

## **6.0 CONCLUSIONS AND RECOMMENDATIONS**

### **6.1 CONCLUSIONS**

#### **6.1.1 Archaeology**

Archival research revealed that several historical structures were once present within or immediately adjacent to the project area. These consisted of domestic structures south of the current SR5/S319 intersection, and at the SR319/Lavinia Street and S319/SR5 intersections; and one mill on each bank of Diamond Pond north of S319. While no remains of any of these structures were found during the Phase I archaeological survey, evidence was provided by landowners, and confirmed by archaeological field personnel, of the remains of the nineteenth-century sawmill submerged in the stream bed at the east end of the mill dam, north of Bridge 3-806.

The Phase I archaeological survey resulted in the identification of five historical sites, all with boundaries extending outside the LOC. Three sites occur near the SR5/S319 intersection, the Plum Site (7S-C-88/CRS#S-10025), Driveway Site (7S-C-86/CRS#S-10023), and Chamber Pot Site (7S-C-87/CRS#S-10024). Artifact deposition occurred during the nineteenth century at the Plum and Driveway sites, and the early twentieth century at the Chamber Pot site. No artifacts were recovered below the stratum containing plow scars/tire ruts at the Plum Site, and no features were recorded. One of the two test units excavated at the Driveway Site (TU B-2) contained two subsurface features, both posts. The proximity of the features to a disused driveway suggests that they were road signs or mailbox posts. The core of the Chamber Pot site consists of two surface trash middens; testing in the area failed to identify either cultural features or undisturbed artifact concentrations.

The Shell Button Site (7S-C-89/CRS#S-10026) was characterized by the presence of oyster shell button wasters, reflecting an important regional cottage industry of the later nineteenth century. Since the surface concentration of artifacts was observed well beyond the LOC, subsurface testing was not conducted. The site is believed to constitute secondary refuse. The Two Hills Site consisted of a light scattering of historical artifacts observed to extend outside the LOC. Archival research indicates this area to have once been part of the G.B. Waples estate identified on the 1868 Beers map. The earlier artifacts likely represent field scatter associated with the Waples occupation.

#### **6.1.2 Architecture**

Archival research and reconnaissance level survey prepared in advance of the architectural survey identified three (3) historical buildings and two (2) bridges to be evaluated. Determination of Eligibility Forms are presented in Appendix D.

14559 Sand Hill Road, constructed ca. 1944, is a typical example of a vernacular house constructed in Delaware during the post World War II era. The house was constructed during a period of increased suburbanization in Delaware. 14559 Sand Hill Road is not associated with events that have made a significant contribution to the broad patterns of

history (Criterion A) and the resource is not known to be associated with the lives of significant persons (Criterion B). The design of the house is a typical example of a vernacular building and the resource does not represent the work of a master or possess high artistic values. The house does not portray distinctive characteristics of a type or method of construction (Criterion C). 14559 Sand Hill Road is recommended as not eligible for listing on the NRHP.

14102 Sand Hill Road, constructed ca. 1937, is a typical example of a bungalow constructed in the rural area of Sussex County, Delaware. 14102 Sand Hill Road is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A) and the resource is not known to be associated with the lives of significant persons (Criterion B). The design of the house is a typical example of a bungalow and the resource does not represent the work of a master or possess high artistic values. The house lacks individual distinction and significance. The house does not portray distinctive characteristics of a type or method of construction (Criterion C). 14102 Sand Hill Road is recommended as not eligible for listing on the NRHP.

The Draper/Bonk House, constructed in 1939, is an excellent example of a Colonial Revival-style house constructed with clinker brick. The Draper/Bonk House is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A). The Draper/Bonk House is associated with the Draper family, a locally significant family whose relationship to Milton includes the ownership of the Draper Cannery. As stated in the *Historic Context Master Reference and Summary of the Delaware Comprehensive Historic Preservation Plan*, one of the major cultural trends in the Lower Peninsula area are the influences of Major Families, Individuals, and Events. The Draper family and the Draper/Bonk House are representative of this trend and the house is an example of this property type (Criterion B). The Draper/Bonk House is a fine example of the Colonial Revival style and is further enhanced by its clinker brick cladding (Criterion C). The Draper/Bonk House is recommended as eligible for listing on the NRHP because it is locally significant for its association with the Draper family (Criterion B) and under the area of architecture (Criterion C).

The Reynolds Mill Pond Bridge, constructed ca. 1925, is a typical example of a reinforced concrete box culvert constructed in Delaware during the first half of the twentieth century. The bridge was constructed during a period of extensive upgrading of Delaware's infrastructure, but it is unknown if the Sussex County government agency or another agency was responsible for its construction. Reinforced concrete box culverts were an economical and practical construction type for spans less than 15' from around 1910 and the Reynolds Mill Pond Bridge is a modest example of this type. The Reynolds Mill Pond Bridge is not associated with events that have made a significant contribution to the broad patterns of history (Criterion A) and the resource is not known to be associated with the lives of significant persons (Criterion B). The original design of the bridge combined the needs for vehicular traffic and water control requirements for the area and the associated mills to the east. The Reynolds Mill Pond Bridge is a modest and typical example of the reinforced concrete box culvert. According to DelDOT records and historical maps, a sawmill and grist mill and a dwelling existed on the east side of SR30 at Reynolds Pond until circa 1970 when they were demolished. DelDOT photographs taken pre-1972 detail the mill building on the

east side of the road and the concrete parapet wall and split rail fence at the west side. Details of the parapet wall at the east side of the road are indistinguishable in the historical photograph. After the demolition of the mill, split rail fencing was installed and was replaced by a metal guardrail in 1972. In 1981, due to collision damage, DelDOT had to repair the west side parapet wall. In 1996, DelDOT repaired the apron, walls, and patched spalls in the culvert. The resource does not represent the work of a master or possess high artistic values, and its extensive alterations obscure its embodiment of the distinctive characteristics of a type or method of construction (Criterion C). The Reynolds Mill Pond Bridge is recommended as not eligible for listing on the NRHP.

Bridge 3-806, constructed ca. 1917, was an example of a reinforced concrete box culvert with an unusual parapet wall design. Textual documentation and physical evidence suggests that the bridge was constructed around the same time as Bridge 3-808 and its associated penstock bridge at Wagamon's Pond in Milton, Delaware (HAER 1991:2). Reinforced concrete box culverts were an economical and practical construction type for spans less than 15' since the 1910s and Bridge 3-806 was an early and isolated example of this type. Bridge 3-806 was not associated with events that have made a significant contribution to the broad patterns of history (Criterion A) and the resource was not known to be associated with the lives of significant persons (Criterion B). The original design of the bridge combined the needs for vehicular traffic and water control requirements for the area. The mills historically located along Sand Hill Road off of Diamond Pond were no longer extant at the time of Bridge 3-806's construction. Diamond Pond was historically part of the same power system as Wagamon's Pond to the north. Although the resource did not represent the work of a master, its use of multiple arches in the parapet walls was a unique design feature for reinforced concrete box culverts in Delaware (Criterion C). Historical bridge inventories conducted for the Delaware Department of Transportation identified three examples of this design feature throughout the entire state. The two other examples, Bridge 3-808 and its associated penstock bridge are no longer extant. Bridge 3-806 was recommended as eligible for listing on the NRHP under the area of architecture (Criterion C).

DelDOT has completed mitigation measures needed for widening Bridge 3-806 in compliance with Section 106 of the NHPA and DESHPO guidelines. Historic American Engineering Record (HAER) recordation was conducted prior to reconstruction of the bridge. The HAER document was executed in accordance with the DESHPOs *Guidelines for Documentation of Historic Properties as Mitigation of an Adverse Effect under Section 106 of the NHPA*. The methodology for this report required a written document, following HABS/HAER format; 35-mm black-and-white photographs; and measured drawings of the bridge. As part of the final HAER recordation, monitoring was conducted during the deck removal to ascertain if the bridge contained any unique features that could be only discernable with the removal of the deck. No hidden architectural features of note were discovered once the deck was removed, and the HAER documentation was finalized accordingly.

The methodology for the mitigation was accepted by the DESHPO in an email sent from Gwen Davis (DESHPO) to Simone Moffett (Parsons) dated July 3, 2003. Parsons completed the HAER documentation for Bridge 3-806 and submitted the draft report to DelDOT in

September 2004. The final report was submitted in February 2005. A copy of the final narrative report can be found in Appendix F.

### **6.1.3 Diamond Pond Mill Excavations**

Like many ponds across the state of Delaware, Diamond Pond, outside of the town of Milton, is artificial. It is a reservoir, constructed in the nineteenth century as a mill pond. Mills were located at either end of the earthen dam that created the pond, harnessing the energy of the stored water. Information provided by landowners led to the identification of the remains the mill in the stream bed north of the bridge. The Scope of Work called for documentation of the remains following installation of a cofferdam around the construction area.

During the nineteenth century, a miller's house, bark mill, and sawmill stood on the north side of present-day S319 and Diamond Pond. This area became known as the Upper Mills (as opposed to the Lower Mills, located in Milton itself). The sawmill was built by 1815 and the bark mill was added between 1822 and 1828 on the opposite side of the stream. The complex was owned by a succession of individuals throughout the nineteenth century. While the bark mill operated until ca. 1845, the sawmill was standing and probably still operating in the 1890s. The sawmill was no longer on the tax rolls in 1904, and neither mill appears on a map dated 1914.

As part of the construction activities, the flow of the stream was diverted around the existing dam, a coffer dam was put in place, and water was pumped out of the stream bed in order to provide a dry environment within which the construction crew could remove portions of the old bridge and renovate the structure. Time had been written into the construction schedule for the archaeological investigation to take place once the coffer dam was in place. Structural timbers that had survived from the sawmill were revealed in the stream bed. The structural elements of the mill were extensively documented, and a small track-hoe was used within the coffer dam to help remove the heavy mill timbers and to remove a sample of posts and sheet pilings.

While some of the timbers appeared to have been slightly displaced, most were found at or near their original points of articulation with other timbers in the structure. The structure had been built with hand-fashioned mortise and tenon joints securing the main elements. The tenons bore peg holes indicating that wooden pegs, or trunnels, had been used to secure the mortise and tenon joints. The main timbers were supported on 4-by-4 inch posts driven 3-6 feet into the stiff clay subsoil. Wooden planking, or sheet plies, had been used, mostly on the upstream faces of the timbers, to guard against undercutting by the stream current.

Samples were taken from numerous elements of the structure for wood species analysis. The wood used in the mill consisted of white oak, red oak, and yellow pine—all species that would have been available regionally on the Delaware Coastal Plain. All of the large cross timbers were made of white oak, known for its strength and resistance to decomposition owing to the presence of tyloses—frothy growths in the pores of the heartwood that make the wood impervious to water if properly dried after harvesting. The two side timbers consisted of red oak, which has many of the same qualities as white oak, but is not as resistant to rot due to the absence of tyloses. All of the sheet piles consisted of yellow pine, while the

underlying posts represented all three species. Why white oak was used for most of the structure while the side elements consisted of red oak is not clear—the red oak timbers may represent replacement pieces from a repair episode; they may be evidence of cost considerations; or they may simply be an indication of the use material that was available at the time of construction.

Dendrochronology holds some promise for supplying information about construction and renovation sequences. Preliminary testing indicated that a method known as key-year dendrochronology may be feasible with the samples from the site. This dating method uses computerized analysis of relative growth patterns among trees represented in the timbers from a given site (Heikkinen and Egan 2000). Analysis of the timbers from the Diamond Pond site suggested that an adequate number of pieces with the appropriate growth features are present in the sample to allow dating using the key-year procedure (Hugh Beard 2005, pers. comm.).

Exactly which portion of the original structure at Diamond Pond is represented by the surviving timbers is unclear. There was no evidence of mill-related features between the surviving timbers and the present bridge; however, additional timbers were visible in the stream bed a short distance downstream, and outside the cofferdam. It is possible that the present bridge follows a somewhat different alignment from the original mill dam, which may have been closer to the remains identified in the streambed. If so, the structure may have been the foundation of a penstock that guided water from the dam to the wheel. Were this the case, the timbers visible further downstream could have been the foundation for the wheel well, or the rest of the sawmill. An alternative interpretation is that the mill was a tall and relatively narrow structure, approximately 20 feet wide and at least 30 feet in length, with a penstock and waterwheel (or turbine) on a lower level and saw machinery above.

The context of the mill in the wider landscape was investigated to address questions about the choices behind mill location. Analysis of data from Beer's 1868 Atlas of Sussex County indicated that in the nineteenth century, most mills were located within a narrow, 3-to-6-mile band along the margins of the drainage divide separating the Chesapeake Bay and Delaware Bay drainages, at between 10 and 35 feet amsl. Owing to generally low relief, average head fall for mills in Sussex County appears to have been between 5 and 10 feet. The fall at the Diamond Pond sawmill was unusual in that it may have been as much as 13 feet.

## **6.2 RECOMMENDATIONS**

### **6.2.1 Archaeology**

This report concludes that adequate investigation was conducted of the portions of the five sites identified in the project area (Driveway Site, Plum Site, Shell Button Site, Chamber Pot Site, and Two Hills Site) within the LOC for the project area (Table 5-1). Although artifact distributions within the LOC and nearby landforms suggest that portions of the sites fall outside the LOC, artifacts found in association with the sites lack the diversity necessary to draw other than very general conclusions. Further investigation within the LOC likely would produce more artifacts, but not more usable analytical data. In addition, aside from two

postholes at the Driveway Site and plowscars/tire ruts at the Plum Site, no other features were recorded at the sites. Although the Shell Button Site appears to be the result of episodic dumping, and thus is not the best site example to serve as a case study, Herman and Siders (1989:55,61) identify a need for more research into shell button production under the Manufacturing theme in the *Historic Context Master Reference and Summary* for the Industrialization and Early Urbanization and Urbanization and Early Suburbanization periods in the Lower Peninsula/Cypress Swamp Region.

The Delaware SHPO provided comment on May 6, 2003 regarding the identification and further work recommendations of the five archaeological resources (Appendix E).

**Table 6-1. Recommendation for Archaeological Resources**

Name	CRS #	Eligibility*	Recommendation
Plum Site	S-10025	NPE	No Additional Work within LOC
Driveway Site	S-10023	IND	No Additional Work within LOC
Chamber Pot Site	S-10024	NPE	No Additional Work within LOC
Shell Button Site	S-10026	NPE	No Additional Work within LOC
Two Hills Site	S-10027	NPE	No Additional Work within LOC

\* NPE – Not Potentially Eligible, IND – Indeterminate

### 6.2.2 Architecture

Parsons recommended that the Draper/Bonk House (CRS #S-3527) and Bridge 3-806 (CRS #S-9849) were eligible for listing on the NRHP (Table 5-2). The Draper/Bonk House is recommended as potentially eligible under Criterion B for its association with the Draper family, a locally significant family whose relationship to Milton includes the ownership of the Draper Cannery. The Draper/Bonk House is also recommended as potentially eligible for listing under Criterion C as representative of the Colonial Revival style. Bridge 3-806 was recommended as potentially eligible for listing under Criterion C. The original design of the bridge’s parapet wall was a unique architectural feature found only on Bridge 3-806 at Diamond Pond and Bridge 3-808 with its penstock bridge at Wagamon’s Pond. Although Bridge 3-806 had undergone continuing deterioration of its physical components, the resource had retained sufficient integrity to convey its historical significance. Parsons recommended that DelDOT consult with the Delaware SHPO concerning possible mitigation for Bridge 3-806 prior to widening the bridge. This was done, and HAER recordation of the bridge was completed.

**Table 6-2. Recommendation of NRHP Eligibility for Architectural Resources**

Name	CRS #	Date of Construction	Potentially Eligible?	Criteria
14102 Sand Hill Road	S-3461	1937	No	N/A
16046 Federal Street (Draper/Bonk House)	S-3527	1938	Yes	B, C
Bridge 3-806	S-9849	ca.1917	Yes	C
Bridge 3-918	S-9850	ca. 1925	No	N/A
14559 Sand Hill Road	S-9851	ca. 1944	No	N/A

The remaining three resources are recommended not eligible for listing on the NRHP. 14559 Sand Hill Road is typical of post World War II vernacular architecture, and 14102 Sand Hill Road is typical of the bungalow style. However, both lack high artistic value, individual distinction and significance. The Reynolds Mill Bridge is a modest and typical reinforced concrete box culvert from the first half of the twentieth century, but extensive alterations disallow distinctive characteristics of a type or method of construction.

The Delaware SHPO concurred on May 6, 2003 with the recommendations regarding the NRHP eligibility of the five architectural resources (Appendix E).

### **6.2.3 Diamond Pond Mill**

The results from Diamond Pond Mills suggest a variety of directions for future mill-related archaeology in Delaware. The features discovered at Diamond Pond appear to be roughly similar to the sequence of penstocks and wheel wells found at Cabbage Pond. However, the features are clearly not identical, nor do they represent as wide a variety of wood types. Excavations at additional mill sites in Delaware may help to expand our understanding of the various designs for these features, and what sorts of materials were used. The selection of white oak for the timbers at Diamond Pond Mill was probably based on its suitability for construction—the wood is strong and resists rot. But why less durable red oak was chosen for some of the timbers, particularly along the sides of the structure, is less apparent. Nor is it clear why the Diamond Pond and Cabbage Pond mills should differ in the choices of material.

Data that might help shed light on the selection of building materials at the mill could come from dating the timbers used in the Diamond Pond structure more precisely than to the 85-year period of the site's known use. Dendrochronology holds some promise for supplying this type of information, and was an effective technique in distinguishing evidence of three separate construction periods at the Cabbage Pond Mill. For example, establishing whether all of the timbers in the lowest portion of the Diamond Pond structure were contemporary might be possible. If so, it may further be possible to determine whether the structure was built early in the mill's history or whether at some point part of the mill had been reconstructed. Alternatively, if the white oak and red oak elements can be shown to have different dates, they may be shown to represent different periods of construction or repair. The construction history of Diamond Pond sawmill would shed light on the development and technological evolution of mills in Delaware.

To assess the feasibility of dating the timbers from Diamond Pond, consultations were held with Dr. Jack Heikkenen and Hugh Beard of Dendrochronology, Inc., as to the potential of dating timbers from the site using a method known as key-year dendrochronology. This method entails computerized analysis of relative growth patterns among trees represented in the timbers from a given site (Heikkenen and Egan 2000). In order for wood samples to be used in the procedure, they must retain either the bark on the exterior of the tree trunk, or the outermost edge, referred to as the wane edge. Analysis of the sample of timbers from the

Diamond Pond site suggested that an adequate number of timbers with the appropriate growth features are in fact present to allow dating using the key-year procedure. That is, the sample is sufficiently large to provide a statistically valid confidence level for the results of the analysis (Hugh Beard 2005, pers. comm.). It is therefore recommended that dendrochronological indexing be carried out using the sample of timbers from the Diamond Pond Mill site.

A variety of questions related to the landscape distribution of mills may also be addressed in future research (Table 6-3). Mills were of necessity sited where there was sufficient head to power the mill apparatus, as well as sufficient water supply to keep the mill running as often as needed. Clearly, the further downstream a mill was located the larger the watershed that was available on which to draw. Yet, lower relief at lower elevations could have meant less variation in height between the top of the dam and the stream below, resulting in less fall or head, and consequently less power. More research could be conducted on specific mill sites to determine whether this seeming trade-off between power and reliability were indeed the case. The number of mills upstream and downstream from a mill site could also have been an important factor in site location. Mills upstream could potentially interrupt or slow water supply, while mill ponds downstream could back up into a mill's tail race, slowing water flow out of the mill. Further analysis could be undertaken as to how these technological issues were balanced with the need to obtain raw materials and ship finished goods to market. Integrating historic transportation patterns within the county into the available landscape data on mills will be a necessary step in such a research effort. Lastly, tracking the output of the mills in Sussex County as described in the Industrial Census may provide an additional measure of mill economics. Together, these lines of inquiry will help provide a better understanding of how mill owners chose locations for their operations, and what sort of success they met with.

**Table 6-3. Future Mill-Related Research Questions**

<b>Questions</b>	<b>Data Needed</b>
What was the Construction/Repair Sequence of Mills in Delaware?	Comparative dating of mill timbers through dendrochronology.
How do watershed size and available headfall influence mill siting?	Comparative data on mill elevation and available headfall
What was the optimal separation of mills on watercourses?	Analytical reconstruction of historic mill ponds and waterflow models.
What is the role of transportation networks in mill siting?	Comparison of mill location with historic roads and waterways