CHAPTER 11
SITE SUMMARY

Overview

The Cubbage Mill Site (7S-C-61) was identified in 1977 during the replacement of Bridge 3-936 over Cedar Creek in Sussex County, Delaware. Phase I and II investigations at Site 7S-C-61 sought to define the context and content of the site through the exposure and analysis of the mill remains and associated components. Because of the significance of the finds and the fact that the site could not be avoided, Phase III archaeological data recovery investigations were completed prior to bridge construction. These investigations focused largely upon the identification of functional and structural elements that would further an understanding of mill construction and operation, centered on the mill's waterpower system.

Archeological investigations made an important contribution toward our understanding of mills in the region due, in part, to the number and well-preserved condition of many of the site's structural remains. Moreover, this study was successful in uncovering information concerning mill construction technology and providing insights into the development and changes of the mill's waterpower system.

Using the *Management Plan for Delaware's Historical Archaeological Resources* (DeCunzo and Catts 1990) as a guide, four general research domains or themes were identified regarding gristmill sites in Delaware. These included: 1) issues related to the natural environment of a water-powered gristmill; 2) the evolution of technology and construction within the broader context of gristmill operations; 3) the economics of the gristmill; and 4) the investigation of the gristmill as a property type. In general, these issues were addressed with data obtained from a combination of archaeology, geomorphology, and documentary research.

Methods

Investigations included archaeological fieldwork and analysis, documentary research, geomorphology field study, dendrochronology, informant interviews, and comparisons with other Delaware mill sites and structures. The general excavation strategy employed hand excavation and limited hand stripping, and the use of mechanical equipment to remove disturbed soils and debris covering intact archeological remains. Use of mechanical equipment, supervised by an archaeologist, permitted the efficient removal of large volumes of earth in a short time span.

Archaeological excavations included systematic and judgmental shovel test pits, test units, collection units, and machine trenches, along with the recovery of geomorphologic data. Additional information was acquired through the analysis of soil stratigraphy, recordation of architectural construction details, artifact analysis, evaluation of site setting, and dating of structural beams by dendrochronological methods.

Results

Archeological fieldwork identified the mill complex, including a brick foundation, east addition (brick piers), and portions of a log foundation. The mill foundation and addition contained intact sections of a concrete floor, (earlier) brick floor, and machine mounts, fasteners, and supports, the latter ostensibly for anchoring mill machinery and equipment. This hardware served to reduce vibrations to the machinery that would have otherwise damaged mill components and equipment. Like so many historic mills, archeologists determined that the structure had burned, in whole or in part, on at least two occasions.

Appended along the south side of the mill's brick foundation were the archaeological remains of a waterpower system including a concrete culvert superimposing four wooden penstocks, two (concrete) turbine pads, one wheel pit and a (wood) turbine chamber/wheel pit, two wing walls, and a tailrace. Dendrochronology results provide dates of 1881, 1824, 1824, and 1703 for groups of timbers (upper to lower) representing four construction episodes related to the penstocks and turbine/wheel pits. As evidenced by numerous, unused notches and mortises and the 1824 date for two separate construction episodes, the Cubbage Mill penstocks and wheel pit were undoubtedly cobbled together with structural elements derived from earlier structures.

These remnants of the waterpower system revealed changes in the construction and technology of the mill over time. One of the few undershot waterwheels in operation in this area during the early 19th century, it is not surprising that historic documents suggest that the waterwheel system was discontinued at Cubbage Mill and replaced with a turbine in the mid-19th century as was surely the case at most other mills in the region. Unlike the more efficient turbine which represented an advance in power generating technology, it seems clear that the (waterwheel) pit represents a short-lived technology associated with the mill's early log structure.

Archeologists observed numerous wooden stakes underpinning the foundation, which confirmed the tenuous nature of construction on saturated soils. Clearly, maintenance efforts to stabilize the foundation were an ongoing task throughout the history of the mill. Excavations also uncovered several different stratigraphic sequences within the mill foundation and waterpower system providing a sequence of construction identified through documentary research and dendrochronology. As a result of the study, investigation of Cubbage Mill provided insights into problems millers faced from natural events such as floods, fires, and foundations built on unstable soils.

Analyses

Archeological investigations at Cubbage Mill provide an important contribution to Delaware's industrial heritage. Few archeological excavations of water-powered mill sites (of any type) recovered remains as well preserved as those at Cubbage Mill. Two such excavations include the East Creek Sawmill Site (28Cm20) in Cape May County, New Jersey, and the Gallatin Sawmill and Dam Site (36Fa428) (Frye et al. 1995) in Fayette County, Pennsylvania.

Despite the abundance of construction remains at the East Creek Mill Site, Morin (1991: 93) summarized the results of the archeological investigations as follows:

> The historical research provided most, if not all, of the information concerning the site's chronology, siting criteria, structural and technological changes, and operation. Archeological data provided new information concerning structural changes to the mill; however, these changes could only be dated grossly and could not be related to documented environmental or social/economic variables that might have caused these changes. The results of this study, and the review of other archeological investigations of mills in the region, forced us to question the ability of archeological research to provide important information on changing mill technology, and the roles mills played in the social and economic fabric of the areas they served. This does not mean that archeological studies of mills should not be done, but that different research issues relating to mills need to be explored.

Excavations at the Gallatin Sawmill and Dam addressed different research questions, including site chronology, construction and technology, evidence of catastrophic events, site environmental location issues, and economics (Frye et al. 1995: 6-7). Like Cubbage Mill, investigations at the Gallatin Sawmill site also included a geomorphology study, dendrochronology analysis, and thorough background research to compliment archeological field and laboratory work. As a result, data recovered from excavations, combined with information retrieved during background research and analyses, provided sufficient information to answer a series of research questions (Frye et al 1995: 89).

Technology issues at the Gallatin Sawmill site related to identifying overall site layout, determining the basic components, evaluating how these components were constructed and their function within the mill complex, and identifying evidence of technological innovations or modifications. Excavation results from Cubbage Mill were capable of addressing only general types of technology-related questions.

Research questions relating to the economics of the Gallatin Sawmill relied almost solely on background research, although archeological and geomorphological investigations uncovered problems that highlighted expensive repairs due to the mill's location and natural hazards, similar to findings at Cubbage Mill. For all of these mill sites, background research provided the most detailed information on site economics.

Historical research places each of these three sites within its broader social context for the region. For Cubbage Mill, the discussion included an overview of the shift from an agrarian to a more industrial and urbanized society as well as the exploration of the local customer

base and competing mills in the region. Rather than question the ability of archeological investigations to provide information on the roles mills played in the social and economic fabric of the areas they served (Morin 1991: 93), one must note that this information compliments archeological results and provides a more complete picture of the mill than that available from a single source alone.

This study also illustrates the importance of placing a gristmill/sawmill site within its proper context and environmental setting. According to Burrow and Liebeknecht (2000: 9-3), it is "impractical and undesirable" to "study a single mill" within a stream basin that had "a thoroughly managed watercourse." While this study provided some insights into the benefits and drawbacks of mill seat locations, interpretations of Cubbage Mill lacked sufficient comparative data from Sussex County and the Delaware Coastal Plain. More work is needed to understand the complexity of the mill system in Delaware's waterways and landscape.

Recommendations for Future Research

Productive research goals for future excavations might include the development of the milldam as a property type, evaluating the models of adaptive re-use of construction materials, wood usage over time, and the ways millers overcame problems associated with flooding and building subsidence issues.

Milldam/Bridge as a Property Type

GAI is recommending the addition of the mill dam/bridge as a distinct property type to the existing state historical archeological plan (DeCunzo and Catts 1990). In 18th and 19th century Delaware, milldams served as local thoroughfares (Heite 1991). A state law required the county to build and maintain bridges over mill spillways crossed by public roads. Heite (1991:35) lists 11-milldam/bridge structures in his study conducted for Wagamon's Pond Dam. He argues that while mill dam/bridge structures were common, they were intended to be part of a power system and "it is illogical to consider one without the other."

The mill dam/bridge is defined as a road crossing (bridge) over a dam that creates an artificial pond for supplying water to a mill. The addition of this property type to the state plan is important, in part, because: 1) it represents a predominant industry of great significance to local communities throughout the state; 2) this thoroughfare was maintained by the county thereby representing a public facility; and 3) a high potential exists for the discovery of similar archeological sites in similar settings.

Importantly, the Cubbage Mill project demonstrates that despite assumed disturbances related to the development and maintenance of a modern road and right-of-way, intact, well-preserved archeological remains survive in these contexts. In fact, as discovered at Cubbage Pond, the modern road and culvert overlying the site were important factors in the preservation of the mill's waterpower system. As a result, it is essential that, prior to any bridge replacement projects in the vicinity of existing or former millponds, thorough background research be conducted beginning with, but not limited to, a review of historic maps and available secondary sources followed by a site reconnaissance.

Adaptive Re-use of Construction Materials

Cubbage Mill is a testimony to adaptive reuse of building materials during the late 18th century and 19th century. Morin et al. (1988: V-35) observed re-used and out-of-place mortised timbers during the excavation of the East Creek Sawmill (1782 – ca. 1913) in Cape May, New Jersey. At that site, mill builders recycled old structural elements to satisfy big-timber needs in the face of deforestation. This study concluded that notwithstanding the loss of large trees in the 19th century, scavenging represented an economical means for gathering the materials required for construction (Morin et al. 1988). This pattern of recycling wood members should be considered the model for similar mill sites.

Industrial sites, especially mills, contain architectural remains that, in general, do not lend themselves to precise methods of dating. Dendrochronology provides a more precise dating method for structural members of the mill, including the penstock and wheel pit. When combined with documentary research and informant data, this proved to be an effective approach to establishing a detailed site chronology.

Notwithstanding positive dendrochronology results, dates were limited to structural courses or groups of wood members. Given that many of the beams were recycled, it would also have been useful to have individual dates for various beams. In addition, Atlantic white cedar beams were used almost exclusively for Penstock No. 3 and its associated wheel pit (circa 1800-1802 reconstruction), which was assigned a collective date of 1703. Since Atlantic white cedar is found in marshes and may not be subject to the same sequence of dry and wet cycles as trees found in non-wetland environments, it is recommended that future dendrochronology studies include information on individual wood dates and a discussion of the viability of dates obtained from wetland species.

Wood Usage over Time

At the Cubbage Mill site, the type of wood species and the age of the trees (when felled) indicated a shift in wood use through time. The 18th century construction (to circa 1802) used Atlantic white cedar from virgin forests (trees generally over 125 years old). This was followed by (circa 1824) use of white oak (hardwood) from virgin forests (trees generally over 160 years old). Later construction at the mill site (circa 1880) relied upon a mix of secondary growth trees (trees were generally less than 75 years old) of Tulip poplar, American chestnut, red oak and white oak species. While there are insufficient data on wood species and regional chronologies to determine whether the pattern observed at Cubbage Mill reflects the availability of wood species or individual preference, clearly, Atlantic white cedar was selected for its reputation as a solid, rot-resistant hardwood.

Flooding and Building Subsidence

Despite rechanneling the stream, and other measures taken by mill owners and operators, geomorphology and archeology studies indicate significant flood damage to Cubbage Mill. Archeological investigations uncovered extensive flood deposits within both the brick mill foundation and the east mill foundation. Moreover, archeologists observed numerous wooden stakes underpinning the foundation, which confirmed the tenuous nature of construction on saturated soils. The use of vertical cribbing was documented along the

western and southern walls of the foundation and parts of the penstock and wheel pit in an effort to further stabilize the structure. The use of wood piers, wood sills, and brick nogging in various areas of the site demonstrated the importance and frequency of maintenance activities.

Conclusion

In conclusion, the Cubbage Mill site provided important information regarding the origin and evolution of the mill's waterpower system and the accompanying physical alterations to its structural system (penstock and wheel pit). Similar technological modifications occurred at many other mills across the country. While these changes would not be visible at most sites, Cubbage Mill's remarkable preservation allows us to identify and interpret construction changes that accompanied technological advances in the power system. The site also revealed evidence of construction technologies used to compensate for difficulties associated with the site setting.

Investigations at Cubbage Mill also contributed to our understanding of the past lifeways of a miller. This included selection and development of a mill seat, individual responses to fire and flood hazards and building subsidence, obtaining an adequate water supply, and providing suitable access to the mill.

The research design provided a context for water-powered gristmills and identified a series of research questions regarding site location, economics, construction, and manufacturing technology that could be addressed at similar sites. It is recommended that a research synthesis and context be prepared for Delaware mills detailing a variety of issues that could be addressed with archeological and historical data. A regional study that places water-powered grist (and saw) mills in the context of their location, economics, and community (behavior and social interaction) would benefit future archeological studies.

Cubbage Mill has reoriented our thinking regarding the archeological potential of future bridge replacement projects, providing a baseline to evaluate the National Register significance of archeological remains encountered at other mill sites. Excellent preservation at Cubbage Mill, along with a wealth of documentary research, provides a working model of a gristmill property type in the Coastal Plain of Sussex County. Future archeological research could test different aspects of this model to expand our understanding of this diminishing aspect of Delaware's important industrial heritage.