocky nature of the upper Illinois River hindered steamboat travel past the rapids located at LaSalle-Peru. In order to make the upper Illinois River navigable to commercial traffic and connect the Illinois River to the Great Lakes, a relatively long canal was needed.

In northern Illinois, the Illinois and Michigan Canal, which opened for navigation in the summer of 1848, connected the southern tip of Lake Michigan and the port city of Chicago (and the major east coast markets connected by the Great Lakes waterway) with the upper Illinois River valley and greatly influenced the settlement of the northern region of the state. The construction of this commercial waterway helped transform the northern region of the state from a sparsely settled frontier district to a commercial, agricultural, and industrial region with Chicago as its entrepot (cf. Cronon 1991). As one contemporary newspaper reporter noted, with the opening of the Illinois and Michigan Canal, "Chicago will now rise from her position of a mere three-penny retailer to the dignity of a wholesale dealer" (Ottawa Free Trader 4/7/1848).[6]

Interest in building a canal connecting these two waterways began immediately after the War of 1812. In 1816, Ninian Edwards negotiated the purchase from the Indians of a 100-mile strip of land along the Illinois River in hopes of constructing the canal. In 1822, in response to a petition from the Illinois legislature, Congress authorized construction of the Illinois and Michigan Canal. Although the state was expecting a large land grant to finance the construction project, they were granted only a 90-foot wide strip each side of the proposed canal right-of-way. This narrow strip of land each side of the canal, sufficient for a towpath, was needed for the operation of the canal. Although a private corporation received a charter to construct and operate the canal at that time, little was accomplished. In 1827, in response to the State's multiple pleas, Congress granted alternate sections of land for five miles on each side of the canal to the State to help finance the construction of the canal. During this transaction, the State received title to over 290,000 acres of land. A stipulation of this land grant was that the work must be initiated within five years, completed within 20 years, and the Federal Government could use the canal toll free for the life of the canal (Howard 1972:193-196; Krenkel 1958; Pease 1918).

[6] The Illinois and Michigan Canal has been listed on the National Register of Historic Places and designated a National Historic Landmark. The Illinois and Michigan Canal was also the impetus for the creation of the Illinois and Michigan Canal National Heritage Corridor in 1984. This was the first such corridor recognized by the National Park Service, and was established to enhance and interpret the cultural, historical, natural, recreational, and economic resources within the region (cf. Conzen and Carr 1988).

Construction on the canal did not begin until July 1836. Using hand tools, animal power, and a large number of imported Irish laborers, construction initially proceeded quickly, only to be interrupted by the economic Panic of 1837. During the late 1830s and initial years of the 1840s, work on the canal proceeded slowly due to the difficulty in raising funds, and in 1842, work on the canal stopped completely for a short duration. In 1845, under Governor Ford's leadership and with the levy of new taxes directed at repaying the canal debts, new loans were negotiated with British bondholders to complete the canal (Howard 1972:229-230).

The Illinois and Michigan Canal officially opened on April 23, 1848. By the end of the first 180-day navigation season, 162 canal boats had used the system and paid nearly $88,000 in tolls (Howard 1972:239).[7] The canal had taken 12 years to construct at a cost of nearly 6.5 million dollars. Stretching 97 miles in length, the Illinois and Michigan Canal maintained a 6-foot-deep channel, minimally 60 feet in width at the top (and 30' in width at its base) and required 15 locks, numerous aqueducts, and multiple feeder canals to operate. As Howard (1972:239) notes, "So great was the canal's help in developing northern Illinois that, of all man-made waterways in North America, only the Erie Canal surpassed it in importance" (See also Putnam 1918; Howe 1956).

During the initial years of construction, settlement along the canal corridor was sparse, and contractors relied heavily on recruiting Irish immigrants for their work force. Many of the Irish workers were later to settle along the corridor, improving farms within the countryside and establishing businesses within the many communities that sprang up along the corridor. In contrast, with the opening of the Erie Canal in New York State, many New England families settled along the corridor, bringing a strong Yankee culture to the region. By the late 1830s, settlement along the Canal had intensified and many small communities had begun to develop in the region.

During the early years of navigation along the Canal, mule-powered packet boats, traveling at the rate of 5 to 6 miles per hour, transported passengers as well as a wide range of small commodities, competing successfully with the overland stage and teamster service typical of the period. By the Civil War period, and the introduction of the competing railroad system that paralleled the Canal, the majority of the cargo hauled along the Canal was bulk commodities such as grain, coal, stone, and lumber. These boats traveled at a slightly slower rate of approximately 3 miles per hour.

But, the canal era in Illinois was not to last long. Although interest in a railroad system in the State had also been developed with the internal improvement plans of the 1830s, it was not realized until the early 1850s with the construction of the Illinois Central Railroad. By the early 1850s, the Chicago, Rock Island, and Pacific Railroad had established a line from Chicago to Rock Island that effectively competed with the Illinois

[7] Local newspapers noted that the tariff rates on the Illinois and Michigan Canal were high. One newspaper that published a partial list of the rates noted that "it is noticeable that the rates are higher by at least one half than on most of the eastern canals, for what reason, we are unable to tell. It may be good policy, but as a general thing, we believe low tolls are considered more productive than high tolls" (Ottawa Free Trader 5/12/1848).

and Michigan Canal, particularly for the passenger traffic (Howard 1972:246). Revenue collected by the Canal Commissioners peaked in 1866 and declined throughout the remaining decades of the nineteenth century, picking up slightly during the period 1908 through 1918. The greatest tonnage hauled on the Illinois and Michigan Canal occurred in 1882 (See Figure 4; Putnam 1918:161).

Although the late nineteenth century was a period of gradual decline in the use of the canal, it continued to transport a wide range of bulk commodities along the corridor (c.f. Monckton 1995). Nonetheless, by the late 1880s, the competition from the railroads had taken its toll and the tonnage hauled along the Canal quickly declined. The economic collapse of 1893 dramatically affected the volume of grain sales, and thus the volume of traffic along the canal declined never fully recovering (Benedetti 1990:12). Coupled with the fact that revenue was declining, the state put little money into canal maintenance during the late nineteenth century, and the canal became clogged with silt hindering transportation. By the middle 1890s, most of the canal boats that had been in use on the Canal had been relocated to duty along the Illinois River. Although several studies were conducted during the late nineteenth century to revitalize and/or expand the Canal, they ultimately resulted in limited improvements to the waterway with a greater percentage of the Canal traffic being relegated to pleasure boating and leisure activity.

One of the final blows to the economic viability of the Illinois and Michigan Canal was the construction of the Chicago Sanitary and Ship Canal (which was initially designed to transport raw sewage from Chicago to the Mississippi River). Beginning in the early 1870s, the City of Chicago reversed the flow of the Chicago River, depositing the City's sewerage into the Illinois and Michigan Canal. Although this increased the flow of water through the Canal, it did not succeed in eliminating the City of Chicago's waste problems. Construction of a new, larger canal to remove the City's sewage down the Illinois and Mississippi Rivers was opposed by many down river communities as well as the Illinois and Michigan Canal Commissioners. Nonetheless, a new canal was constructed and the main channel of the Sanitary and Ship Canal opened for navigation in January 1900. This channel was extended from Lockport to Joliet between 1903 and 1907. The construction of the Calumet-Sag Canal in 1906 cut through the upper reaches of the Illinois and Michigan Canal forcing canal boat traffic along the upper reaches of the Illinois and Michigan Canal to travel along the Chicago Ship and Sanitary Canal (Kamish 1990).

By the late 1910s, canal boat traffic along the Illinois and Michigan Canal had all but ceased. One of the last efforts to commercially utilize the canal was by the Morton Salt Company, which transported salt over the canal for three years beginning in the spring of 1912. At that time, the firm used "three old canal boats." Although the water levels were low in the canal, which was heavily silted up at the time and hindered their ability to fully load their boats, the firm was pleased with their efforts and continued transporting salt over the canal through 1914 (Morton 1915). Nonetheless, the last commercial use of the Illinois and Michigan Canal occurred in 1914 with the run of William Schuler's canal boat *Niagara* (Lamb 1978:224). As R. F. Burt, General Superintendent of the Illinois and Michigan Canal noted after the 1916 season "while there was not commercial boating of

importance on the Canal this season there is no telling to what extent nor how many miles pleasure and motor boats used the Canal" (Burt 1917). The December 31 1918 issue of the Morris *Daily Herald* (page 8, column 5; roll 52) noted that on September 22, "Traffic … resumed on Canal after ten years." The extent of this 1918 traffic was inconsequential.

The final death blow to the canal was the Federal construction of the Illinois Waterway System which consisted of a series of locks and dams that maintained a 9-foot channel for navigation on the Illinois River. The Illinois Waterway System opened in 1933 to a much larger series of tow boats. With the opening of the Illinois Waterway System in 1933, the Illinois and Michigan Canal ceased to operate as a canal.

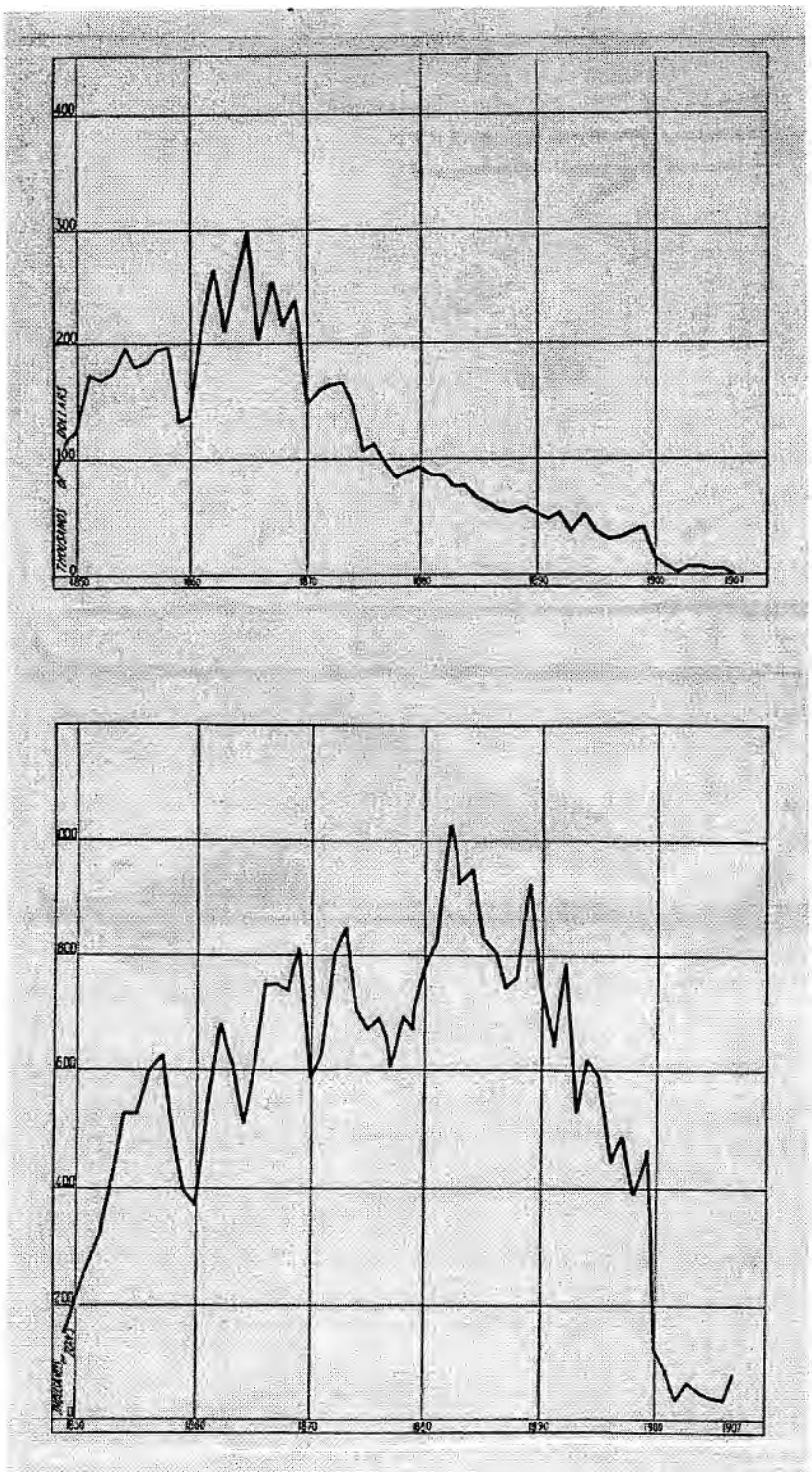

Figure 4. These two graphs illustrate the decline in the revenue collected (top) and tonnage transported (bottom) along the Illinois and Michigan Canal from its opening in 1848 through 1907. As these graphs illustrate, although canal revenues declined gradually after the middle 1860s, the maximum tonnage was not reached until 1882. By the late 1890s, the canal tonnage dropped precipitously low (Sauer 1916:171-72).

Canal Boats of the Illinois and Michigan Canal

The Documentary Evidence

The Illinois and Michigan Canal officially opened during the 1848 season. During the early years of the Illinois and Michigan Canal, some canal boats apparently were transported over the Great Lakes to Illinois even though it was a perilous trip (see Lamb 1978:212-213). These early canal boats probably were manufactured at construction facilities along the Erie Canal and potentially at other Great Lakes ports. One such boat was the *Colonel Yell*, an Ohio-built keelboat that was owned by the firm of Walker and Hickling of Ottawa (Ottawa Free Trader 4/21/1848).

Once the canal neared completion, it didn't take long for individuals to realize that boats were needed for use on the canal, and the local boat building industry quickly developed. According to local tradition, the first canal boat used on the Illinois and Michigan Canal was the *General Fry*, named after Colonel Jacob Fry, a native of New York who came to Lockport in 1837 and became one of the original Canal Commissioners overseeing the construction of the canal. The *General Fry* was constructed by C. M. Porter of Lockport in 1847 and launched in April 1848 (LeBaron 1878:95-96; Lamb 1978:211-212).

By the middle-to-late 1850s, commercial boatyards had been established at three locations along the Illinois and Michigan Canal –at Bridgeport (today incorporated into the city of Chicago), Lockport, and Salisbury (later known as Peru).[8] Besides these three boatyards, much smaller and less successful boat-building operations probably were scattered along the canal, especially during the early years of its operation. The April 7th, 1848 issue of the Ottawa Free Trader noted that one of their community's "enterprising fellow citizens", a Mr. H. F. Eames, launched

> this afternoon his new and staunch built freightboat, the *Coal Trader*, at the side cut, near the lock. The "*Trader*" is a fine boat, of 120 tons burden, creditable to her builder, her owner, and the place. We understand Mr. E. will leave with a load for Chicago to-morrow.

This news brief in the Ottawa Free Trader was entitled "FIRST CANAL BOAT FROM OTTAWA" and suggests that the production of this canal boat was not to be an isolated event and that other canal boats were expected to be built at this location. Along eastern canals such as the Erie, boatyards often were small affairs (similar to that located at Ottawa), only making a few boats a year during good times. According to the Canal Museum (1981:12), each yard specialized in a particular boat type "with its own design

[8] Peters (1993:20) notes that local builders in Michigan serviced a region that encompassed an area with a radius of approximately 30 miles. Two of the three boatyards along the Illinois and Michigan Canal are located at each end of the canal (at Peru and Chicago where they can also participate in the riverine and Great Lakes trades, respectively). The third was located at Lockport (near the eastern end of the Canal) which became the headquarters of the Canal Commission.

features." Unfortunately, little is known about these nineteenth-century industrial facilities in Illinois.

The 1850, 1860, 1870 and 1880 Federal population and industrial censuses give us some insights –albeit limited-- into the character of the men working at these boatyards. The 1850 Federal census enumerated only four ship carpenters, all working at Chicago. By 1860, the number of ship carpenters had increased dramatically with these records documenting over 50 men working within the boat construction trades (as ship carpenters, shipwrights, and caulkers) during these years. Although the censuses document numerous blacksmiths, it is impossible to isolate the smiths working within the boatyards as we have done with the carpenters. According to the censuses, many of the men working on the boats came from the Northeast U. S. (including New York State, Vermont, and Maine), as well as from England, Ireland, Canada and even Germany. Although this research has identified over 50 individuals working in the boat construction trades along the canal, it has been unsuccessful in locating additional information on the individual families participating in the canal boat construction industry.[9]

According to the Federal Census, in 1880, there were approximately nineteen boat builders practicing their trade along the Lake Michigan shore, and seven establishments that were constructing boats that plied the Western Rivers (such as the Ohio, Illinois, Missouri and Mississippi Rivers). During the previous year (1879), these seven establishments had constructed only eight new river boats. According to this source, boat builder's specializing in canal boat construction were few in Illinois. The 1880 Compendium of the Tenth Census notes that there were only two establishments in the state that were building and/or repairing canal boats at that time. In contrast, seven were located in Maryland (which constructed 60 new vessels), nineteen in New Jersey (which constructed ten new vessels), 123 in New York (which constructed 441 new vessels), fourteen in Ohio (which constructed one new vessel), nineteen in Pennsylvania (which constructed 122 new boats), three in Vermont (which constructed five new boats), and two in Virginia (which constructed three new boats). During the previous year (1879), only one new canal boat had been constructed in Illinois (with Illinois canal boat builders having constructed less than 0.2% of all the canal boats constructed in the United States

[9] For a detailed list of the individuals participating in the regional canal boat construction industry, see Mansberger (n.d. a). Working with both the Chicago and Peru data is difficult. Many of the individuals enumerated in the Chicago boatyard probably were participating solely in the Great Lakes trades. Similarly, those enumerated within the Peru boatyards were also working on steamboats (and other craft) that were plying the waters of the Illinois River system. Of the three boatyards documented along the canal, Lockport is the only one that was landlocked along the canal and its trade presumably was solely canal boats. Limited archaeological investigations have been conducted at the site of the Lockport boatyard (Ingalls et al 1984).

One of the few boat carpenters that we have been able to find additional information on was Thomas Ryan. Ryan, a native of Ireland, was trained as a house(?) carpenter in his native country. In 1861, he arrived in Lockport, and "after living in Lockport for some time learned the boat builder's trade, and in connection with his brother John built canal boats." Business was apparently successful, as in 1886, along with other local businessmen, he organized the Lockport Loan and Homestead Association. In 1890, the Ryans apparently abandoned the canal boat business, and besides operating a construction firm, became dealers in lumber and coal.

that year). As such, it would appear that the repair of existing canal boats played a significant part in the business of these two Illinois establishments during the year 1879. It is presumed that both of these establishments were located along the Illinois and Michigan Canal, one being located at Lockport, the other at either Chicago or Peru.

Unfortunately, little else is known about canal boat construction in nineteenth-century Illinois boat yards. The 1880 Compendium of the Tenth Census gives us insights into the character of the single canal boat which was constructed in 1879 (as well as the more common repair work being conducted during that year). The single new vessel was constructed with a draft of 88 tons. During the course of the work at these two shops (in both new construction and repair), the two firms used 18 "knees", 10,000 feet of white pine lumber and 24,000 feet of white oak lumber. Apparently, no hard pine (southern "yellow" pine) was used at either of these two establishments. No other lumber was used in the construction of this vessel besides the white pine and white oak. The two establishments used 1,500 pounds of iron and 200 pounds of "yellow metal and brass" over the course of the preceding year. Unfortunately, it is not known how much of this material went into the construction of the single new canal boat.

The total value of the materials used in the construction of this canal boat was $2,600 and the "total value of all products" produced by the two shipyards was estimated at $8,300. Considering that the two establishments expended a total of $4,700 on wages during the course of the year, the two firms expenditures totaled $7,300, leaving an estimated annual profit of only $1,000 (or $500 per firm). Considering that the eight employees averaged an approximate $588/year wage ($4,700 total wages paid out divided by the eight employees), this was not an overly high profit for each firm (Walker and Seaton 1883:1182-1183)

During the nineteenth century, each boat plying the waters of the Illinois and Michigan Canal was required to file a "Certificate of Registry" listing the owner of the boat, the boats name, its tonnage (or size based on draft), the type of boat placed into service, and its home port. A scan of these documents on file with the Illinois State Archives note that during the 1850s and 1860s, three boat "types" were registered with Morris as a home port. These included a "Small Scow" (with a 30-ton draft), several "Scows" (with a 100- to 150-ton draft; average 125-ton), and "Lake Boats" (with a 100-150-ton draft; averaging 130-ton draft). According to Funk and Wagnall (1973:1206), a scow is "a large boat with a flat bottom and square ends, chiefly used for freight and usually towed." A Lake Boat was a scow specially adapted to use on the Great Lakes. Distinctive aspects of the Lake Boats were their tight hatches and the transom that projected over the stern. During the 1870s and 1880s, skiffs and pleasure boats were being registered, emphasizing the change in character of the canal during these post-railroad years. By 1906, gasoline-powered boats such as the 16-foot *John Thompson* (by that time the boats were being designated by their length and not draft) were being registered for use on the canal (Illinois State Archives, microfilm). During any given year, multiple boats would have registered Morris as their home port. In 1872, ten boats were known to have sailed from Morris as their home port (including the *Onondaga, Brilliant, France, Atlanta, Wave, Lilly, General Sherman, LeMont, J. B. Preston, and Contest*). In April of that

year, Captain Lorette of the canal boat *Atlantic*, noted "there are ten boats owned here and they are all good ones, some of them perhaps the best on the canal" (Unidentified Morris newspaper, April 1872).

During the nineteenth century, several different varieties of commercial boats used the Illinois and Michigan Canal. These canal boats were characterized predominately by the type of cargo carried by the boats and included Lake boats, packet boats, stone boats, grain boats, and lumber boats. As Lamb (1978:219) notes, "the variety of boats using the canal was as diverse as those using the Great Lakes." Nineteenth century plat and atlas illustrations note the variation in boat construction (see Figures 5 and 6).

The Packet Boat was a specialized vessel adapted for passenger travel between Chicago and LaSalle. Although still pulled by mules, they were quicker than the freight barges, traveling 5-6 miles per hour. In 1851, Carl Culmann, a Swiss engineer, described one such packet as a "floating dormitory" noting that it was 100 feet long by 12 feet wide. Lamb (1978) contains excellent descriptions of canal packet boats, as well as the quality of travel experienced by the passengers. With the introduction of competing railroads during the later 1850s and 1860s, many of these packet boats were converted to other uses.

Three types of Freight Boats were common on the Illinois and Michigan Canal during the nineteenth century. The first was the Lake Boat. As Lamb (1978:220) notes, Lake boats had a high upswept stern often with windows or inserts, rounded bows with watertight hatches and decks with the main cabin in the stern and "the hatches were about as wide as the boat and ran almost the entire length. Like all Illinois and Michigan boats the Lake boats had a continuous row of freeing ports or rail running the length of the boat." The second type of freight barge was the Grain Boat. In the grain boat, the main cabin was amidships with the crew's quarters forward in the bow; it had four hatches, two forward and two aft. The third type of freight barge was the Lime or Stone Boat. These boats had an open deck with the deckhouse located on the boat's bow and higher bulwarks to aid in storing the stone. All three variety of canal boats averaged approximately 100 feet long by 18½ feet wide. As Lamb (1978:220) notes, "since the size and tonnage of canal boats were limited by the size of the locks, all vessels were about the same size and tonnage." Later stone boats traveling the upper reaches of the canal often measured 120-128 feet long and 20 feet wide maximizing on the size of the larger lock that was installed at the Chicago River in 1871. These canal boats, which were some of the largest in the United States, were able to work only between Chicago and Lockport (Lamb 1978:220).

By the late 1850s, steam powered towboats (with propellers) were also operating on the canal. Eventually, these towboats completely eliminated the use of mules along the canal's towpath.[10] With the introduction of steam power, some freight boats were outfitted with steam engines and propellers. In other cases, smaller steam-powered tugs

[10] With the introduction of the steam powered towboat, shoreline erosion generated by the screw propeller became a concern. In the 1870s, the Canal Commissioners began lining the banks of the canal with stone (rip rap) to prevent erosion caused by the wake from the canal boat propeller (Lamb 1978:220).

were used to transport the unpowered freight boats. An 1871 newspaper along the canal distinguished between the unpowered *canal boats*, the *steam canal boats*, and the *steam tugs* of the period (Ottawa Republican Times 11/30/1871). By 1880, no mule-hauled barges were being constructed in Illinois boatyards. During the late nineteenth-century years, although the number of canal boats using the canal decreased, the tonnage of cargo transported increased (Lamb 1978:220). Not only could the steam powered towboats carry a cargo up to 90 tons, but they also could pull one loaded barge as well as push another, traveling faster than any mule-hauled barge.

Unfortunately, little has survived in the form of construction drawings or photographs documenting nineteenth century canal boats in Illinois. The sole example of line drawings detailing an Illinois and Michigan Canal boat is that of the *City of Henry* (later renamed the *City of Pekin*)(see Figures 7 and 8).[11] Apparently, the *City of Henry* was constructed in Chicago and registered in 1875. The boat was rebuilt dramatically in 1894 for service on the Illinois River, and, at that time, renamed the *City of Pekin*. The boat was again rebuilt in 1911. Although the boat was equipped with engines by the late-nineteenth century, it is suspected to have been constructed originally as a tow boat. By the middle 1930s, the boat was acquired by the State of Illinois in hopes of being restored and interpreted within the Illinois and Michigan Canal Parkway. At that time, the boat was hauled to Channahon and the Works Progress Administration (WPA), as part of the Historic American Merchant Marine Survey, prepared plans of the historic canal boat (and took a series of 8 photographs). Unfortunately, at the time that the plans were drawn, the aft 40 feet of the boat had been removed and rebuilt, presumably when the craft was outfitted for service on the Illinois River. Nonetheless, at that time, the *City of Pekin* was considered to be in the "best state of preservation of any of the remaining barges" (Dalenberg 1937). The plans of the stern prepared by the Historic American Merchant Marine Survey were recreated using details from a "similar vessel and as the State of Illinois has proposed to reconstruct the barge with the aid of these drawings, measurements from a similar barge were used for the missing section" (Dalenberg 1937).

[11] The early history of the *City of Pekin* is clouded (Ehringer 1937; Lamb 1980, 1978; Manley 1998; WPA 1937). One story suggests that the boat was initially named *the Clyde* and constructed as a mule tow boat. Other sources suggest that the boat was initially constructed as the *City of Henry* which was a propeller-driven craft registered in November 1875. Manley (1998:3) suggests that the steam engine was not added until 1911, and that the boat was initially constructed as a tow boat. Lamb (1980:6) notes that "it may be that the *City of Pekin* was originally built as a mule tow boat named the *Clyde*, but it certainly was not built as a tow boat named the *City of Henry*." The *City of Pekin* was transported to Channahon in 1936 in hopes of being restored. In 1941, the boat burned to the waterline and disappeared from the landscape. During the low water of 1997, staff from Fever River Research were able to relocate the badly disturbed remains of this vessel and document its chine detail. Unfortunately, it appears that only a short portion of the mid-section of the boat remains intact with both the bow and stern having been destroyed.

Figure 5. Flat bottomed canal boats with rounded bows and sterns were the work horse of the Illinois and Michigan Canal, transporting a wide range of bulk commodities such as lumber, grain, stone, and coal along the canal corridor. Unfortunately, none of these boats have survived to the present day, and little is known about their construction. This illustration of a mule-drawn canal boat along the Illinois and Michigan Canal was taken from Thompson Brothers and Burr (1873).

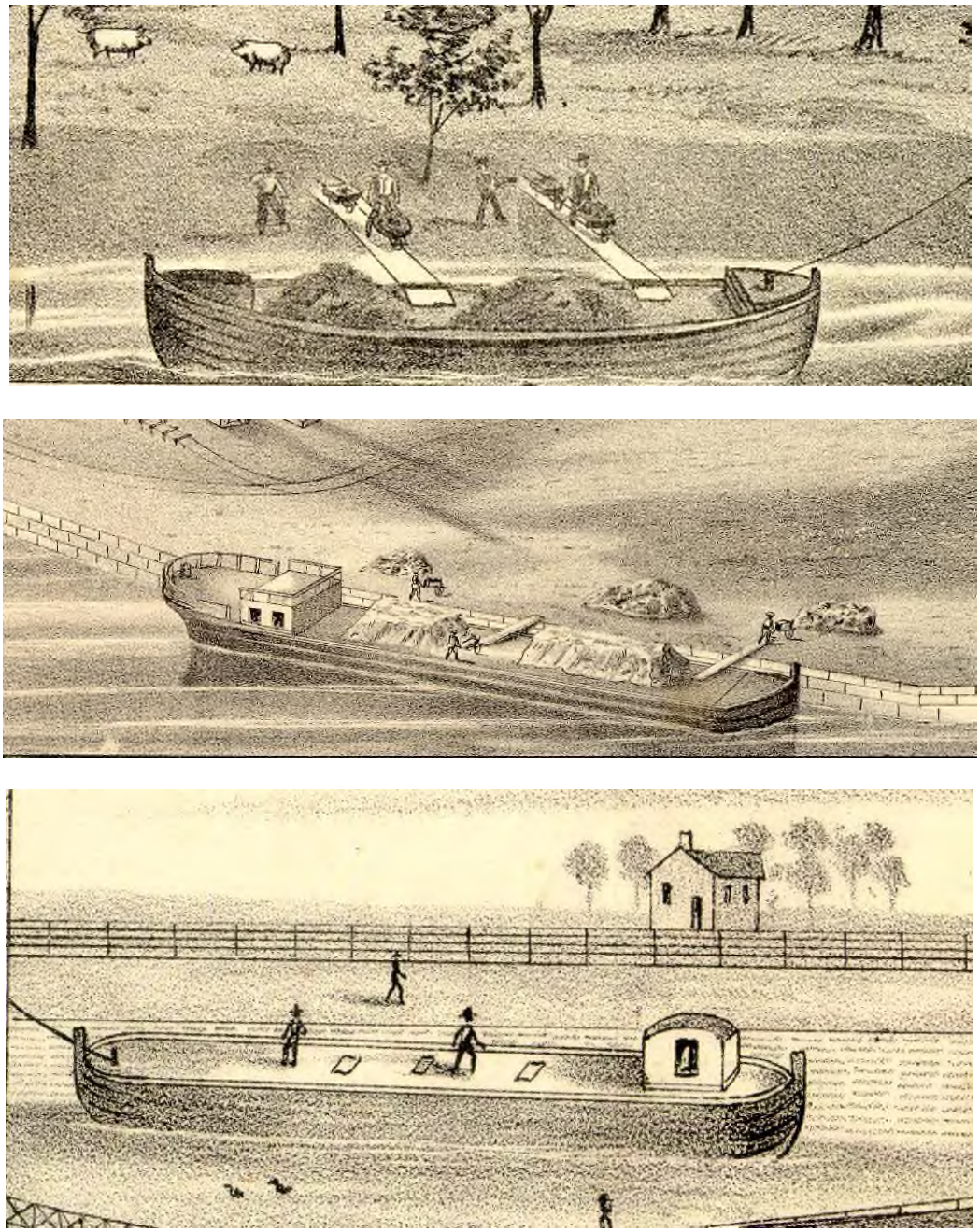

Figure 6. Three basic forms of canal boats present along the Illinois and Michigan Canal during the late nineteenth century, as illustrated in the Thompson Brothers and Burr (1873). Common boat forms included the open barge which lacked a deck cabin (top; here being loaded with coal), the open decked boat with stern cabin (middle, here loading stone and having a transom stern), and the decked barge with stern cabin (bottom).

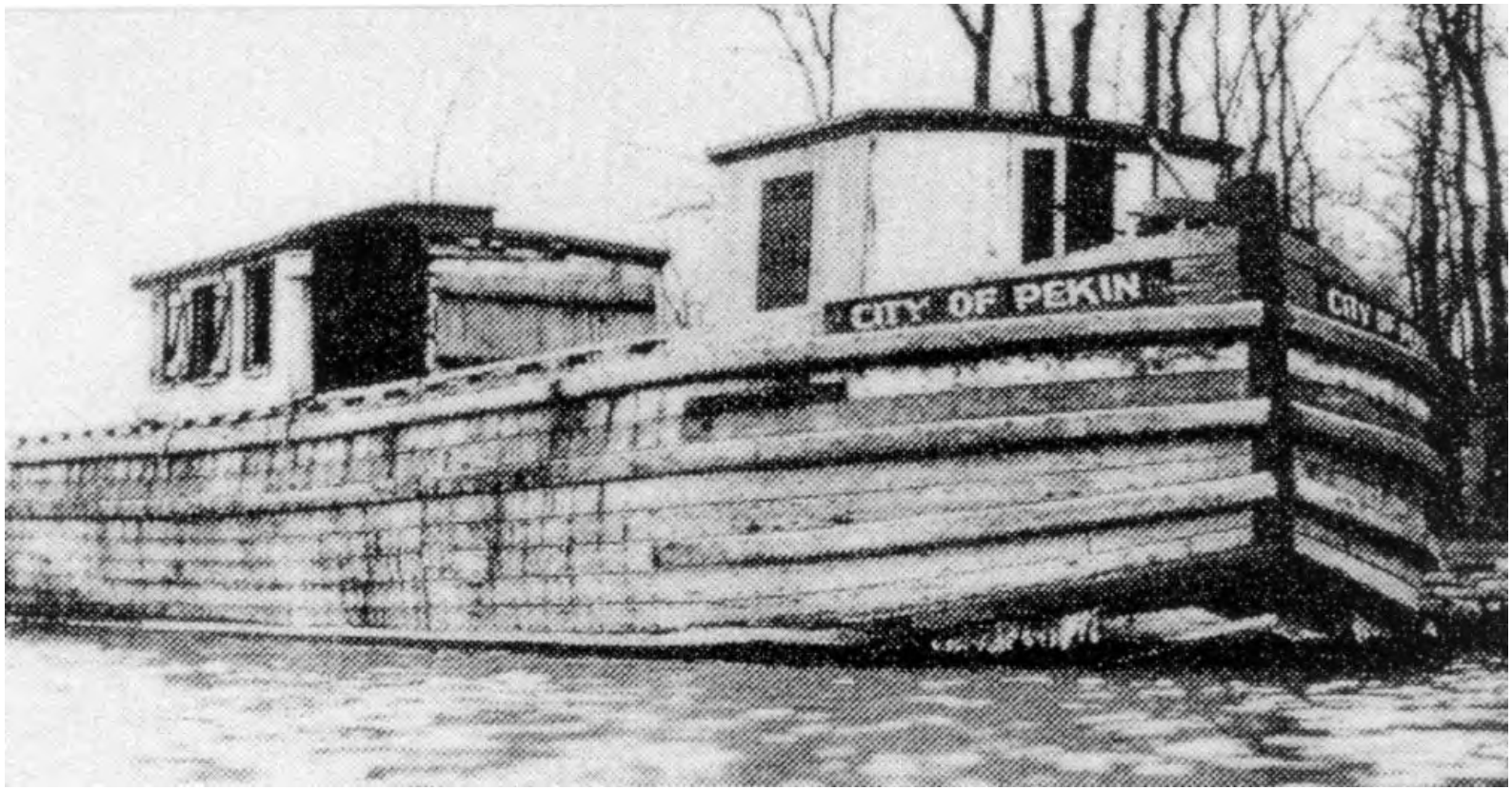

Figure 7. During the 1930s, the *City of Pekin* was purchased by the State of Illinois (Division of Parks) in hopes of being restored. At that time, this boat was touted as being in "the best state of preservation of any of the remaining barges" along the Illinois and Michigan Canal (Dalenberg 1937) and detailed plans of the boat were prepared by the Historic American Merchant Marine Survey. Unfortunately, this boat was destroyed by fire in the early 1940s prior to the restoration of this maritime structure. During the present study, the remains of this boat were rediscovered and limited details recorded (Lamb 1987).

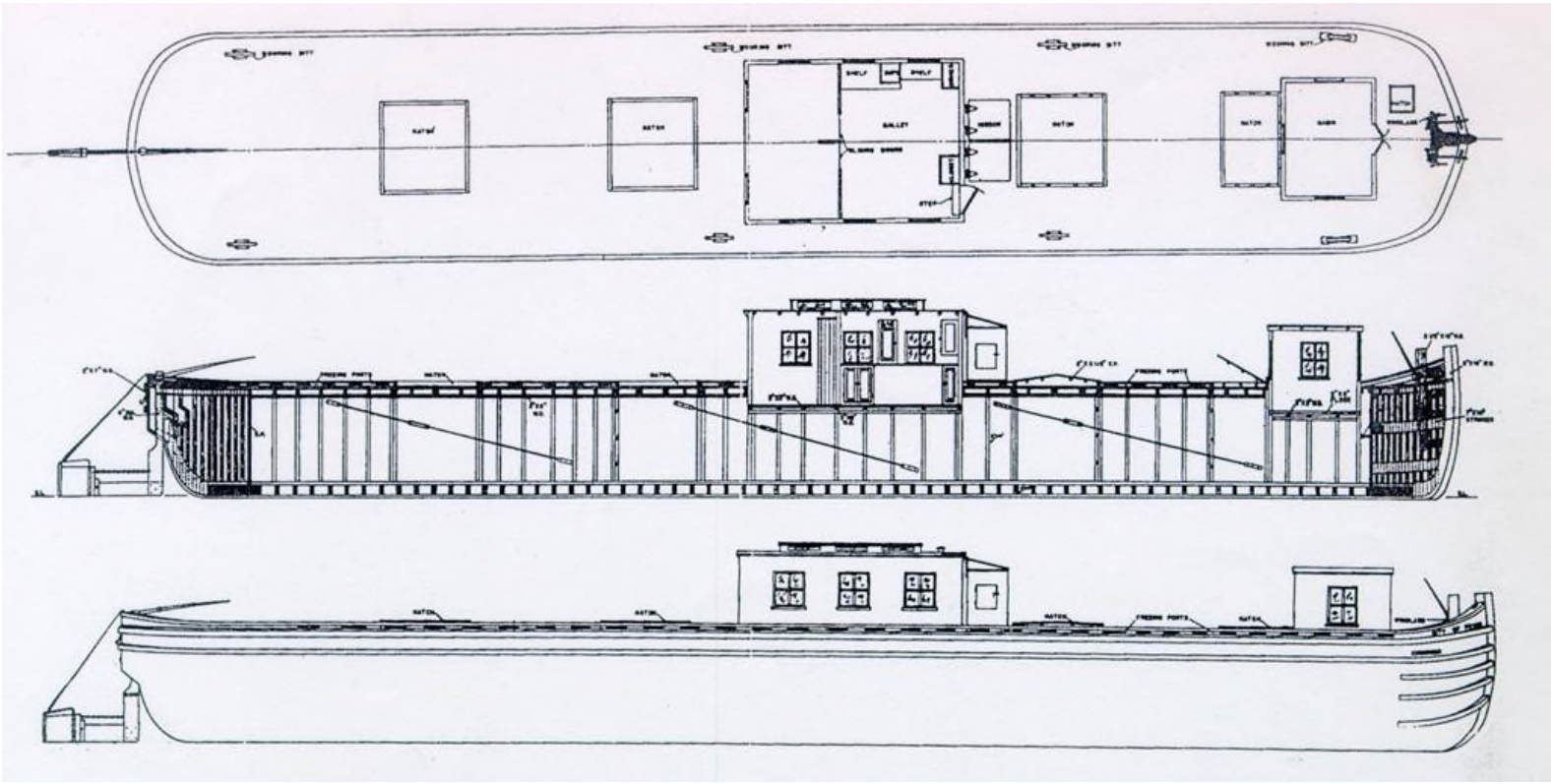

Figure 8. Inboard profile and outboard profile of the *City of Pekin* as drawn by the Historic American Merchant Marine Survey (sheets 4 and 5; as presented by Manley 1998). The stern and rudder details illustrated in these drawings were recreated, apparently based on other known examples.

As Lamb (1980:4) notes, "the drawings do not conform in either stern or rudder detail to a typical Illinois and Michigan Canal tow barge such as the *Irene* or to a propellar [sic] I. and M. Canal boat." Nonetheless, the plans for the *City of Pekin* "are the best and most detailed plans for a 19th century canal boat in existence" (Lamb 1980:5). Although one of the more interesting (and often cited) sources of information regarding canal boat construction along the Illinois and Michigan Canal, the use of the data relating to this boat is fraught with difficulty.

The Archaeological Evidence

Figure 2 illustrates the relative location of the seven canal boats located within the Morris Wide Water. Boat 1, which was located near the eastern opening of the wide water, was represented by a single line of exposed tips forming only one side of its side frames. The archaeological investigations documented that, although the bow section of this boat appears to be missing, the rear two-thirds of the boat are extremely well preserved beneath two feet of silt. The degree of preservation of this boat, which may represent one of the best preserved boats at the Morris Wide Water, was not realized until late in the excavations, however. Boat 2 appears to have been the first canal boat moored against the bank of the Morris Wide Water. This vessel, which rests at a slightly higher elevation than the other boats, has been badly impacted by fluctuating water levels and ice scouring. Although a major section of the bow has floated away, the dislodged stern post, some of the floor frames (all dislodged), and part of the hull bottom are intact (See Figure 9). Based on its orientation, the bow of Boat 7 appears to have been tied to the stern of Boat 1. Except for the tips of an occasional side frame and the dislodged bow post, little of Boat 7 was exposed. Limited excavations of Boat 7 indicated that the bottom 1-2 feet of this boat was well preserved. Lying side by side and moored to Boat 7 are the remains of Boats 5 and 6 (see Figure 11). These two vessels were moored with their bows pointing east. Sitting very near the channel, these two boats were well covered with sediment and, although both the bow stem and stern post of these two boats had been dislodged, the boats were in an excellent state of preservation. The archaeological investigations exposed the bow, stern and midsection of both Boats 5 and 6.

Moored with its bow abutting the stern of Boat 6 is the remains of Boat 3 (see Figure 10). This boat was relatively well preserved with the top of the intact floor frames exposed. Although the bow stem of this boat had been dislodged, it still had its iron nosing intact. The stern of Boat 3 had been covered with fill (brick, tile, household trash, clinkers, etc.) deposited during the early-to-middle twentieth century and associated with the occupation of the adjacent dwelling along the north bank of the canal. Unlike the other boats documented by this research, this fill has kept the stern post from dislodging. The upright ironwork associated with the stern post of this boat remains in situ. The final boat located within the Morris Wide Water is Boat 4. The bow of Boat 4 appears to have been tied to the bow of Boat 5, and thus, appears to have been one of the last boats moored in this location. This boat probably represents the only vessel still afloat in Sauer's 1910 photograph of the Morris Wide Water (Sauer 1916:179, see Figure 12 and following

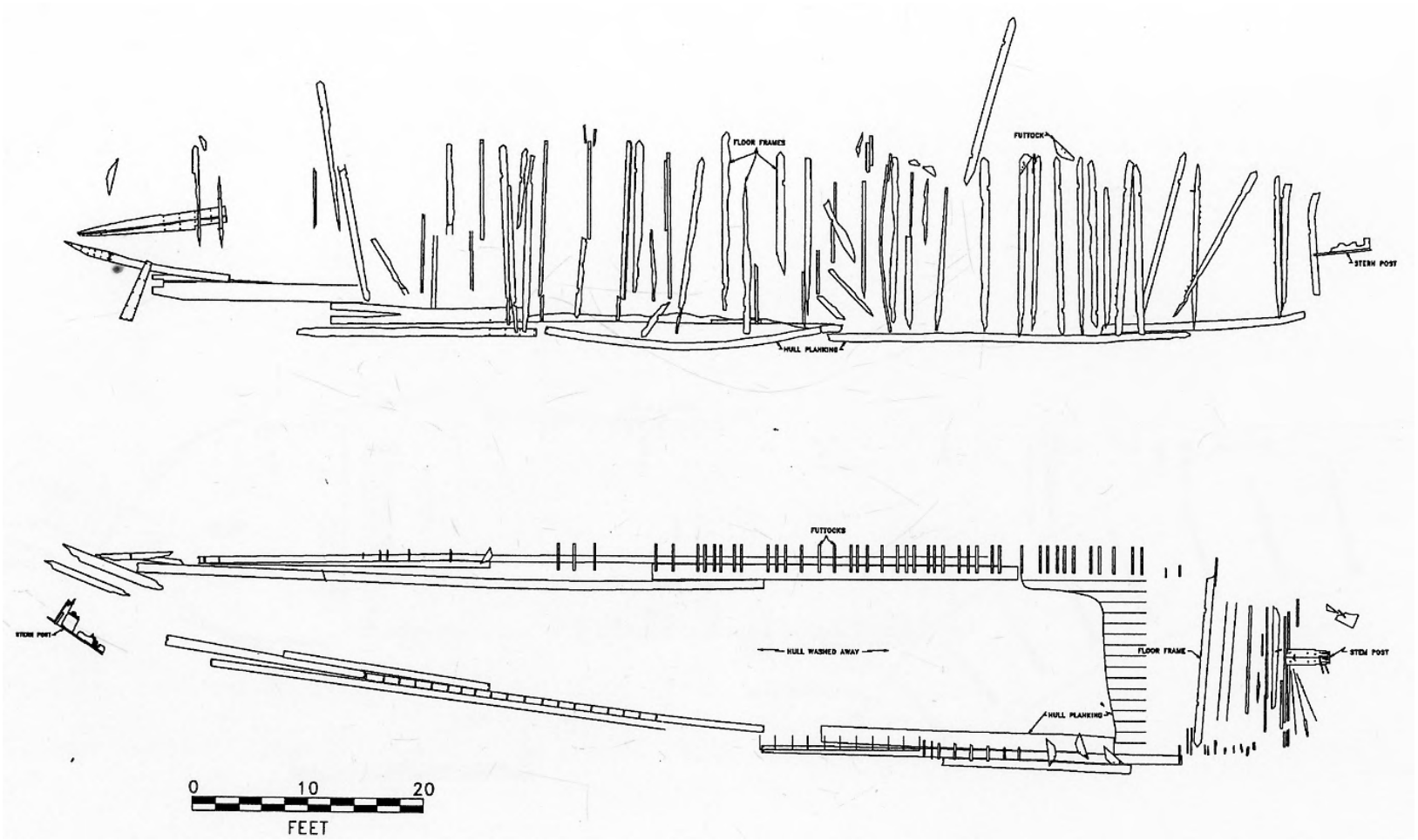

Figure 9. Plan view of Boats 2 (top) and 4 (bottom) at the Morris Wide Water. Neither of these two boats exhibited a very high level of integrity. Although much of the hull planking was intact, the majority of the floor frames in Boat 2 had been dislodged. Little of the bow nor stern remained intact. Boat 4 is in even poorer condition, in that a large section of the hull has completely floated away. Although the stern was nearly completely gone, the bow of this boat is partially remaining.

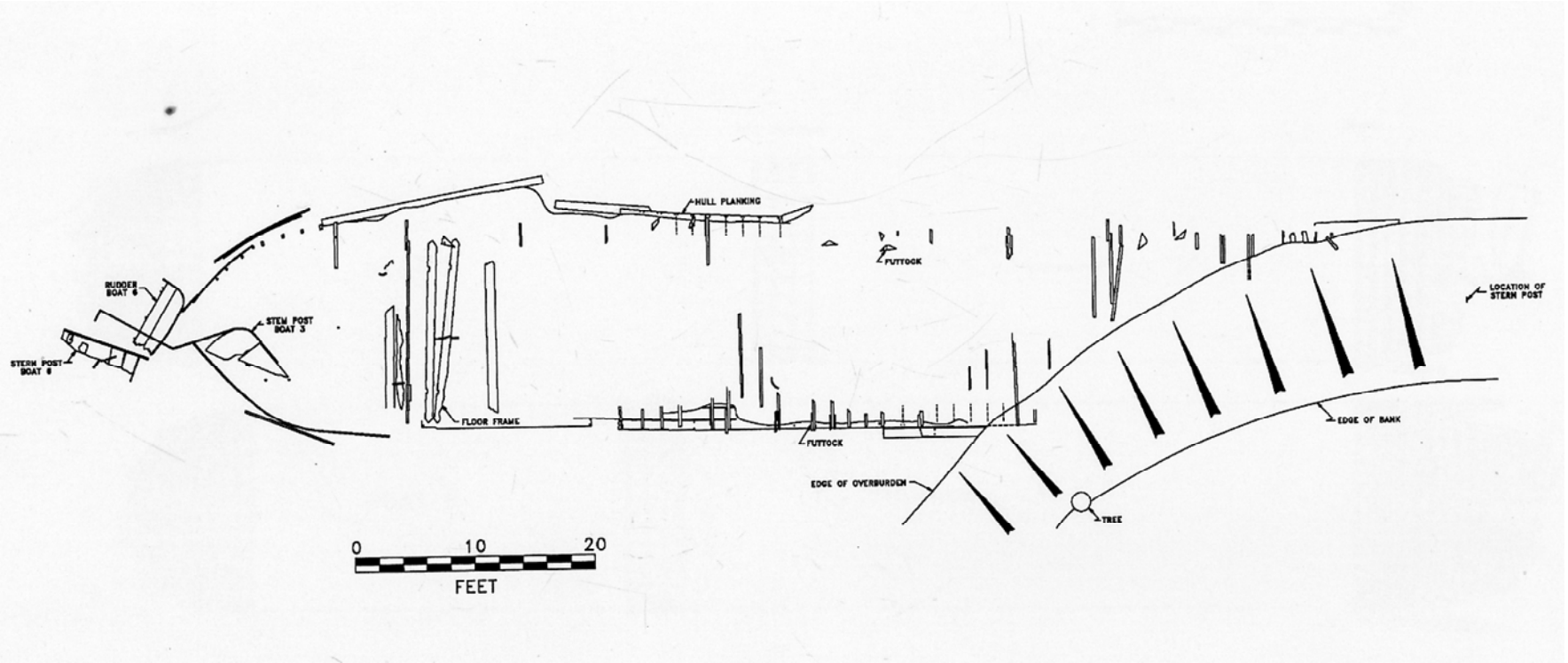

Figure 10. Plan view of Boat 3 at the Morris Wide Water. Only the fore two-thirds of this boat were exposed by the canal de-watering, as the stern of this boat has been covered with post-1930s fill deposited along the edge of the canal. Nonetheless, surface indications are that both the bow and stern of this boat are well preserved under a mantle of sediment. Most of the floor frames are in situ. This is the only one of the boats that retained the entire bow post iron.

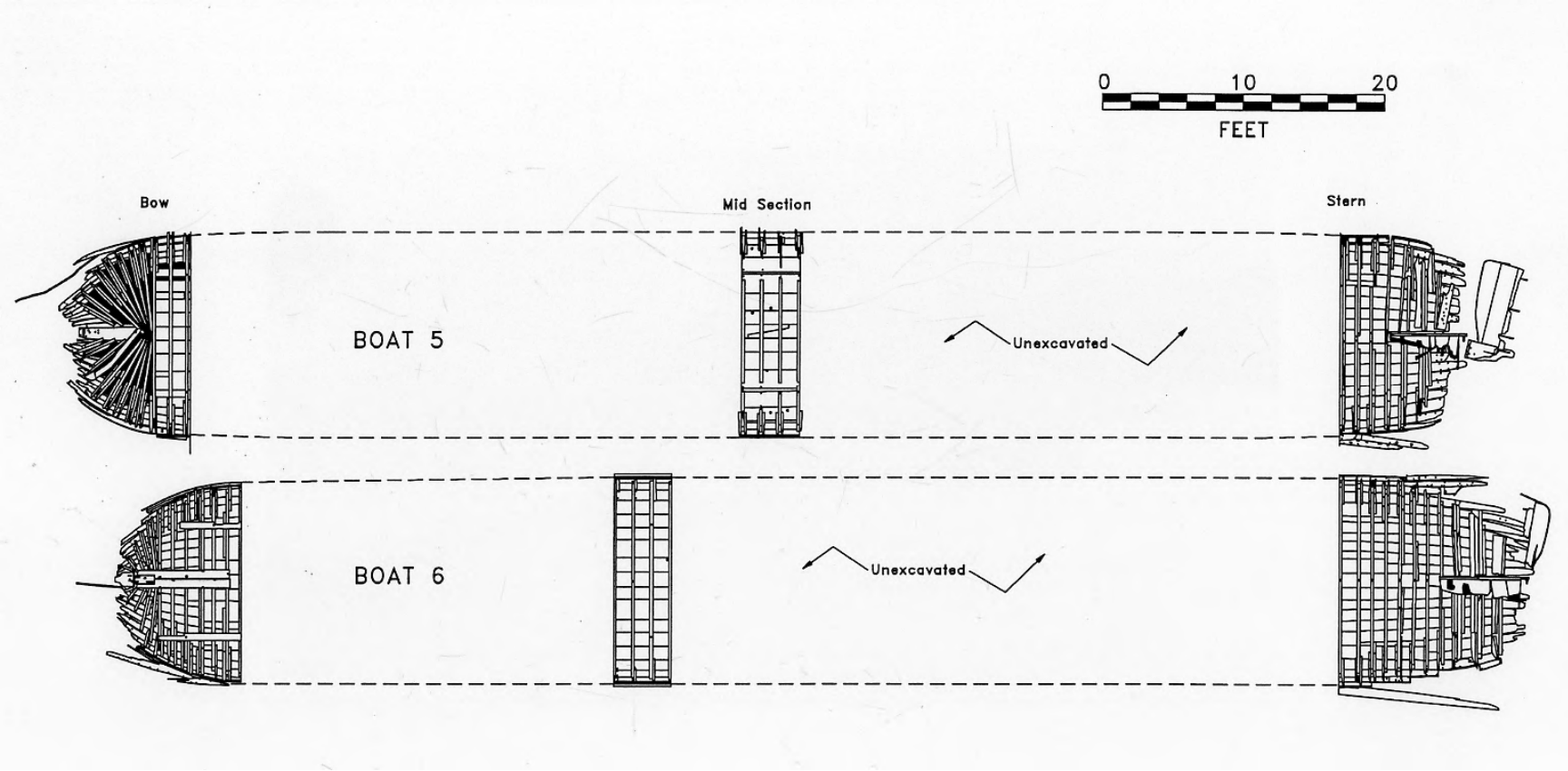

Figure 11. Boats 5 and 6 after excavation. Except for the raised stern posts and the protruding top of the futtocks and/or cleats, little of these two boats were exposed after the de-watering of the canal. A thick mantle of sediment covers the in situ floor frames and hull planks. Although minimal excavations were performed on either Boats 1 or 7, it is apparent that that both of these two boat are at least as well preserved as Boats 5 and 6.

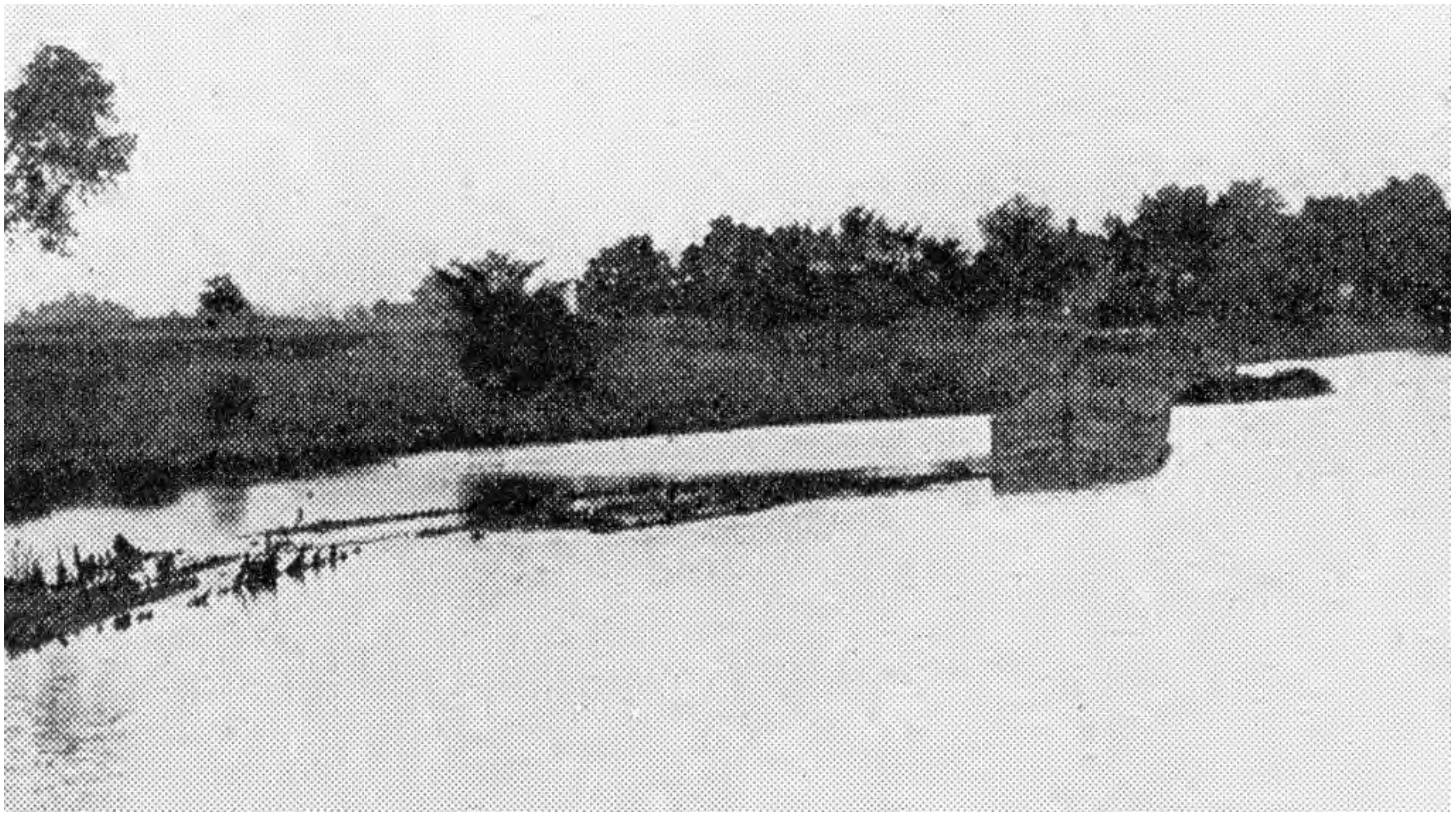

Figure 12. This circa 1910 photograph, simply labeled "Canal boat above Morris, a relic of bygone days" appears to illustrate the remains of the canal boats located at the Morris Wide Water. If indeed illustrating the Morris Wide Water, it suggests that Boats 2 and 7 had decayed to a level well below the water line by this time, that a few of the boats (Boats 3, 5 and 6) had exposed portions above the water line suggesting that they only recently had been burned, and only a single canal boat (Boat 4) was relatively intact and potentially still afloat by that date (Sauer 1916:179, Figure 66).

discussion). Although some of the floor frames, futtocks (and/or cleats), and bow of Boat 4 remain intact, a major portion of the stern section has floated away leaving an isolated stern post (see Figure 9). Limited archaeological investigations exposed a portion of the bow structure of this boat.

The success of the archaeological investigations at the Morris Wide Water far exceeded our expectations. Although at best, less than two feet of the bottom of the boat hulls were intact, we were able to document significant structural details of these maritime structures and also recover a wide range of artifacts (leather, glass, metal and wood) attesting to the use of the boats and the lifeways of the individuals that operated and lived on these structures. The following discussion summarizes our current knowledge of these boats, based on our combined archaeological and archival research.

Date of Construction and Abandonment: Determining when the canal boats at the Morris Wide Water were either constructed or abandoned has been difficult to determine with any degree of certainty. Circumstantial evidence points to a pre-1885 date of construction for all the boats documented by this research. Documentary information suggests that few canal boats were constructed after the middle 1880s, and that the majority of the boatyard work conducted during these later years was repair and/or maintenance activity. Similarly, the presence of forged and machine cut nails for the construction of these boats suggests a pre-1890 date. As will be discussed later, it appears that some of our boats (such as Boats 2 and 7) may be slightly older than the others. Therefore, it is suspected that the boats discovered at the Morris Wide Water may have been constructed during the years circa 1865-85.

As to the date these boats were abandoned, it would appear that they may have been moored at this location sometime during the last decade of the nineteenth or beginning years of the twentieth century. The U. S. Department of Agriculture aerial photographs of Grundy County clearly document this portion of the Morris Wide Water and indicate that the boats at this location were not visible above the water line in October 1940. Several informants suggested that they had seen and/or skated around the decaying hulks during the early years of their life (circa 1920s or 1930s).[12]

An early twentieth-century photograph published in Sauer (1916:179; Figure 66) is simply labeled "Canal boat above Morris, a relic of bygone days" and appears to represent the Morris Wide Water in circa 1910.[13] Although the clarity of this photograph

[12] In 1978, then Illinois Department of Conservation historian Mary Yeater noted that "local legend has it that vandals, campers, hunters, etc. scavenged the upper wooden portions of the boats for fire wood, etc. Finally, the vessels were so damaged that they sank" (Anonymous 1978:8). Several individuals recently interviewed at the project site remembered seeing the boats during their lifetime. One individual even noted that he remembered seeing the boats burn.

[13] The field work for Sauer's report was conducted during the summer of 1910 (Sauer 1916:11). As such, it would appear that this photograph may date to the summer of that year. Efforts to locate an original copy of this photograph (within the records of the Illinois State Geological Survey) have failed. As this manuscript was written as Sauer's dissertation while at the University of Chicago (Department of Geology), an original copy of the photograph may be present with his dissertation.

is poor, it appears to document the remains of our canal boats which were, at that time, in various states of abandonment. This photograph suggests that the boats adjacent to the shoreline (Boats 2 and 7) had decayed to a level well below the water line by that date, that a few of the boats (Boats 3, 5, and 6) had only recently been burned to the water line, and a single boat (Boat 4) was relatively intact and potentially still afloat. This appears to suggest a natural progression from older abandoned boats near the shoreline, to more recently abandoned boats near the channel –a common occurrence in areas that were used for the abandonment of old vessels. As such, it would appear that Boats 2 and 7 were slightly older vessels that were abandoned at an earlier date (circa 1895-1905) than Boats 3, 5, and 6 (which were potentially abandoned circa 1900 to 1910). Based on the extremely low annual tonnage being shipped along the canal during the first decade of the twentieth century, these boats may all have been derelict at this location by 1906 (see Putnam 1918).

One of the last efforts to commercially utilize the canal was by the Morton Salt Company, which transported salt over the canal for three years beginning in the spring of 1912. At that time, the firm had difficulty locating serviceable boats and they used "three old canal boats." The Morton Salt Company noted that "the trip was accomplished by a very old wooden boat, in poor condition. We had to keep her pumps going all the way to keep her afloat." The firm was pleased with their efforts notwithstanding the character of the shallow water in the canal and "the condition of the antiquated boats we were compelled to use –boats that were more than forty years old and the only survivors, so far as we could ascertain, of the big fleet that once navigated the Illinois and Michigan Canal, and two of these boats were fished out of the bottom of the Illinois River to be put into this service" (Morton 1915).

Canal boats along the Erie Canal were reputed to last approximately 20 years (Muller 1975:77), while oak bottomed, pine-sided canal boats along the Chesapeake and Ohio Canal were known to last 25 years (National Park Service 1991:56). Hall (1884:226) noted that "a good canal-boat ought to last fifteen years, but it must be taken care of; the majority disappear in about ten years. On the other hand, there are plenty of boats running that are from twenty to thirty-four years old, well built of choice materials in the first place, and well taken care of by their owners since."[14] Therefore, during the twilight years of the canal boat era along the Illinois and Michigan Canal, it is not unreasonable to suspect that many of the boats remaining in use averaged 30 to 40 years of age as noted by Morton (1915). As such, the more recent canal boats abandoned in the Morris Wide Water could easily have been constructed circa 1870 to 1880 (1910 minus 30 to 40 years) with the earlier boats having been constructed circa 1860 to 1870 (1900 minus 30 to 40 years).

To summarize, it appears that the boats located along the shoreline in the Morris Wide Water were the first to be abandoned, having decayed to well below the water line by circa 1910. The boats toward the center of the canal appear to have been abandoned at a slightly later date, potentially still exposed above the water line into the 1920s or early 1930s. As to the age of these boats, we suspect that they were 30-40 years old at the time

[14] Similarly, scow schooners such as the *Rockaway,* often were in use for over 25 years on the Great Lakes (Pott 1993:32).

of abandonment. As such, the date of construction of these boats may range from circa 1870 (or slightly earlier) through 1880. Although we documented a wide range of repair activity that probably post-dates 1885, it is doubtful that any of the boats were constructed after that date.

Size and General Hull Shape: Generally, the size of a canal boat is dependent on the size of the locks that service that particular canal, with the canal boats being constructed to maximize their carrying capacity yet fit into the smallest of the locks. Along the Illinois and Michigan Canal, the locks are 18 feet wide by 110 feet long. For the period, these were fairly large locks, and according to Hall (1884:231) permitted "the construction of longer boats than are used anywhere else in the United States." Hall (1884:231) also notes that the boats "that go through the Illinois river are 103 feet long, 14 feet wide on the floor, 17 7/12 feet wide on the beam, and 6 feet deep." The canal boats that plied the waters of the Illinois and Michigan Canal were fairly uniform in size being slightly smaller than the locks, thus maximizing on the size of the load that the boat could transport. Near their base, the canal boats at the Morris Wide Water were approximately 100-foot in length (from bow post base to stem post base) by 13'6" to 14'8" in width. The width of the boats at the deck level probably approximated 17 feet.

The canal boats within the Morris Wide Water all were flat bottomed with a fairly well rounded bilge (or chines). Both the bow and stern were distinctively rounded with the hull planks running longitudinally down the length of the boat. Based on the remains of the two boats that were investigated in detail (Boats 5 and 6), we could not determine whether the sterns were transom-shaped. In contrast, the *City of Pekin* appears to have a fairly square or box-like chine detail –representing a distinctively different form than the boats documented at the Morris Wide Water. Discussing the *City of Pekin*'s bow construction, Dalenberg (1937) noted that it was "quite unusual inasmuch as there was a very blunt bow." The square-shaped bow of the *City of Pekin* was similar to the box-like canal boats in use along the Chesapeake and Ohio Canal (National Park Service 1991), the "Lakers" in use along the Erie Canal (which had "square bilge, perpendicular sides, straight body, round bow and stern," see Hall 1884:227), as well as the "Narrow Boats" of the English Midlands (Paget-Tomlinson 1993). The box-like character of the *City of Pekin* also was reminiscent of a scow designed in the early 1920s by the State of Ohio (State of Ohio 1923).

Clearly, the *City of Pekin,* with its relatively square chine detail and square bow, represents an unusual boat when compared with the more streamlined vessels found at the Morris Wide Water. The construction of canal boats with rounded sides, and rounded bows and sterns resulted in a more streamlined vessel that traveled through the water more easily when full, but required a much more complicated framing system to construct

than the box-like canal boats in use elsewhere. Although more complicated to construct, the reasons for this streamlined form may have been mandated by canal regulations. The Board of Commissioners of the Illinois and Michigan Canal (1885:6-7; as cited in Lamb

1978:219) mandated that the boats in use along the canal have rounded bows and a rudder that would not catch the tow line.

The above deck construction and plan of the seven canal boats documented at Morris is more difficult to assess. Although some details of the upper structure were discerned from this research, it is unfortunate that only the bottom 12-14" of the boats were preserved, making it impossible to assess many aspects of the boats' construction above the level of the ceiling.[15] The excavations of Boats 5 and 6 indicate that an above-deck cabin probably was located at the stern end of both boats. Similarly, the presence of pine wainscot and sawn lath found within the bow of Boat 6 suggests that an above-deck fore cabin was also located near the bow of that vessel. Hall (1884:227) notes that the "Lakers" in use along the Erie Canal had multiple "houses" with "one forward for horses, with hatch on top and on side to the deck; one away aft for boatman and his family, rising about 2 feet above the deck-way to allow for windows; all of white pine."

Basic Hull Construction: Unlike the "solid-sided" scows discussed by Hall (1884:226), the Morris canal boats were "regularly-framed" boats.[16] As Hall (1884:227) notes, scow-side boats" were cheaper to construct and generally "the preference is for a framed boat." The double-ended craft found at the Morris Wide Water lacked a keel and were constructed with a flat bottom, slightly rounded sides and rounded ends. Except for the bow and stern posts, all lumber used within the construction of these boats was dimensional stock or "scantling" as described by Hall (1884). The bow construction in the boats at the Morris Wide Water exhibited a slightly curved stem post whereas the stern appears to have incorporated a relatively straight stem post.[17] As will be discussed later, the earlier boats appear to have been constructed using a single curved piece of lumber hewn to its proper shape, whereas the later boats used composite construction building up the post to its appropriate shape using multiple pieces of sawn lumber. The canal boat frames were held together with iron fasteners throughout, attached using a combination of nails and carriage bolts. Materials used in the construction of these water craft consisted predominately of oak (presumably white oak) for the hull construction and white pine for the above deck structures.

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[15] The ceiling is the flooring that was placed over the floor frames.

[16] Woods (n.d.) contains an excellent description of the steps taken to construct a canal boat.

Hall (1884:226) describes the "solid-sided" scows as being "built-up of white-pine logs 5" thick and from 12 to 14 inches wide, scarfed, closely fitted together and fastened by long iron rods or bolts ½, ¾, or 1 inch in diameter, spaced from 16 to 19 inches, according to the fancy of the builder, driven clear through from the topmost gunwale to the bottom of the bilge log." Boats using this method of construction were described variously by Hall (1884) as "Scow Sided of solid logs" and as "Scow Sided Boat with Molded Bow and Stern." This method of framing is similar to the "frameless side" canal boats which "became common to canal boat building throughout New York" (Cozzi 1996:132). These "frameless side" canal boats are different than the sailing canal boats documented by Cozzi (1993) which have a transverse bottom planking supported by an internal keel and multiple bilge stringers and chine strake.

[17] The stem post of Boat 5 was set at an approximate 100-degree angle to the plank keel.

Although these boats do not have a keel, the construction of these vessels was oriented around a wide plank that ran longitudinally down the center of the boats' hulls. Hall (1884:224, 227) refers to this "plank keel" as a "heavy garboard plank." Both the bow and stern posts were attached directly to this hull plank which fit into a simple rabbet joint. False keelson or deadwood was then nailed to the hull plank and spiked to the stem posts with steel drift pins. Details of Boat 5 indicate that a wood dowel, or trenail, was driven into the joint between the hull plank and stem post. Although the function of this dowel is unclear, it may have functioned to tighten this joint. Floor frames were then attached directly to this central plank (Figures 13-15).

Once the floor frames were in place, the adjacent hull planks were attached longitudinally to the floor frames to form the flat bottom of each boat. Hull planks varied dramatically in width and thickness. The thinnest hull planks appear to have been associated with Boat 2 and 4, which were 1 ½" thick. Boats 3 and 6 had hull planks that were 1 ¾" thick. Boat 5 had some of the thickest hull planks, which were 2" thick. Hall (1884:227) notes that the New York built "Lakers" had oak hull planking 2" thick. The canal boat hulls described here are somewhat thinner than the 2 ½" to 3" hull planks found on the similarly constructed Missouri riverboat *Bertrand* , which was constructed with a thicker hull to withstand the more difficult Missouri River conditions (Petsch 1974:76).

Although the majority of the hull planks (at least those midsection) were approximately 10-12" in width, some boats had planks that approached 18-20" in width. One hull plank on Boat 5 was 27" wide. The hull planks of Boat 5 ranged from 6" to 28" wide with the vast majority being between 12" and 16" wide. Similarly Boat 6 had hull planks that averaged 10-12" in width with an occasional plank 18" in width. Loose knots present within the hull planking had been drilled out and plugged with a round oak dowel Determining the length of the hull planks was difficult. Hull planks in Boat 2 appeared to be approximately 16' to 20' in length. In contrast, hull planks used in the construction of Boat 4 appeared to be approximately 30' to 32' in length. Although generally simply butt joined, many of the hull planks were scarf joined for a more stable result. Any loose knots present within the hull planks were drill out and plugged with a tapered oak dowel.

Hull Frames: As discussed above, the canal boats at the Morris Wide Water were constructed using a plank keel (a wide oak plank laid down the center of the boat from which the stern and bow posts were attached). From this plank keel, the floor frames were attached allowing the construction of the bottom and sides of the hull. The boat frames consisted of a floor frame and side frame that were joined together by a triangular piece of wood referred to as a "futtock".[18]

[18] Some authors (such as Chappelle 1994:278) refer to the side frame as the futtock, and the triangular attachment as a "cleat or gusset." We prefer to use the terminology outlined by Hall (1881).

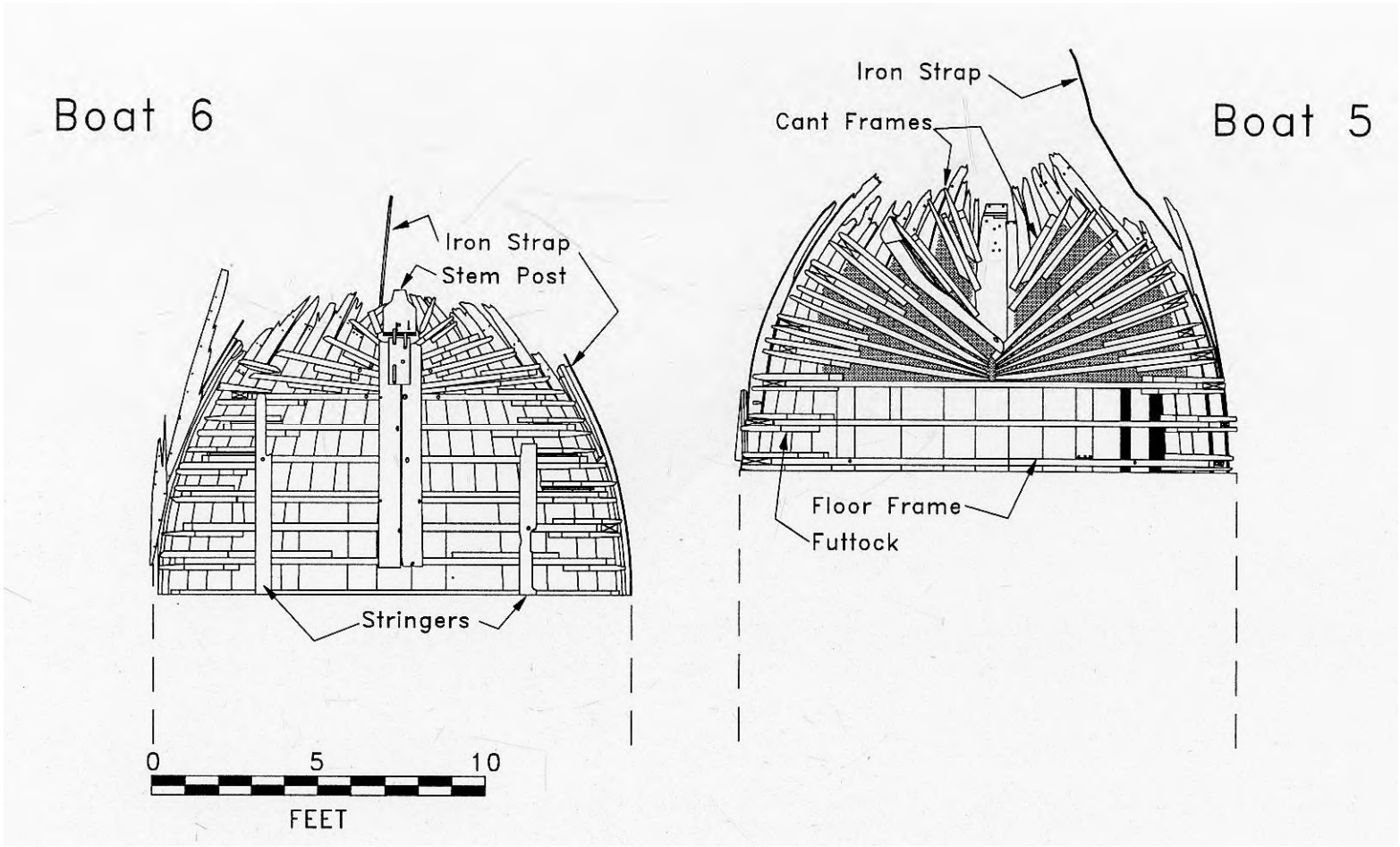


Figure 13. Bow detail of Boats 5 (right) and 6 (left) after excavation exposed the intact floor frames and underlying hull. Although the bow post had been dislodged in Boat 5, it was still partially intact in Boat 6. Similarly, remnants of the bilge stringers, albeit badly decomposed, were still intact on Boat 6. Each boat exhibited a different manner in framing the bow. Boat 5 used predominately radiating floor frames, whereas Boat 6 used substantially more straight frames.

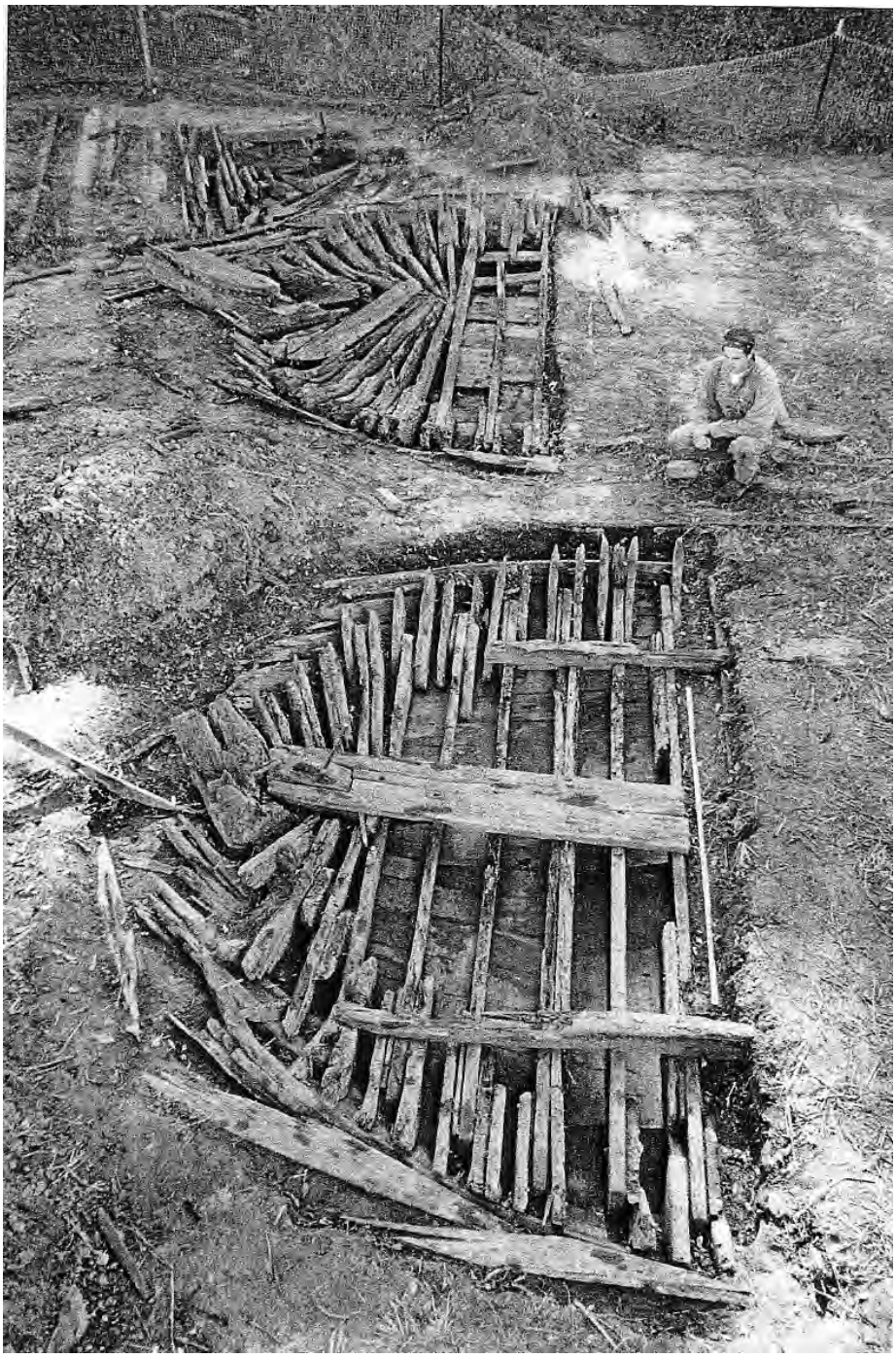


Figure 14. Bow detail of Boats 5 (top) and 6 (bottom) after excavation.

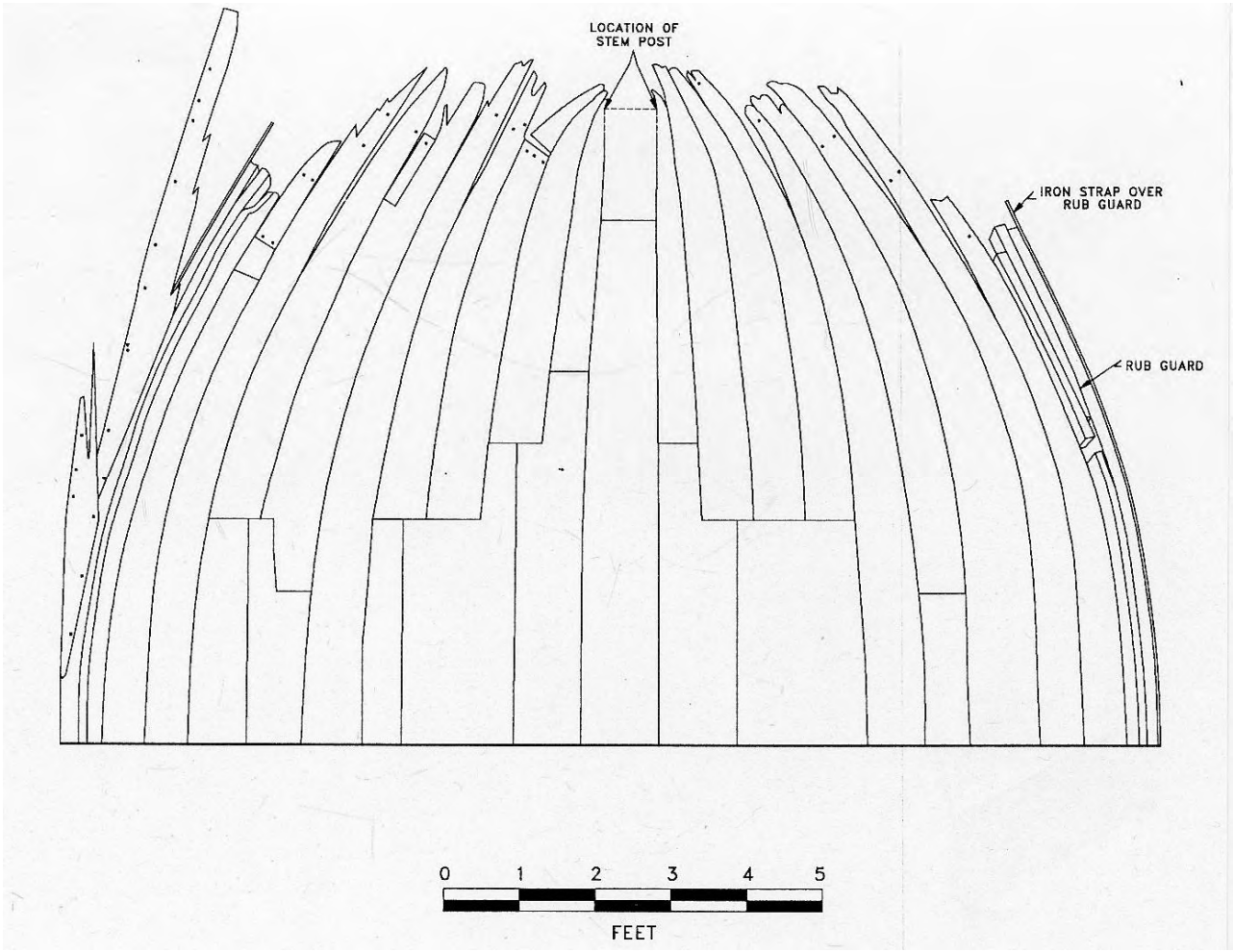


Figure 15. Detail of the hull planking in the bow of Boat 6. The floor frames have been removed for clarity. Note the presence of a wide central plank (often referred to as a plank keelson or garboard plank) from which the hull construction was oriented around.

Hall (1884:227) notes that the floor frames used in the construction of an Erie Canal "Laker" were oak timbers that measured 3" x 8" and spaced on 15" centers. Floor frames present on the Morris canal boats were sawn oak planks that approximated 2" by 8" in size. Boats 4 and 5 were a full dimensional 2" by 8", Boat 2 was 2 ¼-2 ½" by 7", while Boat 3 and 6 were approximately 2 ½ to 2 ¾" by 8" in size.

The floor frames were spaced fairly evenly throughout the boats, averaging approximately 16" on center. In order to withstand the more substantial tension generated from the bent hull planks in the bow and stern sections (as well as to accommodate the irregular pattern of hull planking within these areas), the frame spacing generally diminished to 12" in both the bow and stern sections (as with Boats 5 and 6). The frame spacing is substantially narrower than that associated with many Great Lakes scow schooners which often is at 20-21" on center (cf. Pott 1993:32).

Small weep or limber holes were cut into the bottom surface of each floor frame (Figure 24). The location of these weep holes varied between boats and averaged from 24", 30", or 36" from the end of each floor frame. These weep holes, which averaged 1 ½" by 2 ½" in size, allowed water to flow between the floor frames, presumably to an interior pump. The ends of each floor frame were cut into a v-shape. Towards the bow and stern section, the bottom portion of each v-cut began to take on a curved shape to conform to the curved hull shape. At the midsection, the maximum width of the floor frames varied from 13'5" (Boat 2) to 14'2" (Boat 6) to 14' 4-6" (Boats 3 and 4) to 14' 6-8" (Boat 5).

An occasional fragment of side frame was often found intact and attached to the upper end of the futtock. Side frames on Boat 1 were 2" x 6" in size and well preserved compared to the other boats. Except for noting that the side frames were dimensional, sawn-oak lumber, little could be discerned about the side frames on the majority of the boats investigated.

The side frames of the canal boats were joined to the floor frames by a triangular piece of wood referred to as cleats, knees, gussets, or futtocks. Hall (1884:227) notes that the side frames of the Erie "Lakers" were "joined to the floors by two sawed knees or futtocks, which are about 2 feet long, a foot wide, and 2 inches thick." Within the seven canal boats located within the Morris Wide Water, there is great variation in the method in which the futtocks were attached to the floor and side frames. The simplest method consisted of the use of nails, with the futtock being attached using one or two large spikes placed into each framing member (cf. Boats 2, 3 and 4). The failure of the side walls of Boat 4 was due in part to the lack of nails used to attach the futtock to the floor frame. Many of the cleats in this boat were attached with only a single nail to the floor frame and the result was the collapse of the side walls into the channel. Other boats used a combination of nails and bolts to attach the cleats to the floor frames. The futtocks in these boats were first attached to the floor and side frames with nails, and then a hole was bored through these structural members so that a carriage bolt or two could be inserted. Due to the dense nature of the white oak frames, seldom was a washer used with the bolt. Some boats (such as the front third of Boat 6) incorporated a single bolt in each end of the floor frame while others used two bolts per floor frame end (such as Boat 5 and the

rear two-thirds of Boat 6). As well as having been attached with multiple nails and two bolts, the more substantially constructed boats (such as Boat 5 and 6) had two futtocks on each end of the floor frame, with a futtock attached to each side of the frame. Boat 6 had two futtocks on each end of the floor frames on the rear two-thirds of the boat and only a single futtock on each end of the floor frames on the front third of the structure (See Figures 16 and 17).[19]

Another characteristic that varies among the canal boats investigated was the shape of the futtock. Most of the futtocks documented on the canal boats at the Morris Wide Water were cut from dimensional 2" by 8" stock similar to that used in the floor frames. These triangular pieces of wood were cut with equal exposure for the side and floor frames. Variation existed in the number of cuts required to make these futtocks. The "single-cut" futtocks (such as those in use on Boats 2 and 3) were created by cutting a triangular piece of wood out of a plank. The "double-cut" futtocks (such as those on Boats 4, 5, and 6) had the outer angle of the futtock lessened by an additional set of cuts, thus creating a chine detail with slightly more curvature. In contrast, the chine of Boat 1 was created with an asymmetrically shaped futtock, which gave the hull of this boat an angular or box-like appearance. Similarly, the angular appearance of the *City of Pekin* was created without the use of any futtocks. Instead a "bilge log" or "stringer" ran longitudinally along the top edge of the floor frames and butted up against the inside edge of the floor frames. This gave the *City of Pekin* a distinctively angular and/or box-like appearance similar to that of Boat 1 (see Figure 17) and the scow boat designed by the State of Ohio (State of Ohio 1923).

Fenders or rub guards: These features, which protected the hull from damage due to colliding with docks and other structures, were present along the base of the side frame, near its junction with the floor frames. Some of these fenders had guard irons on the surface of the wooden fender that wrapped around the ends of the boat connecting to the stem and stern posts. Boat 3 had protective iron straps that measured 3/8" by 1 ¾" in size, and Boat 5 iron straps that measured ½" by 2". Although we only documented a single fender at the base of the side frames (due to the lack of preservation of the side frames), Hall (1884:227) notes that the Erie "Lakers" often had seven fenders butting onto the stem and stern posts, and "running around the curve of the bow and stern to the flat of the sides, spiked on, and ironed on the outer surface with 3- by 5/8-inch straps".

Ceiling: The "ceiling" is the boards laid over the top of the floor frames. Unfortunately, little of the ceiling was intact on our boats. Boat 1 had the most intact ceiling, which consisted of variable width, 1" pine deck boards attached with short machine-cut nails. Although the ceiling had decomposed, the presence of multiple nails on the top surface of the floor frames of Boat 2 indicated that a ceiling was once present on this boat. In contrast, no nails were present on the top surface of the floor frames of Boats 5 or 6,

[19]The construction of the floor frame and the chine detail of the Morris canal boats is very reminiscent of the methods used on the Missouri River steamboat *Bertrand* (cf. Petsch 1974:76; Figure 76), suggesting that the construction of this river boat steamer and the Morris canal boats may have been coming out of a very similar building tradition. This method was also similar to the freight boats documented by Botwick (1998).

suggesting that the floor frames had not been floored over, or if they were, the boards were set in place without the aid of nails with the planks loosely set (potentially allowing for bilge water to be pumped out).

Bilge Stringers: Long, narrow boats such as the canal boats found at the Morris Wide Water, have a tendency for their relatively heavier ends to sink down causing the center of the boat to heave upward –a condition known as hogging. The longitudinal strengthening of canal boats was achieved in multiple ways. Some boats, such as the *City of Pekin*, incorporated long iron rods with turnbuckles into the construction of the side walls that created a truss system to support the stern and bow sections. These iron rods were known as "hogging irons." Whether the hogging irons found on the *City of Pekin* represent original features of the boat or later additions associated with one of the rebuilding episodes is uncertain (Lamb 1980; also see Petsch 1974:84-85). Little evidence of hogging irons was found on the canal boats investigated at the Morris Wide Water. This may be due, in part, to the fact that much of the iron from these boats appears to have been salvaged prior to their final abandonment. Large forged iron nuts chisel cut from heavy threaded rod were found in Boat 6 and may represent the remains of salvaged hogging irons.

Although little evidence is present that the canal boats at the Morris Wide Water used hogging irons, the framing systems of these boats incorporated laminated beams attached to the top surface of the floor frames that increased their longitudinal strength. These "stringers" appear to have been present on most, if not all, of the canal boats located at the Morris location. These laminated beams were constructed by laying a series of 4" x 6" timbers on top of the floor frames and pinning them to the frames with 1" iron drift pins (set into pre-drilled holes). These stringers extended from the bow to stern and were located approximately 24-32" from each side of the hull. These stringers may represent the "main keelson" described by Hall (1884:227) as 10 by 12 inches square, bolted into every floor." Petsch (1974:76) suggests that these stringers were referred to as "floor strakes." As Hall (1884:227) notes, it was "not uncommon to use sticks from 75 to 80 feet in length" for these framing members.

Some of the boats (such as Boats 1, 5, and 7) had a 2" thick plank nailed to the inner (or upper) surface of the futtock, giving the boat additional longitudinal strength. Petsch (1974:76) refers to this plank as a bilge stringer. This may represent the "bilge keelson, 2 by 12 inches" described by Hall (1884:227).

Bow Construction: The canal boats documented in the Morris Wide Water all had distinctively rounded or spoon-shaped bows. According to "Rule 18" of the Illinois and Michigan Canal *Rules, Bylaws, and Regulations* all boats had to have a bow that was "so curved that the versed line of the depth of the curve shall be one fourth the cord or width

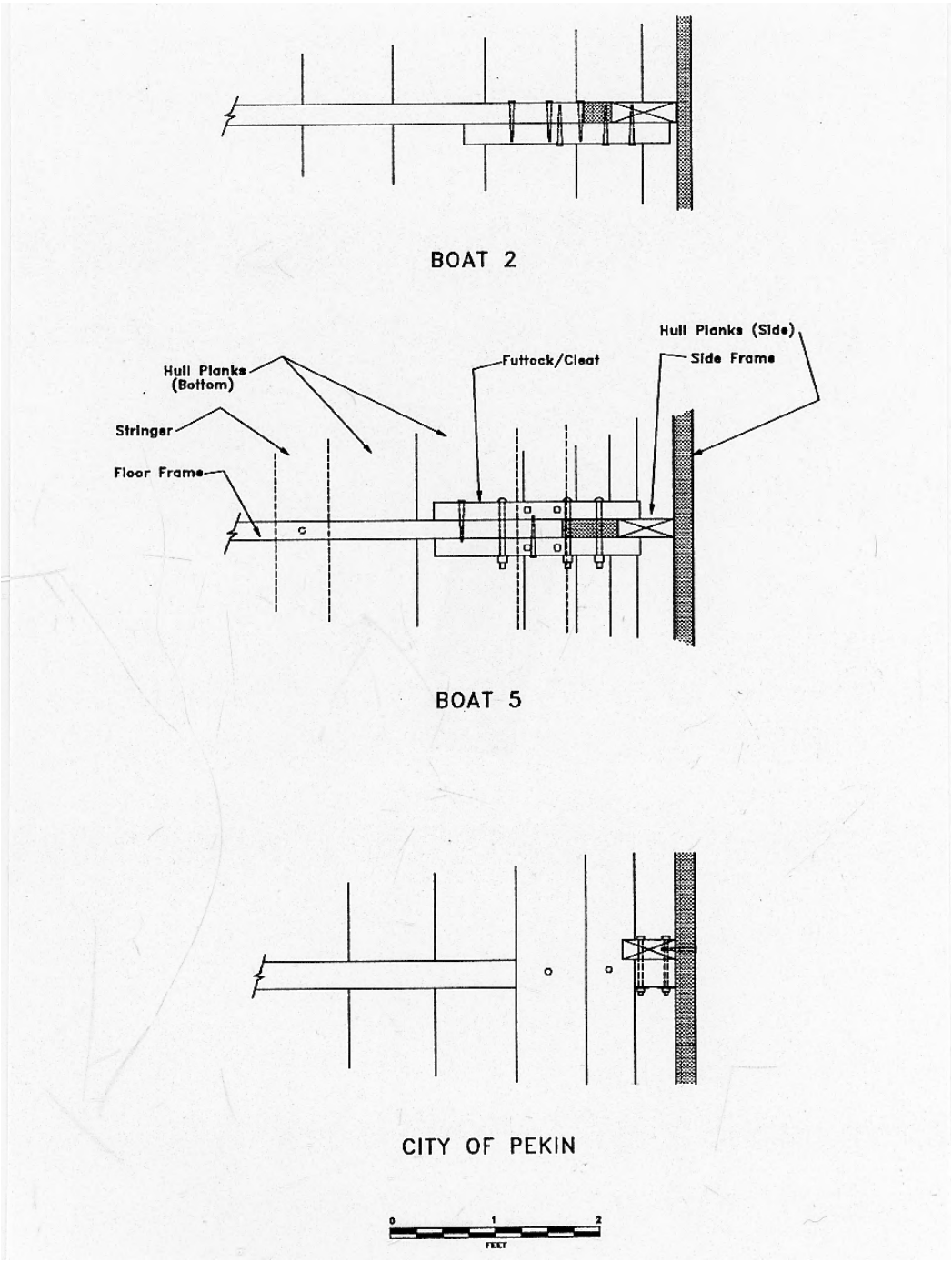


Figure 16. Detail illustrating variation in the methods used for attaching the floor frame to the side frame (plan view). The view is looking down on the plan of the floor frames. Boat 2 used only a single futtock which was nailed in place. Boat 5 used two futtocks which were both nailed and bolted in place. In contrast, the more box-like construction of the *City of Pekin* did not have any futtocks but utilized a series of heavy timber stringers pinned to each floor and side frame. Boat 1 used a combination of techniques, employing two side frames and a futtock, all nailed together.

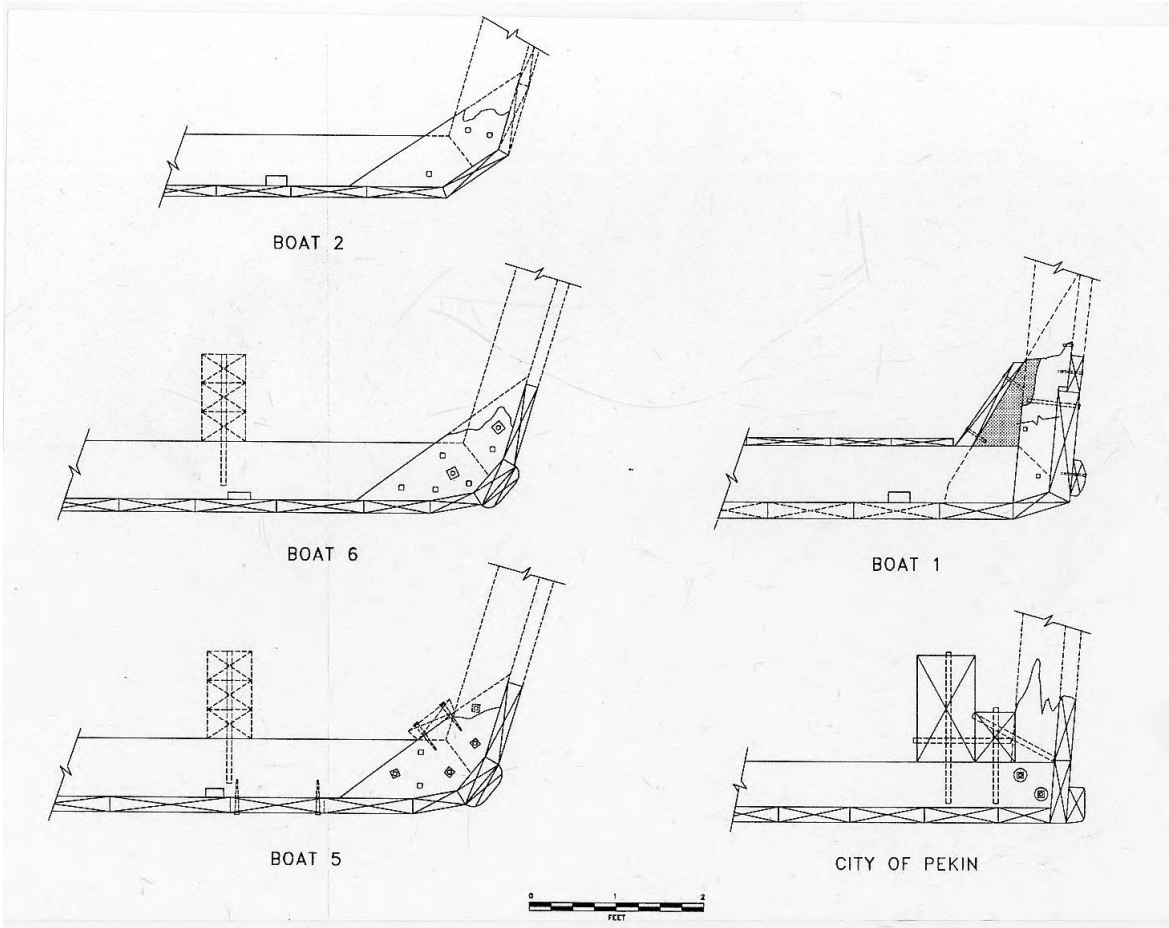


Figure 17. Detail illustrating variation in the methods used for attaching the floor frame to the side frame (sectional view). Boat 2 used a single-cut futtock which was attached solely with nails. In contrast, Boats 5 and 6 utilized double-cut futtocks that were attached with both nails and bolts. Futtocks on Boat 6 were attached with a single bolt per frame whereas Boat 5 was attached with two bolts per frame. Boat 1 and the *City of Pekin* were much more box-like in their hull shape. Whereas the *City of Pekin* did not use futtocks in its construction. Boat 1 utilized a single, asymmetrical futtock and a double side frame which overlapped the mitered joint of the main side frame further strengthening this joint.

of the boat" (Board of Commissioners of the Illinois and Michigan Canal 1885:6-6, as cited in Lamb 1978:219). Hall (1884:226) discussing the boats of the Erie canal noted that

> One of the old fashions was to build canal-boats with square, raking ends, and it was only abandoned in 1855 upon the peremptory command of the state authorities, issued to prevent them from injuring each other with their sharp corners. A regulation was adopted in May of that year forbidding any new boat to navigate the canals of the state unless it should have a round or elliptical bow, described with a radius of not less than 8 2/3 feet.

The excavations at the Morris Wide Water resulted in detailed mapping of three bows. The bows of Boats 5 and 6 were fully exposed while the bow of Boat 4 was only partially exposed (Figures 13 and 14). The bow of Boat 5 was constructed with a series of radiating floor or cant frames that fanned out from the last full-length floor frame (or first square frame) that formed the floor of the hull. The first six radiating cant frames on each side of the bow were approximately 6 ½' in length. These cant frames had been shaped on their lower surface to approximate the shape of the curved hull of the bow and were nailed together at their opposite ends (which formed a tight cluster of planks nailed together near the center of the circle defined by the bow). The remaining four cant frames in the bow were of gradually decreasing length and were fastened into the deadwood which secured the bow's stem post in place. The majority of the cant frames in the bow had two futtocks –one on each side of the frame. This arrangement created a fairly well proportioned, securely constructed bow with a radius of approximately 6 ½' to 7'.

The bow of Boat 6 was constructed in a slightly different fashion and reminiscent of the 1923 scow constructed by the State of Ohio (State of Ohio 1923) as well as those described by Botwick (1998). In these boats, a series of five parallel (or square) floor frames of slightly decreasing length formed the floor of the bow of Boat 6, extending to within 2' of the boat's stem post. At that point, five short cant frames were placed on a radiating pattern on each side of the deadwood that secured the stem post in place. This framing pattern also created a well proportioned bow with a radius of approximately 6 ½' to 7'. Although the bow of Boat 4 was in a poor state of preservation, we were able to discern that it was reminiscent of the bow structure of Boat 6.

The bow posts of all three boats investigated in detail indicate that they had been anchored to the plank keel with nails. As with the bow framing, the shape of the bow posts exhibit great variation in detail. The bow stem post of Boat 7 was formed from a crooked tree trunk and incorporated the knee/deadwood and upright post into a single piece of wood. In contrast, the bows of Boats 4, 5 and 6 exhibited a similar method of construction which employed two-piece construction (post and related deadwood) secured with a combination of nails and drift pins. The bow stem posts for these two boats had been hewn from a large, square timber. In contrast, although still of two part construction, the bow post of Boat 3 was hewn from a large, thick, sawn plank that

incorporated much less hand shaping than that associated with the stem post of either Boats 4, 5 or 6 (Figures 18 and 19).

The bow stem post of Boats 3, 4, 5, and 6 all exhibited evidence that they had been protected with an iron band ("faced with iron") that extended from the end of the plank keel to the top of the stem post. Although the stem post iron of Boats 4, 5, and 6 had been salvaged with little remaining intact, the entire iron of the Boat 3 bow was intact. This particular stem post iron provides the best indication we have of the approximate depth of the hull (from the top of the deck surface to the base of the hull planking).

Stern Construction: The stern sections of the boats at the Morris Wide Water were much less well preserved than the bow sections. With Boats 2 and 4, the stern sections were all but completely washed away. In the stern section, the large vertical stem post was nailed to the plank keel and anchored with large deadwood. The first square floor frame was attached to the end of the deadwood. Approximately four short, cant frames had been seated in the deadwood and upright stern post, each rising progressively higher as one progressed towards the stern post. The hull planks, which had been bent around the curved stern resulted in great stress being placed on the stern section of the boat. Evidence of multiple attempts to strengthen the stern floor and cant frames was evident, generally consisting of newer softwood floor frames nailed alongside (or sistered onto) the original floor frames. Much of the reworking of the boat frames appears to have been accomplished with the use of wire-drawn nails. Once the boat began to fall apart, the tension built up within the frame was released as the hull planks sprang down and out, and the stern post and associated deadwood sprang upward. In both of the stern sections excavated (Boats 5 and 6), the stern post and associated deadwood had been displaced, resting on silts well above the floor frames (Figures 20-21). The stern of Boats 1 and 3 are the best preserved of all the boats at the Morris Wide Water. The stern posts of both of these boats are still in an upright position.

Rudders: Hall (1884:227) notes that the rudder of the Erie Canal "Laker" was constructed of stock "about 10 inches in diameter [with a] blade … 7 or 8 by 5 feet." This agrees well with the size of the rudders uncovered at the Morris Wide Water. Well preserved rudders were exposed on both Boats 5 and 6. The blade of the rudders had been constructed with 2" thick planks approximately 1'3" wide that were edge fastened by drilling holes in their edges and driving 10" long iron drift pins into them. The bottom or running surface of the rudder had been faced with a 2" iron strap. The rudder blade measured approximately 3'6" tall by 6' long. The blade was fastened between two upright planks that had an iron band around the base and an iron plate with a central hole. This hole received the pintle which was attached to heavy iron hardware attached to the stern post (see Figures 20-23).

Attached to the base of the stem posts of Boats 3, 4, 5, and 6 was an iron strap with a pin on which the rudder swiveled. According to Lamb (1978:219) one of the few regulations governing canal boat construction requirements on the Illinois and Michigan Canal was "Rule 16" which "required all boats to cover the opening between the keel and the rudder

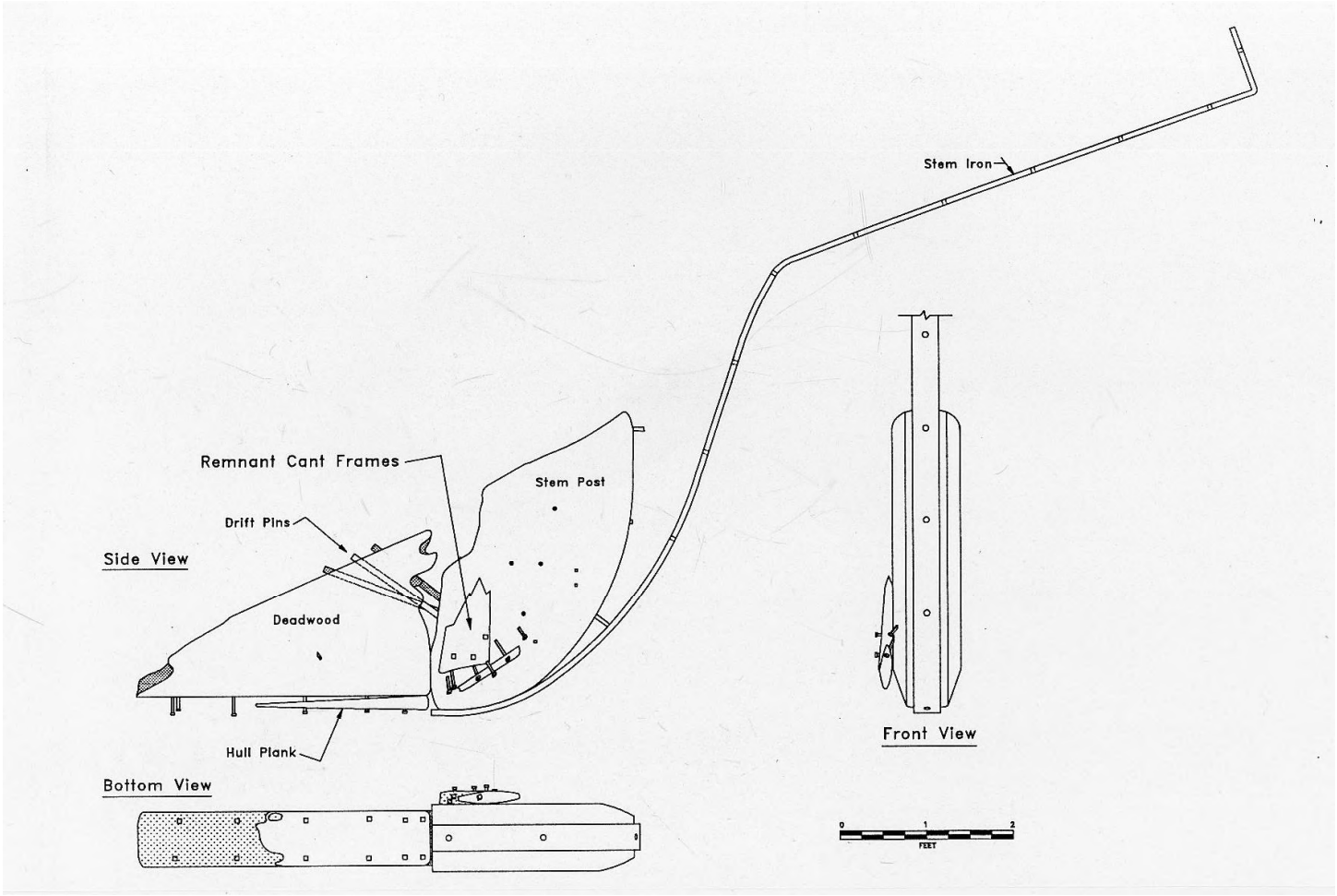


Figure 18. Three views of the bow post of Boat 3. Unlike the bow post of Boats 5 and 6 (which were hewn from a square piece of wood), this bow post was formed from a thick plank. This stem post retains the complete bow stem iron which is the only such example at the Morris Wide Water.

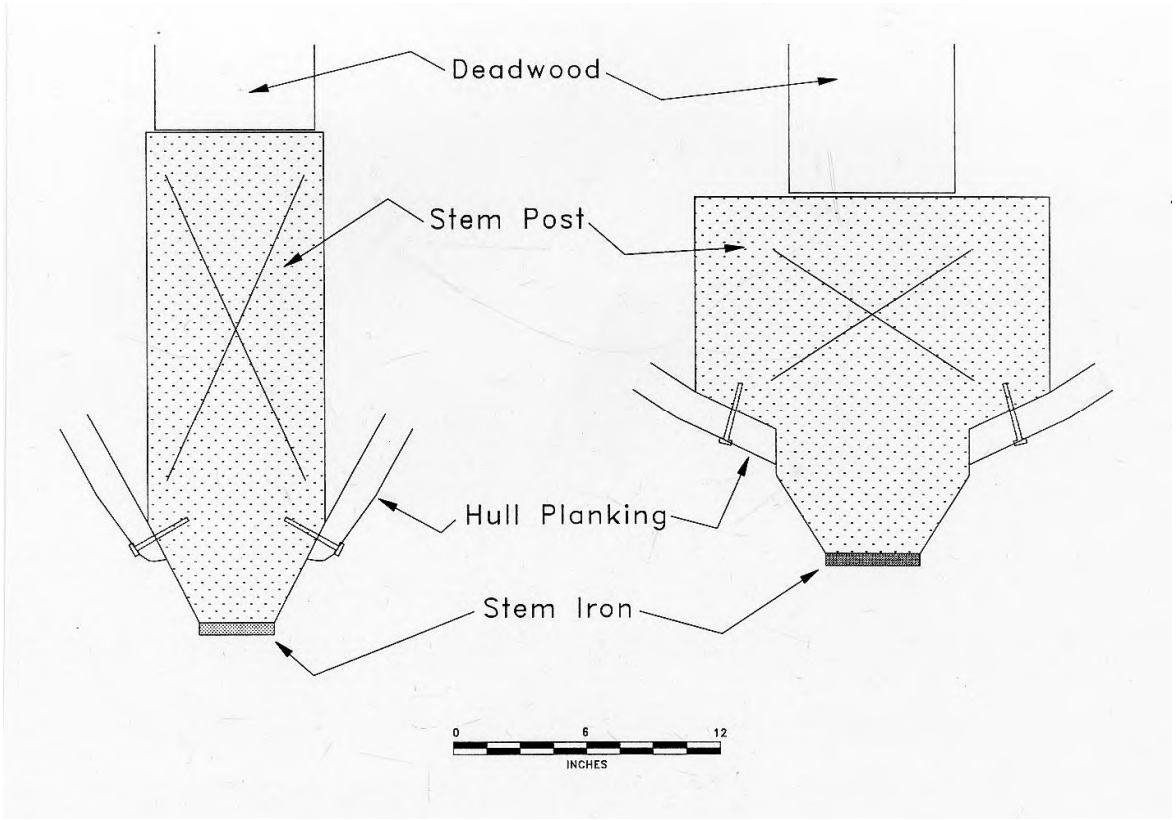


Figure 19. Comparison of bow post construction of Boats 3 (left) and 5 (right). The bow stem post of Boat 5 was hewn from a large timber creating a recess for attaching the hull planks immediately behind the bull nose. In contrast, the stem post of Boat 3 was fabricated from a large, sawn plank and the hull planks were attached to the edge of the bull nose. The method employed in constructing Boat 3 required much less skilled labor to produce. The bullnose of each boat was edged with iron to protect it from damage.

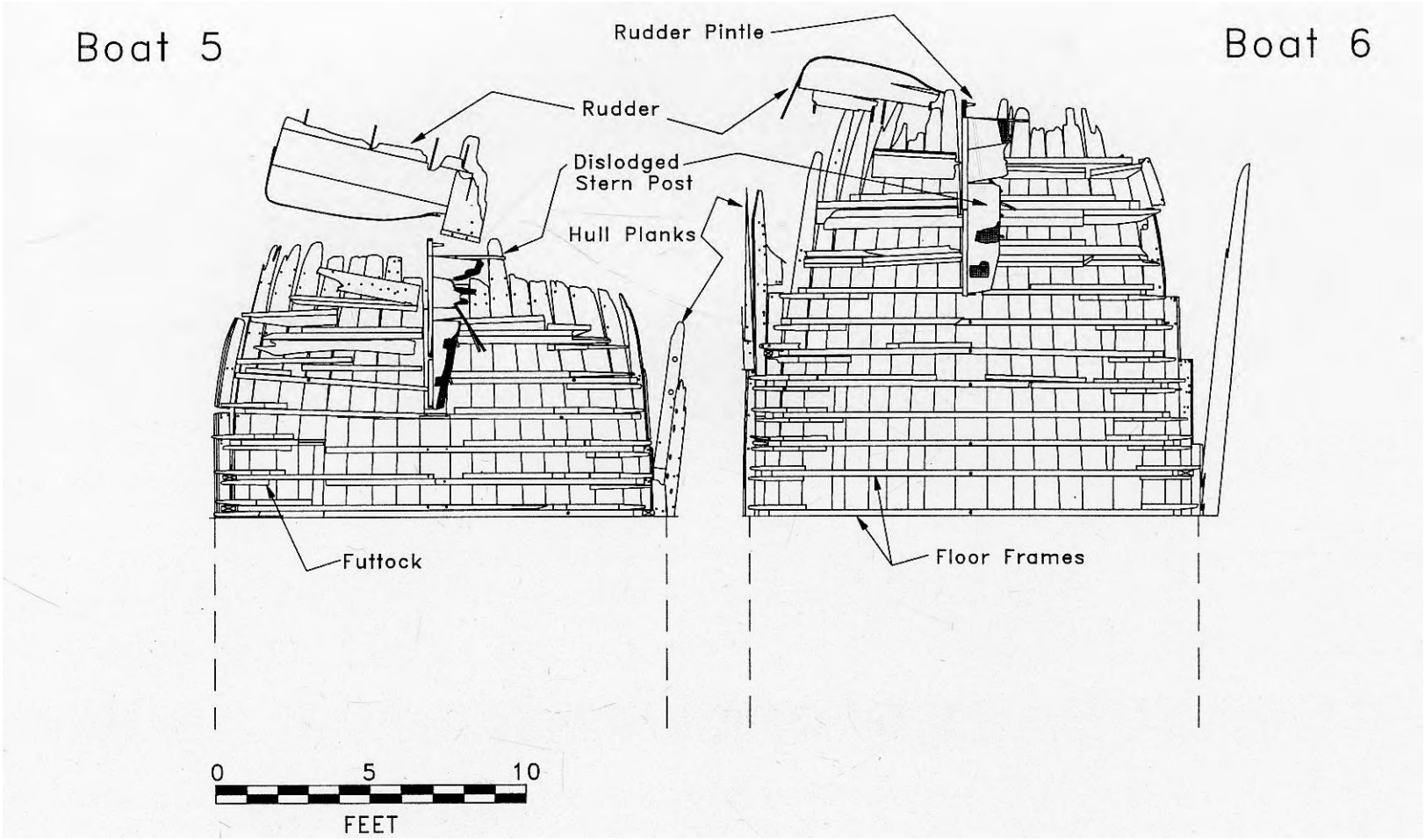


Figure 20. Stern detail of Boats 5 (left) and 6 (right left) after excavation exposed the intact floor frames and underlying hull. The rudder was slightly better preserved in Boat 5 than in Boat 6. In both instances, the stern post was dislodged, having been sprung upward with the release of the tension in the hull planking as the boat disintegrated. Both boats used a series of straight floor frames to fabricate the stern section.

Figure 21. View of Boat 5 stern illustrating well preserved rudder in situ.

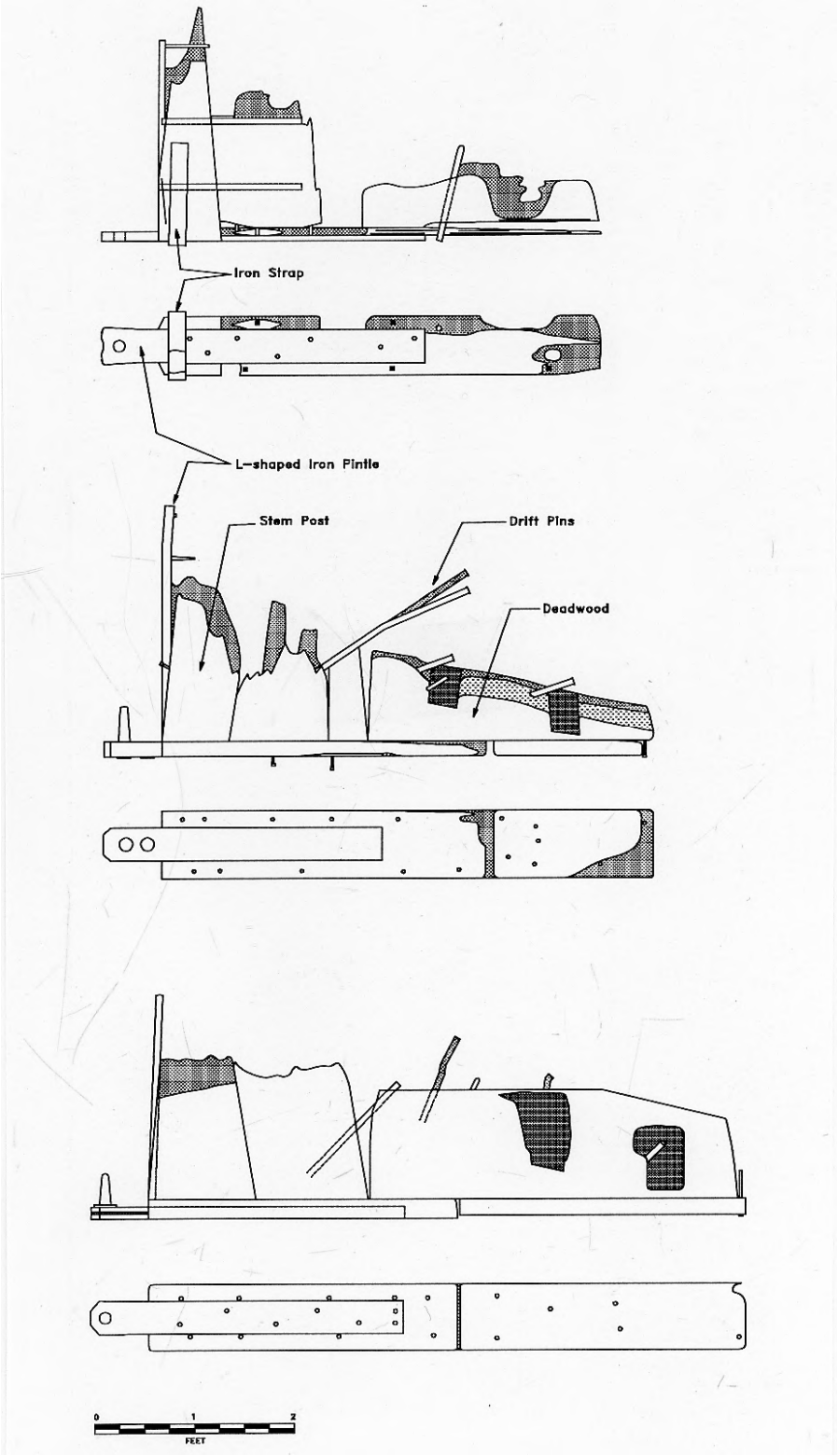


Figure 22. Side and bottom details of stern post and pintle hardware of Boats 4 (top), 5 (middle), and 6 (bottom).

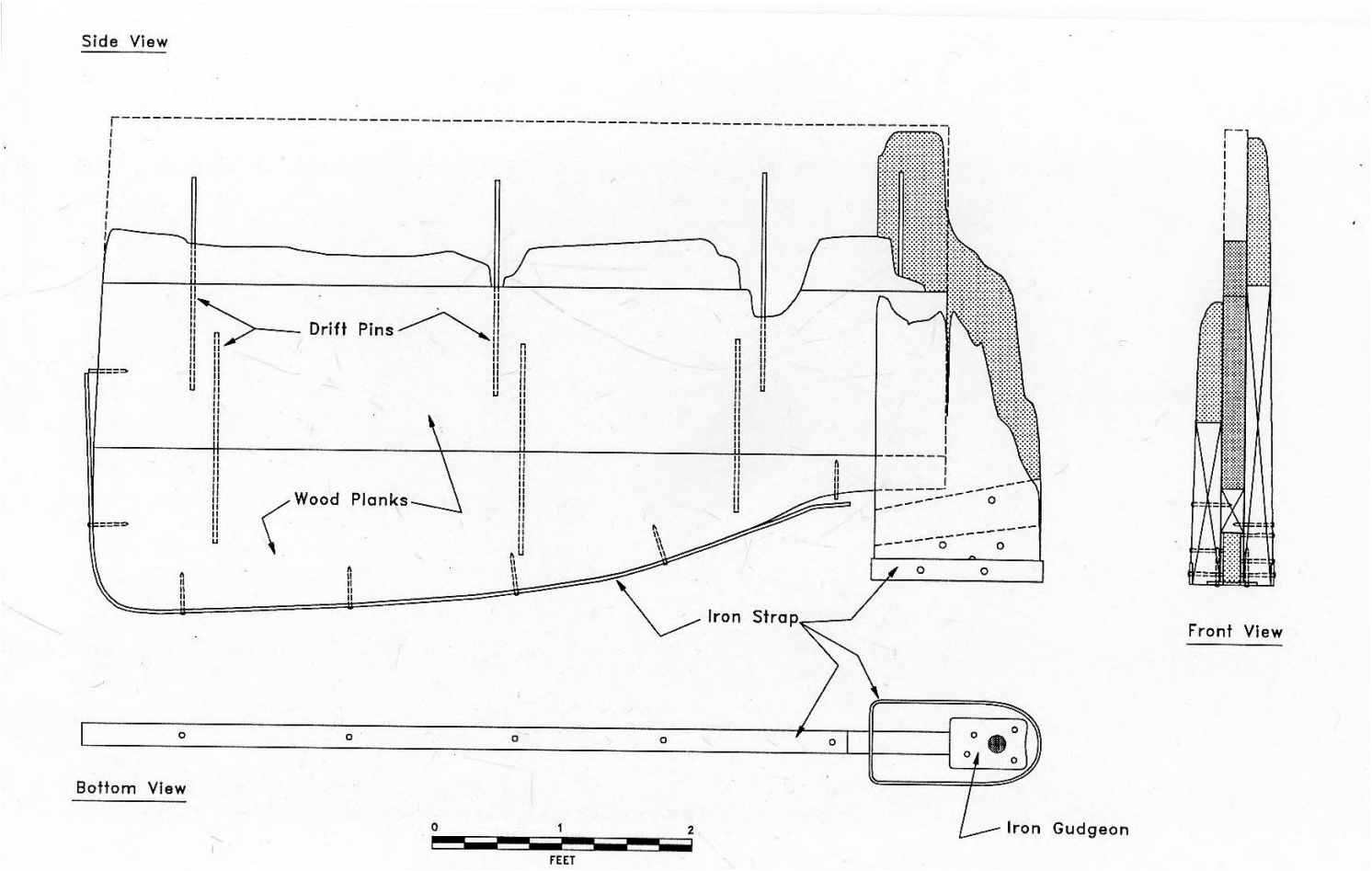


Figure 23. Detail of the rudder of Boat 5. The rudder of Boat 6, although less well preserved, was nearly identical in construction.

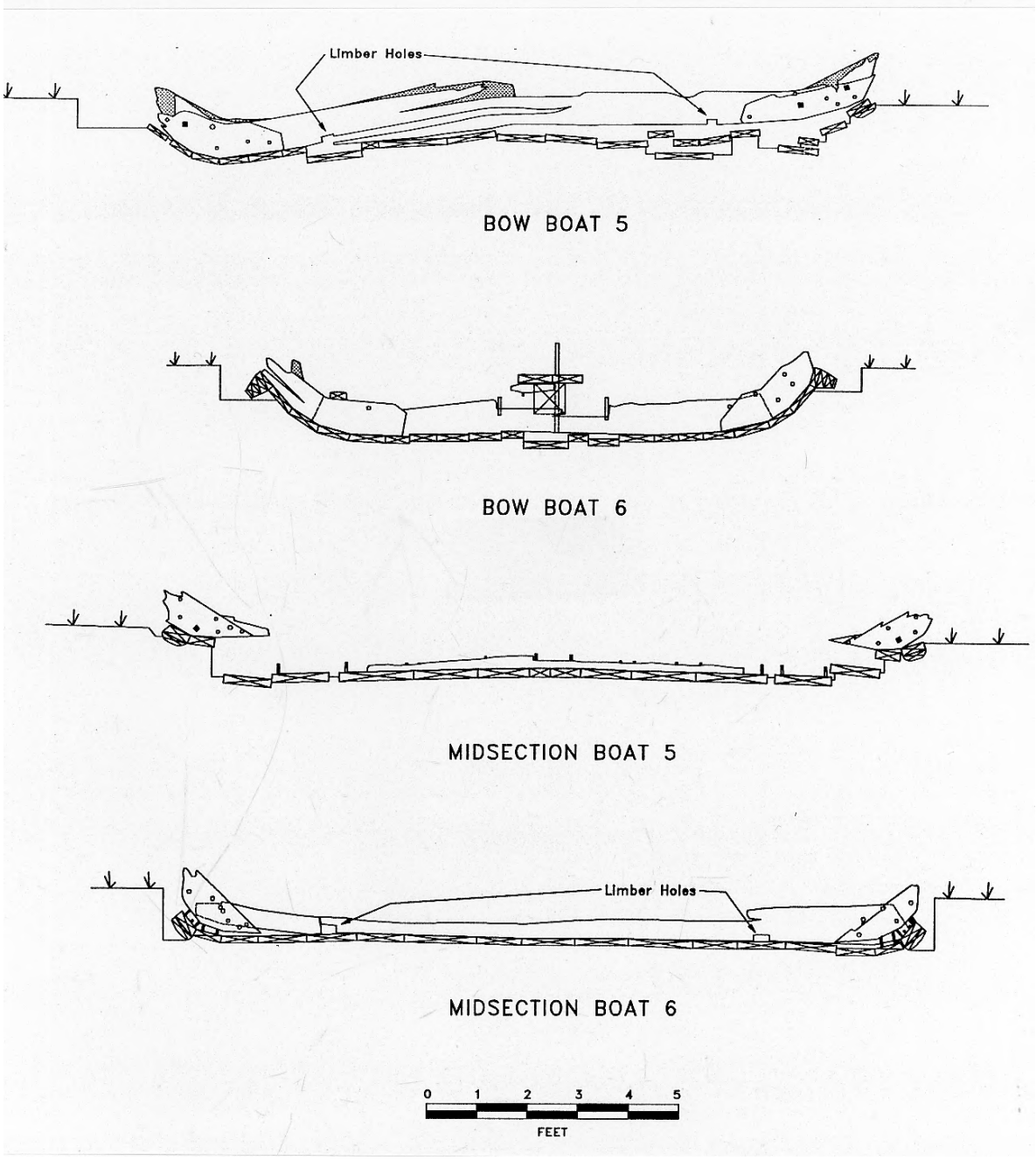


Figure 24. Sectional views of Boats 5 and 6. After abandonment and partial decomposition, the boats settled into the sediments of the canal. As they settled into the sediments, the boats hogged causing the midsection of each boat to rise up in relationship to the stern and bow sections. As a result, the stern and bow sections of these boats are covered with slightly more sediment than the midsections, and thus are slightly better preserved than the midsections.

with an iron bar so that the towline could not be caught on the rudder of a passing boat." This requirement seems to have been met with the design of the iron pintle which was fairly uniform on all the boats inspected. It is interesting to note that the rudder assembly documented at the Morris Wide Water is very different than that illustrated on the *City of Pekin* drawings of 1937.

Materials: Hall (1884:227) provides a list of materials necessary for constructing a canal boat (a "Laker") of the size similar to the boats documented along the Illinois and Michigan Canal at Morris. Hall's (1884) materials list included "18,000 feet of oak and hardwood, from 20,000 to 22,000 feet of white pine and chestnut, 5,800 pounds of bolts, spikes, and nails, 1,500 to 2,000 pounds of flat iron, 600 pounds of castings, 10 or 12 barrels of salt, $90 worth of paints and oils, and $50 worth of oakum."[20]

Artifacts recovered during the course of the archaeological investigations consisted predominately of lumber (wood) and iron. The majority of the lumber recovered archaeologically was that which had been used in the hull construction and consisted of white oak planks. The bottom hull and side wall planks of the boats at Morris appear to be white oak lumber. Documentary evidence suggests that the hull of the *City of Pekin* was constructed using red oak lumber (Works Progress Administration 1937). Unfortunately, due to the deteriorated condition of these timbers, few planks exhibited any evidence of saw marks. The few saw marks that were evident clearly indicated the use of a large-diameter, circular saw. No evidence for the use of a vertical reciprocating saw was found on any of the timbers. The use of vertical-sawn lumber in the canal boats would have had some significance in dating the construction of these structures, as the transition from vertical-sawn to circular-sawn lumber in northern Illinois occurs between the later 1850s and early 1870s (Mansberger 1996). The presence of vertical-sawn lumber would have hinted at an earlier boat dating from the pre-1870 period. As all the sawn lumber encountered in these boats was circular sawn, it would appear that the boats post date circa 1870.

The use of oak throughout the hull contrasts with canal boats constructed in other regions, such as along the Erie Canal, where vessels were constructed with oak bottoms and pine side walls. The oak planks were more durable than the pine planks, and thus were placed on the bottom of the hull which received the greatest mechanical damage scraping against the canal bottom. It is suspected that this differential use of woods in the Erie Canal region was due to the depleted supply of quality oak lumber. In Illinois, quality oak lumber, which was a local product, was more readily available (and/or cheaper) than it was within New York State during the later nineteenth century. As such, the local boatyards used oak planks for both the hull bottom and sides.

When discussing the construction of canal boats, Hall (1884:227) notes that "the scantling [used by the boat builders] varies slightly with the fancy of the builder or the

[20] Hall (1884) also noted that these boats required 450-500 days of labor to complete. Based on an 1880 labor rate of $1.75 to $2 per day, the Erie Canal "Laker" cost from $900 to $1,025 to build, and cost an average of $3,800 to purchase (with prices ranging from $3,700 to $4,200) (Hall 1884:227).

stuff which he can buy to advantage… ." Similarly, the Morris Canal boats exhibited subtle variability in the size of the framing members –variability that may have been influenced by the availability of lumber and/or the idiosyncratic behavior of the multiple sawyers that supplied lumber to these shipwrights.

The archaeological investigations suggest that the lumber used within these boats was of variable quality. As discussed earlier, loose knots present within the hull planking had been drilled out and plugged with a round, tapered oak dowel. The number of plugged knot holes per boat may indicate the relative quality of oak timber used in the construction of each boat. The exposed midsection of the hull of Boat 6 indicates quality timber being used in that boat (as evidenced by only 2 plugged knot holes in the midsection; or 3.5 plugged knots per 100 square feet of hull). In contrast, Boat 5 had 6 plugged knot holes and multiple additional unplugged knot holes were noted in the midsection of the hull planking. This represents 10 plugged knot holes per 100 square feet of hull in Boat 5. Clear oak planks lacking knots were easier to work but probably hard to find in the lengths necessary to construct the boats, particularly by the later nineteenth century. If available in clear stock in these lengths, the lumber clearly would have been much more expensive to purchase. If clear planks were available, the labor may have been cheaper to plug the knot holes than purchase quality lumber.

Hall (1884:227) notes the presence of white pine and chestnut in his material list. Although we did not recover much detail about the canal boats' upper superstructure, it was apparent (particularly in Boat 6) that the above-deck structure was constructed with non-hardwood lumber, presumably white pine. Several pieces of tongue-and-groove yellow pine were also found redeposited in the fill above the boat's ceiling. This wood may represent flooring or interior paneling associated with the above-deck cabins.

Iron fasteners (particularly nails) were extremely common among the artifacts recovered from the canal boat investigations (Table 1). The nails recovered from the excavations were of three varieties and included forged, machine cut, and wire drawn (Figure 25). Hand-forged and machine-cut varieties were found in nearly equal percentages with wire-drawn nails being recovered in extremely small percentages. By the 1870s, the use of hand-forged nails was uncommon within the building trades, except for the occasional clinched nail used within a door batten. Machine-cut nails, which replaced the use of forged nails, in turn, were quickly replaced by the use of wire-drawn nails during the very late nineteenth century (ca. 1890-1900).[21] The forged and machine-cut nails from the canal boats appear to have been used in the construction of these maritime structures. In contrast, the presence of the wire-drawn nails in the assemblage represents repair and/or maintenance activity that occurred on the boats after ca. 1885.

[21] Much has been written about nail technology. The more significant works include Nelson (1968), Fontana (1965), and Edwards and Wells (1993).

Table 1
Nail Type By Size and Location

	Boat 5						Boat 6					
	Bow		Midsection		Stern		Bow		Midsection		Stern	
	#	%	#	%	#	%	#	%	#	%	#	%
Forged Nails												
3 1/4 - 1/2"	0	0.0%	0	0.0%	0	0.0%	4	0.7%	0	0.0%	0	0.0%
3 3/4"	0	0.0%	0	0.0%	0	0.0%	8	1.4%	0	0.0%	0	0.0%
4"	0	0.0%	7	18.4%	0	0.0%	27	4.9%	3	3.8%	0	0.0%
4 1/4 - 1/2"	43	34.1%	4	10.5%	6	3.7%	74	13.3%	22	28.2%	12	30.0%
4 3/4"	0	0.0%	0	0.0%	0	0.0%	61	11.0%	2	2.6%	0	0.0%
5"	12	9.5%	4	10.5%	28	17.3%	10	1.8%	2	2.6%	0	0.0%
5 1/4 - 1/2"	8	6.3%	3	7.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
5 3/4"	0	0.0%	0	0.0%	0	0.0%	15	2.7%	0	0.0%	0	0.0%
6"	12	9.5%	3	7.9%	18	11.1%	37	6.7%	2	2.6%	4	10.0%
6 1/4 - 1/2"	7	5.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
7"	0	0.0%	0	0.0%	0	0.0%	1	0.2%	0	0.0%	0	0.0%
8"	0	0.0%	0	0.0%	0	0.0%	1	0.2%	0	0.0%	0	0.0%
8 1/4 - 1/2"	1	0.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
9"	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
9 1/4" - 1/2"	0	0.0%	0	0.0%	0	0.0%	1	0.2%	0	0.0%	0	0.0%
Total	83		21	55.3%	52	32.1%	239	43.0%	31	39.7%	16	40.0%
Machine-Cut Nails												
2 1/2"	0	0.0%	0	0.0%	2	1.2%	4	0.7%	0	0.0%	0	0.0%
3"	0	0.0%	0	0.0%	0	0.0%	1	0.2%	0	0.0%	0	0.0%
3 1/2"	0	0.0%	0	0.0%	32	19.8%	15	2.7%	0	0.0%	8	20.0%
4"	0	0.0%	0	0.0%	0	0.0%	4	0.7%	0	0.0%	0	0.0%
4 1/2"	18	14.3%	6	15.8%	35	21.6%	51	9.2%	0	0.0%	10	25.0%
5"	4	3.2%	1	2.6%	35	21.6%	107	19.2%	23	29.5%	0	0.0%
5 1/2"	1	0.8%	3	7.9%	0	0.0%	96	17.3%	0	0.0%	0	0.0%
6"	7	5.6%	7	18.4%	2	1.2%	25	4.5%	24	30.8%	6	15.0%
Total	30		17	44.7%	106	65.4%	303	54.5%	47	60.3%	24	60.0%
Wire-Drawn Nails												
3"	0	0.0%	0	0.0%	2	1.2%	0	0.0%	0	0.0%	0	0.0%
3 1/2"	13	10.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
3 3/4"	0	0.0%	0	0.0%	0	0.0%	2	0.4%	0	0.0%	0	0.0%
4"	0	0.0%	0	0.0%	1	0.6%	3	0.5%	0	0.0%	0	0.0%
4 1/2"	0	0.0%	0	0.0%	1	0.6%	2	0.4%	0	0.0%	0	0.0%
5"	0	0.0%	0	0.0%	0	0.0%	7	1.3%	0	0.0%	0	0.0%
Total	13	10.3%	0	0.0%	4	2.5%	14	2.5%	0	0.0%	0	0.0%
Total Nails	126	100.0%	38	100.0%	162	100.0%	556	100.0%	78	100.0%	40	100.0%

The presence of large numbers of forged nails within the canal boat assemblage suggests that the use of forged nails in the canal boat building trades persisted for a much longer period of time than within the house construction trades. One potential explanation is that the forged nails had an advantage (whether real or perceived) over the more brittle machine-cut nails. Our impression is that the hull planks from the canal boats were attached to the floor frames with forged nails, and that the upper portions (including potentially the side walls of the hull) of the structure were held together with machine-cut nails. As the side walls deteriorated, the nails moved downward and collected in pockets between the ends of the floor frames adjacent to the futtocks. These nail concentrations included both forged and machine-cut varieties.

The forged nails were of variable size and were manufactured with a limited amount of hand work (see Figures 26, 27 and 28). The square iron stock was cut to length and minimally pointed and headed with a non-tapered shank. Unlike forged nails used in the house trades (which generally have a well tapered shank), the nails used in the canal boats were not tapered and the pointed end of the nail was crudely pointed (generally only on two sides). Similarly, the head was only crudely flattened and slightly rounded. Although originally suspected as being locally manufactured at the various boat yards, such "Wrought Boat Spikes" were stock items marketed by such firms as S. D. Kimbark (Kimbark 1876; Figure 26). Kimbark's Illustrated Catalogue offered these wrought boat spikes in 3/8", 7/16", 1/2", and 9/16" shank size (up to 12" long). Longer wrought nails, from 12" to 18" in length, were offered in 3/8" and 7/16" shank sizes only. Similarly shaped, yet machine-cut, chisel-point "barge spikes" and "boat spikes" were marketed by the American Steel and Wire Company as late as the 1930s (American Steel and Wire 1933:42, 45; Figure 28).[22]

Although the majority of the forged nails found at the Morris Wide Water were manufactured from ¼" square stock, some of the larger examples were forged from 3/8" square iron bar stock.[23] Many of the forged nails had a gray, metallic substance that adhered to the nail's head. This material probably represents the remains of the caulking applied to the nails after they were inserted into the hull. The forged nails from Boats 5 and 6 predominately were of the 4 ½", 5" and 6" sizes. Whereas these three nail sizes were evenly distributed in Boat 5, Boat 6 had a preponderance of nails that were 4 ½" in size. All three nail sizes represent common framing nails.

The machine cut nails recovered from the excavations were typical of those being used in the house construction trades. Large cut spikes like those marketed by S. D. Kimbark (Kimbark 1876) were available in 4", 4 ½", 5, 5 ½" and 6" sizes and sold for $0.25 per keg. Many of the larger machine-cut nails had a stamped head with a raised oval that is

[22] These nails were manufactured with three different head varieties (button or oval, diamond, and flat).

[23] It is interesting to note that the frame of the steamboat *Bertrand*, which was constructed in 1864,, was held together with bolts and "a few square cut nails" (Petsche 1974:76). Apparently, no forged nails were found in association with this river boat. Excavations at the site of a boatyard in Lockport (Will County), indicates the presence of numerous machine-cut and forged nails within the artifact assemblage, similar to that recovered from the Morris canal boats (Ingalls et al 1984).

referred to as a rosehead. The machine-cut nails in use in Boats 5 and 6 were predominately of the 3 ½", 4 ½", 5", 5 ½", and 6" sizes.

Although our initial thought was that the earlier boats (such as Boats No. 2 and 7) had been constructed solely with forged nails, the excavations indicated that both nail varieties were present on all boats. The canal boat suspected as being one of the earliest boats moored at this location (Boat 2) had both forged and machine-cut nails present. As such, it would appear that the differential use of these two nail types is based on either an economic reason (with forged nails costing slightly less money), or a functional difference (with the machine-cut nails potentially being used above the water line and the forged nails below the water line). It is interesting to note that some of the forged nails found in Boat 2 (one of the earlier boats documented at this site) had a tapered shank typical of a forged nail and distinctively different than the non-tapered shanks associated with the majority of the forged nails found on Boats 5 and 6. Although only speculative, this may suggest that the earlier boats were being constructed using a variety of locally forged nails, commercially produced "wrought boat spikes," and machine-cut nails. By the late nineteenth century, the later boats were being constructed using only commercial boat spikes and machine-cut nails, having dropped the use of locally produced forged nails.

A comparison of the nail size distribution between the bow and stern sections of Boats 5 and 6 gives us insights into the cabin locations on these canal boats (Figure 29). Both Boats 5 and 6 had a slightly higher percentage of small-sized nails found in the stern section compared with the bow or midsection of the boat. Although mostly of the machine-cut variety, a few small-sized forged nails were also recovered. It is our contention that these small-sized nails were predominately used for light frame construction such as that found in the construction of the deck cabins. The presence of these small-sized nails in nearly equal numbers within the stern sections of Boats 5 and 6 substantiates that both of these structures probably had a main cabin at the stern which was typical of these maritime structures. Unlike Boat 5, Boat 6 also had a number of small nails recovered from the bow section. Similarly, several pieces of pine wainscot and lath were recovered from the bow of Boat 6 suggesting that a deck cabin was once present on the bow of that boat. The lack of small-sized nails in the bow of Boat 5 suggests that this vessel probably did not have a bow cabin.

Other metal fasteners recovered on the canal boats include carriage bolts and large iron drift pins. The drift pins were found throughout the boats and were used to fasten the deadwood and stringers to the boat frame. These 1" iron pins, which were not pointed or headed, had been driven into pre-drilled holes and were found in a variety of lengths. The carriage bolts were found on only a sample of the boats and were used to attach the futtocks to the floor and side frames. Generally, these bolts were approximately ½" in diameter and 4" to 8" in length. Several large (1 7/8" square) iron nuts still attached to short (2") fragments of 7/8" threaded rod were recovered from the bow of Boat 6. One of the nuts had been split in two as if it had been chiseled off the threaded rod. These iron

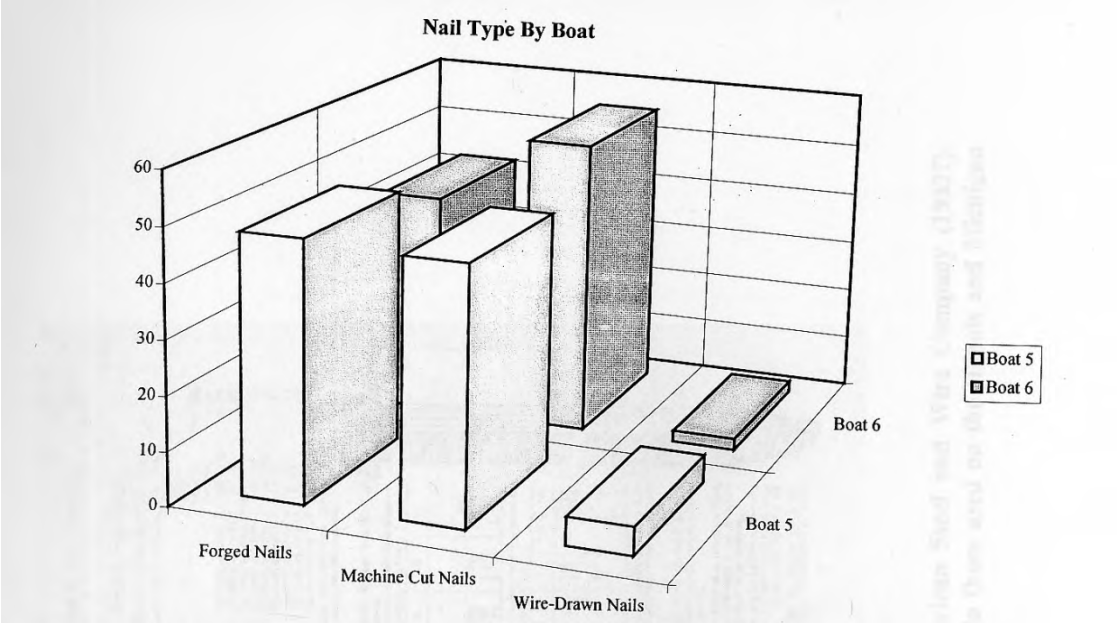
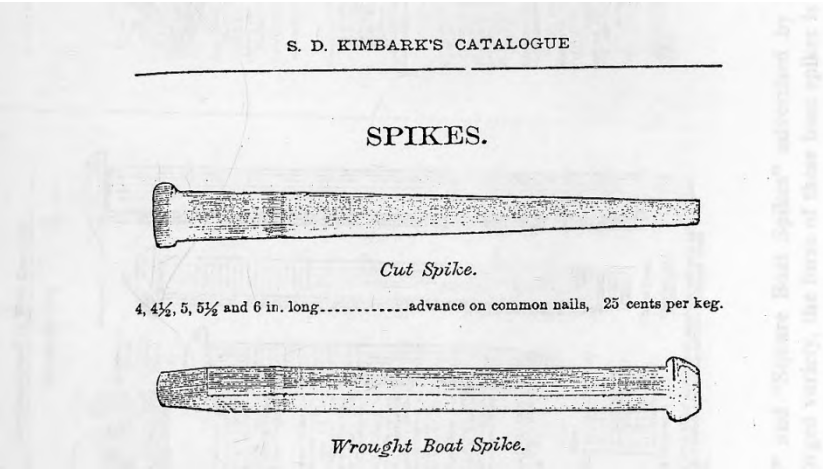


Figure 25. Distribution of nail types by boat. These percentages reflect the total number of nails recovered from the excavation of the bow, stern and midsections of these two boats.


S. D. KIMBARK'S CATALOGUE

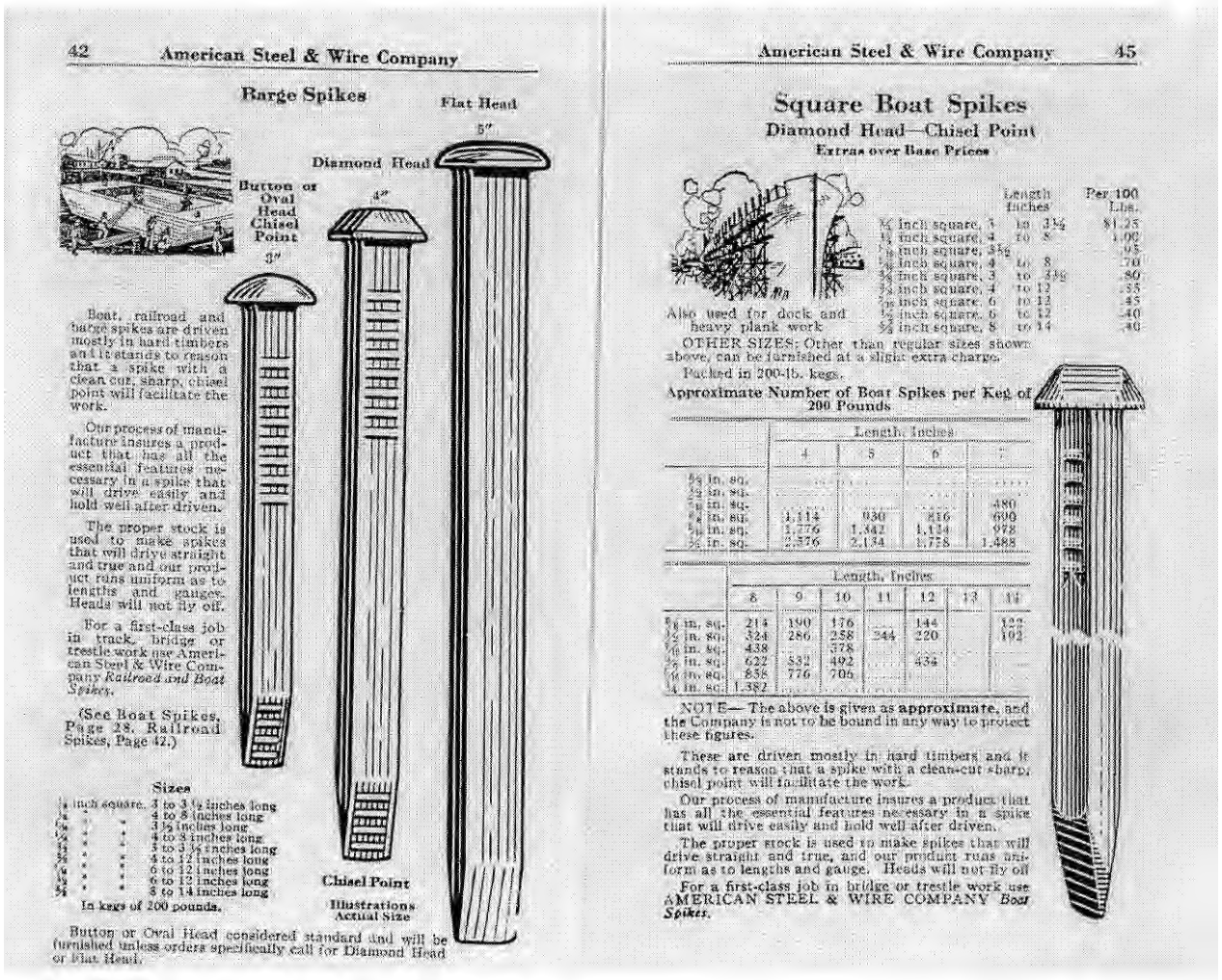
SPIKES.

Cut Spike.

4, 4½, 5, 5½ and 6 in. long.....advance on common nails, 25 cents per keg.

Wrought Boat Spike.

Figure 26. This page from S. D. Kimbark's <u>Illustrated Catalogue</u> (Kimbark 1876:96; as reproduced from Fontana 1965:96) illustrates the two main nail types recovered from the excavations of the Morris canal boats. Nearly equal numbers of machine-cut spikes and forged nails were recovered from Boats 5 and 6. Kimbark's <u>Illustrated Catalogue</u> illustrates distinctive forged nails similar to those recovered from the excavations and refers to them as "Wrought Boat Spikes". Although we initially suspected that the forged nails were being manufactured at the local boatyard, it seems likely that they were being purchased from a supplier as were the machine-cut nails.



42 American Steel & Wire Company

Barge Spikes

Flat Head

Diamond Head

Button or Oval Head Chisel Point

Boat, railroad and barge spikes are driven mostly in hard timbers and it stands to reason that a spike with a clean cut, sharp, chisel point will facilitate the work.

Our process of manufacture insures a product that has all the essential features necessary in a spike that will drive easily and hold well after driven.

The proper stock is used to make spikes that will drive straight and true and our product runs uniform as to lengths and gauges. Heads will not fly off.

For a first-class job in track, bridge or trestle work use American Steel & Wire Company *Railroad and Boat Spikes*.

(See Boat Spikes, Page 28. Railroad Spikes, Page 42.)

Sizes

½	inch square,	3 to 3½ inches long
⅝	" "	4 to 8 inches long
⅝	" "	3½ inches long
¾	" "	4 to 8 inches long
¾	" "	5 to 8 ¼ inches long
⅞	" "	4 to 12 inches long
⅞	" "	6 to 12 inches long
1	" "	6 to 12 inches long
1	" "	8 to 14 inches long

In kegs of 200 pounds.

Chisel Point

Illustrations Actual Size

Button or Oval Head considered standard and will be furnished unless orders specifically call for Diamond Head or Flat Head.

American Steel & Wire Company 45

Square Boat Spikes

Diamond Head—Chisel Point

Extras over Base Prices

	Length Inches		Per 100 Lbs.
½ inch square,	3	to 3½	$1.25
⅝ inch square,	4	to 8	1.00
⅝ inch square,	3½		.95
¾ inch square,	4	to 8	.70
¾ inch square,	3	to 3½	.80
¾ inch square,	4	to 12	.55
⅞ inch square,	6	to 12	.45
1 inch square,	6	to 12	.40
1 inch square,	8	to 14	.40

Also used for dock and heavy plank work

OTHER SIZES: Other than regular sizes shown above, can be furnished at a slight extra charge.

Packed in 200-lb. kegs.

Approximate Number of Boat Spikes per Keg of 200 Pounds

	Length, Inches			
	4	5	6	7
½ in. sq.	...	...	...	.....
⅝ in. sq.	...	...	...	.....
¾ in. sq.	.....	.....	.....	480
⅞ in. sq.	1,114	930	816	690
1 in. sq.	1,276	1,342	1,124	978
1⅛ in. sq.	2,576	2,134	1,728	1,488

	Length, Inches						
	8	9	10	11	12	13	14
⅝ in. sq.	214	190	176	.....	144	.....	122
¾ in. sq.	324	286	258	244	220	.....	192
⅞ in. sq.	438	...	378	.....	.....	.....	.....
1 in. sq.	622	532	492	.....	434	.....	.....
1⅛ in. sq.	856	776	705	.....	.....	.....	.....
1¼ in. sq.	1,382	...	.....	.....	.....	.....	.....

NOTE—The above is given as **approximate**, and the Company is not to be bound in any way to protect these figures.

These are driven mostly in hard timbers and it stands to reason that a spike with a clean-cut sharp, chisel point will facilitate the work.

Our process of manufacture insures a product that has all the essential features necessary in a spike that will drive easily and hold well after driven.

The proper stock is used to make spikes that will drive straight and true, and our product runs uniform as to lengths and gauge. Heads will not fly off.

For a first-class job in bridge or trestle work use AMERICAN STEEL & WIRE COMPANY *Boat Spikes*.

Figure 27. "Barge Spikes" and "Square Boat Spikes" advertised by the American Steel and Wire Company (1933?). Although not of the hand forged variety, the form of these boat spikes is similar to those used on the Illinois and Michigan Canal boats.

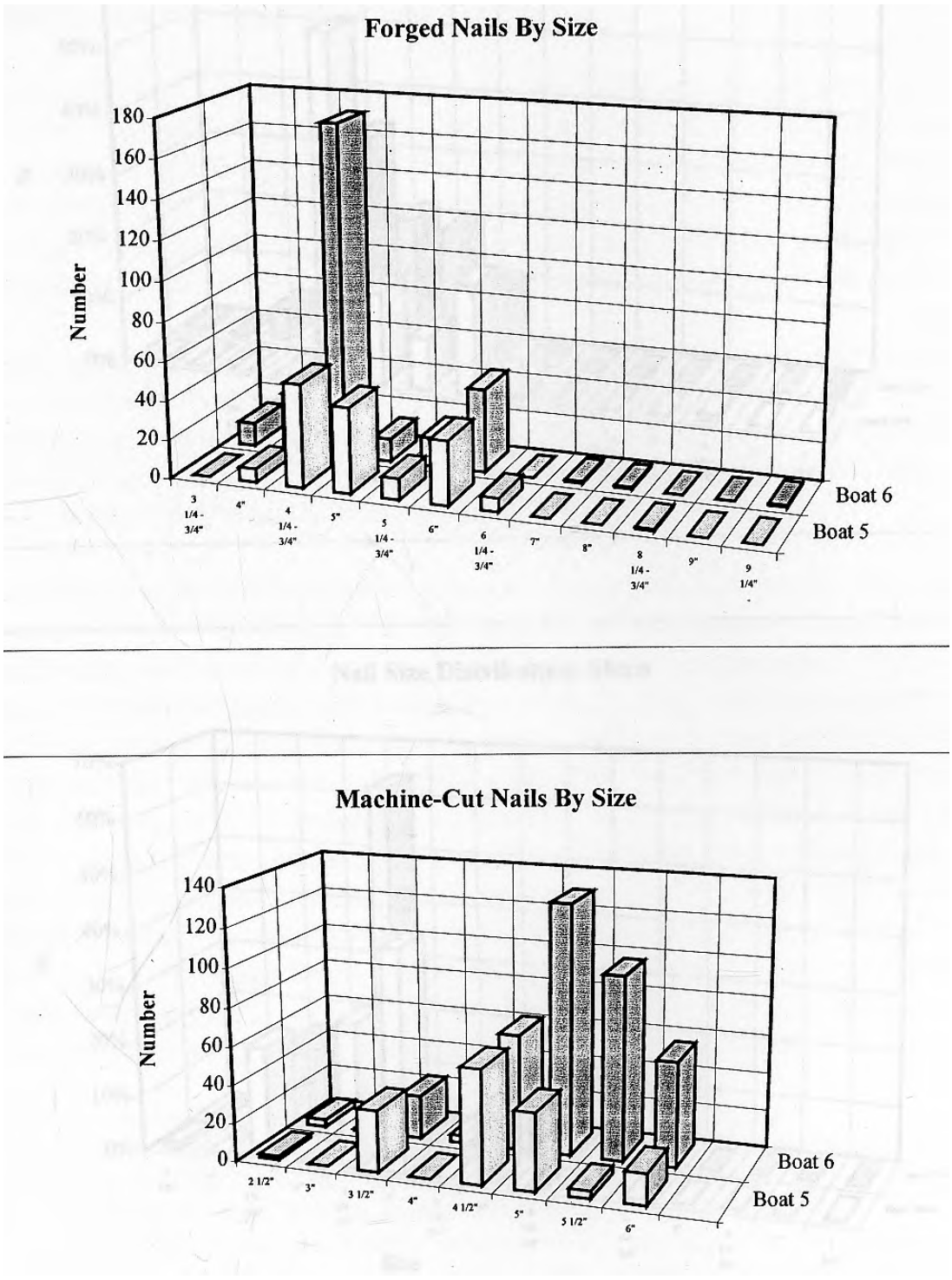


Figure 28. Distribution of forged nails (top) and machine cut nails (bottom) by size. Both nail types were represented predominately by large framing nails that ranged in size from 4" to 6" in size. The machine-cut nails were represented by a slightly higher number of small nails that represent non-framing and/or finish nails.

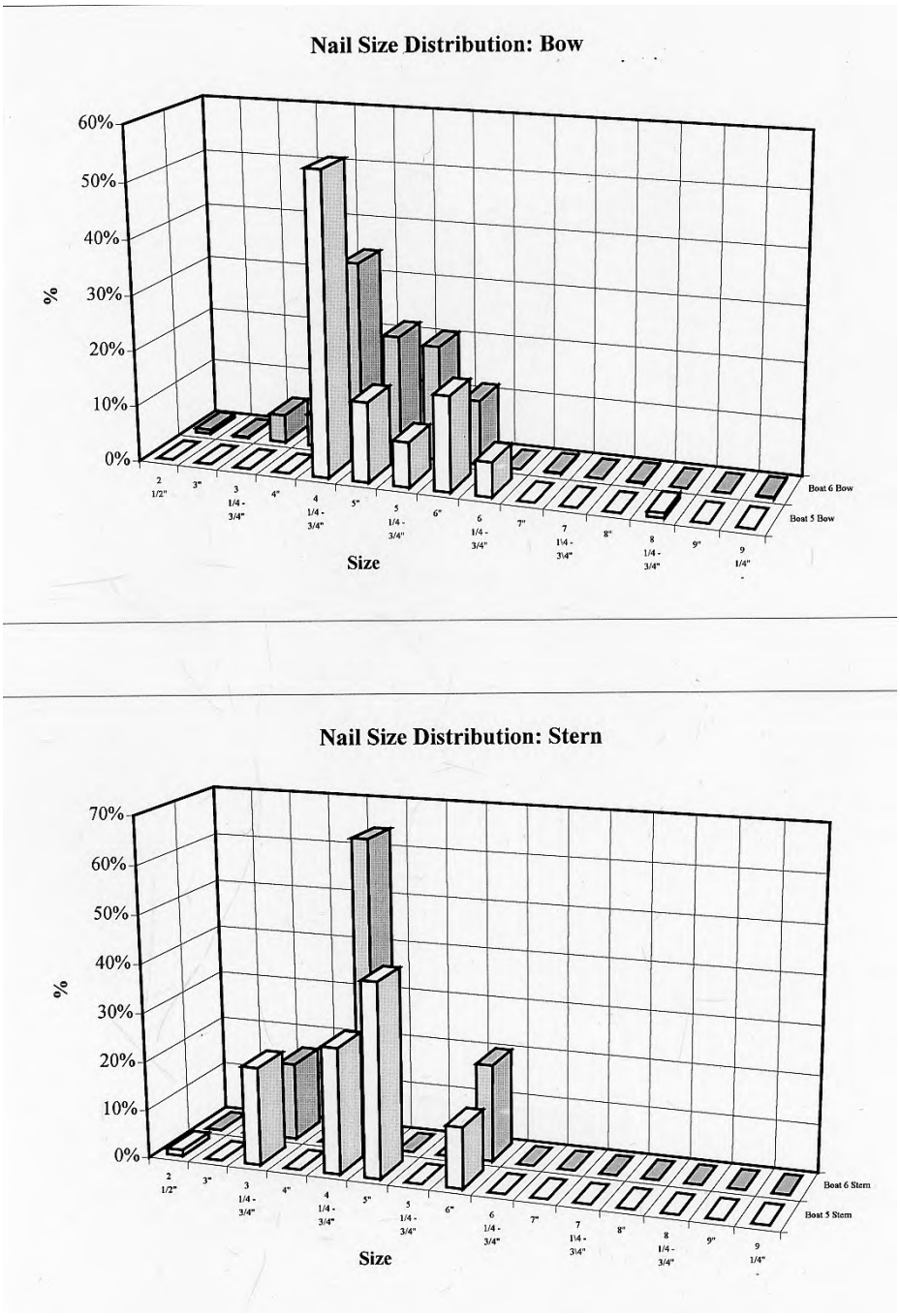


Figure 29. Comparison of nail size distribution by location (bow at top; stern at bottom) and boat. The presence of small finish nails in the bow of Boat 6 contrasts with the lack of such nails within the bow of Boat 5, suggesting that a deck cabin may have been present in the bow of Boat 6 and not in Boat 5. Similarly, the nearly identical distribution of small nails within the stern of Boats 5 and 6 suggest that a stern cabin was probably present in both boats.

nuts may have been part of hogging irons incorporated into the side of the vessel. A pair of 7" strap hinges (of the stamped variety) were also recovered from the bow of Boat 6 and probably were once attached to a door or hatch.

Maintenance/Repair: Evidence suggests that some of the canal boats found at the Morris Wide Water were relatively older craft that had underwent some repair and maintenance activity during their life. Many floor frames, particularly in the sterns of Boats 5 and 6, had been strengthened by the addition of short sections of new frames nailed alongside the original. The use of wire nails to attach these new floor frames suggest that these repair activities occurred during the very late nineteenth or early twentieth centuries.

Contents and/or Material Culture: Historically, the fore cabins and/or the interior of the bow of a canal boat was used as an "equipment storage locker" or store room for such items as rigging, kerosene lamps, tools, harness, and paint supplies (cf. Cozzi 1996:131; Paget-Tomlinson 1993:9). Similarly, the stern cabin and/or interior of the stern generally was the location of the family's living quarters.

The archaeological investigations also gave us insights into the interior layout of the large vessels at the Morris Wide Water. Within the bow of these boats we found the remains of rigging (blocks), harness hardware, and bottles (both glass and ceramic). The presence of the harness hardware suggests that horses and/or mules may have been stabled within the bow of these vessels. The presence of the bottles (both glass and salt glazed stoneware) suggests that these areas were frequently visited by the boat hands either during the course of their work day or during slack periods.[24] Similarly, personal items (such as an 1887 dime, a harmonica, and smoking pipes), furniture remains (wooden chair legs and spindles), cooking utensils, and the remains of a cast-iron cooking and/or heating stove were found in the stern section suggesting that this was the primary area inhabited by the "canaler family." Although the number of these artifacts were limited in scope, they give us insights into the quality of life lead by the canal boat families and their crews and compliment the limited archival information available on the subject.[25]

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[24] These included blue glass soda water bottles (with improved tool blob top finishes) marked "J. A. LOMAX/14 & 1[6]/CHARLES PLACE/CHICAGO" as well as salt glazed stoneware bottles stamped "J. G. B." on the shoulder. John Lomax, a soda water manufacturer, first appears in the Chicago city directories in 1859. At that time, his business address was 28 Lake Street. By 1867, the address for the Lomax bottling company had changed to 16 Charles Street, and the address remains the same through 1870. In 1871, the company's address became 14 and 16 Charles Place –an address it maintained through 1873. In 1874, the firm's address was changed to 14, 16, and 18 Charles Place. As such, it would appear that the bottles found in the hull of the canal boat at Morris were manufactured during the years 1871 through 1873 (Miscellaneous Chicago City Directories).

[25] Lamb (1980) and Barben (1973) contain excellent descriptions of cabin interiors as well as life on a canal boat. One of the more interesting sources of information about the lifeways of the canal boat families and crew can be obtained from daily store ledgers which document the purchases of these individuals. One such account book is that of a Mr. H. A. Hall who operated a tavern and store near the Illinois and Michigan Canal at Morris. We find that canal boats often stopped and purchased supplies from his store during the 1850s. On March 22, 1851, the canal boat Democrat purchased 3 dozen eggs (for 24¢), one plug of tobacco (5¢), and two bushels oats at 35¢ each (70¢). The Democrat returned five days later and purchased one pint of wine for 35¢. Other boats known to stop and conduct business at Hall's store during the year 1851 include the Henry (which purchased a bushel of potatoes, onions, nails, coffee, four loaves of

We had hoped to be able to comment on the cargo that the various canal boats had transported during their lifetime. Unfortunately, we were not able to assess the boats' cargoes with any certainty. Many of the bulk commodities such as grain and lumber quickly decomposed leaving no trace behind. Many of the boats did have a fine dusting of coal dust over the bottom of the boats and an occasional piece of coal lodged between the floor frames, suggesting that they may have transported coal –whether as a cargo or to be used on the boat is unclear. A dense concentration of coal (4" to 5" thick) was found between the floor frames of Boat 7 within the midsection of that vessel –strongly suggesting that the cargo had been coal. Similarly, a large pile of stone appears to have been located within the stern of Boat 7, suggesting that this boat may have once hauled stone from the nearby quarries. One informant claimed that these boats were the remains of his grandfather's fleet and that they had transported stone during the course of their life. In either case, stone and coal were a common bulk commodity transported by the canal boats along the Illinois and Michigan Canal.

Summary and Conclusions

Variability in canal boat design and construction can be attributed to a wide range of factors, such as the date of a boat's construction, geographical location of the boatyard that constructed the vessel, the cultural background of the mechanics and/or shipwrights that constructed the craft, the availability of materials, the anticipated use of the canal boat, and even legislative mandates. Boatyards along the Illinois and Michigan Canal were small affairs that generally made only a few boats a year during good times. As along the Erie Canal, these boatyards often specialized in a particular boat type "with its own design features" (Canal Museum 1981:12). The construction of boats is a specialized form of carpentry that requires skills uncommon among most nineteenth-century carpenter/builders who were adept at constructing square, straight-walled buildings. The curved hulls of a nineteenth century boat required a completely different set of building methods.

Although canal boats discovered within the Morris Wide Water exhibited a similarity in size and hull shape, great variation seems apparent in the manner in which these boats were constructed. As will be discussed in detail below, some of these differences may be attributed to the date the boats were constructed (with earlier boats being constructed in slightly different ways than the later boats). Similarly, some of these structural differences were probably related to the use, and/or the anticipated carrying capacity of,

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bread, and some brandy), the War Eagle (which purchased ham, butter, coal, sugar and drinks), the John, the Minden, the Rosetta Square, the Irish, the Empire State, the Batavia, the Mary, the Henry Hurlbert, the Davy, the Pekin of Peoria, the Marietta, the George Steel, the Water Witch, the Phoenix, the Iris, the Johns, and the Rochester. Other provisions purchased by the various crews of the passing canal boats and documented in Hall's ledger books include whiskey, corn, hay, brandy, codfish, as well as an occasional meal and overnight accommodations for the crew. The original account book has been donated to the Morris Public Library by Mr. Clyde Hiney, Morris, Illinois, copies are on file at the Springfield office of Fever River Research. Mansberger (n.d. b) contains a summary of the various items purchased by the various canal boat workers.

the boat. Boats that were to be subjected to heavy cargoes were constructed more solidly, using better construction techniques and materials. Additionally some of this structural variation may simply represent idiosyncratic behavior between shipwrights. It is interesting to note that the Lake Underwriters Rules rated scow schooners based on their carrying capacity and quality of construction (See Dorr 1876).

Cost and ease of construction are two factors that play a significant role in the design, and the methods used in the construction, of a canal boat. Boats with flat bottoms and square bilges are more easily constructed than a boat with a round bilge which requires more complex curved framing system (Paget-Tomlinson 1993:9). During the construction of utility craft such as canal boats or scow schooners, cost cutting measures were often undertaken by the shipwright to produce an acceptable product for his client.

As mentioned above, each of the canal boats examined at the Morris Wide Water exhibited a slightly different manner in bow, stern, and rib construction. Some of this variability appears to be related to the date when the boats were constructed. With the earlier boats, the bow post was fabricated by using an adz and carving the post from a curved section of oak tree utilizing the natural curvature of the tree to form the deadwood necessary to support the vertical post. Other boats, suspected as being slightly younger craft, utilized straight upright posts that were hewn to shape by hand with large pieces of deadwood laid against them (and fastened with metal drift pins) for support. In contrast, the most recent vessels were constructed using multiple pieces of sawn lumber pinned together with large iron drift pins. The upright posts used on the youngest craft were considerably more "plank-like" than the earlier vessels having been only slightly shaped by hand. The use of naturally curved oak timbers on the earlier boats probably was curtailed as the supply of adequate timber resources dwindled and/or became more expensive. Additionally, as Cozzi (1993:32) notes, the use of naturally curved oak timbers required a higher level of skill by the shipwrights for shaping the frames. Cozzi (1993:58) recognized a shift in construction techniques used in canal boat construction within the Northeastern United States during the nineteenth century that is similar to that recognized in Illinois. This shift was partly due to the boatyard's efforts at economizing on the cost of materials (a shift from more expensive oak lumber to white pine lumber) and the use of less skilled labor. In Illinois, we recognize a shift in techniques (particularly within the construction of the bow stem post) that may reflect a shift in labor (from skilled to less skilled craftsmen), but the shift in materials (from oak to pine) was not realized.

Another substantial difference in boat construction techniques was noted in the manner in which the side frames (or ribs) were attached to the floor frames. As with the bow and stern details, each boat exhibited a different manner of joinery. All boats used dimensional, sawn-oak lumber for the ribs and floor frames. The joint where these two framing members met was strengthened with an additional piece of triangular wood called a futtock. Some boats only had a single futtock lying on one side of the frame, whereas others had two futtocks (one on each side of the frame). Similarly, some boats utilized only nails to join the futtock to the frame, while others used various combinations

of bolts and nails. The more substantial boats had two futtocks per floor frame and were joined by four bolts and multiple nails.

These variations in framing techniques may be related to idiosyncratic differences between craftsmen and/or the construction practices utilized at the various boatyards along the Canal. Similarly, these variations may also reflect functional and/or quality differences between the boats. The boats that had multiple futtocks attached with multiple bolts were much better constructed vessels capable of holding up to rough use (and heavier cargoes) than those that had a single futtock nailed onto the frames. Whether these framing details reflect functional differences between grain boats and stone boats, or simply a difference between a poorly constructed, less expensive boat and a finely constructed, more expensive boat, is unknown at the present time.

With the decline in use of the Illinois and Michigan Canal during the 1890s and early 1900s, seven of these bulk cargo carriers were moored within the Morris Wide Water, where they soon sunk into the mud bottom of the canal, were stripped of their hardware, and eventually burned or rotted to the water line and were forgotten. Although only the bottom 1 to 1-½ feet of these maritime structures remain intact, they retain sufficient archaeological integrity and have the potential to supply significant information regarding canal boat construction and use along the Illinois and Michigan Canal, that they warrant listing on the National Register of Historic Places.

In attempting to determine the potential National Register of Historic Places eligibility of the canal boat hulks at the Morris Wide Water, we must beg the question "How unique are these resources?" Documentary (particularly photographic) evidence suggests that canal boats were abandoned in a variety of locations both along the canal bank and within various basins associated with the operation of the canal. The abandonment of vessels along the banks of these hydraulic basins probably began during the life of the canal with the number of occurrences multiplying dramatically with the abandonment of the canal itself at the turn-of-the-century. Older vessels may lie closer to the bank of these hydraulic basins with more recent boats located closer to the center of the basin and the main channel. Many of the communities along the Illinois and Michigan Canal maintained hydraulic basins which have since been filled. These hydraulic basins have a high potential to contain similar remains as those located at Morris.[26] The abandonment of hulks along the banks of the main channel of the Canal probably did not occur until after the abandonment of the Canal. The main channel of the Canal also has been affected more dramatically by post-abandonment dredging and maintenance activity. As such, it seems much less likely that well preserved remains of canal boats will be found along the main channel edge.

[26] Two middle-twentieth century (1930s-50s?) photographs labeled "Remains of Old Canal Boat (?)" are in the Illinois and Michigan Canal vertical files at the Reddick Library, Ottawa. These pictures, apparently donated by C. L. Tisher of Ottawa, illustrate a man standing in a wetland at some unknown location along the Canal. The floor frames, futtocks, and stem posts of an abandoned canal boat are clearly visible protruding from the surface of the marsh.

The seven canal boats within the Morris Wide Water are tangible remains of the wooden-hulled, bulk carriers that once plied the waters of the Illinois and Michigan Canal. Approximately 100 feet in length and 16-17 feet in width, these maritime structures were the work horses of the canal, transporting bulk commodities such as coal, grain, lumber and stone. The submerged structures at the Morris Wide Water retain sufficient integrity of their hull structure, contributing significantly to our understanding of canal boat construction along the Illinois and Michigan Canal. Additionally, these structures contribute to our understanding of the lifeways of the families and workmen that occupied these structures during the late nineteenth century. Therefore, the submerged maritime resources at the Morris Wide Water are being nominated to the National Register of Historic Places under Criterion A (history), C (architecture), as well as D (archaeology). These submerged boat hulls have yielded significant information on canal boat construction techniques and design, as well as the lifeways of the workmen and families that occupied these floating structures. Additionally, these resources have the potential to yield additional information (particularly with regard to the contents and construction techniques used in boats 1, 3 and 7) regarding the construction of Midwestern canal boats.

At the Morris Wide Water, the mapping of surface features followed by limited subsurface excavations have resulted in the collection of a substantial amount of information regarding the design, construction, and use of seven canal boats that were once used along the Illinois and Michigan Canal. As Pott (1993:32) has noted with regard to his work with Great Lakes scow schooners, our study "is beginning to suggest several different classes of scows, patterns of change in their development, and we hope, a more thorough understanding of the cultural and environmental factors that influenced these changes."

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APPENDIX I

ARTIFACT INVENTORY BY PROVENIENCE

Canal Boat No. 2

3 forged nail fragments
2 forged nails (4" long) [All forged nails are ¼" stock unless otherwise stated.]
3 forged nail (4¼" long)
2 forged nails (4½" long)
2 forged nails (4 ½" long; clinched and/or bent)
2 machine cut nails (4" long)
4 machine cut nails (4 ½" long)
1 machine cut nail (6" long)

Canal Boat No. 4 (Bow)

25 forged nails (unknown size)
21 forged nails (4½" to 4¾" long)
6 forged nails (5¾" long)
1 forged nail (3/8" stock; 5¾" long)
6 machine cut nails (Unknown size)
1 machine cut nail (3 ½" long)
2 machine cut nail (4" long)
3 machine cut nail (4 ½" long)
1 machine cut nail (6" long)
2 wire drawn nails (4 ¾" long)
1 wire drawn nail (5" long)
1 wire drawn nail (6 ¼" long)
1 drift pin (7" long)
1 partial bolt (with 7/8" square nut; 5" long) [All bolts are ½" round shaft unless otherwise stated.]
3 partial bolts (?)(12" long with 1 ¾" round washer and flattened head)
2 partial bolts (?)(3 ½" to 4 ½" long with 1 ¾" round washer and flattened head)
1 clear glass bottle lip fragment (machine-made crown finish)
1 clear glass bottle lip fragment (patent medicine/chemical bottle, improved tool finish)
3 clear glass milk (?) bottle base fragments (round, machine-made, embossed "ONE Q[UART]/DURAGLAS"; cross mends with fragments found in Boat 5 Bow)
1 clear glass bottle base fragment (oval, medicine?; cross mends with fragments found in Boat 5 bow)
1 clear glass container fragment
1 bone (fowl)

Canal Boat No. 5 (Bow)

37 unidentified nail fragments (unknown size)
35 forged nail fragments (unknown size)
40 forged nails (4 ¼" to 4 ½" long)
3 forged nails (4 ¼" to 4 ½" long; 3/8" stock)
12 forged nails (5" to 5 ¼" long)
5 forged nails (5 3/8" to 5 ½" long)
3 forged nails (5 3/8" to 5 ½" long; 3/8" stock)
12 forged nails (5 ¾" to 6" long)
2 forged nails (6 ¼" long; 3/8" stock)
1 forged nail (8 ½" long)
3 forged nails (6 ¼" long; bent)
2 forged nails (6 ½" long; bent)
58 machine cut nail fragments (unknown size)
18 machine cut nail (4 ½" long)
3 machine cut nail (5" long)
1 machine cut nail (5" long; bent)
1 machine cut nail (5 ½" long)
6 machine cut nail (6" long)
1 machine cut nail (6" long; bent)
12 wire drawn nails (3 ½" long)
1 wire drawn nail (3 ½" long; bent)
1 round drift pin (3" long; ½" shaft diameter)
1 round drift pin (4" long; ½" shaft diameter)
1 round drift pin (7 ½" long; ½" shaft diameter)
1 round drift pin (9" long; ½" shaft diameter)
2 partial bolts (7 ¾" long with 1 3/8" round, flattened head)
1 large steel strap (1/2" by 2" by 12" long; broken with two screw/nail holes)
1 large iron ring (7 ½" diameter; 3/8" stock by 1 7/8" wide)
1 piece copper flashing; cut for fitting around round stove pipe (?)
1 clear glass milk bottle fragment (round; machine made, upper half of bottle; cross mends with fragments in Canal Boat 4 Bow)
1 clear glass bottle (oval; 1 5/8" by 3 ¼", embossed "-PIX-"; 3-piece plate bottom mold; cross mends with fragments in Canal Boat 4 Bow)
6 clear glass whiskey bottle fragments (top half of bottle; round; 3" diameter; improved tool lip with fire polished finish; Ricketts mold)
2 aqua bottle base fragments (round; approximately 2 ½" diameter)
1 whole clear glass soda pop bottle (machine made, enameled "NEHI BEVERAGES")
2 amber glass bottle neck fragments
21 blue glass soda water bottle fragments (improved tool blob top finish; three-piece plate bottom mold; embossed "J. A. LOMAX/ 14 & 1[6]/ CHARLES PLACE/ CHICAGO" on front of bottle, "THIS BOTTLE MUST BE RETURNED" and "A. & [?]. H. C[0.]" on opposite side, and "JL" on base; two bottles present)
8 salt glazed stoneware bottle fragments (molded with faceted sides; impressed on shoulder "J. G. B.", represents one restorable bottle)
4 clear glass container fragments

12 aqua window glass fragments
2 bone
1 peanut shell
1 4-hole milk glass button
3 clear glass chimney globe fragments
1 clear glass, blow-over-mold chimney globe top
1 metal flat file (14 ½" long)

Canal Boat No. 5 (Midsection)

9 forged nail fragments (unknown size)
7 forged nails (4" long)
4 forged nails (4 ½" long)
4 forged nails (5" long)
3 forged nails (5 ½" long)
3 forged nails (6" long; 3/8" stock)
6 machine cut nail fragments (unknown size)
6 machine cut nails (4 ½" long)
1 machine cut nail (5" long)
3 machine cut nails (5 ½" long)
7 machine cut nails (6" long)
2 drift pins (6 ½" long)
2 bolt fragments (3" long with ¾" nut on threaded end)
1 bolt (8" long with ¾" nut on threaded end and rusted head on opposite)
1 whole terra cotta/earthenware, extruded building tile (may not have been original to boat)
Ash and charcoal present in thick lens near floor

Canal Boat No. 5 (Stern)

14 unidentified nail fragments (unknown size)
51 forged nail fragments (unknown size)
6 forged nails (4 ½" long)
26 forged nails (5" long)
2 forged nails (5" long; bent)
14 forged nails (6" long)
4 forged nails (6" long; bent)
49 machine cut nail fragments (unknown size)
2 machine cut nails (2 ½" long)
32 machine cut nails (3 ½" long)
35 machine cut nails (4 ½" long)
35 machine cut nails (5" long)
2 machine cut nails (6" long)
2 wire drawn nails (3" long)
1 wire drawn nail (4" long)
1 wire drawn nail (4 ½" long)

2 partial bolt fragments (2” long with ¾” round, flattened head)
2 partial bolt fragments (2 ½” long with ¾” square nut on threaded end)
1 partial bolt fragment (4” long with ¾” square nut on threaded end)
1 drift pin (4” long; ¾” stock)
1 drift pin (8” long; ¾” stock)
1 drift pin (9” long; ¾” stock)
1 drift pin (10” long; ¾” stock)
1 drift pin (9 long; ½” stock)
1 whole, clear glass soda water bottle (3-piece plate bottom mold, improved tool lip with crown finish; round; 2 ½” diameter; 9” tall; base embossed “S. B. & G. CO.”; side embossed ‘WILLIAM GEBHARD/MORRIS, ILL.”)
1 whole clear glass milk bottle (half pint size; machine made; embossed cow’s head on front)
1 whole clear glass medicine bottle (machine made; 1 ½” by 1 ¾” Blake-shaped base; 4” tall; screw top finish)
13 aqua window glass
2 clear glass lid (?) fragments
1 4-hole milk glass button
1 2-hole milk glass button
1 cast iron skillet handle
1 metal tablespoon fragment
1 10” diameter cast iron skillet (less handle)
1 soft mud brick fragment
1 fragment of red oil cloth flooring
1 unidentified piece of non-ferrous metal
coal

Canal Boat No. 6 (Bow)

66 unidentified nail fragments (unknown size)
100 forged nail fragments (unknown size)
4 forged nails (3 ¼” to 3 ½” long)
8 forged nails (3 ¾” long)
27 forged nails (4” to 4 ¼” long)
71 forged nails (4 3/8” to 4 ½” long)
3 forged nails (4 3/8” to 4 ½” long; bent)
55 forged nails (4 ¾” to 5” long)
6 forged nails (4 ¾” to 5” long; bent)
5 forged nails (5” long; 5/16” stock)
5 forged nails (5” long; 3/8” stock)
13 forged nails (5 ½” to 5 ¾” long)
2 forged nails (5 ½” to 5 ¾” long; bent)
35 forged nails (6” long; 3/8” stock)
2 forged nails (6” long; 3/8” stock; bent)
1 forged nail (7 1/8” long; 3/8” stock)
1 forged nail (8” long; 3/8” stock)

1 forged nail (9 ¼” long; 3/8” stock)
57 machine cut nails (unknown size)
4 machine cut nails (2 ½” long)
1 machine cut nails (3” long)
15 machine cut nails (3 ½” long)
4 machine cut nails (4” long)
51 machine cut nails (4 ½” long)
105 machine cut nails (5” long)
2 machine cut nails (5” long; bent)
94 machine cut nails (5 ½” long)
2 machine cut nails (5 ½” long; bent)
25 machine cut nails (6” long)
1 wire drawn nail fragment (unknown size)
2 wire drawn nails (3 ¾” long)
2 wire drawn nails (4” long)
1 wire drawn nail (4” long; bent)
2 wire drawn nails (4 ½” long)
7 wire drawn nails (5” long)
1 partial bolt fragment (1/2” rod; 6” long with 1 ¼” round, flattened head)
1 partial bolt fragment (1/2” rod; 7” long with 1 ¼” round, flattened head)
2 partial bolt fragments (3/4” rod; 9 ½” long with 1 1/8” square nut on threaded end)
1 bolt (1/2” rod; 14” long with 7/8” nut on threaded end and 1 1/8” round head)
1 bolt (3/8” rod; 14” long with 7/8” nut on threaded end and 1” round head)
1 partial bolt (1” rod; 11” long with 2” round head)
1 drift pin (4 ½” long; ½” rod))
3 drift pins (5 ½” long; ¾” rod)
3 drift pins (6” long; ¾” rod)
1 drift pin (6 ½” long; ½” rod)
1 drift pin (7 ½” long; ½” rod)
1 drift pin (7 ½” long; ¾” rod)
3 drift pins (8 ½” long; ½” rod)
2 drift pins (9” long; ½” rod)
1 drift pin (10” long; ½” rod)
1 drift pin (10” long; ¾” rod)
2 drift pins (12: long; ½” rod)
1 drift pin (12” long; ¾” rod)
1 drift pin (15” long; ¾” rod)
1 drift pin (17” long; ¾” rod)
3 drift pins (18” long; ¾” rod)
1 tie rod (¾” rod; 20” long with 1 ¼” round head; upper half is round in section and lower half is flattened with single hole in flattened end)
1 piece strap iron (whole; 22” long by 1 ¼” wide by 1/8” thick with nail holes)
1 piece strap iron fragment (4” long by 1 ½” wide by 3/16” thick with nail holes)
1 piece strap iron fragment (13” long by 1 ¾” wide by ¼” thick with nail holes)
2 pieces strap iron brackets (z-shaped; 1 ½” wide by 3/8” thick; approximately 24” long with nail holes)

1 clear container glass fragment
24 aqua glass bottle fragments (two-piece mold, round with 3 ½" diameter; applied tool lip; represents one bottle)
9 clear glass container fragments
2 clear glass whiskey bottle necks (improved tool with fire polished lip; represents two bottles)
4 clear glass kerosene lamp reservoir body fragments
1 faceted tear drop glass pendant for a kerosene lamp
3 clear glass lamp chimney bodies
1 unidentified clear glass container fragment
1 zinc canning jar lid with rubber casket (badly decomposed)
1 harmonica sound board (4" long)
1 whetstone (well worn)
1 wooden lead pencil
2 broken halves of a stamped iron hinge
1 window weight pulley
1 unidentified metal (iron)
1 unidentified metal (non-ferrous; zinc?)
1 harmonica
4 large handforged iron nuts (1 ¾"-2" square by 1" thick); still threaded onto 2" section of broken 1" threaded rod
1 large handforged iron nut (1 ¾" square) chisel cut in half
1 unidentified piece of "twisted" wire
1 iron ring and U-shaped staple (mooring ring with anchor)
1 circular sawn piece of wood lath (discarded)
1 piece double-beaded, tongue-and-groove beadboard (approximately 7/8" by 5"); finished on both sides, beads are not centered; painted
1 fragment strap leather (7/8" wide; with metal grommet)
coal

Canal Boat 6 (Midsection)

9 forged nail fragments (unknown size)
3 forged nails (4" to 4 ¼" long)
22 forged nails (4 ½" long)
2 forged nails (4 ¾" long)
2 forged nails (5" long)
2 forged nails (6" long)
19 machine cut nail fragments (unknown size)
21 machine cut nails (5" long)
2 machine cut nails (5" long; bent)
22 machine cut nails (6" long)
2 machine cut nails (6" long; bent)
1 drift pin (4 ½" long; 5/8" rod)
1 drift pin (5" long; ½" rod)
1 drift pin (5" long; ¾" rod)

1 partial bolt (3” long with ¾” round, flattened head)
1 partial bolt (3” long with 3/8” round, flattened head)
1 partial bolt (3 ½” long with ¾” square head)
1 piece sawn lath

Canal Boat No. 6 (Stern)

11 unidentified nail fragments (unknown size)
3 forged nail fragments (unknown size)
12 forged nails (4 ½” long)
4 forged nails (6” long)
3 machine cut nail fragments (unknown size)
8 machine cut nails (3 ½” long)
9 machine cut nails (4 ½” long)
1 machine cut nail (4 ½” long; bent)
6 machine cut n ails (5 ¾” to 6” long)
1 drift pin (8 ½” long; ½” rod)
1 drift pin (9” long; ½” rod)
1 drift pin (7 ½” long; ¾” rod)
1 drift pin (4 ½” long; ½” rod)
1 partial bolt (8” long with 1 ¼” round head)
8 aqua window glass fragments
14 clear glass container fragments
4 clear glass food jar fragments (machine made; 3” diameter base; screw top finish)
4 amber bottle fragments (approximately 2 ½” diameter base)
1 clear glass milk bottle lip fragment (machine made)
1 clear glass food jar base fragment (machine made)
3 aqua glass bottle fragments (improved tool lip with crown finish)
1 aqua glass bottle fragment (embossed “[Coc]a C[ola]/Regis[tered]/…N 185…”)
1 aqua glass jar fragment (blow-over-mold with screw top finish; 1 3/8” diameter mouth; rim only)
4 clear glass bottle fragments (machine made; rectangular body approximately 1” by 2 ¼” by 4 ½” in size; screw top lip; melted)
1 glass thermometer fragment
1 whole aqua glass beer (?) bottle (machine made with crown finish; 2 ½” diameter base; 9 ½” tall)
5 clear glass milk bottle fragments (improved tool lip, embossed body “THOS> FLYNES”; base embossed “ACME”)
1 clear glass food (?) jar rim fragment (machine made with screw top finish)
1 aqua glass container fragment
8 clear glass bottle fragments
3 unidentified clear container glass fragments
3 clear glass chimney globe fragments
25 aqua window glass fragments (thick)
2 milk glass collar stud
2 kaolin pipe stem fragments impressed “GERM…”

1 wooden barrel/churn/bucket hoop fastener
2 terra cotta building tile fragment
1 red brick fragment
4 red paste earthenware drain tile or flower pot body fragments
1 seated liberty dime (dated 1887)
1 stamped gray metal (zinc?) button
1 iron/tinware table spoon
2 wood handled table knives
1 large cast iron stove (?) leg
1 unidentified piece of iron
1 large (1 7/8" square by 7/8" thick) handforged nut still attached to a 2" long section of 3/4" threaded rod
1 horseshoe
2 unidentified metal "paddles"
7 unidentified metal object, round with with mica panels
1 tripod [the "paddles", round object with mica, and tripod appear to be the same object. This may represent the remains of a light or navigational object?]
3 fragments of turned chair leg and spindles
1 circular sawn wood lath
2 fragments of bead board (painted red)
1 tinware bowl (10" diameter mouth, 5" diameter base, 4 ¾" tall)
1 cast iron kettle with wire handle (no legs; 9 ½" diameter, 7 ½" to 8" tall)
1 rolled-up or coiled piece of copper wire
8 leather strap fragments with buckles (harness hardware)
6 leather horse collar fragments
1 small fragment of small cordage
1 bone
coal

Canal Boat No. 7 (Midsection)

4 forged nails (4 ¾" to 5" long)
1 machine cut nail (4 ½" long)
1 machine cut nail (5" long)
1 machine cut nail (5 ½" long)
1 washer (2" diameter)
1 partial bolt (5" long with remains of nut on threaded end)
1 red terra cotta building tile fragment
coal

Canal Boat *City Of Pekin*

1 forged nail (unknown size)
3 forged nails (6" long; 3/8" stock)
1 bolt (6" long, round carriage bolt head with 1 ¾" washer and nut of unknown size on the threaded end; ½" diameter rod)