CHAPTER 6: FEATURE INTERPRETATION

While their function could not be absolutely determined, the features appeared to represent low bulkheads or footers for a superstructure over the stream channel. Features 2 and 8 were most intact on the east side of the cofferdam. Based on the surviving portions of each, the structures consisted of a series of large horizontal beams supported by a line of 4-inch diameter posts, driven into the subsoil. The beams were lined on the north, or upstream side with vertical planks, serving as sheet pilings. A final element consisted of a 2x18-inch plank overlying, or capping the horizontal beam. Vertical mortise joints had been cut into the horizontal beams, and a fragment of timber bearing a tenon to fit the mortises was found in association with each feature. These bulkheads appeared to have wooden wing walls associated with them. In some ways, these features resemble features found during excavations at Cubbage Mill, Sussex County, DE (Figure 57).

Figure 57: Excavations at Cubbage Mill. Photo courtesy of Greenbank Mill Associates.

There was no evidence of a floor associated with any of the features, such as might be expected to be associated with a wheel box or with formal waste gates. This conclusion is based on excavation that exposed undisturbed clayey subsoil in all areas within the cofferdam. Deep mechanical excavation along the centerline of the present channel did provide evidence of a bridge wash-out in 1935, which prompted the construction of Bridge 238 in 1936 (DelDot 1991). The washed out area began approximately 5 feet north of Feature 2 (clearly separated from Feature 24), and continued upstream for a distance of 25 to 30 feet, crossing the line of Feature 8. At the lowest point, subsoil lay roughly 2 feet below the level encountered in other parts of the stream channel. The fill in the washed out area included a layer of asphalt debris.

The circular saw marks on the timbers suggest that the finds most likely date to the mid to late 19th century, rather than the early 19th century. This suggests that the remains were more likely related to the waste gates originally built before 1814 indicated on the 1860 map rather than mill remains associated with a forge built some time after 1805 and which was gone by 1826 (Figure 4). The late date implied by the saw marks may mean that the original gates required occasional repair, or were replaced in whole or part at some time, perhaps in 1857 when the gristmill was rebuilt. The vertical members suggested by the mortise joints could have supported a superstructure that housed the mechanism to raise and lower the gates. Such gates would have been needed to control water levels in the millpond.

It is also possible that these remains formed the foundation for a mill's wheel box, the floor of which no longer survives. It may be that flooring for either a wheel pit or for culvert-style waste gates once covered the identified timber elements. However, if this were true, the trash rack in Feature 2 would not have been exposed to water, but would have been sealed under the floor.

According to 19th-century mill literature some waste or flood gates were designed to be closed under normal circumstances with excess water flowing over the top of the dam. Hinges attached the gate to a sill running across the opening in the dam. The weight of water in a flood would cause the gate to swing open, relieving the excess water in the pond (Grimshaw 1882). The downstream side of such dams needed to be protected from the fall of water and logs that might undermine the dam. Dams built upon soft ground (clay or sand as opposed to rock) needed to be reinforced in some way. Typically some kind of wood foundation was used, such as wood pilings. A crib that was then filled with stone, or earth was sometimes used. Plain earthen dams were built without such foundations, but in large streams, or streams prone to flooding, this would be liable to wash out (Craik 1870).

Dams that carried roads could not use this method unless there was a bridge over the gate. Culverts or raised-board systems were also used that would allow a bridge to cross the gates (See Figures 58, 59, 60, 61).

The transverse features may also be bulkhead-like footers for removable-board waste gates with a bridge across the stream. The features are not perpendicular to the present stream channel, suggesting that the course of the channel was different in the 19th century, running slightly more to the west. Most of the structural remnants within the cofferdam were deteriorated, either heavily weathered or disturbed by construction of Bridge 238 in 1936. Thus it is difficult to say whether certain aspects of Features 2 and 8, such as the mortise and tenon joints and the spillway, were characteristic of the entire bulkhead structure or signal particular structures on the east side of the stream that lie largely outside the area of the cofferdam.

Comparison with existing waste gates in Delaware and New Jersey suggest possibilities for what the waste gates at Middleford Mills may have looked like. Some configurations, like that at Greenbank Mill outside Willmington, have a box-like culvert with two vertical gates. This design would include a floor all the way across the bottom of the gate. Since no floor was found at Bridge 238, the piles may foundations for a wooden floor that is now absent. This configuration might have resembled that for the floor of the wheel pit at Cubbage Mill.

However, if the foundations identified under Bridge 238 were completely covered by a floor, the purpose of the trash rack in Feature 2 would be unexplained.

Figure 58: Culvert-like waste gates, Greenbank Mill, Willmington, DE.

Figure 59: Removable-Board Type Waste Gate, Hearn and Rawlins Mill, Seaford, DE.

Another possibility is that the bulwark features are the foundations of the dam, and the foundations for the gates themselves were in the middle of the channel, where remains were very fragmentary. However, if this was the case, then the wooden features would be expected to extend throught the dam itself, but excavation for the new bridge wing walls showed that Feature 8 extended only 2 feet beyond the cofferdam, and excavation for a wing wall on the other side showed no wood foundations at all.

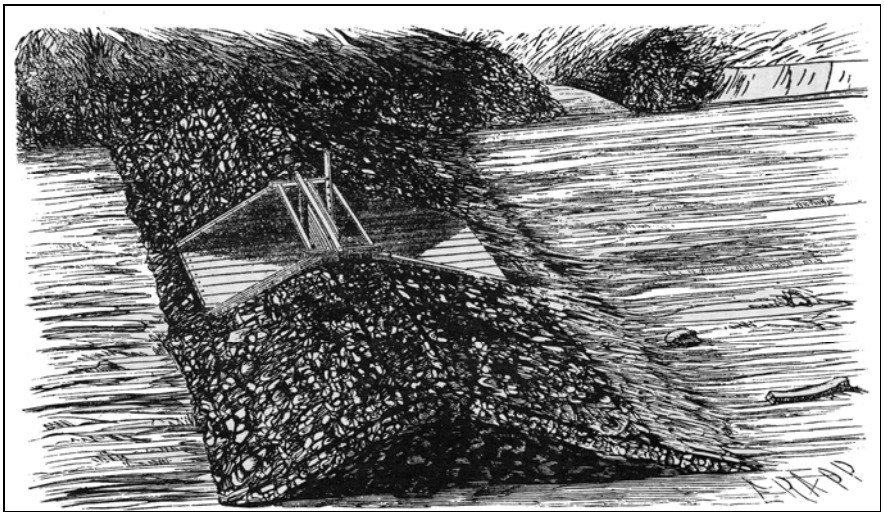

Figure 60: Waste Gates in Rip Rap Dam (Leffel 1880, p. 19).

Figure 61: Removable-Board Type Waste Gates; Kirby's Mill, Medford NJ. Courtesy Greenbank Mill.

A third possibility is that the waste gates at Middleford Mills could have resembled those at Kirby's Mill, Medford NJ. Here the gates consist of removable horizontal boards resting on a sill rather than gates that are raised. The boards are removed one-by-one to increase the water flow as desired. The boards rest between vertical posts or rails. Buttresses set at an angle parallel to the stream flow support these vertical posts. Such a configuration would explain the three parallel rows of sills running across the race found below Bridge 238—one sill to support the horizontal planks and the other two to support the buttresses. This scenario would leave the trash rack in Feature 2 exposed to water flow, although the need for the trash rack is still unclear.