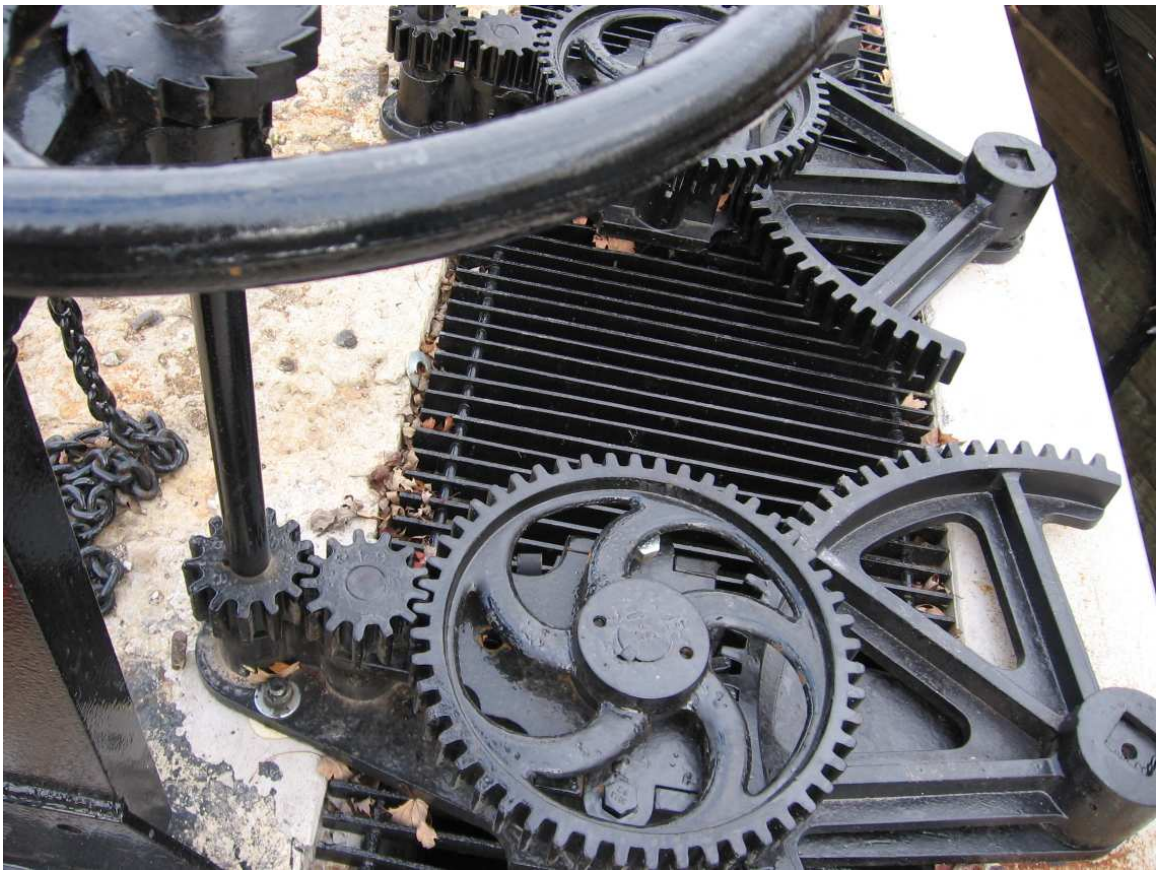
The Restoration and Rehabilitation of the Lower Fox River Navigational System

Appleton Lock 1, 2006

Report on Appleton Locks 1 through 4
April 2007
[An Excerpt]

Contents

Executive Summary



Appleton Lock 4, 2007

C.R. Meyer and Sons Company of Oshkosh restored the gears and flywheels used to open the upper valves as part of the restoration and rehabilitation of the Appleton locks. A specific methodology was developed for cleaning metal elements or replicating them as needed.

The navigational features on the Lower Fox River are artifacts from Wisconsin's earliest territorial beginnings. They are situated along a waterway that had been utilized as an important transportation and trade corridor by both Native Americans and European explorers and are significant for these cultural associations. The locks are significant, as well, for representing turn-of-the-century navigational technology in an extant and functional hand-operated system that remains fully intact. One purpose of this report is to document the historical significance of the locks on the Lower Fox River, both as a system and for its component features as represented in the four Appleton locks. This report also will serve as a record of the processes implemented in restoring the first segment of the Lower Fox Navigational under the direction of the Fox River Navigational System Authority (FRNSA).

The navigational authority was created as a state agency in 2001 to oversee the repair and reopening of the locks after the state acquired the navigational features on the Lower Fox River from the United States Army Corps of Engineers (COE) in 2004. The restoration and rehabilitation of the four historic locks in Appleton, which had not been in use since 1987, represents the first phase of a larger project. In establishing and implementing a specifically tailored methodology for the Appleton locks, procedures were developed that will provide a model for subsequent projects. This report will describe and document the specific restorative treatments utilized in rehabilitating the four Appleton locks.

An innovative arrangement was established between the navigational authority and the Wisconsin Historical Society (WHS) Division of Historic Preservation for the review of documents that described procedures intended for implementing the work. The seventeen locks along the Lower Fox River had been listed on the National Register of Historic Places (NRHP) in 1992. As listed properties, modifications being undertaken in a project involving an expenditure of federal dollars were subject to the review of the office of the State Historic Preservation Officer (SHPO). An understanding of the history of the construction of the locks in Appleton and the modifications that occurred over time was crucial to assessing the degree of architectural and historical integrity the navigational features had maintained, which in turn was important to planning for their repair and restoration.

The Appleton locks, each in essentially the same location as they remain today, were described in 1866 shortly in advance of the COE assuming control of the features in 1872. The federal government sent Major Charles Sutter to survey the canal system and make recommendations for improvement. Major Sutter reported on the two fully completed canals, two dams and four locks in the Grand Chute area; he described the first three (or upper) locks as positioned along a 3,600 foot canal bypassing the upper dam and the fourth lock on a separate 1,267 foot canal bypassing the lower dam. After assuming management of the system the COE began to make systematic repairs and rebuilt most of the locks on the Lower Fox, including those in Appleton, around the turn of the century. This “modernization” of the locks was critical to the early twentieth century development of industry in the communities along the river, especially the paper industry. But the locks ceased to serve commercial purpose in the early 1950s and their use became largely recreational. By the late 1970s COE representatives began to state publicly a desire to relinquish responsibility for the navigational aspect of the waterway if its singular function was to accommodate pleasure boating. This put both the COE and the state on the path of what became over two decades of negotiations, which eventually led to the state’s acquisition of the navigational features on the Fox River, along with the responsibilities that came with ownership.

The transfer of ownership of the seventeen locks, 94 acres of land, three harbors, and an assortment of related buildings along the Lower Fox River occurred on September 17, 2004. With the transfer the COE pledged the funds that they would have used to permanently close and fill the structures to the state for use in their restoration. In its final analysis, the COE asserted the value the Lower Fox lock system as a cultural resource and lauded its special qualities and design features. Under its stewardship the COE had maintained the historic integrity of the locks, with most retaining their turn-of-the-century stone walls and fill-and-discharge technology. In 2001, the COE reported correctly that the engineering technology of the nineteenth century was still present and visible.

The FRNSA was determined to maintain the historical integrity of the locks as part of its rehabilitation project. It planned for the restoration of the seventeen locks to occur sequentially over a multiple-year period, with the first phase of the work being the four locks in Appleton. The board decided to undertake this initial phase as a design-build project, which is distinct from a more customary design-bid process in which design documents are prepared as a separate phase of work and estimates or bids are secured from contractors. The process documented in this report is a reflection of the design-build approach instituted by the navigational authority. Without the preparation of formal design documents, a nontraditional review process was implemented that was intended to facilitate the accelerated schedule established by the FRNSA. Therefore, the essential purpose of this report is to satisfy the requirements of the state office of Historic Preservation for reviewing documentation concerning restorative work on National Register properties, in this instance without construction drawings. This report provides a compilation of information that was used in making and reviewing design decisions, leading to a sound preservation treatment approach for this first phase of the work.

Historical Overview

Plans for the development of the Fox-Wisconsin Waterway were proposed first in 1829 when the Michigan Territorial Legislature organized a company to dig a canal joining the Fox and Wisconsin Rivers at Portage; it called for roads to be constructed around the rapids of the Lower Fox River.[1] This early plan never was realized. In 1837 Michigan became a state and Wisconsin was organized as a territory. The following year Territorial Governor Henry Dodge requested that Congress approve the sale of 150,000 acres of land with proceeds going to improvements on the

[1] Rocky Mountain System Support Office, *Historic American Engineering Record (HAER) WI-83,* Denver, CO: National Park Service, 1995, 6; John N. Vogel, et al., *Lower Fox Corridor Survey,* 1992, 62. Samuel Mermin, *The Fox-Wisconsin Rivers Improvement: An Historical Study in Legal Institutions and Political Economy,* Madison, WI: Board of Regents of the University of Wisconsin, 1968, 2.

Fox and Wisconsin Rivers. His petition met with favorable response; land was made available for sale, and surveys of the Fox-Wisconsin waterway were undertaken by the federal government. Morgan L. Martin of Green Bay actively promoted the development of navigational features along the Lower Fox River west of Green Bay. In 1846, as Wisconsin's Territorial delegate to Congress, he sponsored a bill that would secure a land grant for the Fox-Wisconsin Waterway. The bill was subject to approval at the territorial convention that year and failed, but was advanced again at the 1848 convention, which was chaired by Martin, and approved. Later that year, with Wisconsin admitted to statehood, the state legislature created the Board of Public Works, which oversaw the sale of land grant lands leading to the development of navigational features on the Fox River.[2]

Three years later only one-third of the property intended to help finance the Fox-Wisconsin Waterway had been sold. Concerns with the general solvency of the project led the state to incorporate the Fox and Wisconsin Improvement Company in 1853 and charge it with completing the Fox-Wisconsin project. Work progressed under the new organizational structure. In 1856 the first boat, the steamship *Aquila*, made the passage from the Mississippi River to Green Bay arriving there on June 16, 1856. But while the system was operational, it was not fully functional. Fluctuations in water level limited the use of the canals to vessels with a draught of only two to three feet. Shortly following the passage of the *Aquila*, work began to increase the depth of the canal to a consistent four feet. Ten years later, with costs continuing to overrun revenues, the Fox and Wisconsin Improvement Company filed for bankruptcy. Within months its assets were purchased and it was reorganized as the Green Bay and Mississippi Canal Company. However, the new organization was interested in developing water power along the river more than it was in operating the navigational features. The navigational features were turned over to the federal government as authorized by an act of the United States Congress in 1870; the transfer was completed on October 28, 1872.

Nineteenth-Century Development of the Appleton Locks and Canals

Two separate canals were built to skirt the Fox River along its southern shore in Grand Chute, as Appleton was known early in its history. The rapids along this stretch of the waterway fell in elevation about four feet over a distance of approximately 1.5 miles. Specific recommendations for developing this portion of the river first were advanced in 1848 to the state Board of Public Works. In 1850, the board sought bids for the development of the two canals and four locks at Grand Chute. The contract to build the locks and canals was let to Fitch P. Talmadge, who had

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[2] *HAER,* 7, 8; John N. Vogel, et al., *Lower Fox Corridor Survey,* 1992, 70. Mermin, *The Fox-Wisconsin Rivers Improvement,* 19–28.

proposed to complete the work for $56,747. The project began in 1851, and suffered a number of delays. However, by 1856 the canal was sufficiently operational to allow the passage of some boats, including the *Aquila*; by 1859 work was considered complete.[3]

Four years after the control of the Lower Fox River was transferred to the Green Bay and Mississippi Canal Company, and in 1872 the United States government assumed control of the locks along the Lower Fox, including those in Grand Chute. Once in the care of the Army COE, another survey of the man-made features was completed and the structures in Appleton were reported as generally being in poor condition.[4] The COE initiated a systematic repair and maintenance program that remained in place for over a century. For the balance of the nineteenth century, its central component was the phased repair of all of the locks on the Lower Fox River with the long-term goal of rebuilding them using stone masonry blocks in constructing the chambers. The structures in the worst condition were given top priority. Under the COE, maintenance and reconstruction became an ongoing effort with work occurring consistently at some point along the waterway. Repairs took place through the 1870s that stabilized the earlier structures. The following decade, the COE began replacing the deteriorating facilities on the Lower Fox River with more permanent stone construction. In Appleton reconstruction began in 1884 at Lock 1, when the chambers were rebuilt using cut quarried stone and the operational components were upgraded.

Between 1884 and 1907, the COE rebuilt all four Appleton locks. After the rebuilding of Lock 1, the reconstruction of Appleton Locks 2 and 3 followed nearly twenty years later and concluded with the completion of work at Appleton Lock 4 in 1907. Cut stone chambers were put into place and the locks were provided with increasingly sophisticated mechanical equipment. While work was underway on Appleton Locks 2 and 3 in the early 1900s, improvements were made at Lock 1 consistent with those being implemented at the two other Appleton sites. The reconstruction of Lock 4, which was designed in 1906 and completed in 1907, also drew upon the improvements that had been instituted at Locks 2 and 3, but more importantly, it was the first of the four to be rebuilt using concrete and milled steel for the floors and the valves. Ongoing improvements in the durability and functionality of the operational features are apparent in the turn-of-the-century rebuilding of the Appleton locks and even more obvious when considering the seventeen locks of the Lower Fox system as a whole. Later in the mid- to late-1920s, the four Appleton locks saw

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[3] *HAER,* 14. This work did not occur in isolation; a similar project was taking place along the Illinois River, entering Lake Michigan at Chicago, also with the objective of creating a transportation corridor between the Great Lakes and the Mississippi. In fact, the Illinois and Michigan canal has an overall history that runs parallel to that of the Lower Fox, and physically the systems are similar even in their respective evolutions that were geared toward repairs and integrating new technology.

[4] *HAER,* 15.

similar upgrades when timber and iron elements were replaced throughout with concrete and steel. This was with the exception of the timber gates. Although the gates have been fully reconstructed a number of times at each site, the same method of construction and the use of salvaged or replicated metal elements results in an appearance consistent with how they looked at the turn of the century. The Appleton locks were maintained over the years, with more substantial improvements (including some gate replacement) taking place by the early 1940s and again in the early 1970s and 80s, shortly before the COE ceased operation of the locks as a precursor to it relinquishing control of the navigational system.

Transfer of the Lower Fox River Navigational System

The COE had planned to formally suspend its operation of the locks in 1982, bringing to conclusion over a century of stewardship. However Wisconsin's congressional representatives Toby Roth and Tom Petri succeeded in securing funding for the COE to continue its operation of the locks through the 1983 and 1984 seasons, which extended the COE's management of the locks two years beyond what it initially planned.[5] On May 11, 1984 Governor Tommy Thompson created the Fox River Management Commission to assume responsibility for the continued operation of the Lower Fox River locks, and from 1985 until the end of 1987, the commission operated all seventeen locks on the Lower Fox. The following summer, the commission suspended operation of fourteen of the seventeen locks, maintaining those at Menasha, Little Kaukauna, and De Pere. Operation of the four Appleton locks ended in 1987.

The following year, the COE extended a formal offer to transfer the system to the state, but the state was reluctant to assume responsibility for the care, maintenance, and operation of the locks. In August 1988, after reviewing a draft of the COE's *Disposition Report on the Fox River Project*, Governor Thompson stated his opposition to the navigational system being decommissioned by the COE and transferred to a nonfederal entity, indicating his preference that responsibility continue to rest with the COE. Meetings took place that fall and into the spring of 1989; by summer of 1989, the COE again stated its intention to proceed with either transferring or shutting down the locks. The COE offered that if a nonfederal entity assumed responsibility for a portion or all of the navigational features, money that would have been spent in placing the locks in long-term inoperable condition would be allocated to the transferee for making repairs to the system. Once the COE put forth these terms the interest of the state was piqued, but then cost analysis

[5] John Forester, former president of Friends of the Fox, unpublished historical chronology, Harlan Kiesow papers, Fox River Navigational System Authority, Kaukauna, Wisconsin.

associated with the closing down and repairing the locks became a principal point of contention between state and federal agencies involved in the negotiations.[6]

Discussions continued between the state and the COE through 1990 concerning the financial settlement the state would receive if it assumed responsibility for the locks, but by December the two parties had come to an impasse. The COE contacted local municipalities and counties to learn if they had an interest in assuming the care and control of a portion of the system. Based on the noncommittal responses from local governments, the COE suspended attempts at further communication in February 1991 and that September it issued its *Final Interim Disposition Report*. The document indicated that since terms for a transfer of the navigational features to an appropriate nonfederal entity had not occurred, the system would be placed into "long-term inoperable condition," partly in the interest of public safety.[7]

Through the early 1990s, Wisconsin's congressional representatives led initiatives to create legislation that would result in a greater monetary contribution on the part of the federal government toward maintaining and operating the locks and also sought support for the establishment of a National Heritage corridor along the Lower Fox River. While federal appropriations did not materialize, the Fox-Wisconsin River was named as one of four tourism pilot projects in Wisconsin by the National Trust for Historic Preservation. A Heritage task force was formed, with the director of the Fox Cities Visitor and Convention Bureau named as chairperson.[8]

Also, in an effort undertaken by the COE that was important to the long-term preservation of the navigational features, the seventeen locks sites on the Lower Fox River locks were nominated for inclusion on the National Register of Historic Places. In 1992 the "Water Resources of the Lower Fox River, 1850–1940," was established through a series of district and individual nominations. Appleton Locks 1 through 3 were listed as a historic district and Appleton Lock 4 was submitted as an individual nomination. Recognized as historically and archeologically significant federal properties, a preservation and rehabilitation plan as described in Section 106 of the National Historic Preservation Act (NHPA), would be required prior to the COE's disposition of the structures. Further, eligibility for inclusion on the NRHP insured that any work that took place to repair the navigational features following their transfer would be reviewed by the Division of Historic Preservation at the WHS, as is typical of eligible historic properties.

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[6] United States Army Corps of Engineers, *Disposition Report on the Fox River Project*, September 1987.
[7] Richard Dexter papers, WHS. COE, *Final Interim Disposition Report*, 1991.
[8] John Forester, unpublished chronology, Kiesow papers.

The COE issued its review draft of the *Final Disposition Report* and its draft *Environmental Impact Study* in August 1997; in these documents, the COE indicated that negotiations with the state had faltered and that permanently closing and filling the locks remained the option being advocated. The governor requested that negotiations be reopened. However, in September, the COE released its *Final Disposition Report and Environmental Impact Statement*, which maintained the recommendation that the locks be closed and filled. Thompson's appointed DNR Secretary George Meyer negotiated on behalf of the state. Meyer and COE representatives established the "Fox Locks Work Group," which completed a report in October 1997 that provided a response to the COE disposition study, offering that the principal stumbling block was the issue of financial compensation.

Over the next couple years a resolution was established that both parties found acceptable and by the summer of 2000, positive forward momentum toward state acquisition of the locks again was at hand. That September a "Memorandum of Agreement between the Department of the Army and the State of Wisconsin for the Transfer of Locks and Appurtenant Features of the Federal Fox River Project, Wisconsin" was signed by Governor Thompson, George Meyer, and Joseph Westphal, Assistant Secretary of the Army with the COE. The memorandum detailed the monetary agreement and offered additional provisions concerning the completion of studies having to do with cultural and historical resources and environmental issues. In July 2001 the *Environmental Assessment: Transfer of Locks and Appurtenant Features of the Federal Fox River Project, Wisconsin*, was issued by the COE and addressed the specifics of the pending transfer.

The official ownership transfer occurred on September 17, 2004; Governor Doyle formally accepted the Fox River Navigational System Locks from Lieutenant Colonel Donald Lauzon, district engineer for the COE, at a meeting of the State Building Commission in Appleton. According to a statement issued by the governor's office, Doyle said, "Today's transfer ensures that the locks will be an important part of Wisconsin's economic future. . . . Instead of having the federal government spend twelve million dollars to shut down the locks, under this agreement, we'll invest that twelve million dollars into the future of the locks. A rehabilitated system of locks will offer the opportunities for navigation and recreation necessary to attract tourism and spur riverfront renewal." According to the terms of the September 2000 Memorandum of Agreement the transaction secured for the state an $11.8 million lump-sum payment from the COE for the rehabilitation and restoration of the locks and the pledge of an additional $5.5 million, subject to funds appropriated by Congress, to match state and locally raised funds. Senator Herb Kohl and

Congressmen Tom Petri attended the event and Governor Doyle thanked them for their efforts in the transfer of the locks to the State of Wisconsin.

Preservation Plan

When the COE began to discuss the possibility of relinquishing control of the navigational features on the Lower Fox River, it was apparent that this change would be subject to federal regulations, specifically Section 106 of the NHPA. Section 106 is put into effect when an action is planned that impacts a federal property listed or eligible for listing on the National NRHP. Regulations stipulate that the federal agency consult with appropriate state and local officials and members of the public when undertaking actions that affect federally-owned historic properties. When such a situation exists, the federal agency (here the COE), the State Historic Preservation Officer (SHPO), and other parties consult in an effort to resolve adverse effects to the mutual satisfaction of the consulting parties.

Although the historical significance of the locks and their sites had not yet been fully assessed when the COE first began to talk of transferring them, it was widely accepted that the structures were important cultural artifacts and their preservation was a broadly upheld objective. In complying with Section 106 requirements to identify and evaluate the historical significance of the Lower Fox River Locks, the COE completed a number of cultural resource investigations, which aided in determining the eligibility of the locks for listing on the NRHP. Given the COE's diligence in complying with Section 106 regulations and its nomination of the properties to the NRHP, its recommendation concerning filling the locks if an appropriate agency could not be found to assume ownership is somewhat surprising. Clearly such a modification would have resulted in an "adverse effect" and would "diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association."[9] Negotiations continued to find alternatives to the COE's preferred option through the 1990s. State leaders and local planning agencies created and sustained a momentum that brought together area communities with the objective of preserving the qualities that are irreplaceable about the structures. The preservation plan in place today finds its origins in these actions.

Once involved in the process of repairing the locks using a federal contribution, pursuant to Section 106 requirements the SHPO reviewed plans related to the FRNSA's effort to restore and rehabilitate the locks, calling attention to potential "adverse effects" that could result from the proposed work. Also, as part of the state legislation that created the FRNSA, the SHPO or a

[9] National Historic Preservation Act, Section 106, regulation 800.5(a)(1).

designated representative was assigned a seat on its board, facilitating the WHS' participation in policymaking relative to planning and implementing the restoration of the locks. National Park Service regulations provided terminology that expressed general preservation goals concerning the repair of the structures. After documentation of the history and condition of each lock was assembled, the Appleton locks were photographed and assessed so that their historic and architectural integrity could be determined. Another step in developing a preservation strategy and creating a framework for making decisions about the rehabilitation of the locks was to establish the "period of significance" for the Lower Fox system.[10]

The designated period of significance for the Appleton Locks 1 through 3 is 1884 to 1941; for Appleton Lock 4, it is 1907 to 1941. These spans represent the times during which the navigational features were rebuilt and maintained by the COE. Between 1884 and 1907, each of the earlier mid-nineteenth century Appleton locks was reconstructed with cut-masonry chambers and improved mechanical equipment; thirty years later, improvements, including replacement of original wood floors with steel and concrete, were made at each of the Appleton sites. Analysis of the context and the circumstances surrounding construction, maintenance, and existing conditions at each lock site helps determine the authenticity of the significant features at each location, which provides an understanding of the historical integrity of the locks and lock system. Certain features of the locks are considered to be character-defining and are critical within the context of the preservation plan. Character-defining features, in this case, were understood to be those elements that are essential to the function of the locks; special interest was given elements put into place at the turn of the century or in modifications that occurred prior to 1941.

A good deal of historic fabric remains from the period of significance, and what is not original has been faithfully replicated in the repair and maintenance of the structures over the past hundred years. With the overall integrity of the structures ranking high, the period of restoration was established as 1884 to 1941, consistent with the period of significance. Although parts and pieces of the locks had been replaced over time, the mechanical nature of the structures required that elements be replaced "in-kind." With the period of restoration determined, the structures were subject to the application of the Secretary of the Interior Standards for the Treatment of Historic Properties. The standards differentiate between four approaches to preservation, using a terminology that is general enough to apply to most building types. The four treatment approaches are "preservation," "rehabilitation," "restoration," and "reconstruction." Based on an analysis of the NPS criteria in consideration of existing conditions at the locks, *rehabilitation* was

[10] The National Park Service "Checklist for Rehabilitating Historic Buildings" was used as a guide in structuring the evaluation process. See "Checklist for Rehabilitating Historic Buildings, National Park Service," http://www.cr.nps.gov/hps/tps/checklist.htm.

identified as the preferred treatment for the sites in general, with the *restoration* of elements as required. Since there is no intent to modify the function or use of the locks, replacement in-kind of elements too deteriorated to restore contributes to the goal of restoration. In the case of some of the nonintrinsic elements on the sites, *reconstruction* was determined to be the appropriate approach.

The application of Section 106 regulations contributed to the high degree of planning that led to the historically sensitive restoration and rehabilitation of the four Appleton locks. In undertaking this first phase of the larger project, a preservation philosophy was established for refurbishing the historic elements that characterize the locks and their sites. As it was determined that features of a type could be treated similarly from site to site, these general findings should apply as the project continues to the other locks sites along the Lower Fox River.

Preservation Approach

After determining that the four Appleton locks would constitute its first discrete project, the FRNSA initiated a competitive bid process for their restoration. The scope of work was informed by a pair of studies on the Lower Fox navigational system that had been completed by the Madison-based engineering firm Mead & Hunt. Its first report was completed in August 1995 for the Oshkosh Chamber of Commerce. Following the transfer of the locks in December 2004 the FRNSA received a follow-up study describing changes observed at the seventeen lock sites since the earlier documentation. The 1995 report was intended to begin the process of rehabilitation by identifying ways to preserve the system both lock-by-lock and on a system-wide basis. The *Fox River Locks Rehabilitation Study* assigned costs, prioritized the efforts, and provided a preliminary budget for the on-going maintenance of the locks.[11] Based on a second inspection of the seventeen locks between De Pere and Menasha, a technical memorandum was issued by the firm on December 30, 2004.[12] Mead & Hunt found that the structures had not deteriorated significantly in the nine years between each evaluation. When the FRNSA solicited bids in response to its request for proposals (RFP), prospective contractors were expected to have assimilated Mead & Hunt's condition assessment and recommendations in their bid documents.

The FRNSA hired Oshkosh-based contractor C. R. Meyer and Sons Company to undertake the restoration of the Appleton locks based upon an approach to the work itemized in its proposal

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[11] Mead & Hunt, *Fox River Locks Rehabilitation Study,* Prepared for the Oshkosh Chamber of Commerce, August 1995.
[12] Mead & Hunt, *Fox River Locks Rehabilitation Study Update: Technical Memorandum and Supporting Documentation,* Prepared for Fox River Navigational System Authority, December 2004.

dated November 22, 2005. In its bid, C. R. Meyer advocated a methodology that would "open the locks" and make the repairs necessary for their safe and efficient operation. The proposal document draws upon the Mead & Hunt reports and its own evaluation of the sites for an assessment of conditions. Once under contract C. R. Meyer's approach to project design integrated practical engineering and construction considerations with visual objectives suggested by historical documentation. At the request of the FRNSA, C. R. Meyer secured the services of historic preservation consultant, Cornerstone Preservation of Cross Plains, Wisconsin, to work as a liaison between the contractor and the WHS to establish and expedite a nontraditional and streamlined review process. In the earliest stages of submitting statements concerning proposed treatments for the review of WHS staff, priority was given to the responsiveness to budgetary concerns and the identification of areas in which a preservation-sensitive approach might affect. With work beginning at Appleton Lock 1, that site became the model for implementing approaches to the restoration and replication of features that were considered "character-defining."

Since historically each lock had been developed and maintained independently of the others, analysis was extended to each site discretely. However, although each lock was constructed and maintained independently, the four Appleton locks share more traits in common than not. They clearly are components of a type that exist as elements within a larger system. Early in the process, it became clear that an approach to preserving a specific feature at one lock site could be carried over for application at the other sites. Historic research supported the straightforward approach to the restoration and rehabilitation of the locks proposed by C. R. Meyer as being consistent with the precedent of the COE for maintaining these utilitarian structures. Historically, what could be repaired was repaired and those elements that had deteriorated to the point of no longer being viable were replaced in-kind. Since the design of the locks represents an instance in which "form follows function," the principal concern was mechanical functionality. From the time the locks were built, their maintenance required that new elements be integrated periodically. When this occurred, there could be little deviation from the existing components because the pieces and parts were required to work together. The locks had retained a great deal of integrity as the result of this approach, and C. R. Meyer undertook a methodology that resembled the approach to the repair and maintenance of the structures that had been used for over a century by the COE.

The locks of the Fox River navigational system consist of three principal elements: the masonry chamber, the wooden gates, and the mechanical apparatus that facilitates the movement of the gates and the filling and emptying of the chambers with water. The cut stone chambers are the

most essential and monumental elements associated with these structures. A statement of proposed treatment was presented for review by the WHS for the following features: masonry walls, poured concrete elements, timber gates and hardware, gate maneuvering machinery, valve operating machinery (for both upper and lower sections), the lock keeper's shacks, chamber and gate railings, and electrical components, most specifically chamber lighting. In considering these features in terms of materials requiring repair or replacement, procedures were established for (1) repairing and replacing concrete; (2) cleaning and repairing masonry; (3) rebuilding the wooden gates; (4) cleaning and refurbishing metal components; (5) reconstructing the shacks; (6) retaining existing railings; and (7) reconstructing and replacing light fixtures. For each aspect of the work the WHS preservation staff approved a proposed treatment plan after having evaluated intended techniques to ensure that NHPA requirements for mitigating adverse effects were satisfied.

Since Appleton Lock 1 served as the prototype, the specifics of the treatment plan were worked out in greater detail at Lock 1 and were more thoroughly documented than at the other Appleton sites. At Appleton Lock sites 2 through 4 essentially the same treatment that had been reviewed, approved, and implemented at Lock 1 was used with variation in degree based upon the specific conditions found in each location, which determined the need for repair and replacement of elements. With the historic construction of the locks and their subsequent repairs and modifications having been fairly consistent from site to site, common character-defining elements were identified throughout the project area that required implementation of similar treatment approaches.

Project Documentation

As an appendix to this report, photographic documentation from the spring of 2006 has been provided that illustrates existing conditions at each of the Appleton sites prior to the start of construction. This is supplemented with historical photographs of each site. The documentation that took place while construction processes were being implemented is more exhaustive for the Lock 1 site than the other three locations, although images are included representing construction underway at Lock sites 2 through 4. In some instances during the review process, site visits took place and documentation was prepared concerning the effectiveness of a selected treatment approach. This either was to verify that the preservation plans were being implemented appropriately or to establish ways to improve the implementation process. These images are included, as well.