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Archeological Assessment of Historic Great Lakes Shipwrecks

Surveys of the Steamers *Niagara* and *Francis Hinton*

UW Sea Grant Project R/PS 41

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Introduction

Between 1992 and 1994, the State Historical Society of Wisconsin (SHSW) conducted an underwater archeological survey of the steamers *Niagara* and *Francis Hinton* in Lake Michigan, under a grant from the University of Wisconsin Sea Grant Institute. The grant provided operational funding and equipment to the underwater archeology program of the SHSW to assist with ongoing resource assessment work, conducted in cooperation with the Port Washington Historical Society, the Two Rivers Museum Partnership, the Wisconsin Department of Natural Resources, and the Wisconsin Underwater Archeological Association.

The study of the shipwrecks *Niagara* and *Francis Hinton* is part of a broader series of underwater archeological surveys in Wisconsin waters conducted by the SHSW. Previous to the *Niagara* and *Francis Hinton* investigations, the SHSW underwater archeology program has conducted surveys in the Lake Michigan and Green Bay waters around Door County and the waters of Lake Superior around the Apostle Islands (Cooper 1989; Cooper and Rodgers 1990; Cooper et al. 1991; Cooper and Jensen 1992; Jensen 1994; Cooper and Jensen 1995). Founded in 1988, the SHSW underwater archeology program works to survey, inventory and evaluate Wisconsin's underwater archeological resources; forms strategies for their preservation; develops administrative and field management practices; and enhances public appreciation and stewardship for Wisconsin's precious but vanishing maritime heritage (Cooper 1992, 1993; Jensen 1992, 1993). The state underwater archeology program is located in the SHSW Division of Historic Preservation, Office of the State Archeologist.

The State Historical Society of Wisconsin (SHSW) is the principal historic preservation agency for the State of Wisconsin, and is charged under state statutes 44.02 and 44.30-44.31 with the research, protection, restoration, and rehabilitation of historic properties in Wisconsin. Under Wisconsin state statutes 44.47, the SHSW is also charged with the identification, evaluation, and preservation of Wisconsin's archeological resources. These include the many historic shipwrecks, prehistoric sites, and, even, historic aircraft sunk on the beds of state-owned lakes and rivers, including the beds of the Great Lakes. Recognizing the multiple-use values of underwater archeological sites to scientists, historians, and recreationalists, these remnants of our past are broadly termed "submerged cultural resources." The management of submerged cultural resources goes beyond the traditional parameters of historic preservation programs, encountering diverse multiple-use concerns such as public recreation and commercial salvage.

The State of Wisconsin has additional management responsibilities for submerged cultural resources under federal law, including the National Historic Preservation Act of 1966 and the Abandoned Shipwreck Act of 1987 (Public Law 100-298). New state legislation (1991 Wisconsin Act 269) and modifications to the state law in adherence with federal guidelines issued under the Abandoned Shipwreck Act have provided Wisconsin with a more formalized and rational framework for management of underwater archeological resources. This new legislation also authorizes the SHSW and the Department of Natural Resources (DNR) to designate underwater preserves for the preservation and recreational development of underwater archeological sites.

Methodology

Research designs for underwater archeological surveys and site evaluations are established using the methodology and criteria for listing sites on the state and national registers of historic places, as well as site-specific research questions generated through pre-field historical and archival study. Both field and archival research are conducted using guidelines established by the National Park Service (U.S. National Park Service 1986, 1991).

Underwater archeological surveys begin with the identification and location of potential archeological sites through examination of documentary sources (historical, modern, photographic, and cartographic records), interviews with local persons (divers, collectors, fishermen, local historians, etc.) familiar with the location and nature of various underwater resources, and archeological field survey using remote-sensing or visual survey techniques. SHSW research has produced an inventory of approximately 680 shipwreck sites statewide, largely based on historical sources, with approximately 50 underwater sites documented to some level through archeological field investigation.

Using this information, field survey objectives are chosen on the basis of management needs and feasibility, the latter including such considerations as site environment, available equipment, personnel, time, and funding. Often, survey priorities reflect not only the archeological significance of a site, but other considerations such as recreational value (based on a site's popularity amongst divers), and preservation needs.

Underwater survey consists of the physical inspection, evaluation, and analysis of the archeological site, involving mapping and documentation of the remains, as well as identification of management problems (such as archeological importance and sensitivity, site environment, human and natural threats, visitor access, and safety). Extensive research is also conducted into a site's recorded history.

Field operations on the *Niagara* and the *Francis Hinton* were directed by the SHSW state underwater archeologist (and by the acting state underwater archeologist in 1993), assisted by three SHSW staff underwater archeologists and twelve sport diver volunteers. The University of Wisconsin Sea Grant Institute provided the research vessels *Dawn Treader* and *Orion*, scuba equipment, and a vehicle to the project, in addition to grant funding. The research vessel *Narius* was provided by the UW-Milwaukee Center for Great Lakes Studies.

General field objectives for this survey project were as follows:

Archeological Evaluation

1. Document using still photos, underwater video, and measured sketches those architectural and archeological elements which are diagnostic of (a) vessel type, (b) vessel age, (c) vessel construction style and method, (d) vessel propulsion, (e) vessel use, (f) vessel identification (through comparison with inventory records of

historically-known vessel losses), (g) vessel cargo, and (h) shipboard human activity broadly indicative of occupation, status, ethnicity, subsistence or other questions allied with the study of maritime anthropology and Great Lakes social and economic history.

2. Provide an assessment of a site's condition, environment, and cultural context, and determine its historical significance and archeological potential (according to National Register of Historic Places criteria) as well as recreational potential, and management requirements.

Site surveys and evaluations were conducted using scuba and manual mapping techniques, coupled with still photography and underwater video. Archeologists produced measured sketches, construction schematics, and site plans for National Register-level documentation. Site analysis was conducted using comparative archeological evidence obtained from underwater archeological surveys of similar sites. Archeological evidence was augmented by historical literature relating to individual vessel histories and general Great Lakes maritime history and marine architecture. Detailed discussions of National Register criteria and eligibility for Great Lakes shipwrecks, as well as a detailed overview of Great Lakes maritime history, vessel types, and archeological significance may be found in Cooper and Kriesa (1992).

Research Applications and Outreach

The SHSW's underwater archeological surveys are part of a study to plan and develop a program of marine preserves to protect state underwater archeological and historical resources and to promote diver and non-diver tourism (Cooper 1989:1-2, 105-109). This is allied with regional and nationwide efforts to better protect and manage submerged cultural resources, while encouraging public appreciation and responsible usage.

Federal agencies and other states such as Florida, South Carolina, North Carolina, Texas, California, Virginia, Vermont, Maryland, Michigan, Indiana, and Minnesota (many with federal assistance) have already undertaken submerged cultural resource surveys to identify and manage these resources (Warner and Holocek 1975; Arnold 1976; Shomette and Eshelman 1981; Carrell 1984; Murphy 1984; Carrell 1985; Lawrence 1985; Wilde-Ramsing and Angley 1985; Crisman 1986; Carrell 1987; Lenihan 1987; Labadie 1989; Anfinson 1993). Michigan, Vermont, North Carolina, New York, Maryland, and Florida have carried this further by developing marine preserve systems as a means of protecting sites of historical and archeological interest, as well as enhancing site usage through recreation and tourism (Crisman 1986:34; Indiana University et al. 1988; Halsey 1990). Such preserves have succeeded in protecting important resources, have generated considerable public interest in shipwreck preservation and recreation, and have had a significant positive impact on local economies (Peterson, Sundstrom, and Stewart 1987; Vrana 1989; Halsey 1990). With increasing public and governmental interest in marine preserves for Wisconsin has come a need for state and national register-evaluated submerged cultural resources for inclusion in proposed underwater preserves and diving recreation areas.

The study and protection of submerged cultural resources is of direct benefit to those groups who actively use Wisconsin's shipwreck resources, including sport divers, dive charter services, dive equipment sales and training facilities, and other businesses (motels, restaurants, marinas, etc.) who directly benefit from diver tourism. Agencies charged with the management of public lands and resources thereon are direct beneficiaries as well. Detailed data on submerged cultural resources allows land, water, and cultural resource management agencies to make informed, efficient, decisions about the significance, use, and preservation of cultural resources under their care. Chief agencies in Wisconsin with submerged cultural resource management responsibilities include the Wisconsin Department of Natural Resources (DNR) (the manager for state-owned lake and river bottomlands), the SHSW (the agency charged with preservation and management of state submerged cultural resources), the Board of Commissioners of Public Lands (the landowner-agency for state-owned bottomlands), and the U.S. National Park Service (manager for federal areas such as the Apostle Islands National Lakeshore, and lead agency for the implementation of federal historic preservation programs).

Indirect beneficiaries of this data include those groups who, for recreation, education, environmental impact assessment, entertainment, or simple curiosity, seek out information on Wisconsin's maritime history, underwater archeology, and shipwrecks. The SHSW underwater archeology program responds to approximately 500 telephone, letter, and office requests for information per year from divers, historians, genealogists, civil engineers, archeologists, museums, educators, journalists, mariners, businesses, and members of the general public. In addition, the program reaches hundreds of thousands of persons, through its frequent public outreach programs, publications, and radio and television reports on the activities of the SHSW underwater archeology program (Cooper 1995).

The program also distributes information packets including fact sheets, publications lists, a general historic preservation brochure, and a poster for educating divers about shipwreck preservation and applicable state and federal laws. As requested, more detailed information may be provided on underwater archeological research and methods, historical data on Wisconsin ships and shipwrecks, artifact preservation and conservation, archeological laws and regulations, and other materials pertaining to underwater archeology and submerged cultural resources management.

The SHSW's underwater archeological survey reports serve as a compilation of site history, descriptions, analysis, and management recommendations for use in cultural resource management planning, recreational development, interpretation, and public education. The reports also serve as a source document for producing nominations to the state and national registers of historic places, as well as listing in the SHSW Archeological Site Inventory and Wisconsin Shipwreck Site Inventory databases. The information generated by this research is also widely used in SHSW public programs on Wisconsin archeology and maritime history, as well as distribution through print and electronic news media, newsletters, brochures, sport diver guides, and other popular publications.

As a result of this study, the wrecks of the *Niagara* and the *Francis Hinton* will be nominated

to the State Register of Historic Places maintained by the State Historical Society of Wisconsin Division of Historic Preservation, and the National Register of Historic Places maintained by the National Park Service. These register listings, more than being simply honorary designations, provide an important mechanism for long-term preservation and management, as well as additional legal protection under state and federal law.

It is our hope that this study will help promote a better appreciation not only of these two historic shipwrecks, but of historic shipwrecks and other underwater archeological sites in general. Now more than ever, the preservation of submerged cultural resources has become an issue of international concern to archeologists, sports divers, maritime historians, and resource managers. New technology and heightened public interest promise many new discoveries, but also threaten these discoveries with exploitive and destructive salvage activities. Modifying outdated salvage attitudes through diver education and furthering an ethic of "take only pictures and leave only bubbles" will hopefully produce a new generation of underwater explorers harmonizing resource use with resource preservation. While new attitudes, perspectives, and partnerships in the exploration and study of the underwater world are coming into greater acceptance, reductions in government support for historic preservation programs suggest an uncertain and challenging future for maritime heritage preservation efforts. With the technological possibilities and the allure of the underwater world at an historical peak, vigorous educational, preservation, and stewardship activities, public and private, are absolutely vital for the future of historic shipwrecks and shipwreck diving.

Survey of the Steamer *Niagara*, Port Washington

On a cool Lake Michigan evening in September 1856 a fire of undetermined origins tore through the sidewheel steamboat *Niagara*. A short time later sixty persons were dead and the steamboat lay on the cold lake bottom -- its wreckage a testament to the triumphs and failings of antebellum maritime technology. Found by scuba divers in the 1960s, the wreck of the *Niagara* is one of the few readily accessible examples of mid-nineteenth century sidewheel steamboats on the Great Lakes. The wreck's accessibility to recreational scuba divers, the rarity of side-wheel steamer sites, and the vessel's association with nationally recognized ship and engine builders, make the *Niagara* an important recreational and historic resource. In the summers of 1992, 1993, and 1994, underwater archaeologists and volunteer divers from the State Historical Society of Wisconsin conducted underwater investigations of the wreck of the *Niagara*. Archeological investigations have been supplemented by historical research. This report summarizes the current results of ongoing historical and archeological research into the *Niagara*.

The Era of the Palace Steamer

Marine historian Patrick Labadie denotes the period from 1844 to 1857 as the "era of the Great Lakes palace steamers." During that 13 year stretch no less than 25 lavish sidewheel steamers of greater than 1000 registered tons (old measurement) burden, were built to service the booming Great Lakes passenger and cargo trade (Labadie 1989:23). While dozens of smaller sidewheel steamers were also built during this period, the "palace steamers" set the standard for fast and luxurious lake travel. Inaugurated by the launching of George Washington Jones' *Empire* in 1844, the era of palace steamers exemplified a halcyon period in American westward migration and development. In the days before an integrated east to west railroad network, sidewheel steamers provided the quickest and most comfortable (if not always the safest) means of transportation across the upper tier of the Old Northwest. The sidewheelers were expensive to build, run, and maintain, and thus could thrive only in a period of high cost transportation. The development of better passenger services on railroads and the invention of screw-propelled freighters which burned a quarter of the fuel and required much smaller crews, doomed "palace steamers" to eventual extinction on the Great Lakes. Their final demise, however, came suddenly, with the panic of 1857. By September of that year some steamboat lines were losing $1,000 per day and many of the newest and largest steamers were withdrawn from service forever (Reeves 1960:29). Most of these vessels were scrapped or converted. Their engines were removed and their fine hulls used as barges, screw propellers, or even drydocks (Herdendorf and Schuessler 1993). Fire spared the *Niagara* that fate.

Niagara Vessel History

On April 15, 1846 C.M. Reed's new steamer *Niagara* had her first experimental trial on Lake Erie. Over a year in building, *Niagara* was designed to rival any steamboat on the Great Lakes. With an extreme length of 245 feet and an old measurement tonnage of 1,084, Col. Reed's boat was second in size only to the mighty *Empire*, G.W. Jones's behemoth, but was

predicted to carry a larger cargo and thus make a greater profit. Despite choppy seas and a roughly operating steam engine, during her shakedown cruise the *Niagara* received favorable notice for her speed (said to have exceeded 15 miles per hour) and her luxurious accommodations (*Buffalo Commercial Advertiser* 16 April 1846; *Buffalo National Pilot* 12 May 1845; 16 April 1846; *Buffalo Daily Courier* 16 April 1846). Less than a week later, the *Niagara*, under the command of Capt. Thomas Richards, embarked on what was described as a "pleasure trip" to Detroit. This short trip seems to have been successful, for the boat returned to Buffalo carrying a mixed cargo of approximately 500 barrels of flour, several casks of ashes, and complimentary reviews from the *Detroit Advertiser* who noted of the *Niagara*, that "we had been led to anticipate a most magnificent boat, but the reality far exceeded our highest anticipations" (*Buffalo Commercial Advertiser* 25 April 1846).

The *Niagara*'s impressive performance and overall splendor reflected her strong pedigree. Built along the latest design, the *Niagara* embodied the efforts of one the Great Lakes most successful businessmen, Charles M. Reed; the region's best known shipyard, Bidwell and Banta of Buffalo N.Y.; and the senior marine steam engine builder in the United States, James P. Allaire.

Charles M. Reed was a third generation western entrepreneur. His grandfather, Colonel Seth Reed, was a Massachusetts physician who had commanded a regiment during the Revolutionary War and fought at Bunker Hill (Nelson 1896:543). The first Reed had a penchant for land speculation and in 1795 purchased land at present-day Erie, Pennsylvania. Reed opened a crude public house which was soon replaced with a larger "hotel." Seth Reed soon placed the hotel's operation with his son Rufas S. Reed, and retired, dying in 1797. If Seth Reed was a shrewd businessman, Rufas Reed was a shark. Opening his own store in 1796, Reed traded extensively with Native Americans, buying furs and selling finished goods, apparently including copious amounts of liquor. When Pennsylvania outlawed the sale of liquor "by the quart, gill, or barrel", Rufas Reed circumvented the law by having long hollow sticks fashioned, filling them with spirits which were then sold by the yard (Nelson 1896:543). Over the years Rufas Reed became a dominant player in the nascent lakes economy, developing extensive holdings in shipping, milling, and land.

In 1803 Charles M. Reed, Rufas Reed's only child, was born in Erie. Benefiting from his family's position, Charles Reed received a college education and studied law at Philadelphia. In 1824 Charles was admitted to the bar and returned to Erie and the family business. The Reed family fortunes expanded rapidly under the joint management of Rufas and Charles Reed. The exact nature of their business relationship is not specified in the sources currently available, but it appears that Charles M. Reed took a major role in the family's shipping enterprises. Taking an early interest in steam navigation, Read became the largest owner of steamboats on the lakes (Nelson 1896:544; Spencer 1964:314).

Charles M. Reed was often referred to as "General" Reed, a reference to a commission purchased in the Pennsylvania State Militia. Membership in Reed's infantry company was said to be a decided advantage in Erie society and the title of General remained with him the rest

of his life. Reed also dabbled in politics, serving terms in the Pennsylvania state legislature and the United States Congress. Unlike many of his contemporaries Reed survived the tumultuous economic climate of the mid-nineteenth century with his fortune intact, dying in 1871 with a net worth of between $5,000,000 and $15,000,000 (Nelson 1896:544; Spencer 1964:314).

In 1845 Reed began two major projects, the construction of the fabulous Reed Mansion in Erie and the building of a large steamboat, ultimately named *Niagara*. Money appears to have been no obstacle in either project and Reed commissioned the finest architects and craftsman the region had to offer. In the case of the steamboat, Reed, (although having his own shipyard at Erie) contracted with the prominent Buffalo yard of Bidwell and Banta. Benjamin Bidwell, as the apprentice and later partner of Asa Stannard, had connections to the earliest days of commercial ship construction on Lake Erie. Jacob Banta, designer of huge sidewheel steamers during the 1840s and 1850s and, according to a prominent early lake captain, "a genius of high order," had been apprenticed while quite young to New York City shipbuilder Henry Eckford. One of the most important builders of his time, Eckford indirectly influenced American shipbuilding for several generations. His successors designed and built the great sailing ships, both packets and clippers, that gave the United States dominance over international ocean carrying trades in the decades before the Civil War (Walker 1902:292, 315; Albion 1965:83-85).

The single most expensive component of a steamboat during this period were its engines. Each engine was individually designed and manufactured, a costly and labor intensive process (Abbott 1851). In powering the *Niagara*, Reed, as he had done on previous occasions, turned to New York engine builder James P. Allaire. Allaire had been closely associated with Robert Fulton and had bought out the Fulton works upon the famous man's death. In 1845 Allaire operated the oldest and perhaps the finest engine works in the country. Laden with enormous debt, Allaire was nearing the end of his career, and the engine built for the *Niagara* represents one his late efforts (Coombe 1980:263-271).

Steamboats were costly enterprises and the *Niagara* was no exception. The *Buffalo Commercial Advertiser* gave its readers the following cost breakdown for the crack steamboat:

Hull	$30,000
Engine	32,000
Fixtures	5,000
Joiners	8,000
Painting	3,500
Upholstery	3,000
Furniture	4,000
Anchors, Chains, Cables, Boats, Sails, Blocks, Cutlery, Lamps, Cooking Utensils, Table linen, and Such.	9,500
Total Cost	$95,000

(*Buffalo Commercial Advertiser* 10 January 1846)

Fed by the Erie Canal, Buffalo was an important hub for a large stream of westward migration. By the late 1830s this traffic had become immense. For example, on a single day in 1838 5,000 people departed westward from Buffalo's busy shore (Reeves 1959:308-310). In the absence of connecting railroads, the Great Lakes, with its thousand mile westward reach, offered the most expeditious route to the developing Midwest. In 1839 at least eight ships were engaged in the run between Buffalo and Chicago, with one boat scheduled to leave every sixteen days. By 1845 no fewer than three shipping lines were servicing this run, and a steamboat left Buffalo for Chicago every day during the shipping season (Reeves 1959:195). The cross-lakes run was perhaps the most dramatic part of a much larger transportation network that stretched from the New York City dockside to the infant communities of Wisconsin. During the 1840s, when European immigration was burgeoning, C.M. Reed's agents met new arrivals at the dock and sold them westbound tickets along a railroad, canal, and steamboat route almost entirely owned either outright or in part by Reed (Spencer 1964:314). By mid-century, Reed's successes had earned him the title of "the Napoleon of the Lakes" (Plumb 1949:229).

The *Niagara* was built to take part in the Buffalo to Chicago run. Her initial foray into that service, however, ended unsuccessfully. Dispatched to Chicago on April 29, 1846, the *Niagara* grounded at the St. Clair flats. The year 1846 saw the culmination of several years of declining lake levels and, unable to pass one of the Great Lakes' most persistent bottlenecks, the *Niagara* was forced to unload her cargo onto a smaller steamer. Despite failing to reach her destination the *Niagara* returned to Buffalo (via Detroit) carrying a mixed bounty from the western lands. Her cargo included 25 tubs of butter, 16 barrels of deer skins, 483 hides, 725 barrels of flour, 731 pigs of lead, 3 boxes and 4 chests of furs (*Buffalo Commercial Advertiser* 5 May 1846; Odle 1959:10).

Fortunately for the steamboat lines, the water levels in the St. Clair Flats finally began rising and by May 20, 1846 the *Buffalo Commercial Advertiser* reported the *Niagara*'s successful transit. The paper noted that the ship's passengers were transferred in boats, but that none of the freight had to be removed -- a common and expensive practice during the early days of cross lakes navigation (*Buffalo Commercial Advertiser* 20 May 1846). The *Milwaukee Sentinel* reported the following:

> The arrival of this splendid steamer created quite a sensation. It was supposed that she could not get over the Flats at the present stage of the water. It was an agreeable surprise, therefore, on Monday afternoon, to see her dashing into port, with all her colors set and music playing. Every body hurried down to the piers to look at her, and a very general verdict of approval and admiration was returned. The *Niagara* is, in truth, a noble boat; well modelled, capacious, convenient, swift and most strongly built. Her after Saloon, on the upper deck, is superbly fitted and furnished and the accommodations for steerage passengers on the main deck are unsurpassed. (*Milwaukee Sentinel* 20 May 1846)

On May 27, the *Niagara* returned to Buffalo in triumph, carrying what the newspapers described as "a large load of freight and passengers." The cargo included 61 tons of beef, 23 barrels of pork, 569 dry hides, and various allotments of furs, flour, wool, and sugar. She was said to have "performed the trip in a manner entirely satisfactory" (*Buffalo Commercial Advertiser* 20 May 1846, 28 May 1846; *Buffalo Daily News Pilot* 28 May 1846).

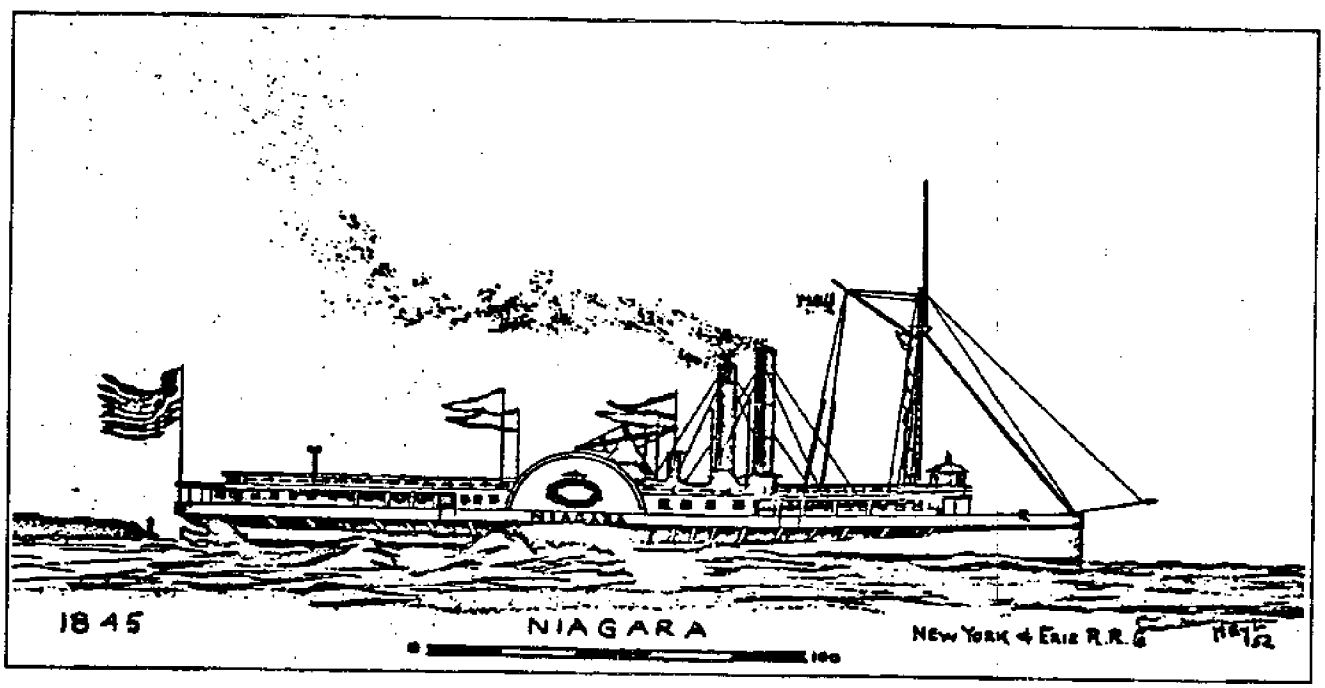


Figure 1 Historical Sketch of *Niagara* (Erik Heyl Manuscript, C.P. Labadie Collection)

The *Niagara*'s powerful Allaire engine seems to have broken in quickly. On June 10, 1846, the *Buffalo Daily Courier* reported that the *Niagara* had set a record time on her second run back from Chicago. Making the trip in 70 hours, (75 hours counting stoppages), the *Niagara* returned to Buffalo 35 hours ahead of her schedule. It appears that C.M. Reed liked a good race and was himself was aboard for this rapid run (*Buffalo Daily News Pilot* 10 June 1846). Observers along the lake were both impressed and dismayed by *Niagara*'s speedy trip. The *Milwaukee Sentinel* stated that the *Niagara*'s time to Chicago was the quickest seen that year, however, they also noted the ire of several people who missed the boat in Chicago. In a hurry to set records, Reed's new steamer refused to tarry at the docks. On July 24, the *Milwaukee Sentinel* reported another record trip (*Milwaukee Sentinel* 18 June 1846, 24 July 1846). In late July *Niagara* engaged in a bit of a race with the *Empire*, the largest steamer on the Great Lakes. Details are sketchy but the *Empire* may have gotten the better of that encounter, with the *Niagara* being forced to give way to avoid collision (*Milwaukee Sentinel* 30 July 1846). The *Niagara*'s captain claimed that he was not racing at all, but that his steamer had gotten off course, and as a result ran alongside of the *Empire* for a few moments (*Cleveland Herald*

27 July 1846). The *Niagara*'s first year of service was successful, but not uneventful. Making one trip every two weeks, *Niagara* carried a large variety of cargo including furs, minerals, agricultural products, and consumer goods. In the fall, as lake levels dropped, the steamboat's deep draft again caused problems. On October 15, 1846, newspapers reported that *Niagara* had grounded three times during her most recent trip from Chicago (*Buffalo Commercial Advertiser* 15 October 1846). Two weeks later the news was worse with the *Buffalo Commercial Advertiser* reporting the following woes:

> The steamer *Niagara* returned from the Upper Lakes this morning, after a pretty rough passage. She accidentally ran on the Skillagalee shoals in Lake Michigan, about 10 miles from the floating light and in order to light her, threw overboard about 400 barrels of flour, beef, and part of her fuel, but sustained no injury (*Buffalo Commercial Advertiser* 30 October 1846).

By mid-November most lake vessels were going into winter quarters. Those that remained in service faced worsening weather but increasing profit potentials. The November 23, 1846 *Commercial Advertiser* noted the *Niagara*'s arrival from Chicago. Her listed cargo included:

> Chicago, 522 bbls. flour Kimberly, Pease & Co. -- 200 do. Heley - 101 green 17 dry hides N. Case & Co. 16 half bbls fish Gelston & Evens -- 14 sks ginseng 30 bbls flour H.M. Kinne 86 do. Weed & Co. - 31 do. G.B. Walbridge & Co. - - 1486 pigs lead D.N. Barney & Co. - from Detroit 544 bbls flour J.A. Armstrong (*Buffalo Commercial Advertiser* 23 November 1846).

Winter commerce had its costs as *Niagara* grounded yet again, this time at Buffalo's south pier, where she remained for several days (*Buffalo Daily Courier* 24 November 1846). *Niagara* made one more trip that season, and was reported to have left Ogdensburg "with a heavy load of merchandise" on November 27 for her last trip up the lakes (*Buffalo Commercial Advertiser* 30 November 1846).

Niagara's maiden season set the pattern for several years of cross-lake service. During the shipping seasons of 1847, 1848, 1849, and 1850, *Niagara*'s annual schedule called for 14 to 16 round trips between Buffalo and Chicago. In general, the boat operated from the middle of April through the end of November; leaving on alternate Mondays from Buffalo and Chicago. During late winter and early spring *Niagara* was laid up and received her annual maintenance (*Buffalo Morning Express* 18 March 1847, 25 January 1848; 19 April 1849, 10 April 1850).

Contemporary newspaper references to the *Niagara* diminish in volume after her inaugural year of service. Second season highlights included a new captain (Levi Allen), a fresh paint job (no other improvements or alteration needed), talk of a big steamboat race, and another grounding.

The expanding cities of Buffalo and Cleveland were great rivals and this rivalry extended out onto the lakes. In the summer of 1847 a case of racing fever broke out on the lakes. On July

1847 the *Buffalo Morning Express* noted "another race brewing." Captain Gil Appleby of the new Cleveland steamer *Sultana* was offering a $5,000 wager against any steamboat on the lakes willing to race him from Buffalo to Chicago. The Buffalo paper was enthusiastic and revealed that "C.M. Reed, esq. owner of several steamboats, is not inclined to remain quiet under the imputation and proposes to accept the wager, and put on his best boat, the *Niagara* against the *Sultana* . . . We can afford to risk a hat on the race, which shall hang on the bowsprit of the *Niagara*, labelled 'come and take me.' If the editor of the [Cleveland] *Plain Dealer* is inclined to make a corresponding demonstration, being a chapeau on the bow of the fine *Sultana*, we have no objection. We pause for a reply" (*Buffalo Morning Express* 18 July 1847). The editors of the *Cleveland Plain Dealer* on August 8, 1847, could not resist tweaking the Buffalo press and tempered their own obvious enthusiasm for the race with scolding remarks about the foolishness of steamboat racing, noting: "[N]othing that we can now say will prevent this race, and therefore we shall say nothing, but we want it distinctly understood that we are opposed to racing, especially among steamboats with BOILER's in 'em." That being said, the *Plain Dealer* concluded, "Let the bets go! We hang our hat on the *Sultana*'s Stern, and in somebody else's language, we say "Come and take it!" (*Cleveland Plain Dealer* 14 August 1847). Sadly, it is not clear whether the race ever came off. The lack of further references suggests that it did not. At any rate a month later saw the next reference to the *Niagara* was a notice of her being hauled off a reef at Bois Blanc Isle by the *Empire* (*Buffalo Morning Express* 4 September 1847).

The 1848 season again found *Niagara* with a new captain, William T. Pease, and another grounding. A Buffalo newspaper republished a *Milwaukee Sentinel* editorial that railed against Whig President James Polk's parsimony in dealing with the Great Lakes:

> The St. Clair Flats-Mr. Polk's "Farm" on the St. Clair Flats seriously obstructs navigation again this spring. The *Niagara* both in coming up and going down, lay aground there some 24 hours. The St. Louis and Hudson were also detained at the same spot. It is with great difficulty that load vessels get over at all. Most of them have to resort to lighterage, at a heavy expense, in order to avoid delay. Few steamers, or vessels indeed, from this Lake, carrying loads, escape detention on Mr. Polk's "farm". This tax thus levied upon our Lake Commerce is a heavy one -- Every hour lost, and every dollar paid at the flats, is a charge upon the producers and consumers of the West. Mr. Polk's constitutional scruples cost Wisconsin many thousand dollars annually. How long will Wisconsin Submit to the imposition? Milwaukee Sent. (*Buffalo Commercial Advertiser* 18 May 1848)

President Polk, a North Carolinian Democrat, had vetoed major legislation to fund improvements to harbors and channels across the Great Lakes -- later Democratic presidents did the same. The problem of Great Lakes navigation improvements caused many businessmen in the Northwest to desert the Democratic party during the later 1840s and 1850s and help set the internal improvements agenda of the ascending Republican party. Rising lake levels after 1847 temporarily decreased the pressure for improving the St. Clair Flats (Odle 1959:12-15).

The fare for the eastward trip from Chicago to Buffalo on the *Niagara* was in 1848, according to one source, only $10.00 (*Buffalo Commercial Advertiser* 29 July 1848). Traveling, however cheaply and comfortably, had its hazards, and the only other reference to the *Niagara*'s 1848 season so far uncovered, recounts the August death of an unidentified male passenger who fell from the *Niagara*'s gang plank while going ashore in Cleveland (*Cleveland Daily True Democrat* 3 August 1848).

Despite the commerce-depressing effects of a cholera epidemic, 1849 seems to have been a busy year for the *Niagara* (Mansfield 1972[1899]:I:659). Capt. Pease remained in command and the vessel continued on the Buffalo to Chicago run. An advertisement in the March 9 *Buffalo Morning Express* gave notice of the *Niagara*'s first trip and provided potential travelers with the following advice: "[A]s ice is apprehended in the Straits, passengers would do well to take this strong and reliable boat" (*Buffalo Morning Express* 29 April 1848). On August 11, the *Niagara* landed a huge payload at Milwaukee. Consisting of 650 barrels of bulk freight, 40 tons of merchandise, and 550 passengers (mostly Norwegian and Dutch immigrants), the load was said to be one of the largest of the season (*Milwaukee Sentinel* 18 August 1849). On August 15, the *Cleveland Daily True Democrat* upbraided Capt. Pease and the *Niagara* for ignoring the plight of the wrecked steamer *Empire State* (*Cleveland Daily True Democrat* 15 August 1849). The charge apparently was poorly founded and the *Milwaukee Sentinel* published a heated defense of the captain (*Milwaukee Sentinel* 21 August 1849). On September 3, a Buffalo newspaper reported the arrival of the *Niagara* with a cargo of furs and buffalo robes worth $300,000 --possibly the most valuable cargo that had ever been landed in Buffalo. The report credited the opening of the Illinois canal with diverting this valuable trade from its customary destination of New Orleans (*Buffalo Morning Express* 3 September 1849). The year closed with the traditional foul November weather and newspaper reports of several damaged steamboats limping into port, included among these was the *Niagara*, which had lost several paddle buckets (*Buffalo Commercial Advertiser* 7 November 1849).

The *Niagara*'s 1850 season is less well documented. Despite talk of transferring her to a different run, the boat seems to have continued her traditional Monday sailings from Buffalo and Chicago. An ad in the *Buffalo Morning Express* gives a hint at the integrated nature of railroad and water travel to the west: "[T]he splendid steam *Niagara*, Capt. W.T. Pease, will leave for Chicago and intermediate ports on Monday Evening June 17, at 8 o'clock, immediately after the arrival of the Express Train from Albany" (*Buffalo Morning Express* n.d. 1850). Business seems to have been good, with one source indicating that the *Niagara* visited Milwaukee 13 times, carrying a total of 3,843 passengers during the 1850 season (Labadie n.d.).

Five long seasons with their innumerable groundings, ice jams, and storms had taken its toll on the stout *Niagara*. On February 28, 1851 the *Buffalo Morning Express* offered the following item:

> The *Niagara* -- This noble steamer, so well and so favorable known as one of

> Reed's line of boats on the lakes, is undergoing thorough repairs and receiving new and very strong arches, and will enter service this year as good as the day she was launched. She will be placed in command of Capt A. Walker, a veteran on the Lakes. We have not learned where she will run, but probably in the Chicago Trade by the North Shore. There is a fair possibility of her entering the New York & Erie Railroad Line, to run between Dunkirk and Detroit (*Buffalo Morning Express* 18 February 1851).

In 1851 the New York and Erie Railroad line opened to great fanfare with Dunkirk as its Lake Erie terminus. The *Niagara* along with a number of other prominent Buffalo steamboats made the trip up to Dunkirk for opening celebrations that included such national luminaries as President of the United States Millard Fillmore and Daniel Webster (*Buffalo Morning Express* 16 May 1851). That year, Charles Reed chartered *Niagara*, *Empire*, and *Keystone State*, no longer first line vessels, out to the new railroad for a reported $65,000. The boats ran between Detroit and Dunkirk carrying about 60 passengers per trip (*Buffalo Morning Express* 21 July 1851). In July 1851, the *Niagara* received her last captain, Fred S. Miller. Formerly serving on the *Niagara* as first mate, Miller would continue in command of the ship until its 1856 destruction.

Late in the 1851 season *Niagara* was involved in a serious accident in the Detroit River. While steaming down the river she collided with the anchored brig *Lucy A. Blossom*. The brig sank almost immediately, but not before crashing into another sailing vessel and tearing away part of its headgear. The *Lucy A. Blossom* carried 10,000 bushels of corn and was a total loss. The *Niagara* was apparently undamaged (*Buffalo Morning Express* 1 December 1851).

The 1850s saw the construction of Great Lakes steamboats that dwarfed the *Niagara*. Palatial vessels like the *Western World* and the *Mississippi* exceeded the *Niagara* by over a hundred feet in length, doubled her in registered tonnage, and were much faster. Larger vessels caused the hold ups and accidents related to shallow channels to increase once again. In 1854, at the St. Clair Flats alone, the costs associated with collisions and forced lighterage exceeded $500,000 (Odle 1959:13) Less newsworthy than her huge cousins, the reliable *Niagara* was rarely mentioned in contemporary sources during the 1850s. She seems to have continued on the Detroit-Dunkirk run through the 1853 season (Labadie, n.d.). In 1854, still in connection with the New York and Erie Railroad, she began running between Dunkirk and Toledo with stops at Erie, Cleveland, and Sandusky (*Cleveland Morning Leader* 24 April 1854, *Chicago Journal* 1 April 1854). That year, Charles Reed was operating "Reed's Chicago & Lake Superior Line" which, functioning in tandem with two Lake Superior lines, offered service from Chicago to the shores of Lake Superior. The Niagara may have been shifted over into this service, as the July 22, 1854 *Cleveland Morning Leader* reported several deaths from cholera, including the *Niagara*'s mate, on the ship's previous Chicago to Mackinac trip (*Cleveland Morning Leader* 22 July 1854). Late that season, an unverified report has the *Niagara* springing a leak that required $2,000 in repairs (Labadie n.d.). Of the 1855 season, the only reference to the *Niagara* currently available has her colliding with a Milwaukee pier and sustaining significant damage (*Milwaukee Sentinel* 18 May 1855).

On January 1, 1855 the final phase of the Northern Railway connecting Toronto with the Great Lakes was completed and the new town of Collingwood became an important Northern Lakes port almost overnight (Smith 1956:35-37). In order to connect Collingwood with Chicago, the railroad's directors contracted with Charles Reed. A May 10, 1856 item in the *Milwaukee Daily Sentinel* notes that *Niagara, Keystone State, Louisiana, Buckeye State, Queen City,* all but one owned by Reed, had been chartered to the railroad at a contract price of $20,000 per vessel for the navigation year. It was to be the *Niagara*'s final season (*Milwaukee Sentinel* 10 May 1856).

The Fire

On September 24, 1856, a fire of undetermined origins swept rapidly through the *Niagara.* Dozens of people drowned and the steamer and cargo were a total loss. Confusion and rumor obscure the story of this tragedy. The following accounts give only a brief overview of the disaster.

The Captain's Statement

The facts of the disaster, as far as they can be ascertained from the captain's sworn statement are as follows. On 9 p.m. of September 22, 1856, the *Niagara* left Collingwood with 105 tons of merchandise and passenger's baggage; 21 horses and several wagons; about 75 cabin passengers; and an undetermined number of steerage and deck passengers. After a number of brief stops the ship landed at Sheboygan, Wisconsin and disembarked a large but uncounted compliment of passengers and freight. At 2:30 p.m. the *Niagara* left Sheboygan for Port Washington, a small town of about 1,200 people, about 30 miles to the south. After clearing Sheboygan, Capt. Miller retired to his cabin for a nap. Upon getting up, the captain discovered the fire. After ordering one of the engineers to rig a fire hose to the pumps, Capt. Miller proceeded to the pilot house and ordered the wheelsman to head the vessel towards the shore. Not long after the course change, the engine stopped, leaving the ship four to five miles from the beach. Captain Miller ordered the first mate to get the fire axes and to man and deploy the ship's small boats. The stern boat, however, had already been launched and had capsized. Hoping to provides the passengers with floats, the captain and mate started breaking off stateroom doors and casting them into the water. Making his way to the stern, Capt. Miller continued throwing doors and other buoyant items overboard until the fire finally forced him to take refuge on the port paddlewheel, from where he was later rescued by a boat from the steamboat *Traveler* (Captain Fred Miller statement, sworn before the Justice of the Peace 25 Sept. 1856, reprinted in *Milwaukee Sentinel* 25 September 1856).

C.D. Westbrook's Account

Additional newspaper accounts fill in more details, but provide little in the way of facts. A passenger identified as C.D. Westbrook of Green Bay stated that at about 4 p.m., the cry of "Fire!" rang out, and that he saw "flames bursting out from the lining to the engine room." Westbrook heard a call for help from the pilothouse and, upon making his way there, assisted

the wheelsman turn the steamer toward shore. Approximately five minutes after changing course, the engine stopped. Westbrook then went to the forward deck, grabbed a plank, and took it aft of the wheel. Driven into the water by advancing flames, Westbrook lost his plank to other passengers and upon securing a cabin door, paddled back to the side of the vessel and met up with Captain Miller. Ultimately he and the captain took refuge in the paddlewheel, from where they were rescued. Westbrook indicated that the fire progressed rapidly and that it "did not seem more the 15 or 20 minutes from the time the flames burst out until everyone had left the boat." He also reported several explosions and the sounds of gunshots (*Milwaukee Sentinel* 26 September 1856).

Arson?

According to available sources, no definite cause for the fire was determined. A rumor of arson rapidly spread across the lakes and has persisted through the present day (Miller 1993:50, 56). On September 29, 1856 the *Milwaukee Sentinel* printed a letter (originally appearing in the *Chicago Tribune)* attributed to Captain Miller. The letter states that a note threatening to burn the *Niagara* "that very night" had been found just after leaving Collingwood on the ship's previous trip. After a period of cautious vigilance, it was decided that the note was a hoax. The arson story was picked up by papers across the lakes, but no further details were ever forthcoming. The communication attributed to Captain Miller contained the following observations about the fire:

> Now, I am confident that the boat did not take fire from the machinery, nor from the boilers, as every portion of her fire-hold was fire proof. My opinion is that the fire was caused by some combustible material stowed under the shafts, but the nature of which we were unable to tell, as packages frequently come so disguised that we cannot tell what they are; but it must have been something of that kind from the fact that it enveloped the boat in flames almost instantly; and when first discovered, it was impossible to subdue it (*Milwaukee Sentinel* 29 September 1856).

Reason for the Loss of Life

Although *Niagara* carried several boats, dozens of people drowned due to two accidents. In the first instance the large stern boat capsized while being launched by the panicking passengers. The loss of life was further multiplied when, as a boat filled with women and children was being lowered into the water, a very fat and frightened politician, Congressman John Macy of Fond du Lac, launched himself on board. Dropping an estimated seven feet into the boat, the congressman's great weight tore the falls out of its stern and dumped the whole group into the lake, drowning them all (McDonald 1956:195-202). A statement signed by eight surviving passengers held the captain and officers blameless for the high loss of life and offered the following interpretation of events:

> The overturning of the large boat in the stern quarter of the steamer was

> doubtless the occasion of the principle loss of life. Had the crew been there to attend to the lowering of the boat the accident might not have occurred, but it was not three minutes after the fire broke out before all communication was cut off between the bow and stern of the boat (*Fond du Lac Weekly Union* 2 October 1856).

Blame for the disaster, these passengers felt, lay with unscrupulous merchants who heedlessly packed combustible materials like matches and fireworks amongst boxes and barrels of merchandise (*Fond du Lac Weekly Union* 2 October 1856). The final death toll was never certain, but best estimates put the figure at about sixty persons, making the Niagara one of the worst transportation disasters in Wisconsin history.

Despite the value of the *Niagara*'s cargo and machinery, salvage efforts apparently were never mounted and the location of the wreck dropped from public memory until the 1950s and 1960s when the popularization of recreational scuba diving rekindled interest in old shipwrecks. From the 1960s through the 1980s, scuba divers removed a vast number of artifacts, and severely damaged the structure of the wreck.

Archeological Investigations

Site Description

The wreck of the *Niagara* lies in Lake Michigan east-southeast of the town of Belgium, Wisconsin, approximately 8.3 statute miles north-northeast of the city of Port Washington, and approximately .8 statute mile from shore. The wreck event itself and subsequent 139 years of natural and human impact have resulted in a site that covers at least a ¼ mile square area, centered at 43 degrees 29.313 minutes north latitude and 87 degrees 46.493 minutes west longitude. Depths range between 40 and 60 feet, with the main wreck section lying in 52 feet of water. Visibility on the site ranged between 2 and 25 feet, with 7 to 10 feet being the norm. Water temperature varied from 38 to over 60 degrees Fahrenheit.

Components of the site identified during the survey include an approximately 90 foot main hull section that runs from the boiler saddles aft. This section contains the jumbled but complete walking-beam steam engine and paddlewheel shafts. Remnants of the wooden paddlewheel spokes remain. Until recently, the port side paddlewheel was largely intact. Pulled apart by a looter, it now lies broken next to the paddlewheel shaft. Running aft of the engine is a long run of open bilge. The stern assembly, including the deadwood and sternpost, is broken off and lodged beneath a section of the charred starboard side, which has collapsed outward. A similar section of the port side is also splayed outward.

Roughly one hundred yards south of the main section lies another large section of bilge approximately 52 feet in length. Consisting of multiple keelsons and 26 frame sets, this is apparently the section that ran forward of the boiler saddles.

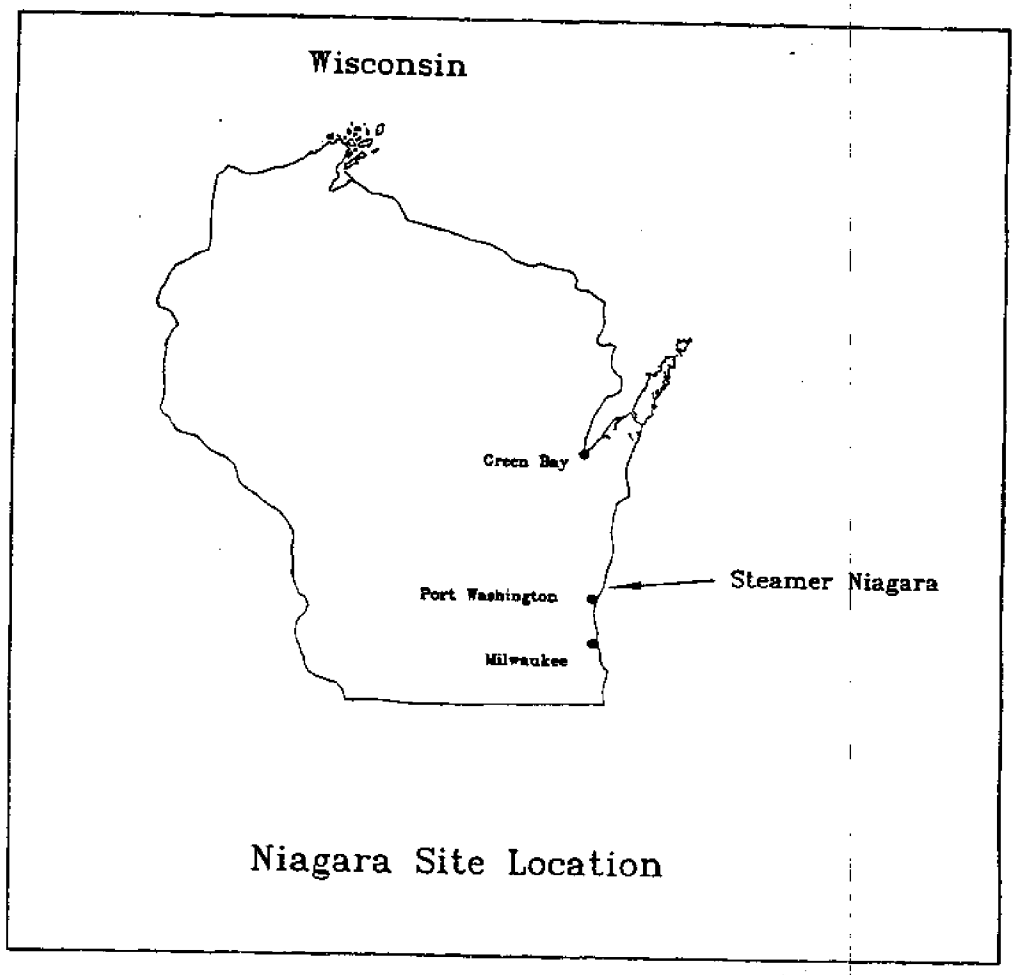


Figure 2

Strewn throughout the entire site area are thousands of fastenings, unidentified items of vessel structure, and remnants of cargo. Unfortunately, the site, which early scuba divers have described as Wisconsin's richest in terms of artifacts, has been extensively looted over the past thirty years. This tragedy continues today despite a developing preservation ethic amongst sport divers and the enactment of tougher state laws protecting historic shipwrecks.

Vessel Architecture

A primary concern in building large ships is longitudinal strength. Building hulls that are long as well as strong and of reasonable cost is a difficult problem. The great weight of early marine steam plants added further challenges, and steamboat builders across the United States devised many methods for strengthening hulls. Contemporary images show endless varieties of external arching and trussing systems. When built, *Niagara* was one of the largest steamships in the United States, and thus her hull architecture is of particular importance.

A drawing based upon the only known contemporary rendering of *Niagara* (Figure 1) shows no evidence of external arches or trussing, nor did underwater investigations uncover any evidence of "Bishop arches" in *Niagara*'s hull. Bishop arches were a common method of external vessel reinforcement that consisted of paired wooden (or composite wood/metal) open arches running fore to aft alongside a vessel's superstructure. These arches, faired into the vessel's sides, were strongly tied into the fore and aft deadwood, providing a rigid truss, resistant to both hogging and sagging (the latter induced by the placement of heavy machinery amidships). These arches were not subtle reinforcements, but soared high above the spar deck and cabin superstructure. The net effect resembled a large bridge arch, or medieval cathedral arch or flying buttress (possibly the source of the name). Many large iron rods were found on the wreck, but the fire and subsequent site formation processes made it difficult to determine if they were part of a hull trussing system. Most of the rods appeared to be associated with the A-frame that supported the steam engine's heavy walking beam. However, discovery of additional wreckage may reveal important details of the ship's longitudinal reinforcement system, including the new arches installed in the 1851 rebuild (*Buffalo Morning Press* 8/18/1851).

Cross-Sectional Details

A cross-section of the port side bilge taken amidships at ship's heaviest area, adjacent to the engine, revealed the following architectural details. The ship's central longitudinals are a 14-inch sided and 10-inch molded center keelson and a light keel measuring 10 inches sided and 5 inches molded. These longitudinals sandwich the ship's open-jointed double-timbered frames (discussed below). Twenty-two inches to the outboard of the center keelson is the large composite port floor keelson assembly. Also notched over the frames, this assembly has measured dimensions that total 30-inches sided and 48-inches molded. A space of 26 inches separates the port floor keelson from a 10-inch molded by 14-inch sided bilge keelson. A space of 25 inches separates that bilge keelson from a second outboard bilge keelson of identical dimensions. A 13-inch space separates the second bilge keelson from the first of a series of thick strakes (10-inch sided by 10-inch molded) that begin below the turn of the bilge and extend up the vessel's sides. Due to the wreck's condition, the exact number of thick strakes was not precisely determined, but probably numbered at least eight or nine, with six observed above the turn of the bilge in the area of the engine. The thick strakes were attached to each frame set by two 3/4-inch threaded bolts capped by 1 5/8-inch square nuts. Above the thick strakes a series of 3 to 3½-inch thick ceiling planks of varying widths (observed planks include widths of 11, 12, 13, 15, 17, and 18 inches) are attached to the frames. Exterior planking along the sides is 2 inches in thickness with observed widths near deck level of 8, 6, 5½, and 5½ inches.

An intriguing feature is a large internal ceiling arch that is built of 3-inch thick planks with measured widths of between 12 and 17 inches. The maximum total width of the arch is approximately 65 inches. The burned and deteriorated condition of the wreck makes precise determinations difficult, but the arch seems to have peaked near the paddle wheel shafts. Surviving fragments indicate that the arches began and ended below the turn of the bilge and

ran for an estimated total of about 118 feet along the steamer's sides. Measurements taken along the charred starboard side suggest that the arch curved up to a maximum height of at least ten feet. This may not have *Niagara*'s original arch, as it may have been put in place during the 1851 refit mentioned above.

Keelsons

Much of the *Niagara*'s longitudinal strength comes from a series of seven keelsons that form the backbone of the hull. The centerline keelson is fairly light as are the four outboard bilge keelsons (see above). The heaviest and most complex are the port and starboard floor keelsons. Running nearly parallel to the centerline keelson, the port and starboard floor keelsons begin as single timbers of 11 inches sided dimension that are fastened to the frames by 1¼-inch drift bolts. Moving forward from the stern break, these keelsons gradually widen and deepen. Approximately 27 feet forward of the stern break, a second timber is joined outboard of the first, bringing the keelsons's sided dimensions to 30 inches. The addition of at least two riders bring the molded dimensions of the keelson up to a maximum of 48 inches, about 77 feet forward of the stern break. This complex "arch" assembly consists of two large timbers, capped by at least two rider keelsons. The assembly is bolted together and notched in over the frames. The first rider measures 6 inches, and the second 4 inches molded dimension. The built up arches are fastened together with 1¼-inch diameter threaded iron bolts capped by 2½-inch square washers and 2-inch square nuts. These are staggered to the port and starboard and are spaced on 34-inch centers. From the stern break forward, the space between the interior edges of the port and starboard keelsons is 56 to 59 inches. About 40 feet forward of the stern break the distance widens to a 66 inches, which it maintains along the rest of the existing bilge.

Bilge Framing

Aft of the machinery, much of the bilge remains open for inspection. From the stern break forward, the bilge internal framing was quite consistent. Each frame set included two single flitch timbers of 6-inch sided and 11 to 12-inch molded dimension. The timbers were separated by a 3-inch sided by 23-inch long spacer chock. This "open-joint" framing is like that observed on the schooner *Meridian*, built in Ohio in 1848, and the sidewheel steamer *Cumberland*, built in Ontario in 1871 (Cooper and Jensen 1992:50-52; Lenihan 1987:65, 221). This type of framing appears to have been rather rare (at least in American Great Lakes vessels). The rational behind this method is not known. It may have been used to help curtail dryrot in the frames by improving air circulation around the timbers. The two frames with the spacer chock may have also acted as a kind of organic "H-beam" arrangement, that provided some of the strength without all of the weight of solid timbers. The room between the frame sets was a consistent 9 inches for a total room and space of 24 inches. The molded dimensions of the frames are 12 inches at the vessel's centerline; they decrease to 9 to 10 inches at the turn of the bilge, and shrink further to about 6 inches at the futtock ends. The floors are notched approximately 1-inch top and bottom for the keelsons and keel. Six inches outboard of the keel, the bottom of the floors are also notched by a 1½- by 3-inch limber hole.

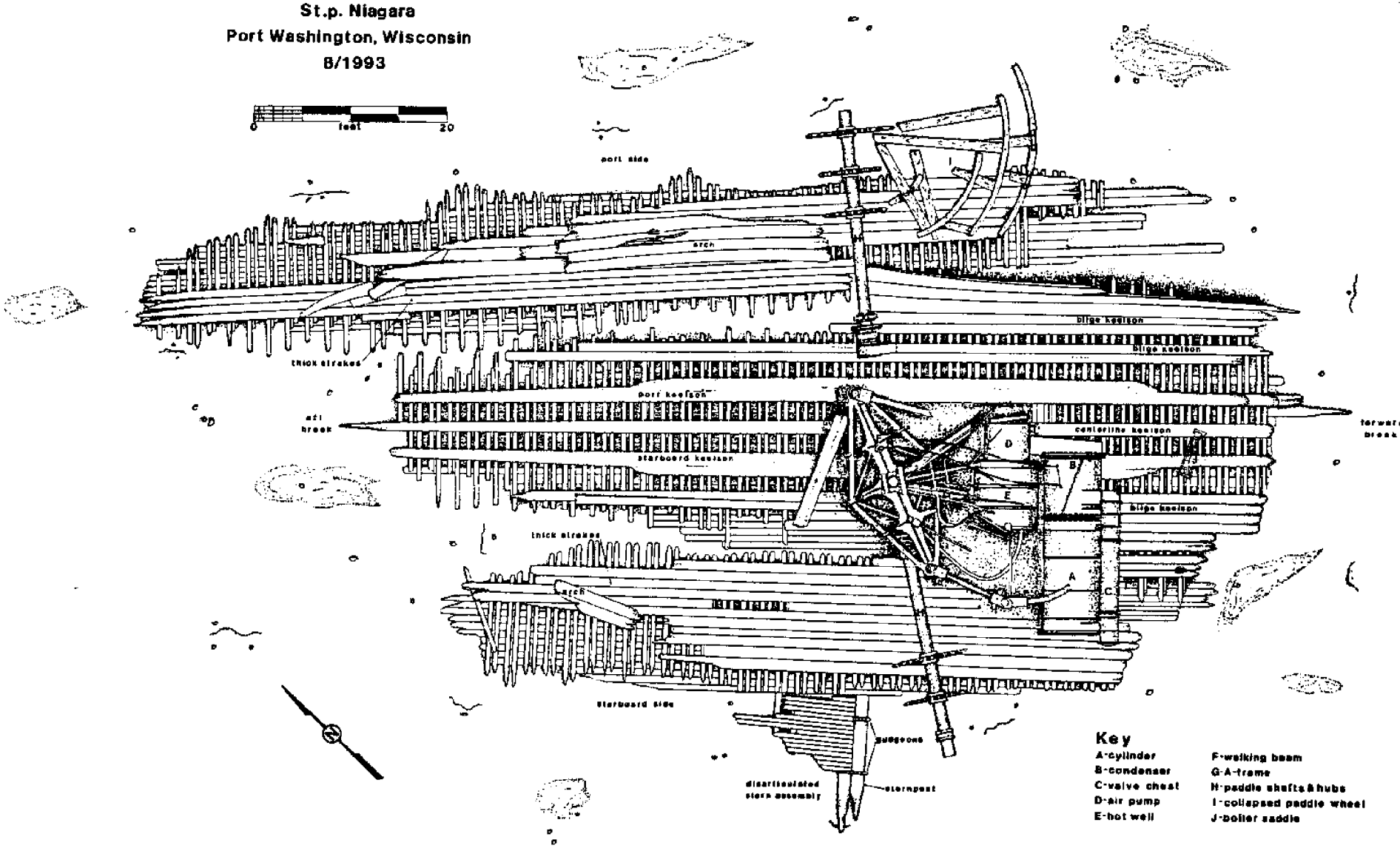


Figure 3 *Niagara* Site Plan

Stern Assembly

The aftermost section of the vessel has broken away from the main wreck and is lodged beneath a section of the charred starboard side. It consists of an inner and outer stern post, two gudgeon straps, portions of 16 exterior planks, and one frame. The sternpost/deadwood assembly consists of what appear to be two large timbers joined by heavy iron drift bolts. The outer stern post is broken off at the top. It is 13 feet in length with 16 inches molded and 6 inches sided dimensions. The interior stern post is more intact and is 14 feet 5 inches long. Dimensions for the exposed portions of the inner sternpost were also 16 inches molded and 6 inches sided. Sixteen exterior planks each 5½ inches wide were attached to the sternpost assembly. Two bronze gudgeon straps that held *Niagara*'s rudder are attached to the stern post. The upper strap has a length of 33 inches and width of 4 inches. It is attached to the outer sternpost by 5 fastenings, all equally spaced at 5 inches apart. The interior diameter of the pintle hole is 2 5/8 inches. The lower strap is shaped differently and is attached to the sternpost by both transverse and longitudinal fastenings, and was designed to support most of the weight of the rudder. The lower strap is 21 inches long, 3½ inches thick and is attached by four fastenings of undetermined type. The strap also consists of a 13-inch long, 2½-inch wide tapering, flange-like support that runs from below the pintle hole down the after end of the outer sternpost where it is attached by three fastenings.

Unidentified Bilge Section

Additional bilge wreckage, consisting of 26 frame sets and five keelsons was located an estimated 75 to 150 yards south of the main wreck. Framing patterns strongly suggest that it also is part of *Niagara*, probably the section of the hull between the boilers and the bow. The overall length of the section is approximately 52 feet. The center keelson appeared heavier than in the aft section of the main wreckage with approximate molded and sided dimensions of 17 inches. Two outboard keelsons measured approximately 10 and 11 inches sided and 13 inches molded. Poor visibility has hampered subsequent attempts to re-locate this wreckage.

Description of the Engine and Associated Machinery

The fire that caused the ship to sink and subsequent site formation processes have cleared most debris obstructing the engine. Nearly all engine components are present and accessible. The engine has fallen over to the starboard side, probably a result of the burning and collapsing of the wooden A-frame support structure.

The engine type, commonly known as a walking beam engine, was named after the large, diamond-shaped beam that towered above the ship. Propulsion was generated in the following way: the beam, mounted on a large wooden A-frame amidships pivoted on a center trunnion. The forward end of the beam was linked to the piston via a connecting rod. The aft end was attached to the crank on the paddle shaft by the shaft connecting rod. As the piston moved up and down, the beam pivoted moving the shaft connection rod up and down. The vertical

motion was transferred to rotary motion by cranks on the paddle shaft which caused the paddlewheels to turn.

Located aft of the boiler mounts, the *Niagara*'s engine consists of several components including the valve chest, cylinder, condenser, air pump, and hot well. The engine valves are located at the engineer's station on the forward side. There the steam throttle was operated and the steam pressure was monitored. There are valve chests at the top and bottom of the cylinder. These provided steam at each end of the piston stroke. The steam supply pipe from the boiler entered the top chest on the starboard side. The pipe has broken off leaving a large hole. Two hollow columns connect the upper and lower chests. The starboard column supplied steam from the boiler and the port column exhausted steam to the condenser. Each chest has one steam and one exhaust poppet valve operated by a vertical lifting rod.

Four valves, operating through the action of an eccentric cam on the paddle shaft, ran the engine cylinder. Eccentrics on the port and starboard side of the shaft provided forward or reverse motion, depending on which was engaged. An eccentric arm connected the eccentric to a horizontal rocker shaft on the valve chest. As the paddle shaft turned, the eccentric cam rotated. This imparted a back and forth motion to the eccentric arm causing the rocker shaft to rock. Wipers attached to the shaft pivoted, striking lifting toes on the lift rods. The up-and-down action of the lifting rods opened and closed the valves on the chests. The steam and exhaust lifting rods for the top chest have fallen off, along with the main rocker shaft, and lay nearby. In addition, a lower rocker shaft used by the engineer to manually operate the valves is missing. The port side eccentric arm remains connected to the eccentric. It measures 23 feet 8 inches between the center of the paddle shaft and the center of the rocker shaft hook. This was the original distance between the paddle shaft and the front of the engine. The starboard eccentric arm was not found.

Niagara's cast iron engine cylinder measures 14 feet long and 6 feet in diameter. Actual piston stroke was 10 feet with a diameter of 5 feet. During the wrecking process, the 7-inch diameter piston rod was broken off flush with the cylinder top. The condenser is bolted to the cylinder's bottom and the two have fallen over as a unit. Fasteners securing them to the engine beds have pulled out. There is a foot valve at the base of the condenser, facing the air pump, that is no longer connected to the air pump.

The air pump and hot well have also broken off their base and fallen over next to the cylinder. The air pump piston projects out of the broken cylinder. There is a groove around the edge for ring packing material and one-way valves are visible on the top surface. The hot well has an open top with a recessed dome cover well inside. The air pump's piston rod passes through the dome.

Just aft of the hot well are the walking-beam and remains of the A-frame. The A-frame was constructed from wood which burned almost completely away during the fire. Many tie rods were used to hold the frame together and are now twisted and strewn around the site. Approximately 10 feet of the A-frame top remains intact although little wood is present. The

trunnion bearing and walking-beam are still articulated.

The walking beam rests athwartship with the forward end on the starboard side. It measures 21 feet 4 inches long and 10 feet 6 inches high and is a typical diamond-shaped beam commonly used on vessels of the period. The interior frame is cast iron with a forged iron band around the outside for added strength.

On the forward end a pair of connecting rods join the piston rod at a crosshead. The crosshead moved up and down in guides attached to the engine cylinder, keeping the piston rod plumb. The connecting rods were able to pivot on the crosshead as the beam moved up and down without placing stress on the piston rod. Portions of the guide that had broken off the cylinder were found attached to the A-frame by iron strap supports.

The end of the connecting rod is secured to a pin on the walking-beam by a crank strap. The pin rides on a brass crank bearing sandwiched between the crank strap and connecting rod. The strap is secured by the crank pin key that passes through the assembly under the bearing. There is a hole on top of the strap for an oiling cup. The cup was periodically filled with oil that slowly trickled into the bearing for lubrication. All oiling cups have been removed from the *Niagara*'s engine. These were often made of brass and make an easy target for collectors.

The fastening assemblies were similar on every connecting rod observed on the vessel. The connecting rods for the air pump are located between the piston connecting rod and the center trunnion. They are badly bent but are attached to a crosshead arrangement similar to the engine piston rod.

Aft of the center trunnion is another set of connecting rods which were used to power a pump; probably a feedwater pump to the boiler, although this could not ascertained. These connect to a small crosshead and piston rod assembly. The pump appears to be located under fallen machinery and was inaccessible for documentation.

The paddle shaft connecting rod is attached to the aft end of the walking-beam. The lower end of the rod passed under the A-frame debris pile and was not examined. It is 8½ inches in diameter below the yoke and expands slightly toward the center. Two smaller, stiffening rods, 2½ inches in diameter, are attached to the larger rod. Normally this rod connects with the crank pin, joining the two cranks on the paddle shaft. The shaft has fallen off its support frame and rests on the vessel's bilges. In the process the rod/crank connection disarticulated and the port and starboard sides of the shaft pulled apart. If the cranks were still articulated they would be separated by a gap of approximately 12 inches.

The port shaft was examined in detail. The crank was present but broken in half. It has an odd configuration for securing the wrist pin on the connecting rod. A U-shaped clamp is bolted to the end of the crank and presumably held the pin. The starboard crank is missing from the shaft and may be attached to the end of the paddle shaft connecting rod. Investigators could not gain access to the assembly to make a determination on the connection.

The pillow block is fastened to the shaft just outboard of the crank, followed by the eccentric. The 16 inch wide pillow block secured the shaft to a support structure and kept the shaft from shifting while the paddlewheels turned. The four long bolts extending from the bottom of the block suggest that the shaft was pulled off its supports. The starboard shaft pillow block has also been pulled from its support structure. Outboard of the eccentric, a heavy 8½ inch wide clamp secured to the hull by two ½-inch bolts capped by 2½-inch square nuts provided further stability for the shaft. The port shaft was 29 feet 8 inches in total length, with a diameter of 1 feet 6 inches.

The paddlewheels are, themselves, no longer articulated. Existing remains include three, six-foot diameter by five-inch wide, notched hubs that are attached to the shaft. Examination of a single hub revealed 25 three-inch deep spoke notches. The wooden spokes were attached to the hubs by three bolts. Broken spokes projected outward from several of the notches. The outboard hub ends 24 inches from the end of the shaft. The space between the outboard hub and the middle hub is 3 feet 8 inches and between the middle and interior hub is 5 feet 11 inches. Portions of the paddle wheel assembly lie collapsed adjacent to the main wreck. Attached to broken spokes are curved iron straps which provided the perimeter support for the paddlewheels. The spokes at the extreme perimeter of the wheels are attached to the iron straps by four bolts. The longest surviving spoke measured 13 feet 6 inches. A sample paddle bucket, picked at random from the port side had the following description. It was a wooden plank 9 feet 11 inches long, 1 feet 3 inches wide, and 1¼ inches thick. The buckets were bolted to the spokes by 2-inch square nuts which were snubbed against a metal backing plate.

Boilers

Mid-nineteenth century sidewheel steamers were noted for high fuel consumption. In 1847 it was estimated that the *Empire* consumed some 238 acres of forest during a single season, and kept 40 wood cutters employed for a year (*Niles National Register* 20 December 1848). The *Niagara* is unlikely to have been much more efficient. This consumptive capacity is reflected in the large size of the *Niagara*'s boiler assembly, which survives upright on the lake bottom, 278 feet north-northeast of the main hull section. It consists of three return fire tube boilers, each measuring 18 feet 10 inches long by 8 feet in diameter. The boilers are connected to a single large firebox, 26 feet 8 inches wide, 7 feet 3 inches deep, and 11 feet high. Atop the firebox are two steam chambers which extend up an additional 6 feet 6 inches. The *Niagara*'s smoke stacks, 3 feet in diameter, passed through the steam chambers but have broken off.

The front of the firebox contains three banks of openings. The top bank consists of four stoking passages each 1 feet 6 inches wide and 1 feet 3 inches in height. The intermediate level contains six openings of similar dimensions. The lowest bank contains a series of six large openings used to remove ashes. The ash openings are 1 feet 4 inches in height and have widths of 3 feet 8 inches, 3 feet 10 inches, and 4 feet 4 inches with the openings getting larger toward the center of the firebox. A series of four 1-inch diameter gauge-cock or try-cock openings are arranged on a diagonal line across the upper corners of the front of the firebox. The try-cocks were used to determine the water level in the boiler. If water levels dropped

below the fire tubes and cold feed water was then allowed to touch them, a flash of steam would ensue, elevating the boiler pressure and possibly causing an explosion. The try-cock's placement on the boiler's face indicates the acceptable range of water level allowable for safe operation (Cantelas 1994:32, 35; Ward 1860:23). The try-cocks were probably made of brass and have unfortunately been removed, probably by collectors.

The boilers originally sat in the space in front of the engine, at or near what is now the forward break of the main wreck section. Laying near the forward break is a disarticulated fragment of a boiler saddle. The saddles originally consisted of two curved iron supports joined at the center by a 1 inch diameter iron rod. The upper side of the saddle was curved to accommodate the round boilers. The lower side was flat and rested on the steamer's bilge. The outboard edge of the saddle is 14 inches high, the flat bottom is 29½ inches long, the interior height was 5 inches and its width is 8 inches. The iron used in fabricating the saddle is 1 1/8 inches thick. Also near the forward break is a 6-inch diameter through-hull fitting, probably used to provide feedwater to the boilers.

General Interpretation

The main wreckage documented in this investigation consists of the stern half of the *Niagara*'s bilge, fragments of about 60 per cent of the port side, and less than half of the starboard sides. Contemporary accounts are sketchy but suggest that the wind was blowing the flames from port to starboard. This seems confirmed by the archeological remains. The starboard side shows extensive fire damage with nearly all of the internal arch burned away. The arch on the port side is, by contrast, largely intact with the damage appearing more structural than fire-related. The deposition of the boilers nearly 100 yards away from the engine remains a bit of a mystery. One diver has theorized that the boilers, emptied of water by the heat of the fire, had enough buoyancy to float away from the steamer (Miller, pers. comm. 1994). The front break of the main wreck corresponds closely to the aft position of the boilers. It is possible the fire was started, or was at least particularly hot in this area of ship and burned through the keelsons and starboard side arch. The heavy boilers may have fallen through the burning timbers, effectively breaking the back of the ship, allowing it to sink in at least two large sections. The position of the sternpost assembly underneath the starboard side is even more perplexing. One possibility is that despite a depth of 50 feet, ice may have reached the wreck and pushed items around. This could also help explain the condition of the engine. At this point, however, all of this remains a matter of speculation. It is clear, however, that there is more of the *Niagara* left to discover and investigate, and still more questions than answers.

Comparative Data: Thoughts on Sidewheel Steamboats

Currently, significant archeological data is only available for four Great Lakes sidewheel steamers. Thus, our understanding of Great Lakes sidewheel design and construction relies mostly upon historical accounts, contemporary artistic renderings, and (for later vessels), photographs (C. Patrick Labadie, pers. comm. 19 June 1995). Based upon such evidence, a typical Great Lakes sidewheel steamer built between the early 1840s and the 1880s had the

following characteristics: they were long and fairly narrow, with overhanging guards that ran the full length of the hull, a freight space on the main deck, and a one- or two-level passenger cabin (Labadie and Murphy 1987:65). The great weight of the propulsion machinery, combined with narrow hulls, sharp tapering ends, and relatively shallow drafts, made longitudinal support a critical factor in sidewheel steamer design. The "typical" sidewheel steamer relied upon a variety of complex arch truss systems, similar to those used by bridge builders, to provide longitudinal strength (Murphy, Lenihan, and Labadie 1987:230).

In practice, what is "typical" sometimes has little meaning. At the present state of archeological study, data from the Great Lakes sidewheel steamers *Niagara* (1846), *Lady Elgin* (1851), *Maple Leaf* (1851), and *Cumberland* (1871) suggest considerable diversity in construction techniques and designs. Oddly enough, the greatest similarity in vessels is between the oldest vessel, *Niagara*, and the newest, *Cumberland*. The most significant differences seem to between the *Niagara* and the *Lady Elgin*. The differences between these latter vessels are particularly interesting as both were products of the same shipyard, and probably had the same designer.

In their investigation of the 1871 Canadian-built sidewheel steamer *Cumberland*, National Park Service archeologists described several architectural features that were very similar to those found on the *Niagara*. Noting the lack of "the typical arched-truss support system," NPS investigators documented the presence of a wooden internal arch that was attached over the ceiling planking, running much of the length of the ship, and rising nearly to the level of the spardeck. The *Cumberland*, like the *Niagara*, had "open-joint" framing. On neither vessel did investigators find conclusive evidence of external arch or truss systems (Murphy, Lenihan, and Labadie 1987:227-233; Jensen and Cantelas 1993).

The similarities between the *Niagara* and the *Cumberland* are made more striking after one looks at the differences between the *Niagara* and the 1851 *Lady Elgin*. The *Lady Elgin* was somewhat longer (although of less tonnage) than the *Niagara*, but both vessels were of the same general class. Published photos and unpublished site documentation suggest that the *Lady Elgin* had a more complex and graceful design (Underwater Archaeological Society of Chicago 1993). Significantly, the *Lady Elgin*'s scantlings are far lighter than the *Niagara*. Unlike the *Niagara*, however, the *Lady Elgin* did possess a complex series of heavy external "bishop's arches" that extended high up over the deck and cabins. The longitudinal strength the arches provided apparently substituted for the heavy internal arching and deep keelsons found on the *Niagara*. Also, the *Lady Elgin* did not have the open-joint frames.

How significant are the design differences between the *Niagara* and the *Lady Elgin*? Was the *Lady Elgin* considered a better vessel? Was she more cost effective in construction and operation? What additional advantages did the heavy "bishops arches" have? As both vessels were probably designed by the well-regarded Jacob Banta, it seems certain that there were clear reasons for adopting a new design. Yet, if the design of the *Lady Elgin* represented a real improvement, why did the older design elements persist in much later steamers like the *Cumberland*? At this point we can only offer speculation, not answers.

As suggested by the career of the *Niagara*, late 1840s and 1850s Great Lakes steamboat operators put a great emphasis upon speed as well as size. Later palace steamers reportedly made speeds in excess of 20 miles per hour (Dayton 1925:406). Where did these fast hull designs come from? Clearly, Great Lakes steamers were not designed in a technological vacuum. Firms like Bidwell and Banta had long established connections with major ship and engine building firms on the East coast. During the 1840s and 1850s a great number of large, fast, steamboats were built to run in places like the Hudson River. A quick look at pictures from the period reveal many similarities between major East coast steamers and the later Great Lakes palace steamers (Lane 1943, Shipley and Addis 1991). In fact, some the largest of these vessels were designed and their construction supervised by eastern builders. The *Western World* and *Plymouth Rock*, two 348-foot long sidewheel steamers launched from the Bidwell and Banta yard in 1854, were actually built by the Brooklyn firm of John Englis & Son, and designed by Isaac Newton, a designer famous for his Hudson River vessels (Dayton 1925:405).

Technical sophistication may have produced fast and elegant looking ships. But when it came to durability, these splendid vessels may have come up short. If the careers of the *Niagara*, *Lady Elgin*, and *Cumberland* are at all representative, and historical evidence suggests that they are, groundings and collisions were relatively common. In the case of the fine *Lady Elgin*, light construction proved no match for the bow of an on-coming schooner. The steamer broke up into several pieces even when as she went down (Mansfield 1972[1899]:I:683-687). A heavier-sided vessel may survived the collision better.

Why would an 1871 shipbuilder resort to what was essentially an 1840s design? One answer is that the older design was not outdated at all, but was appropriate for certain geographic and economic niches. On the post-1857 Great Lakes, speed was less important than it had once been, and the incentive for building huge passenger ships far less. Built in 1871 the *Cumberland* was designed for rough Lake Superior service between Duluth, Minnesota and Collingwood or Owen Sound. The choice of the open-joint construction, heavy scantlings, and internal arching suggest that these features may have been associated with particularly stout hulls. The fact that the *Cumberland* routinely operated during the winters, was run aground on multiple occasions, and caught in an ice pack at least once, suggest that her hull was indeed strong (Murphy and Holden 1987:65-68). This can also be said for the *Niagara*.

The only other Great Lakes sidewheel steamer to receive major archeological attention is the *Maple Leaf*, which, like the *Lady Elgin* was built in 1851. Also, like the *Lady Elgin*, the *Maple Leaf* was built for speed, although not for splendor (Baskerville 1975; Girvin 1993:67-70). Archeological investigations done by East Carolina University, indicate a very lightly constructed hull and a fairly large "bishop's arch" (Cantelas 1994).

Given the rarity of sidewheel steamer sites, and the prominence of her builders and owner, the wreck of the *Niagara* must be considered a very important cultural and historical resource. Further archeological and historic research is clearly warranted. On a general level more targeted research into the economic, geographic, and social context of sidewheel steamer construction and operation would be very useful for the development of effective archeological

research designs. Just what were specific builder's hoping to accomplish with each design? How does the vessel's operational history and its archeological remains reflect or fail to reflect these ambitions? Answering questions like this will add much to our understanding of a rich and confusing period in Great Lakes history.

Recommendations for Future Research

Longitudinal Support

Although we now have a basic understanding of most of the main components of the *Niagara* wreck, much work remains to be done. Future field research should include further documentation of the vessel's internal support system. It still has not been established whether the *Niagara* had some kind of internal or external truss system in addition to her heavy keelsons and internal arches. The iron rods and turnbuckles that are attached to the keelsons appear to be associated with stays for the walking-beam engine A-frame. This may, however, have been part of some kind of longitudinal truss system. Further study of these features may settle this question.

Fuel

There is some debate as to the type of fuel the *Niagara* burned. Most Great Lakes steamers of the period burned wood (Walton 1943:86; Williams 1947). Wood was relatively cheap and provided faster acceleration (Lewis 1985:215). One newspaper account suggests that the *Niagara* was a coal burner (*Buffalo Morning Express* 18 July 1847). Further investigation of the boilers may provide insight into this issue. While it seems unlikely that any of the firebox's contents remain, it is possible, and they should be probed. A sample of ash or coal would provide important information for understanding the operation of the steamer.

Fire

The cause of the fire remains unclear. While underwater investigations are unlikely to determine how the fire started, we have much to learn about how the *Niagara*'s builders attempted to prevent fires. Accounts of the disaster allege that her fire hold was "completely fireproof" (*Milwaukee Sentinel* 29 September 1856). Nothing is said, however, as to the means of fire-proofing employed. The larger site area should be examined for any evidence relating to the actual fire and for evidence of fire-proofing.

Other Wreck Components

Future field work should include locating additional components of the wreck. Relocating the large bilge section is the obvious place to start, however, additional side, bilge, and the bow sections also await discovery. In addition to telling us more about the *Niagara*'s architecture, some of these undiscovered components may harbor significant collections of artifacts that have escaped the all-to-efficient hands of looters.

Further Archival Work

Enrollment documents for the *Niagara* have yet to be located. They may survive in the National Archives. Any existing federal documents in the form of enrollments, master builder or admeasurement forms, or mortgages should be gathered.

On a broader level, in order to more fully evaluate the construction and operation of the *Niagara*, a better understanding of the career of her owner C.M. Reed is necessary. From the 1830s through the 1850s, Reed -- "the Napoleon of the Lakes" -- was responsible for the construction and operation of several important Great Lake steamers. Investigation into Reed's business career through such sources as the R.G. Dunn Collection at Harvard and court records could add much to our knowledge of transportation in the antebellum Midwest.

Management Recommendations

Site Moorings

The wreck of the *Niagara* lies in an often dangerous spot on Lake Michigan. Although near the shore, the site is exposed to the full fury of the lake. A hard bottom and occasionally strong surface currents often make anchoring a difficult procedure, even for the most experienced boatmen. Currently most dive boats anchor into the wreck. Obviously damaging to the site, this procedure can also be very dangerous. It is frequently difficult to retrieve anchors without sending a diver down. Attempts to free an anchor and make a solo ascension can easily lead to accidents. A heavy, professionally-designed mooring would help protect both the wreck and its visitors. Boats attached to a fixed mooring are more stable than those riding at anchor. In addition, the line to the mooring anchor would provide a solid and safe ascent and descent line. In the interests of safety and site protection, the placement of a good mooring should be a priority.

Site Interpretation

The *Niagara* has long been an important recreational dive site, but the complex nature of its machinery and of the wrecksite in general have made it a difficult site for divers to fully appreciate. During a brief but colorful period, the *Niagara* was one of the most prestigious steamers on the Great Lakes. Her hull and machinery represent the best that 1846 American marine engineering had to offer. These factors, along with the dramatic and tragic nature of her demise should be used to generate a broader appreciation of the wreck by both the diving and non-diving public. Interpretive materials that open the wreck to the lay public should be developed. Among these items should be waterproof side guides designed to help divers orient themselves on the wreck, and appreciate what they see. Sport divers commonly spend only very short periods of time on wrecks that they visit. They go down, swim around the wreck (understanding little of what they are seeing), and then are ready to move on. Properly interpreted, the *Niagara* can provide visitors with many different dive experiences and give them reason to return to the wreck many times. This last fact is critical to understand, if

Wisconsin is going to get the most out of its shipwrecks' tourism potential. One possible approach would be to develop a series of scripted site guides that use the wreck to tell a number of different stories that cover the gamut from the building of the ship, to the drama of its fiery death.

While the major historical significance of the *Niagara* was not her tragic end, the disaster that claimed so many lives was an important event in the history of nearby communities. The *Niagara* and her story should be accessible to non-divers as well as divers. The *Niagara*, the story of her wreck, and, ideally, some of the artifacts associated with the wreck would make a fine subject for a permanent museum display. Port Washington, where many of the unidentified victims of the disaster were interred, would be an ideal spot for such an exhibit. The development of such an exhibit could provide the catalyst for the return of some of the estimated thousands of artifacts that have be looted from the *Niagara* wreck since its discovery in the 1960s. Additional interpretation could include an historical marker (or other type of exhibit) on the shore near the wreck site. An accompanying pamphlet could be developed, combining an exhibit tour with a self-guided driving/walking tour to the shoreline overlooking the scene of the wreck and (if appropriate) the cemetery where the victims were interred.

Nomination to National Register of Historic Places

The historical significance of the *Niagara* is virtually unassailable; it is the largest sidewheel steamer to have been lost in Wisconsin waters, and possibly has the most impressive engineering pedigree. James Allaire's most recent biographer, Philip Coombe noted in a 1991 Ph.D dissertation, "that the last Allaire-built engine was melted down decades ago for scrap" (Coombe 1991:xiii). Coombe was wrong, but the statement suggests that the presence alone of a highly intact and accessible James Allaire walking-beam engine makes the wreck nationally significant both for the rarity of its engine as well as its association with a famous builder of steam engines. The wreck's further association with Bidwell and Banta, and the relative rarity of similar sites only add to its historical significance. Inclusion on the National Register of Historic Places would provide additional protection and recognition for the shipwreck, and enhance the *Niagara*'s chance for survival as a cultural resource.

The people of Wisconsin have an unrecognized treasure of national significance in the wreck of the *Niagara*. With imaginative interpretation and proper protection, the wreck can be an exciting recreational and educational resource for current and future generations of Wisconsinites.

Survey of the Steambarge *Francis Hinton*, Manitowoc – Two Rivers

Historical Context

The explosion in the lumber industry experienced during the post civil war years led to the introduction of a new type of commercial vessel on the Great Lakes, the steambarge or lumber hooker. Between 1870 and 1900 over 600 of the vessels were built across the Great Lakes. By packing their holds full, stacking big loads on deck, and towing additional unpowered lumber barges "in consort," steambarges could move large loads of lumber cheaply and efficiently. Related to traditional Great Lakes schooners in terms of hull design and construction, steambarges incorporated many features found on the older craft often including centerboards and gaff-rigged sails. By 1880 steambarge construction styles had standardized with a raised poop-deck and engine house aft, a long single well deck, and a high pilot house sitting forward above a raised forecastle (Labadie and Murphy 1987:56-57). Although ranging in size from 80 to 200 feet, the typical steambarge, according to marine historian C. Patrick Labadie, was about 145 feet in length and could haul 350,000 board feet of pine. Later steambarges, built after about 1890 were often considerably larger and employed a variety of sophisticated trussing and internal supports. As with many commercial vessel types on the Great Lakes, the day of the steambarge was fairly short. When the American lumber industry shifted from the Midwest to the West Coast, the Great Lakes lumber trade gradually died and by 1930 only a few steambarges remained in service: none appear to have survived the Great Depression (Labadie and Murphy 1987:56-57; C. Patrick Labadie, personal communication 8/11/1994; Laurent 1993:52).

An almost archetypical steambarge, the *Francis Hinton* was built for the Manitowoc, Wisconsin, partnership of George Cooper and Horatio Trueman in 1889. She was the final vessel built by the Danish immigrants Hanson and Scove, a shipbuilding partnership primarily known for its fine schooners rather than for steam vessels (Valli 1995:11). Measuring 152.2 feet in length, 30.9 feet in beam, and 10.8 feet in depth of hold, the 417-gross ton steambarge was powered by a 385-horsepower steeple compound engine built by the Manistee Iron Work of Manistee, Michigan. Steam was provided by a firebox boiler 8 feet 6 inches in diameter and 15 feet long (Runge Collection n.d.).

The *Francis Hinton* was operated in the lumber trade by Cooper and Trueman for about 8 years, until being sold to James A. Calbick of Chicago in 1898 (Inland Lloyds 1890-1897; Beeson 1898, 1899). From 1900 through 1902, Beeson's Great Lakes directory lists the owner as A.A. Canavan of Chicago. (The 1902 *Inland Lloyds Vessel Register*, however, lists John Campbell, one of the ship's captains, as the owner.) By 1903 the vessel had been transferred to its final owner, George G. Oliver of the Marine Navigation Company of Michigan City, Indiana (Inland Lloyds 1906).

Other than Captain Campbell, the *Francis Hinton*'s captains have not yet been identified. The Great Lakes Red Books of 1904 and 1905 list Campbell as master, and he was in command when the ship was lost (*Great Lakes Red Book* 1904, 1905). Campbell may have been the

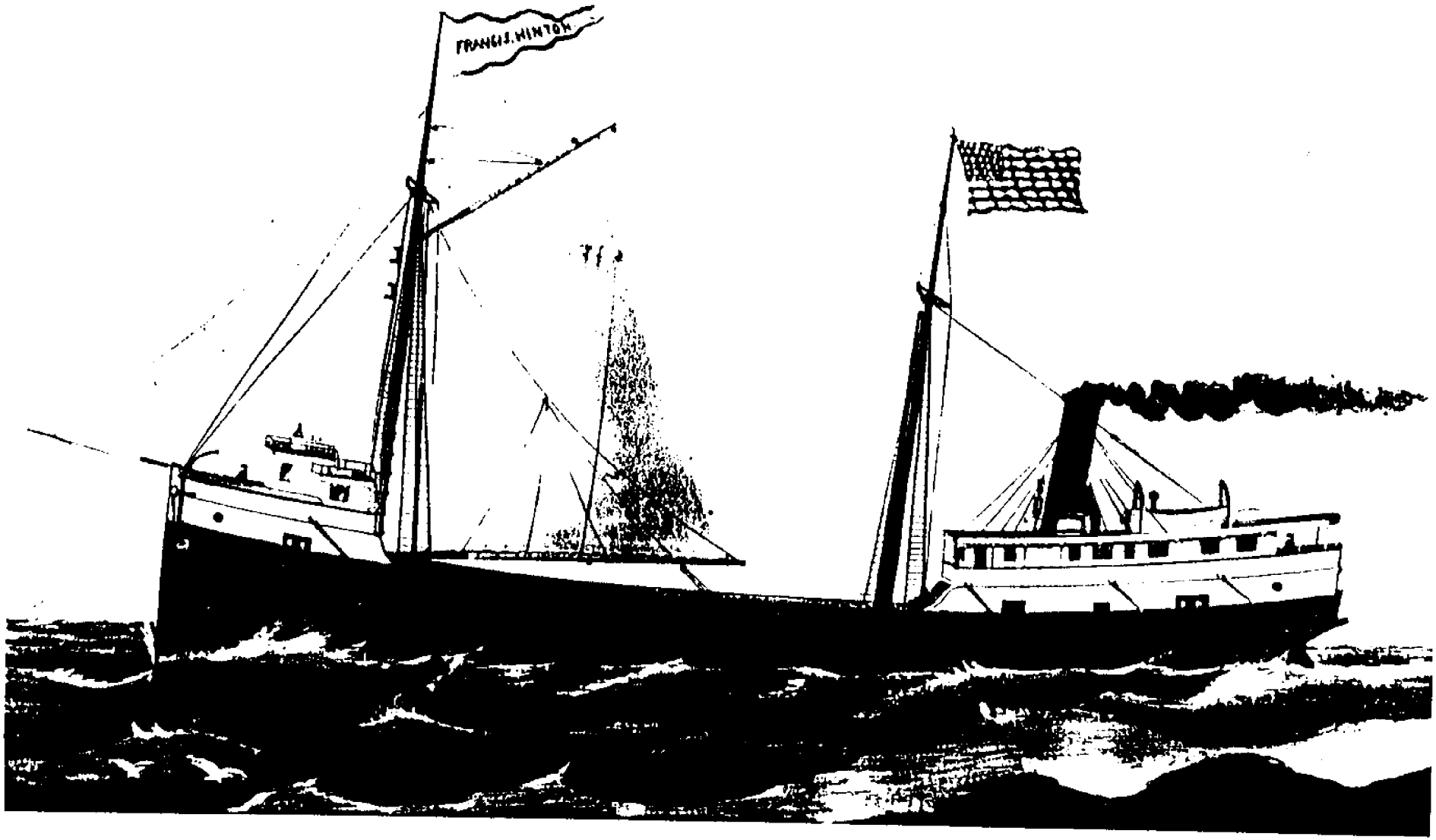


Figure 4 Water Color Painting of the *Francis Hinton* by J.E. Forsyth (Great Lakes

vessel's skipper, if not a part owner, for at least seven years.

Throughout the first decade of the twentieth century, the numbers of lumber carriers on the lakes appeared to be declining and some preference toward larger vessels was evident (Laurent 1993:52). The Beeson's 1909 edition (the final year of the *Francis Hinton*'s service) lists 356 Canadian and American lumber carriers with cargo capacities ranging from under 100,000 board feet to over 1,100,000 board feet of pine. The *Francis Hinton* with a listed capacity of 550,000 board feet appears to have been of slightly less than average size for the 1909 lumber fleet (Beeson 1909).

The vessel was apparently well built. She retained an A1 Inland Lloyds Rating until 1898 and never seems to have dropped below A1½. This longevity of rating may be attributable to regular maintenance throughout her career. According in Inland Lloyds records, unspecified repairs were carried out in 1897, 1901, and 1906. The bottom was recaulked in 1898 and 1902. She was completely rebuilt in 1899, re-decked in 1901, and drydocked in 1905.

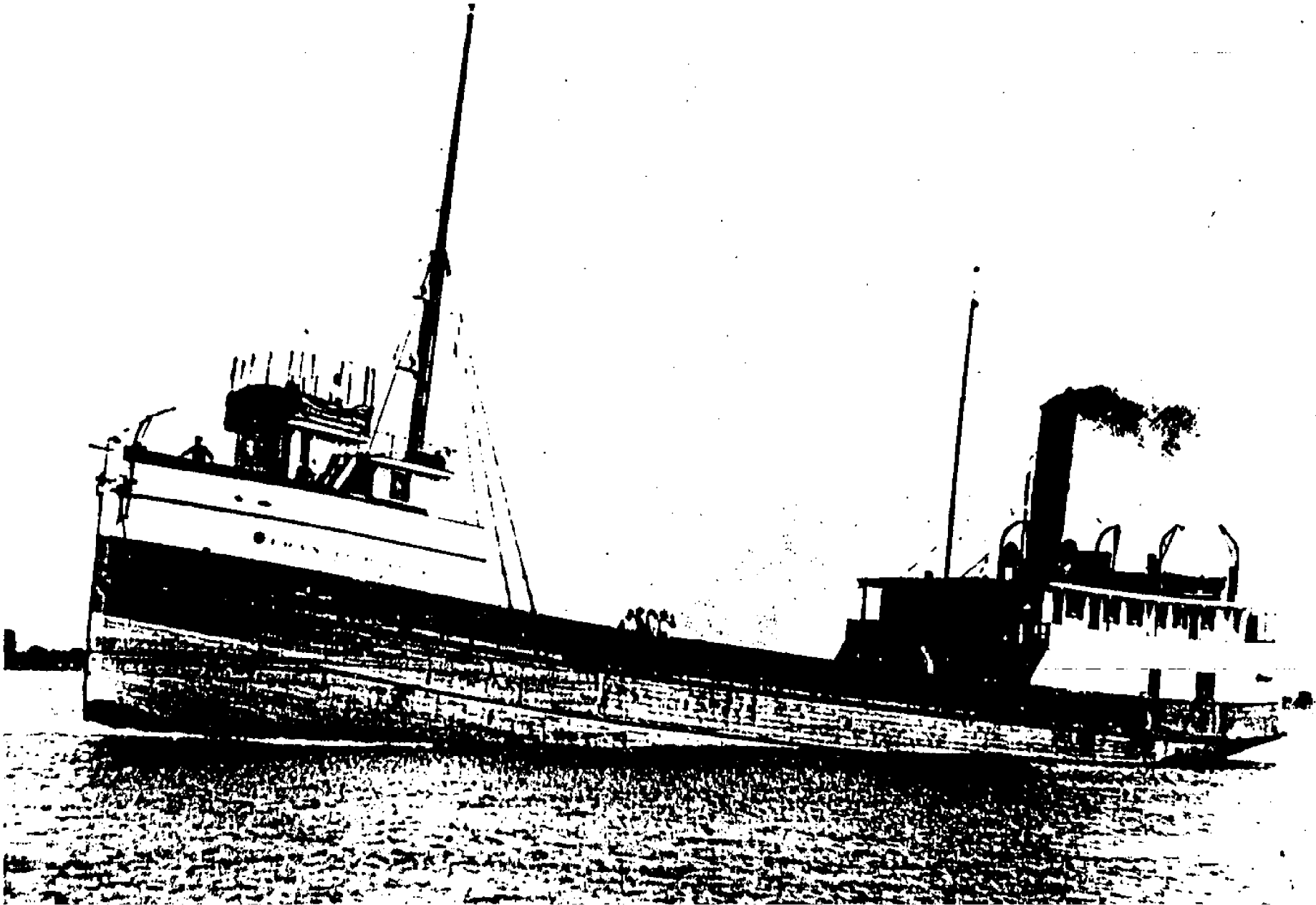
Inland Lloyds Ratings and Valuations (*Francis Hinton*)

1890 A1	$35,000
1891 A1	$24,000
1893 A1	$30,000
1894 A1	$25,000
1895 A1	$25,000
1897 A1	$25,000
1899 A1 ½	$18,000
1902 A1 ½	$20,000
1906 A1 ½	$16,000

The Wreck of the *Francis Hinton*

It was a typical November day on Lake Michigan with the crew of the U.S. Lifesaving Service Station at Two Rivers, Wisconsin keeping a standard lookout. At about 10 a.m. a small heavily laden lumber steamer was reported as passing the station heading south, apparently making good way through rough winter seas (U.S. Life Saving Service Wreck Report 16 November 1909). The situation on the steamer, *Francis Hinton*, however, was anything but good. Bound for Chicago from Manistique, the ship had steamed into a freshening gale and, at about 4 a.m., was discovered to be taking on water. Unable to keep ahead of the flow, Capt. John Campbell headed his vessel towards shore in an attempt to make the Two Rivers Harbor. Before shelter could be reached, the fire in the steam boiler extinguished leaving the *Francis Hinton* helpless. Hoping to save the ship and its cargo of 450,000 board feet of Norway pine lumber, the captain ordered the anchor dropped and signalled for assistance. With no help arriving, the water in the bilge continuing to rise, and foundering imminent, Captain Campbell ordered the anchor line cut away allowing the vessel to drift toward shore (*Two Rivers Reporter* 19 November 1909).

Figure 5 Historical Photograph of the *Francis Hinton* (C.P. Labadie Collection)



At 11 a.m. lookouts at the Two Rivers Lifesaving station once again observed the ship, this time about 4½ miles south of the station. Flying what appeared to be a distress flag from her mast top, the vessel was almost amid the breakers very near the shore. Mobilizing his crew, the head of the lifesavers assessed the state of the weather and, after noting the absence of tugs in the Two Rivers harbor, determined that the seas were too rough to proceed to the *Francis Hinton*'s aid by water. Three wagon teams were quickly hired to carry rescue apparatus, including a surfboat, overland. By noon the lifesaving teams were on the way (U.S. Life Saving Service Wreck Report 16 November 1909).

Newspaper and lifesaving accounts do not provide a clear chronology of the duration of the *Francis Hinton*'s peril, but the ship's distress did not go unnoticed by shoreside observers and hundreds lined the beach to watch the disaster's closing moments. With the hull wedged on the bottom near the shore, the upper works of the after end of the ship began disintegrating. The after cabin, smoke stack, mizzen mast, and much of the deckload washed away. Donning life preservers, Captain Campbell and the eleven man crew climbed into the ship's yawl. Maneuvering the small boat in the huge breakers would have been difficult under any circumstances, but the crew also had to contend with a lake surface full of floating lumber and a menacing series of commercial fishing pond nets and stakes. Demonstrating strong presence of mind, Captain Campbell deployed a small anchor off the stern of the yawl. By working the anchor line carefully, the captain prevented the boat from broaching in the surf while the mate guided the boat into the beach. After a tense several minutes the yawl landed safely and the crew emerged unharmed (*Door County Advocate* 18 November 1909; *Two Rivers Reporter* 19 November 1909).

Meanwhile, at 1:35 p.m. the Two Rivers Lifesaving crew reached the scene and found the steamer underwater from the stern to midships. The pilot house, however, was high out of the water, apparently out of harm's way. In his wreck report the keeper of the lifesaving station was critical the of *Francis Hinton*'s crew for abandoning the relative safety of ship during such hazardous conditions. Upon learning of the crew's evacuation, the keeper took the surfboat out and went out to inspect the wreck and check for stragglers. After the inspection nothing more was to be done for the ship and by 4:45 p.m. the lifesaving crew was back at the Two Rivers Station. The following day, upon request from Capt. Campbell, the lifesaving crew returned to the site to assist the Hinton's crew in stripping the ruined vessel. The *Francis Hinton* was valued at about $15,000 and the cargo $8,000 at the time of the accident. Neither were insured (U.S. Lifesaving Service Wreck Report 16 November 1909; Runge Collection n.d.).

Exposed to easterly storms and ice, the exposed bow portions of the *Francis Hinton* soon disappeared and the wreck's location was forgotten for the next seventy-nine years. In October 1987 Two Rivers sport divers Randy Wallander and Dan Hildebrand re-discovered the wreck (*Manitowoc Herald-Times* 1 October 1988).

Archeological Investigations

Following the wreck's 1987 rediscovery, local sport divers began recovering artifacts, including the ship's windlass and a large brass bell from near the port bow, a bollard from near the starboard bow, and engineering tools, a small brass bell, brass steam whistles, galleyware, a brass steam gauge, valves, a leather boot, a voltage regulator, a wooden double-block, and other artifacts were recovered from the engineering space (*Manitowoc Herald-Times* 1 October 1988; Dan Hildebrand, pers. comm. 1995). The divers also reported seeing a bilge pump just to port of the propeller and a large pile of chain just aft of the propeller. It was theorized by the divers that this chain may have been attached to a buried stern anchor. At the time of the vessel's discovery, the sport divers were unaware that the recovery of these artifacts without permits was illegal under state law. At the request of the Wisconsin State Archeologist, the artifacts were placed in the custody of the Rogers Street Fishing Village Museum in Two Rivers, under an agreement with the State Historical Society of Wisconsin (SHSW).

To provide a better understanding of the wreck, and to enhance the *Francis Hinton* exhibit at the Rogers Street Museum, the State Historical Society of Wisconsin and the Rogers Street Museum planned a cooperative project to document the wreck. Although field work was originally planned for 1991 under a previous Sea Grant-funded project, the discovery of the steamer *Frank O'Connor* off Cana Island in Door County forced the SHSW to shift its priorities. The *Francis Hinton* survey was rescheduled for 1994. Over the spring and early summer of 1994, plans were made for the survey of the site with the assistance of volunteers of the Wisconsin Underwater Archeological Association. Additional historical research was conducted on the ship and historical photographs of the vessel were secured by the SHSW. Plans were also made with Rogers Street to catalogue and photographically document the *Francis Hinton* artifacts over the winter of 1994-1995.

Field work on the *Francis Hinton* began on July 15 and continued through July 27. Prior to development of a site plan and archeological analysis of the wreck, one day was spent conducting a diving reconnaissance of the site. The wreck was located using LORAN-C equipment and a digital fathometer, and teams of divers were deployed to recon the site and to place temporary moorings for the research vessels. GPS coordinates were obtained for the site, as well as shore ranges of prominent landmarks in the event of failure of both the LORAN-C and GPS equipment.

The wreck of the *Francis Hinton* lies between the cities of Manitowoc and Two Rivers in Maritime Bay, approximately 1.9 statute miles northeast of the mouth of the Manitowoc River, and approximately .35 statute miles from shore. The site is located at 44 degrees 06.671 minutes north latitude and 87 degrees 37.879 west longitude. The wreck is embedded in a firm clay bottom, surrounded and partially covered by pockets of silty-sand. The wreck has settled into the clay, and currents have excavated a neat trench around the wreck, allowing the hull to rest almost flush with the surrounding lakebed. The maximum depth of water over the site is nineteen feet of water off the stern. The minimum depth is seven feet of water over the boiler. Due to the site's shallow depth and exposure to wind and seas from the northeast, east,

southeast, and south, the bottom is easily agitated by wave action, and underwater visibility is turbid in all but extremely calm weather. The 1994 survey team experienced exceptional visibility for this site (approximately fifteen feet) on several calm days, and also experienced absolute zero visibility on days when the seas were rough. In calm weather, the site is easily located and may be examined with relative ease. However, the site is not suited to visits or work in rough weather due to bad visibility.

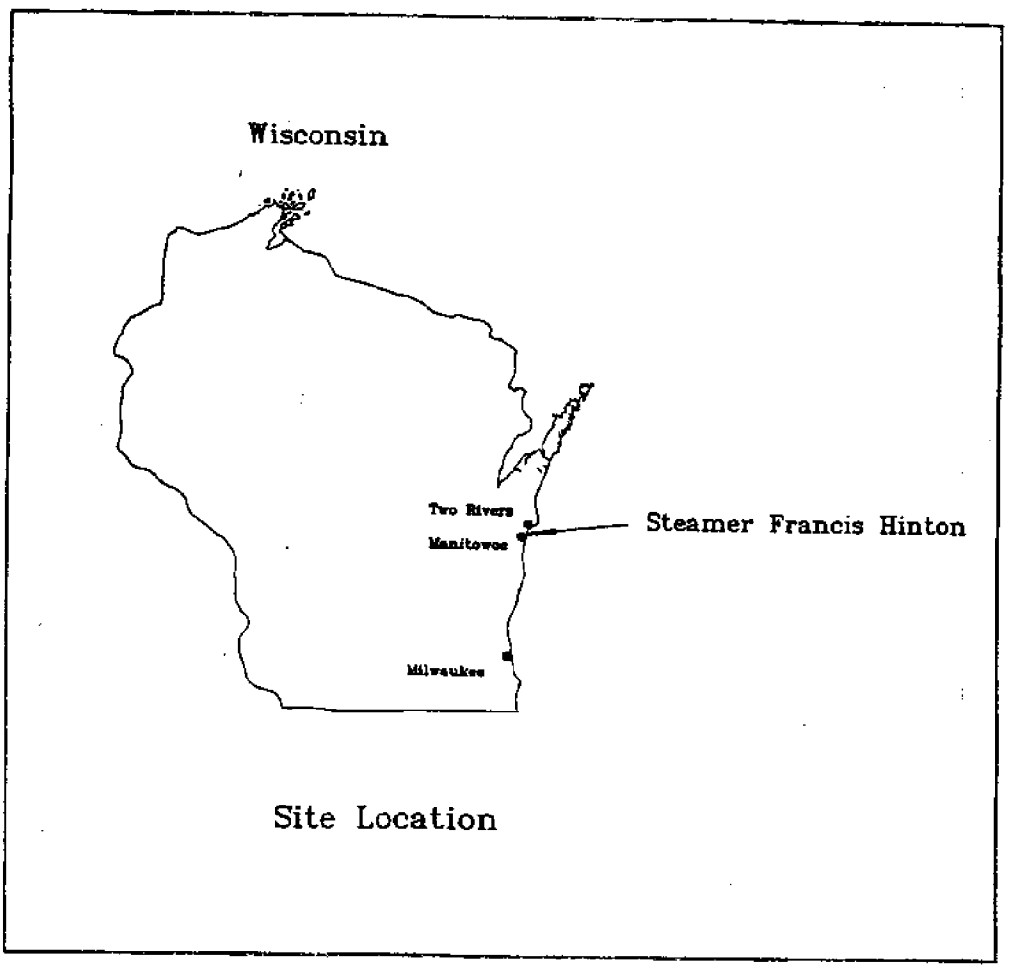


Figure 6

Another unfavorable environmental factor on the *Francis Hinton* is the presence of heavy concentrations of zebra mussels. The shallow depth, ambient surface light, extensive metal and wood structure, and relatively warm water have all combined to create an ideal environment for the invaders. Concentrated principally on the ship's iron boiler and machinery, the mussels have also obscured much of the vessel's wooden structure, greatly adding to the difficulty of documenting the wreck. Diver reports indicate that the mussels first appeared on the wreck in 1993, rapidly colonizing the wreck from 1993 to 1994.

Site Description

The wreck of the *Francis Hinton* consists of the ship's bottom, her machinery, and the broken sections of the vessel's sides. Due to its shallow depth and exposed location, the wreck has received a significant amount of damage from ice and wave action. The upright framing for the ship's steeple compound engine has broken apart and the engine has fallen over the starboard bilge and side of the wreck. The firebox boiler, with a steam drum mounted on top, has rolled off its rectangular iron bed, and lies on its side on the port side of the hull. The stern deadwood is twisted to starboard, with the horntimber broken and angling down toward the bottom. However, the engine drive train is completely intact, from the piston rod, crank, propeller shaft, and flywheel to the large four-bladed iron propeller. The thrust bearings and a cam wheel (probably for driving the air pump) are also in place.

Architectural Data

The ship's bilge section is constructed with a heavy centerline keelson molded 12 inches and sided 33 inches, over which is fastened a rider keelson molded 12 inches and sided 28 inches. Two longitudinal stringers are fastened above the rider on the port and starboard sides. The starboard stringer measures 8½ inches molded and 11½ inches sided; the port stringer measures 9½ inches molded and 10½ inches sided. A 6-inch wide space runs between the stringers, forming a slot for centerline hold stanchions. These stringers run most of the length of the vessel, interrupted only by the placement of the mainmast step. Surviving stumps of stanchions measure 6 inches athwartships and 7 inches fore and aft. The entire height of the keelson assembly, including rider and stringers, is 31½ inches molded. The *Hinton*'s keel, accessible for measurement only in the stern of the ship, measures 12½ inches molded and approximately 12 inches sided.

The forward section of the keelson (in the vessel's extreme bow) shows evidence of what at one time may have been a centerboard trunk. The trunk appears to have been closed up and the centerboard removed as part of a later modification. This is similar to what appears to have happened to the centerboard of the 1887 steamer *Louisiana*, built by the firm of Morley and Hill at Marine City, Michigan, and lost in Washington Harbor, Wisconsin in 1913. An anomalous structure in *Louisiana*'s bow was discovered which was probably her original centerboard trunk. For reasons that are yet unknown, the bottom of the trunk was boarded-over at the keel (Cooper 1989:57-65). Although centerboards are usually regarded as equipment for sailing vessels, in fact, many Great Lakes steambarges and some other types of steam vessels carried centerboards, often in their bows. These were used to improve vessel handling when travelling under auxiliary sail, or when travelling light (Labadie and Murphy 1987:57; Barkhausen 1990:29-31). Judging from the evidence presented by the *Francis Hinton* and *Louisiana*, it appears that the need for these boards diminished around the turn of the century, and the trunks and boards were removed to provide extra cargo space and reduce maintenance costs.

The keelson assembly sandwiches the ship's floors, which are double-timbered flitch, sided 4½

to 5 inches and molded 9 inches. The floors become heavier further aft, with a molded dimension of 12 inches in the vicinity of the stern deadwood. The futtocks taper to 9½ inches molded at the turn of the bilge and to 8¼ inches at the futtock tops. Frame room is 9¼ inches; space is 6 inches forward and 10½ inches through the rest of the hull. A section of triple-timbered floors is placed in the bow, running aft of the chainlocker area. These tripled floor timbers are sided 4½, 5¼, and 5 inches, fore to aft, with a total room of 15 inches and space of 5 inches. The presence of iron plating and bilge ceiling prevented archeologists from determining the precise extent of the triple-timbered floors. These may have been special reinforcement for the chainlocker floor, or for the area of the centerboard.

The mainmast step is located 95 feet aft of the forwardmost surviving end of the keelson. It is constructed of two timbers: one sided 10 inches and the other 12 inches. Both are molded 8 inches and measure 42 inches fore to aft. The mortise to receive the tenon of the mast is 7 inches athwartships and 15 inches fore to aft. The step is fastened on the top of the rider keelson.

The bilge is ceiled by longitudinal planks. This is typical of Great Lakes schooner construction, from which Great Lakes steambarge designs were derived (Labadie and Murphy 1987:56-57). Ceiling planks vary from 5 to 11 inches wide and average 2 to 3 inches thick, except at the turn of the bilge where four "thickstuff" strakes measure 8½ inches wide and 5 inches thick. The thickstrakes are edge-fastened with 3/4-inch diameter bolts, and fastened to the frames with 1-inch bolts clinched over 2 3/4-inch diameter roves. Bilge ceiling planks are fastened with 3/8-inch rosette head square-shanked spikes. Above the turn of the bilge, the ceiling is fastened with 3/4-inch diameter bolts peened over 2-inch diameter roves. Drift bolts of 3/4-inch diameter peened over 2-inch diameter roves are also used in other areas of the hull to fasten major hull components. Limber boards 7 inches wide and 4 inches thick are fitted in between the keelson and the bilge ceiling planks.

A section of the ship's upper port side (from the turn of the bilge to the sheer) lies off the wreck's port quarter, flat on the bottom, outboard side facing up. The exterior planking is accessible on this section. Exterior planks vary from 4½ to 12 inches wide and are 6 to 6½ inches thick at the turn of the bilge and 3½ inches elsewhere. Two rubrails or wales are extant on this section of hull. The upper rubrail is located 30 inches below the futtock ends and is 6 inches wide and 8½ inches thick. The lower rubrail, located 48 inches below the upper one, is 4½ inches wide and 2½ inches thick.

The starboard side of the ship (from the turn of the bilge to the rail) lies flat on the bottom, inboard side up, along the wreck's starboard side. It is preserved to the caprail along part of its surviving length. The bulwark stanchions measure 6 inches molded by 5½ inches sided. The caprail atop the bulwark is constructed of two horizontal planks, one 8½ inches wide and the other 7½ inches wide, 5 inches thick. In some areas, portions of the lodging knees and beams from the deck remain attached to the side along the shelf and covering board. Twelve hanging knees are extant on this side. A typical knee is 39 inches long on its vertical arm, 20 inches long on its horizontal arm, and 5 inches wide. Thickness varies due to the shape of the

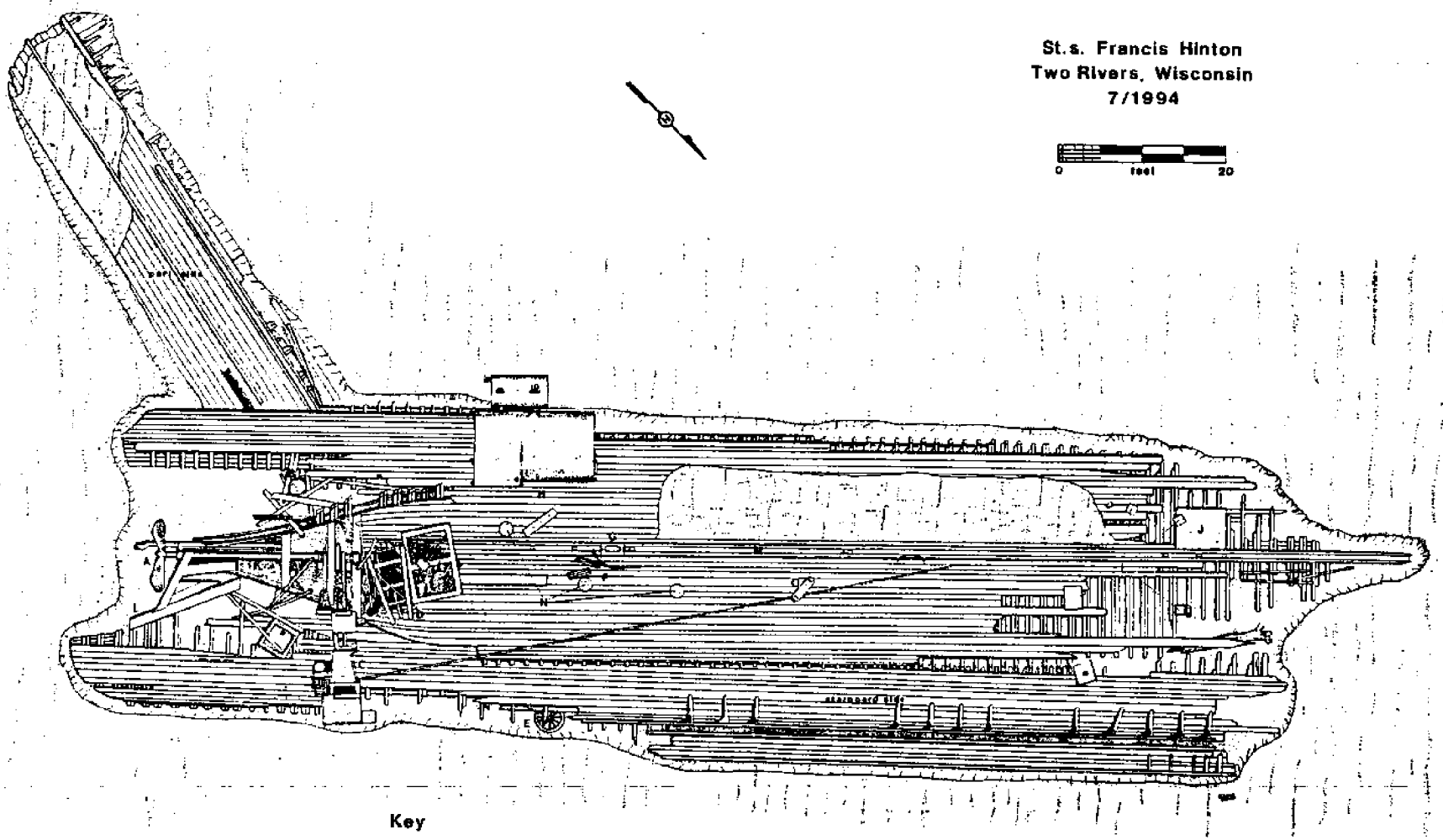


Figure 7 *Francis Hinton* Site Plan

knee, with a maximum of 11 inches between the radius of the two arms. Above the knees, part of the deck shelf is preserved. The shelf is 10 inches wide and 4½ inches thick. Surviving evidence suggests that the deck beams were sided 11 inches and molded 8 inches. An extant section of the covering board is 9 inches wide and 5 inches thick.

Nothing remains of the upper bow and superstructure of the vessel. The stempost and bow structure has broken off directly at the keelson, and could not be located in the vicinity of the wreck.

The sternpost and stern deadwood have collapsed to the starboard side. The sternpost is sided approximately 12 inches and is molded 11 inches. The lower deadwood consists of a longitudinal timber that ran atop the propeller shaft. Above this are three diagonally placed deadwood timbers that form a triangle between the sternpost, horntimber and the lower deadwood timber. The horntimber has a length of 13 feet 11 inches, is sided 12 inches and molded 13 inches. It extends 2 feet 8 inches abaft the sternpost.

Also in the stern the rudder shoe survives intact attached to the bottom of the keel. This component is constructed of an iron strap 14 feet 4 inches long, 12 inches wide and 2½ inches thick. The open area above the shoe for the propeller (between the sternpost and the rudderpost) is 3 feet 6 inches long fore to aft.

Power Plant and Engineering Space

The *Hinton*'s 385-horsepower steeple compound engine has toppled over to the starboard side, but is largely intact. The engine has an overall length, excluding piston rods, of 13 feet 8½ inches. The cast iron valve cover for the low-pressure cylinder has fallen off, and was found under the starboard side at approximately 86 feet along the survey baseline. This cover measures 42 inches on its outside diameter, with reinforcing spokes radiating out from a 4-inch diameter hub. The steam piping that connected the engine to the boilers is present in a jumbled heap in the vicinity of the engine. Other sections of 2½-inch and 3-inch outer diameter steam piping litter the machinery space and bilge. Part of the support frame for the engine lies among the debris pile forward and starboard of the propeller shaft. This structure consists primarily of four hollow cast-iron tubular legs, 7 inches in diameter, connected by a series of cross-pieces. At its base this structure is approximately 5 feet wide and at its top it is 33 inches wide. The base of each leg is reinforced with triangular iron plates attached to their interior faces. While this structure supported the lower end of the engine, the upper and more massive end was afforded additional support by the structure of the upper deck. The presence of tie-rods terminating in stirrup-shaped eyes suggest that additional stay-rods were employed in supporting the machinery.

Aft of the mast step, a pair of heavy longitudinal timbers, running parallel to the central keelson, are fastened over the port bilge ceiling. The timbers, 15 to 17 inches molded and 14 inches sided, appear to be sleepers for the engine mounts or the boiler beds. A similar sleeper timber is fastened over the port bilge aft of the maststep. It measures 11 inches by 11 inches,

and is positioned 26 inches from the keelson. As all the sleeper timbers run aft under the machinery pile, their precise length cannot be determined.

What appears to be the condenser for the engine lies in the port stern area. It is a rivetted, reinforced iron cylinder 43 inches high with an outside diameter of 27½ inches. A recessed plate in its base is pierced by a honeycomb of 1 3/4-inch diameter holes, probably for admitting steam or allowing condensed water to escape.
The firebox boiler and its attached steam drum is lying on its side in the port bilge where it tumbled from its supports. The firebox doors face aft, indicating that the boiler has been turned completely around, probably by ice movement. The boiler is 15 feet long and 8 feet 6 inches in diameter on its forward (originally aft-facing) end. The two firebox doors are 17 inches long and 19 inches high. The steam drum is 7 feet 2 inches long and 3 feet 10 inches in diameter.

The firebox originally sat above a rectangular iron structure called the boiler bed or ash pan. The remains of this structure have been shifted off-center to starboard, and lie at the forward end of the machinery debris pile. The bed was cast with two ash traps, each measuring 4 feet wide by 4 feet 10 inches long (inside dimension). The whole structure measures 6 feet fore to aft by 9 feet 9 inches athwartships.

A few feet to starboard of the boiler is a boiler "saddle" that supported the aft (cylindrical) end of the boiler. This iron support consists of a rectangular base 4 feet 5 inches long by 12 inches wide with four vertical members supporting a concave plate 1½ inches thick into which the boiler set. The saddle is 20 inches high at the outside and 13 inches high under the center of the boiler.

The engine drove a four-bladed propeller 8 feet 9½ inches in diameter. Each blade is 3 feet 8 inches long with a maximum width of 25 inches. The propeller was driven by a shaft approximately 24½ feet long and 9 inches in diameter. The shaft is intact and connected to the engine by the piston rods. The connecting rod for the as-yet unidentified air pump is also still attached to the shaft. Other components extant at the forward end of the shaft are the flywheel and the pillow bearing into which the terminus of the shaft rests and was lubricated. The aftermost end of the shaft, forward of the propeller, extends through the stuffing box, or packing gland, that is let through the base of the sternpost.

Other Structural and Engineering Components

A large area of ¼-inch thick iron or steel plating located in the port bow probably represents the base of the chain locker. It measures 72 inches fore to aft and 53 inches athwartships. Three iron ventilators were also located in the bow of the wreck. These are essentially open-ended boxes 15 inches long, 11 inches wide and 14 inches deep. The iron plates that make up the ventilators are 1 inch thick. Pieces of a cast-iron cabin stove were also found in the port bilge.

Two triple-chambered steam radiators were located in the starboard bilge just aft of the mainmast step. Each radiator measures 7½ inches by 7½ inches by 34 inches. These probably provided steam heat for the aftercabins, supplied by a steampipe from the ship's main boiler. Round iron coal scuttle covers, measuring 20 inches in diameter were also found around the maststep in the vicinity of the former coal bunkers.

The remains of a curved iron or steel davit for raising and lowering one of the ship's small boats was located to the starboard of the mainmast step. The davit has an overall length of 7 feet 7 inches, and is 3 inches in diameter. A 2-inch diameter diagonal brace supports the curved upper end of the davit.

Material Culture

Although the *Francis Hinton* site was heavily collected by sport divers following its discovery in 1987 (see above), a number of artifacts are still to be found on site, particularly in the heavy debris around the machinery. Sherds of whiteware or ironstone ceramics, remnants of the crew's galleyware, may be found in the stern (where, typical of Great Lakes steambarge and bulk carrier construction, the galley and crew's cabins were located). A partially buried rubber boot was also found in the area between the bow and the starboard side. Although the boot is rather modern in appearance (possibly post-World War Two), it was not possible without excavation to confirm whether the boot belonged to a *Francis Hinton* crewman, or if it is intrusive modern trash. Like many other shallow wrecks, the *Francis Hinton* has accumulated its share of debris pushed along the coastline by littoral currents, including many fallen trees and piles of driftwood which have become trapped around the wreck.

Zebra Mussel Infestation

An interesting (but frustrating) by-product of the *Hinton* survey was the opportunity to examine the process by which zebra mussels colonize a Great Lakes shipwreck site. As observed earlier, the engine, boiler, and machinery were heavily encrusted with the organisms, as were the upper elements of the ship's wooden structure such as frametops, sides, and the keelson. The mussels were strongly adhered in these areas, and could only be removed with vigorous scraping. Areas of mussels had to be forcibly removed with dive knives and recording slates in order to obtain measurements of the underlying structure and machinery. The mussels appear to favor the wreck's many curved and angular surfaces, including the edges of timbers and planks, and the surface of the boiler, engine, propeller shaft, and other areas of machinery. Apparently, curved and angled areas offer a greater amount of surface area to be colonized than simply flat surfaces. Also, the interior niches of the boiler, engine, and other machinery appeared to be preferred sites for adhesion. Mussels also colonized the more open sections of wooden hull structure, but the patchy nature of this colonization indicates that it is a newer area of growth, and perhaps less successful than the surfaces of the machinery.

The area least favored for colonization was the ship's bilge. The bilge is a flat, nearly level surface, planked longitudinally in white oak, and fastened with iron spikes. Patches of sand

migrate around the bilge, propelled by wave action. It is probably this latter factor, the presence of migrating sand overburden, more than the relative flatness and greater depth of the bilge which inhibits zebra mussel colonization. Interestingly, the mussels in the bilge continue their preference for curved and angled surfaces, choosing the round heads of the iron spikes and the adjoining edges of planks to colonize. As a result, many of the strakes of bilge ceiling are weirdly outlined with an edging of zebra mussels adhering between the spaces, cracks and butted ends of adjoining planks. Each bilge ceiling plank is fastened in the standard fashion to the underlying floors with four rosette-headed, square-shank iron spikes. The heads of many of these spikes are also clustered with zebra mussels, highlighting the iron bilge fastenings.

Archeologists noted only one organism on the site which seemed to be predating upon the mussels. While drawing and photographing in the machinery area, an archeologist observed what appeared to be a slimy sculpin (*Cottus cognatus*) feeding upon the inner flesh of a broken mussel. It was impossible to tell whether the shell had been broken open by the fish, or if the archeologist had broken the shell with his body movements and measuring activities. As the archeologist had no training in freshwater biology, he was unequipped to make further useful observations of either the predator or its prey, other than photographing the results of their encounter.

Recommendations for Further Research

The shallow depth of water over the *Francis Hinton* and the relatively compact nature of the site allowed for a reasonably thorough survey of the remains, sufficient to answer basic questions about the site and the vessel's architecture and engineering. As is always the case, however, certain areas of the site received less-detailed documentation than others, and many areas of the wreck would benefit from additional archeological investigation. In particular, the machinery area is extremely complex and jumbled, and proved to be difficult to document in detail. This was partially due to low visibility which limited video and photographic documentation, as well as the wreck's heavy encrustation by zebra mussels. With good visibility, a video or photomosaic would greatly assist in documenting and analyzing the dense concentration of machinery debris.

The ship's steeple compound engine was documented in as much detail as time constraints and a heavy encrustation of zebra mussels would allow. A better understanding of the *Hinton* engine's workings still requires more detailed archeological drawings and analysis, as well as additional historical research on steeple compound engines. However, the investigators were unable to locate detailed drawings of any comparable steeple compound marine steam engine with which to analyze the engine. This apparent lack of historical documentation may make the *Hinton* engine itself an important source of engineering data for the study of these engines; however, more archeological and historical research is needed.

Future field work might also include a more detailed analysis of the architectural remains, as well as locating the missing bow and forward section of the port side. A visual search of the area using diver propulsion vehicles in 1994 did not discover the missing sections, although

the remains of another small steamer (probably a tug) were found north of the site. The missing sections of the *Hinton* wreck may be located in the vicinity of the main hull (possibly buried); may have migrated a great distance due to waves and ice action; or may have washed ashore. It is probable, though not certain, that the light and buoyant cabins and decks broke apart and washed entirely ashore, making a search for these components largely futile. If found, these additional sections of wreckage may yield more complete architectural data for the vessel, as well as a better understanding of the ship's break-up and deposition in the site's shallow-water, high-energy environment.

While the *Hinton* did not have the historical prominence of a major steamer like *Niagara*, there are doubtlessly many untapped sources of historical material on the ship, and her builders, owners, captain, and crew which were outside of the scope of this study. At least one painting of the *Hinton* is known to exist, in addition to several historical photographs (Figures 4 and 5). It is possible that additional primary sources such as photographs, logbooks, diaries, or even builder's records might be found, in addition to government documents such as enrollments, admeasurements, and customs records of clearances and arrivals. These materials would all add important scope to our understanding of the *Hinton* and of steambarges engaged in the Lake Michigan lumber trade.

Management Recommendations

While the site's accessibility and shallow depth do not make a site mooring a real necessity, it would certainly be a convenience for recreationalists. It would also help warn large boats of the presence of the wreck; at least one vessel has reportedly struck the top of the *Hinton*'s boiler, unaware of its location. If the *Hinton* site is placed in a historical or recreational preserve, mooring the wreck for safety, accessibility, and to prevent boat anchor damage should be considered by preserve managers.

Like *Niagara*, the *Francis Hinton* would also benefit from increased interpretation, including waterproof site guides. Incorporating a site plan, history, site description, and safety tips, a site guide would offer an interesting, self-guided tour to diving visitors and provides a vehicle for conveying a message regarding the responsible use and preservation of underwater archeological sites.

Many non-divers are also interested in the wreck of the *Francis Hinton*. The rescue of the crew and involvement of life savers from the Two Rivers Life Saving Station make the wreck a significant part of local maritime history, and its proximity to shore makes it immediately visible and understandable to both local persons and tourists. The best focus for telling this story to the public appears to be the Rogers Street Fishing Village Museum in Two Rivers, where many of the artifacts from the site now reside. Adding underwater photographs, a poster-sized copy of the site plan, a detailed discussion of the wreck and of archeological findings, and underwater video to the current exhibit would help bring these artifacts to life and place them in their proper context, both as tools and fittings used aboard the historic ship, and as artifacts from an underwater archeological site. An exhibit guide combining a museum tour

and self-guided driving/walking tour to the scene of the wreck and the U.S. Life Saving Service (now U.S. Coast Guard) station would help provide a physical dimension to the story of the wreck for those unable to actually dive the site. Possibly, a historical marker or other exhibit could be located on shore near the site.

A final management strategy for the site is its nomination to the State Register of Historic Places maintained by the SHSW Division of Historic Preservation, and the National Register of Historic Places maintained by the National Park Service. These register listings, more than being simply honorary designations, provide an important mechanism for long-term preservation and management, as well as additional legal protection under state and federal law.

While the *Francis Hinton* is not of the same historical notoriety, architectural and engineering "pedigree," or archeological rarity as the *Niagara*, it certainly possesses a degree of archeological and historical significance. Steambarges as a class, while not rare historically (there are believed to be at least nineteen and possibly more steambarges wrecked in Wisconsin waters), are archeologically represented by only four known Wisconsin shipwrecks. Only one of these (the *Francis Hinton*) possesses both significant archeological integrity as a steambarge as well as its machinery. The other vessels include the *Granite State* (only fragments of this stranded vessel reportedly remain on the beaches at Clay Banks [Frederickson 1961:I:16-17]); the *Mueller* (the machinery was stripped out of this vessel, and it was dismantled prior to its abandonment [Aerts 1994:9]), and the *Sidney O. Neff* (this vessel is reportedly broken up and largely buried where it was abandoned off Marinette harbor [Harrington 1991:71-72; U.S. Department of Commerce 1995]).

Interestingly, three of these four known steambarges are products of Manitowoc, Wisconsin shipyards (the *Mueller* and the *Neff* were built by the Burger shipyard in 1887 and 1890, respectively). As archeological sites these three vessels, complimented by drawings of the *Neff* done by the Historic American Merchant Marine Survey in the 1930s, provide an important set of comparative data on construction of Lake Michigan steambarges by Manitowoc builders. The *Hinton* also appears to be the only known Wisconsin example of a Hanson and Scove-built vessel, although five other Hanson and Scove ships (four schooners and a tug) were reportedly wrecked or abandoned in Wisconsin waters.

While other examples of Great Lakes steambarges may be located in the future, the *Hinton*'s accessibility and well-preserved machinery make it a valuable data source to archeologists and historians, as well as a site of recreational and historical value to the local community. State and national register listing, in addition to providing formal recognition for the site's significance and making the site more visible to the community, may also be a catalyst for accomplishing better preservation, interpretation, and local stewardship for the wreck of the *Francis Hinton.*

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