

## MILL CREEK BRIDGE CROSSING AREA

The Mill Creek bridge crossing area is described in this section. The information provided includes a description of the natural setting and sedimentary stratigraphy. Discussions of local history and the bridge crossing's potential for containing cultural resources are also presented. The magnetometer survey results, field evaluation findings, and assessment of historical significance are provided along with recommendations concerning further work.

The Mill Creek project area was found to contain three underwater archeological sites. One was Mill Creek Magnetic Anomaly Site "A" (7K-A-112, K-6426). It consisted of a non-articulated scatter of 20th century artifacts. Mill Creek Magnetic Anomaly Site "B" (7K-A-113, K-6427) contained the largely intact remains of a wooden row boat of early 20th century vintage as well as other more recent scattered artifacts.

Mill Creek Magnetic Anomaly Site "C" (7K-A-114, K-4628) was found to largely consist of late 19th century to recent vintage artifacts that were distributed in a scattered fashion. This site also contained an articulated hull fragment of a substantial wooden vessel of early 20th century design. It had been part of one of the motorized work boats that plied the waters of Delaware during the first half of the 20th century. No other wreckage from that vessel was found inside the project area.

### Natural Setting

The project area consisted of terrain that would be affected by construction of the Delaware Route 1 Corridor bridge crossing of Mill Creek. It was situated about one-half mile southeast of the town of Smyrna in Kent County. The location is shown in Figure 82.

The territory covered by the investigation is shown in Figure 83. It consisted of the right-of-way for the proposed bridge as well as a buffer zone 100 feet wide extending both upstream and downstream of the bridge location. The portion of Mill Creek included in the project area was 450 feet in length. The width of the creek at this location varies from 300 feet in the western part of the project area to 175 feet at the narrowest part of the eastern portion.

Aerial photographs of the bridge crossing area are provided as Figures 84 and 85. The first shows Mill Creek as it was at the time the field investigation was conducted. Figure 85 is a photograph of the Delaware Route 1 bridge under construction.

Mill Creek is an important tributary of Smyrna River. It runs for a distance of approximately 7.5 miles from its headwaters, about five miles southwest of the town of Smyrna, to its confluence with Smyrna River about one mile downstream of Smyrna Landing.

There is one substantial impoundment of water along Mill Creek. It is Lake Como, a mill pond created by a dam that originally dates to the middle 18th century. The grist mill from which Mill Creek took its name was formerly located a short distance downstream of the Lake Como dam.

The tidal portion of Mill Creek begins about 0.3 mile downstream of the Lake Como dam. That location is about one-quarter mile upstream from the bridge crossing. At high tide the creek is navigable by small watercraft to the upper limit of its tidal waters.

The creek at the bridge crossing is tidal and shallow. At high tide, Mill Creek in the project area has a maximum depth of about 3.5 feet. At low tide the project area is mud flat except for a rivulet of water about twenty feet wide and three inches deep. Mill Creek supports a thick growth of aquatic vegetation in the vicinity of the bridge crossing, primarily water lily and cattail.

The extent to which Mill Creek was navigable in its natural condition early in the colonial period has not been determined. Apparently, it could have been navigated by vessels as far as its present day tidal limit. Because of the major colonial reliance on waterborne transport, Delaware's waterways were often used as transportation corridors all the way to the head of navigation.

Mill Creek has been affected by alluvial siltation. Following the commencement of the historic period, it probably became more shallow than it was previously as a consequence of siltation. Land clearing and agricultural cultivation led to substantial erosional sediment deposition in similar tidal streams in the vicinity.

The Mill Creek project area is largely bordered by swampy thickets on the north and by steeply sloping upland terrain on the south. There are no grassy marshes such as those characteristic of the lower reaches of many tidal waterways in eastern Delaware.

Level to gradually sloping fast land terrain of low elevation reaches the water's edge at only two places in the bridge crossing area (see Figure 83). At these places, the transfer of cargo between the uplands and vessels in Mill Creek would have been easiest. Both of these fast land physiographic features are situated in the eastern part of the project area (see Figure 83). Each of them has about fifty feet of frontage along Mill Creek.

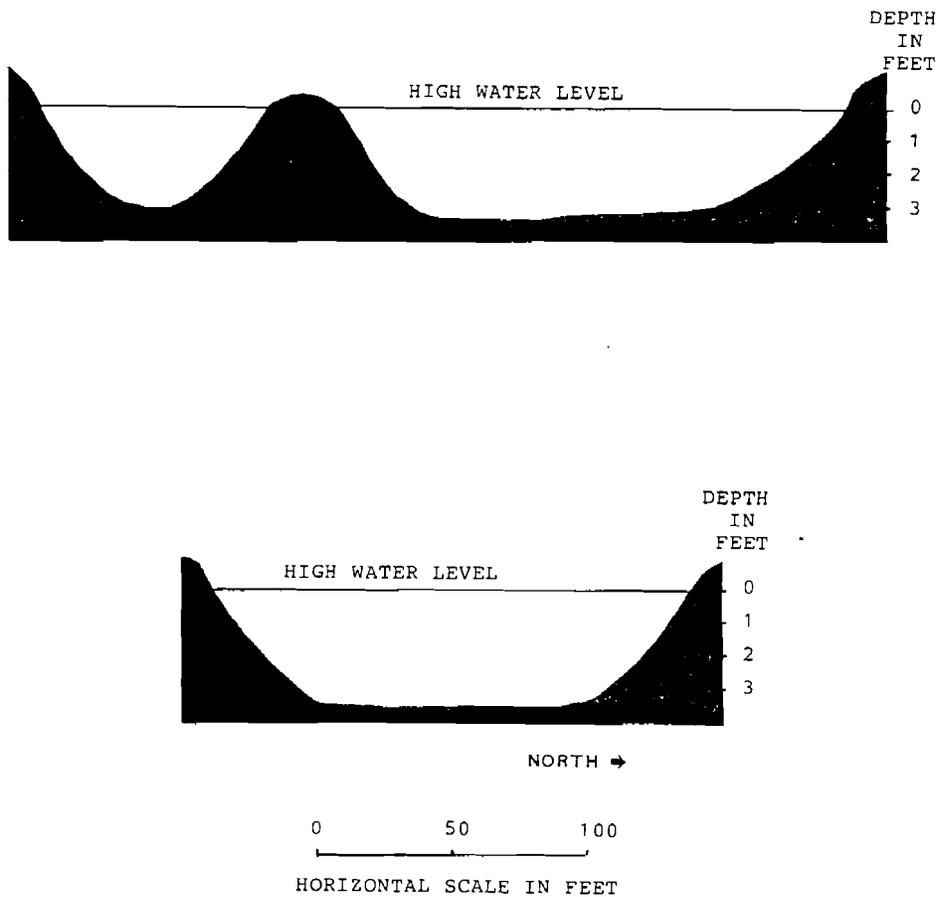
A prominent terrain feature near the middle of Mill Creek is a marshy island located in the western part of the project area. This feature contains soft, moist soil and appears to have been created by the deposition of alluvium. It is almost inundated at high water and supports a thicket of moisture-tolerant bushes and small trees.

There is no mention of any navigation improvement projects in Mill Creek in the records of the U.S. Army Corps of Engineers concerning channel dredging projects along Smyrna River. This watercourse was not considered an economically significant waterway during the late 19th to early 20th century period for which

documentary information is most readily available. It appears that Mill Creek in the vicinity of the bridge crossing has never been dredged.

The present day bottom of Mill Creek at the bridge crossing is virtually flat. Bathymetric cross sections at two locations in the project area are shown in Figure 86. The submerged topography indicates that the naturally deeper portions of the watercourse have been filled to a smooth levelness by the deposition of alluvial sediments. This is characteristic of tidal streams that have undergone heavy silt deposition under low energy current conditions.

**FIGURE 86**  
**Bathymetric Cross Section of Mill Creek Project Area**

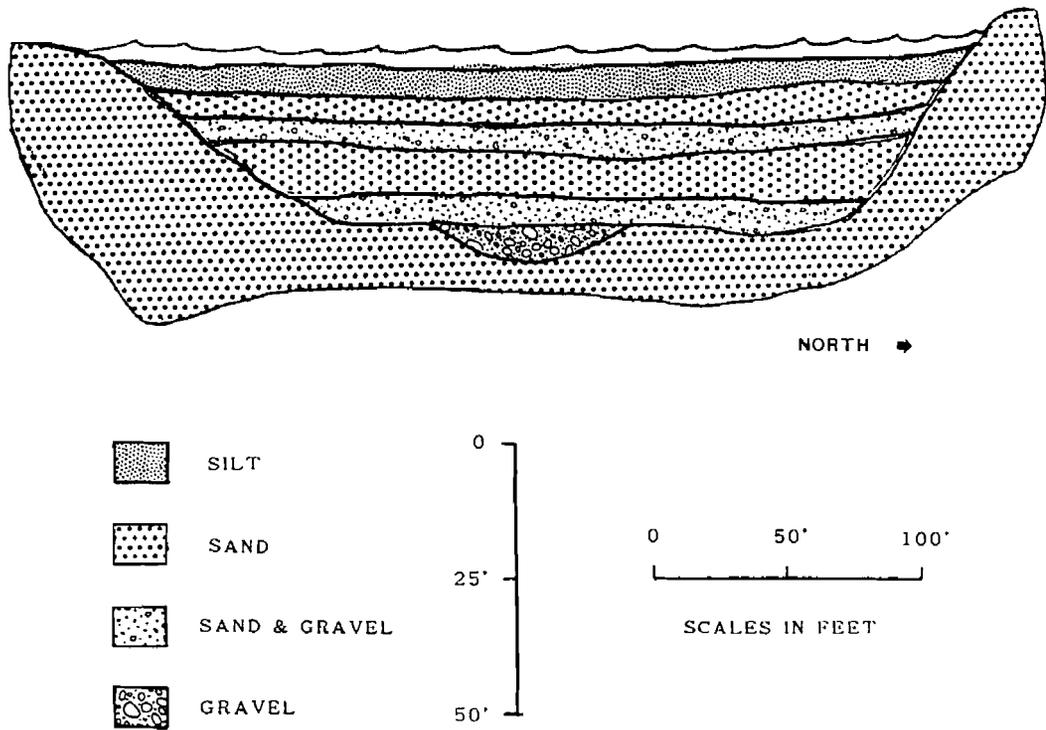


Geotechnical subsoil borings were accomplished in the project area (Gannett Fleming Transportation Engineers, Inc. 1989b). Their data provide information of archeological interest concerning the stratigraphic deposit of sediments during the prehistoric period.

Figure 87 is a schematic cross section of the sediment stratigraphy in Mill Creek based on the soil borings. The vertical scale has been exaggerated to make the sediment strata more readily visible.

The natural subsoil in this vicinity is sandy. Into that subsoil, the ancient ancestral valley of Mill Creek was cut by erosion. The ancient channel was about forty feet below the present water level and is evidenced by a deposit of gravel. The gravelly bottom of the ancient stream indicates that it was a fast-flowing upland watercourse.

**FIGURE 87**  
**Stratigraphic Profile of the Mill Creek Project Area**



Superimposed over the gravel deposit is a sequence of four sand and sandy gravel strata. These sediments indicate the deposit in the stream bed of alluvial materials during a period of fluctuating water flow energy levels. That fluctuating flow was probably of lesser energy than the stream flow that left the deepest gravel deposit. The sand strata probably represent lower energy stream flows than the sandy gravel strata. Capping the uppermost sand stratum is a deposit of silt. This layer was deposited when the stream evolved into its lowest energy level, which was a tidal flow. That situation resulted when rising sea level caused this part of Mill Creek to become inundated.

### **Local History**

Though Mill Creek is but a tributary of Smyrna River, its drainage contains several landmarks of local historical significance. The following historical overview of the vicinity discusses cultural activity with an emphasis on relationships concerning the potential presence of submerged cultural resources.

Several prehistoric archeological sites have been found on the level upland terrain bordering Mill Creek in the vicinity of the bridge crossing. These are documented in the archeological site files of the Bureau of Archaeology and Historic Preservation in Dover. They include Site K-6400, a small Archaic camp, that is situated a short distance inland from the upland fast land feature on the northern shore of Mill Creek adjacent to the bridge crossing (Bachman and others 1988:110). The presence of these cultural deposits and others in the surrounding vicinity is solid evidence of aboriginal settlement activity during much of the prehistoric period.

The presence of prehistoric occupation sites indicates that some form of subsistence-oriented activity probably took place on various occasions in Mill Creek at or near the bridge crossing. No underwater evidence of prehistoric cultural activity was encountered during the field investigation, however. If aboriginal cultural remains are present somewhere in Mill Creek, they are likely to be buried beneath the silty upper sedimentary stratum.

The historic period of Mill Creek's cultural background began during the latter part of the 17th century. William Penn gained possession of the lands that became Pennsylvania in 1682, and also obtained control of the Duke of York's holdings in Delaware (including the project area). Colonial settlement of the Mill Creek area began shortly thereafter.

The colonial organization of the "lower three counties of Pennsylvania" resulted in the delineation of administrative districts called "hundreds" within the counties. The one including the Mill Creek bridge crossing was named "Duck Creek Hundred." It was originally part of the "County of St. Jones" which was later renamed "Kent County."

In 1684, Penn granted to Henry Pearman a tract named "Pearman's Choice." It amounted to 600 acres and was located on the southern side of an important

tributary of Duck Creek (now Smyrna River). That tributary stream (now Mill Creek) came to known as "Pearman's Branch." The southern shoreline of Mill Creek at the bridge crossing includes lands of the old Pearman's Choice tract.

A brick residence was erected on the Pearman's Choice tract in 1686. It was the original section of the historic Belmont Hall mansion. The house and 200 acres of land were sold in 1691 to Andrew Love, who later resold it to Thomas Moore. Belmont Hall is regarded as an important historic site in Delaware.

The closest potentially navigable waterway to Belmont Hall is Mill Creek, located about one-quarter mile north of the mansion. The mansion is located on generally level to rolling uplands that overlook the stream.

The uplands overlooking Mill Creek on the south terminate in a bluff having steep slopes along most of the shoreline in the project area vicinity. This steep terrain would have been an impediment to traffic between Belmont Hall and Mill Creek. There is one location, however, where the slope leading from the uplands near Belmont Hall to the waterway's edge is of moderate grade. It is at the small low-lying terrace of fast land situated next to the southeastern portion of the project area (Figure 83). That location is the closest point of access from Belmont Hall to the tidal waters of Mill Creek. Movement between the navigable portion of the creek and the adjoining uplands would probably have been easiest at that point.

This fast land terrain feature appears to have been suitable to serve as a landing place for watercraft to unload or take aboard cargo or passengers, as well as for other water-oriented activities. As described below, a large underwater artifact scatter was found adjacent to this shoreline feature.

Considering the limitations on overland transportation due to the poor condition of the early colonial road network, it is likely that Mill Creek was used as a route of waterborne transport for passengers and goods at least intermittently during Belmont Hall's 300 years of occupation. Because watercraft transportation was so important in 17th century Delaware, settlements were often situated at locations that had convenient access to navigable waters.

A landing place on Mill Creek would have been very useful to the proprietors of Belmont as a place where vessels could be loaded and unloaded. For example, bricks used in building both the original 1686 portion of Belmont Hall and 18th century additions were likely to have been imported into the area by watercraft. That was because of the difficulty during those times of transporting heavy bulk cargoes overland.

In 1705, members of the Society of Friends (Quakers) established a meeting house along Duck Creek (Smyrna River) at its head of navigation 1.7 miles northwest of Belmont Hall. In 1716, Benjamin Shumer, a landowner there, selected the Quaker meeting house location as the site of a new town that he named "Salisbury," which was also known as "Duck Creek Village."

The village of Duck Creek grew in population and importance through the

18th century. Its vicinity became a focal point of commerce and grain milling for farms in the surrounding area.

Between 1740 and 1750, a grist mill was erected along Mill Creek, which was then known as "Graveley Run" (Caley 1978). It was located 0.3 mile upstream (west) of the project area and was powered by water from the large mill pond now known as Lake Como (Figures 84, 85). The residence for the miller and his family was probably built before 1751. It is still standing and is called the "Mill House."

The mill and thirty acres of land were sold in 1751 by Thomas James to Andrew Peterson. Subsequent to the Andrew Peterson family tenure, it was occupied by the Sharp and Webb families.

Members of the local Presbyterian congregation purchased a small tract of land on the south side of the mill pond (Lake Como) in 1748. That location came to be called "Holy Hill." The area's first Presbyterian church and a burial ground were established there. The original church was demolished in the 1840's. The burial ground remains and is known as the "Old Presbyterian Cemetery."

In 1761, the important colonial roadway called "the King's Road" was laid out in Kent County. Its alignment crossed Mill Creek at the Lake Como mill pond dam and passed in front of the Presbyterian church. This roadway became one of Delaware's most heavily traveled thoroughfares for north-south traffic.

The King's Road passed by the Mill Creek grist mill. Being adjacent to such an important roadway must have been good for the miller's business. Since the upper tidal limit of the creek was also close by, the mill's proprietors may have also relied to some extent on watercraft for hauling grain and flour.

In 1771, Belmont Hall and its estate were purchased by Thomas Collins. He enlarged the original house with an imposing three story addition, more than doubling the size of the structure. Collins later became the sixth governor of the State of Delaware. During his governorship in 1787, Delaware became "the First State" by being the first to ratify the Federal Constitution. Delaware's first legislature under the new Constitution was convened in Belmont Hall in December 1787.

In 1827, Belmont Hall and its farm were purchased by John Cloak. Under his administration, it was developed into a model farm for the latest scientific agricultural practices of those times. His daughter subsequently continued his work and maintained the fine reputation of the Belmont estate's products and agricultural technology.

At the present time Belmont Hall is regarded as one of the most historic residences in Delaware. It is listed on both the National Register of Historic Places and Historic American Buildings Survey.

The vicinity of the bridge crossing is illustrated on maps of the Smyrna area published in 1859 and 1868 (Figures 88, 89, 90). The only cultural features shown along Mill Creek during that period are upstream of the project area.

Adjacent to the creek just below Lake Como is the grist mill, known in 1868 as "Sharp's Mill." The nearby Mill House was also illustrated and labeled the "Sharp" residence. Sharp's Mill ceased operating later in the 19th century. The mill structure was subsequently demolished though the Mill House survives to the present day. Lake Como was eventually purchased by the town of Smyrna and presently serves as a recreational park. The former location of Sharp's Mill is now partially occupied by a wastewater treatment facility.

In 1923, the old King's Road was modernized and partially realigned by the Delaware Bureau of Highways. The new route was named the DuPont Highway and succeeded the King's Road as the state's main north-south thoroughfare. The alignment of the DuPont Highway generally follows or parallels the old colonial roadway. It crosses Mill Creek on the downstream (east) side of the Lake Como dam.

From the early 19th century onward, the major port facility in the vicinity was Smyrna Landing. It appears that most of the maritime traffic along Smyrna River had no compelling reason to enter Mill Creek. The Corps of Engineers

studies of maritime commerce along Smyrna River during the late 19th and early 20th centuries do not mention the use of Mill Creek by commercial watercraft and no dredging was conducted in the creek by the Corps to improve its navigability.

There is little documentation concerning the loss of watercraft in the Smyrna vicinity. During this investigation's background research, no information was found regarding the loss of any vessels in Mill Creek. The historical sources consulted, however, should not be considered as being comprehensive since the most readily available information dates largely to the late 19th century and early 20th century. Information concerning earlier periods is very limited. The historical sources also emphasize larger size vessels lost in storms or accidents. They usually provide very little information on vessels that were purposely abandoned.

### **Field Investigation Findings**

The field investigation of the Mill Creek bridge crossing area was accomplished in two phases. The initial work was a Phase I remote sensing survey utilizing a marine proton magnetometer. The Phase I survey compiled remote sensing data on the distribution of ferrous cultural materials and recorded bathymetric data for the submerged topography.

The Phase II site evaluation field work included direct examinations of three underwater archeological sites that the previous remote sensing survey indicated had the potential of being historically significant. The sites were investigated using the Direct Approach and Mud Walk techniques. Mill Creek was too shallow for scuba diving. Each day's work was scheduled to commence as the tide was falling and continued until the following rising tide prevented further progress. The amount of useful time in each working day varied depending the tidal cycle.

The Phase I magnetometer survey recorded the presence of eighteen targets. Eleven of these were isolated targets and seven were anomaly clusters. Each of the targets was assigned an identification number from 1 to 18. Their locations are shown in Figure 91. Targets # 1 and # 2 were situated outside the project area.

Three discrete groups of targets were identified and interpreted as representing underwater archeological sites. Each consisted of groups of anomalies that appeared to be associated based on their proximity to each other. These groupings ranged from one target (an anomaly cluster) to seven targets.

The three groups were designated Mill Creek Magnetic Anomaly Site "A" (7K-A-112, K-6426), Mill Creek Magnetic Anomaly Site "B" (7K-A-113, K-6427), and Mill Creek Magnetic Anomaly Site "C" (7K-A-114, K-6428). Their locations are shown in Figure 91. Site forms for these sites were filed with the Bureau of Archaeology and Historic Preservation.

Mill Creek Magnetic Anomaly Site "A" (7K-A-112, K-6426) was located in the

western part of the project area. It was a moderate sized anomaly cluster (Target # 8) on the north side of the creek's midstream alluvial sediment island. It had sufficient mass and dimension to possibly be the remains of a small watercraft. The water depth at high tide in this location was about 3.5 feet.

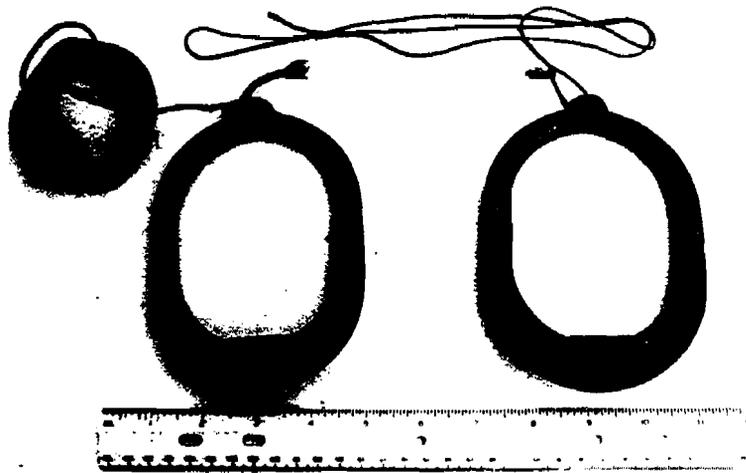
This anomaly cluster consisting of two anomalies having observed amplitudes of 139 and 60 gammas that were detected over terrain measuring about 16 by 20 feet. The anomaly patterning indicated that the site was a cultural deposit containing two or more iron objects having approximate masses equal to 40 and 20 pounds of iron respectively.

The available remote sensing data were not sufficient to determine the identity or potential historical significance of Site 7K-A-112. Further investigation was recommended to determine whether it was archeologically significant and eligible for nomination to the National Register.

Eight artifacts were recovered from Site 7K-A-112 during the Phase II investigation. All were of 20th century vintage. They consisted of two automobile tires, a wooden door fastened with wire nails, a section of brass pipe, one claw hammer, two lead duck decoy weights, and one small mammal trap.

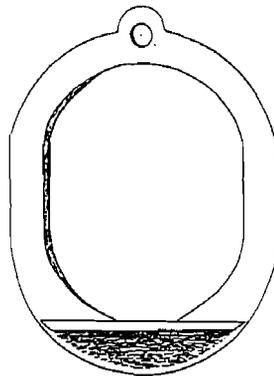
The decoy weights are illustrated in Figures 92 and 93. They are oval in shape with a hole at the top for attaching a line to the decoy and a protruding lip on both sides of the base. The protruding lip near the base was made to lodge in the waterway bottom to prevent the decoy from drifting.

FIGURE 92  
Lead Decoy Weights from Mill Creek



SCALE = 12 INCHES

FIGURE 93  
Lead Decoy Weight from Mill Creek

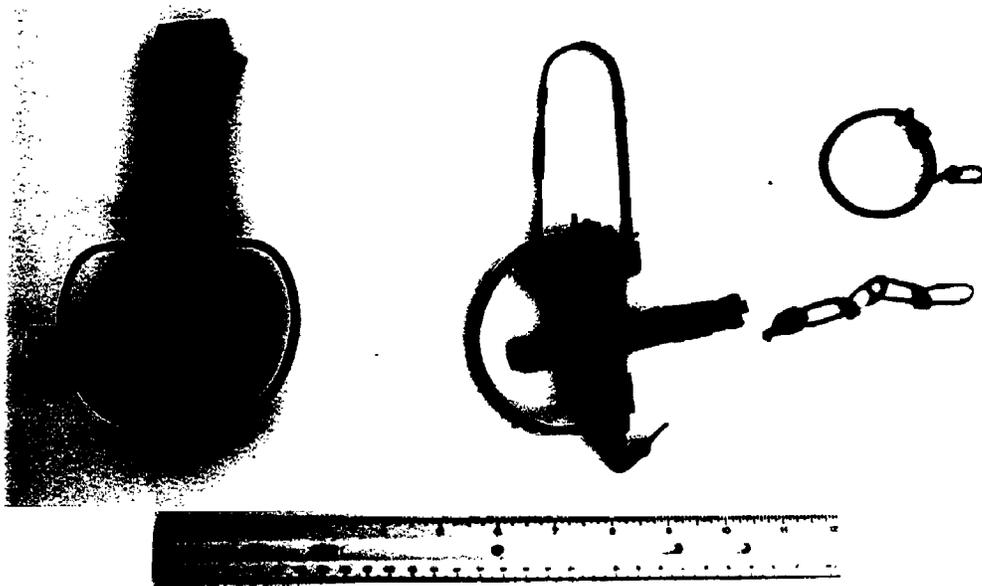


0 1"  
Scale in inches

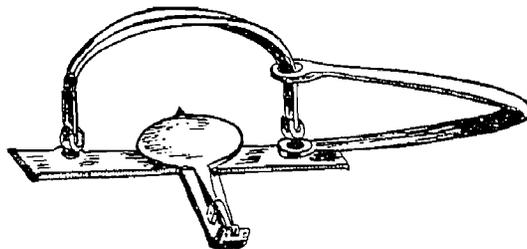
The small mammal trap was a steel smooth-jawed leghold trap, of a type known as the "Newhouse" trap (Bateman 1971). It is illustrated in Figure 94. It consisted of two semi-circular smooth jaws that are snapped together by a powerful spring. The trap is sprung when an animal steps onto the pan between the open jaws and activates the spring by means of a lever. This variety of trap is made to take game by securing a limb in contrast to the body-gripping Conibear trap described earlier (see Figure 79).

The artifactual materials encountered at Site 7K-A-112 did not include a cultural property of archeological interest or historical significance.

FIGURE 94  
Smooth-Jawed Leghold Trap from Site 7A-K-112



Scale = 12 Inches



(Bateman 1971)

A substantial number of remote sensing survey targets were found in the vicinity of the two fast land terrain features in the eastern part of the project area. Several clusters of magnetic anomalies were recorded near those locations.

Mill Creek Magnetic Anomaly Site "B" (7K-A-113, K-6427) was found in the northeastern part of the project area. It consisted of a complex of two moderate-sized anomaly clusters (Targets # 10 and # 11) and one isolated anomaly (Target # 9). This cultural deposit was interpreted to be an underwater archeological site of potential historical significance because of its dimensions and number of anomalies.

This investigation's background research found no documentary evidence of historic period cultural activity on the fast land terrain feature adjacent to Site 7K-A-113. However, prehistoric archeological sites had been discovered there during the terrestrial survey of the Delaware Route 1 Corridor (Bachman and others 1988).

Magnetic anomaly Target # 9 was located a short distance east of the project centerline. It was an isolated anomaly having an observed amplitude of 21 gammas, and was interpreted as being associated with a magnetic mass equal to about 5 pounds of iron. At high tide the water depth at this location was about two feet.

Target # 10 was an anomaly cluster located about 80 feet east of Target # 9. The water depth at that location at high water was 3.5 feet. Two anomalies having observed amplitudes of 109 and 14 gammas were detected there. The associated artifacts were estimated to have magnetic masses equal to about 50 and 5 pounds of iron, respectively.

The other component of the anomaly complex at Site 7K-A-113 was Target # 11. It consisted of two anomalies having observed amplitudes of 21 and 35 gammas. Target # 11 was interpreted to contain iron objects having estimated masses equal to about 10 and 20 pounds of iron. The water depth at high tide there was three feet.

Site 7K-A-113 was interpreted to be a cultural deposit that might be associated with use of the adjacent fast land terrain as a boat landing. Since no recorded historic period habitations or commercial facilities were nearby, however, it was believed that any such activity would have been intermittent at most. The size and magnitude of the site as shown by the remote sensing data indicated that it had the potential to be considered archeologically significant. As a consequence, Site 7K-A-113 was evaluated to determine its eligibility for the National Register.

The most interesting find at Site 7K-A-113 was the well preserved wreck of a small wooden watercraft. It appeared to be the remains of a row boat. This vessel was found totally buried in silty mud at a depth below grade of 32 cm. (1'1"). A photograph of the boat's location is provided in Figure 95.

FIGURE 95

View of Small Boat Wreck Site in Mill Creek



The row boat from Site 7K-A-113 was found to be 10'10" long with a maximum beam of 3'1" (Figures 96, 97, 98). Its bow came to a point and at its stern there was a square transom, giving its outline a somewhat triangular shape (Figures 99, 100, 101). A slight outward bulge along its sides amidships gave it a more boat-like shape. It was built of mechanically-sawn lumber.

The vessel's main longitudinal member was an interior keel 10'4" long measuring 1" tall by 2.5" wide. It lay along the centerline inside the boat. There was no exterior keel on the outside bottom. The boat's traverse bottom planks were fastened to the bottom of the interior keel (Figure 102).

These planks varied in width from 4.5" to 6.5" and were 0.75" thick. Depending on their location along the vessel's bottom, they varied in length from 4.5" to 38.5". From bow to stern there were 25 bottom planks. The fastenings were steel flat head screws and wire nails. Substantially more nails were used than screws.

At the bow, an interior stem was attached to the forward end of the interior keel timber. The forward butts of the side planks were fastened to the stem. The sternward butts of the side planks were fastened to the transom. The preserved part of the boat's transom was a single lateral plank 38" long by 9.75" tall by 1" thick.

The vessel was rectangular in cross section. The sides rose vertically from the bottom. It was an open boat without decking.

FIGURE 96  
Mill Creek Boat in Situ



FIGURE 97  
Mill Creek Boat in Situ



FIGURE 98  
Mill Creek Boat in Situ

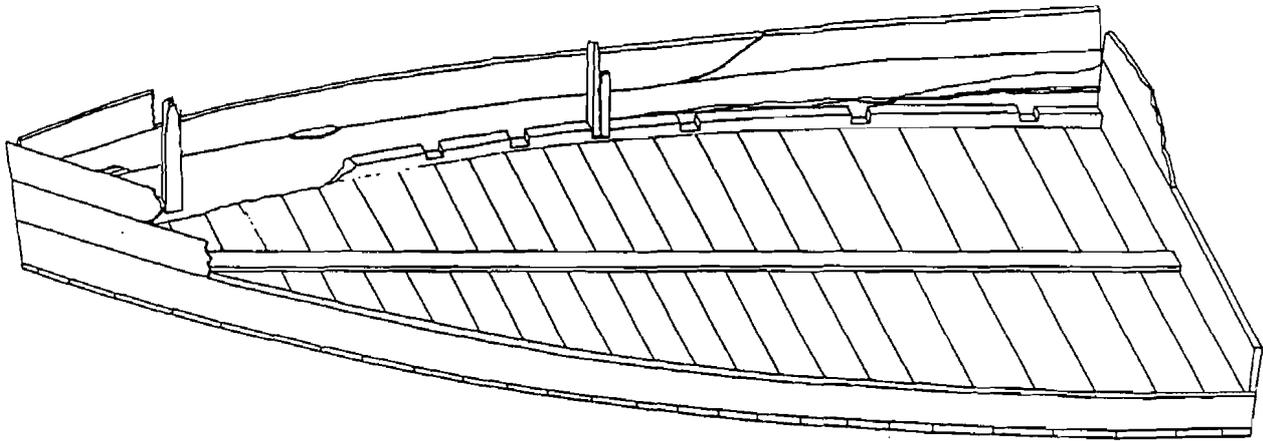


FIGURE 99  
Mill Creek Boat After Recovery



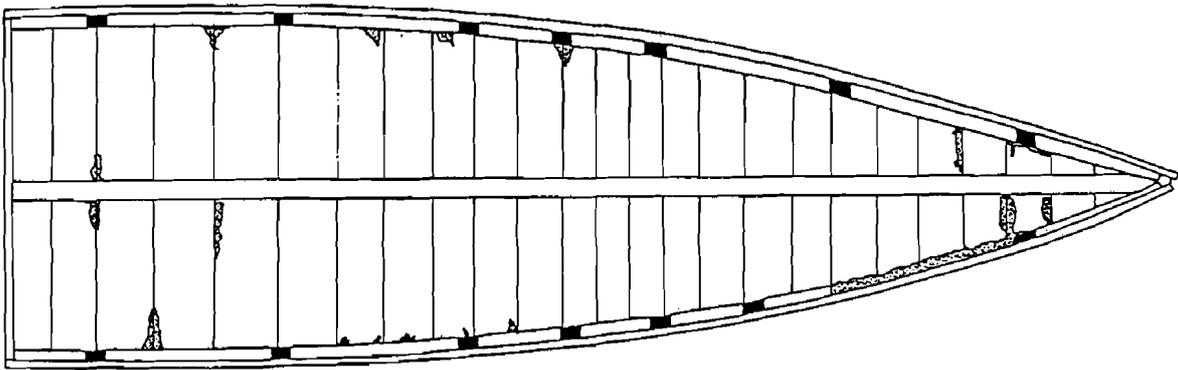
SCALE = 5.5 FEET

FIGURE 100  
Side View of Mill Creek Boat



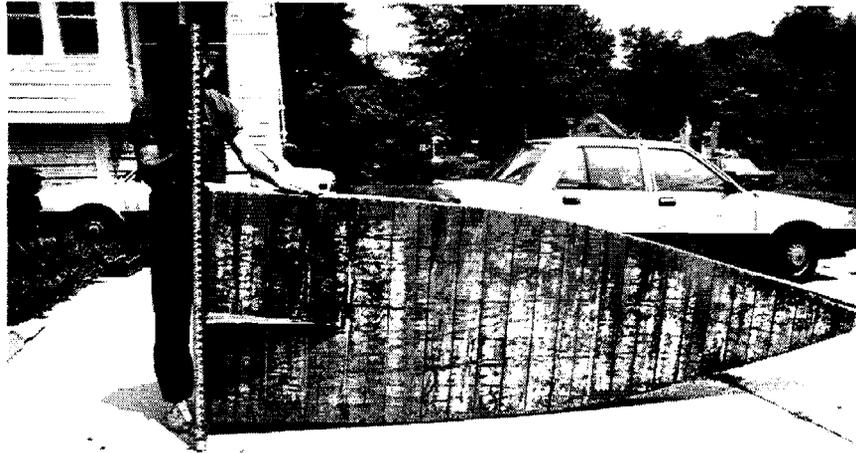
0 1'  
Scale in Feet

FIGURE 101  
Plan View of Mill Creek Boat



0 1'  
Scale in Feet

**FIGURE 102**  
**Bottom of Mill Creek Boat**



SCALE = 5.5 FEET

The lowest side planks were fastened at the base to the outside edges of the bottom planks. On the inside of the joint between the bottom and sides, there was a chine log on both port and starboard for reinforcement. A representative illustration of the position of the chine log in a flat bottomed boat is provided in Figure 103. The chine logs in this vessel were single timbers measuring 1" wide by 2" tall by 10'6" long. They were notched to receive the vessel's vertical frames.

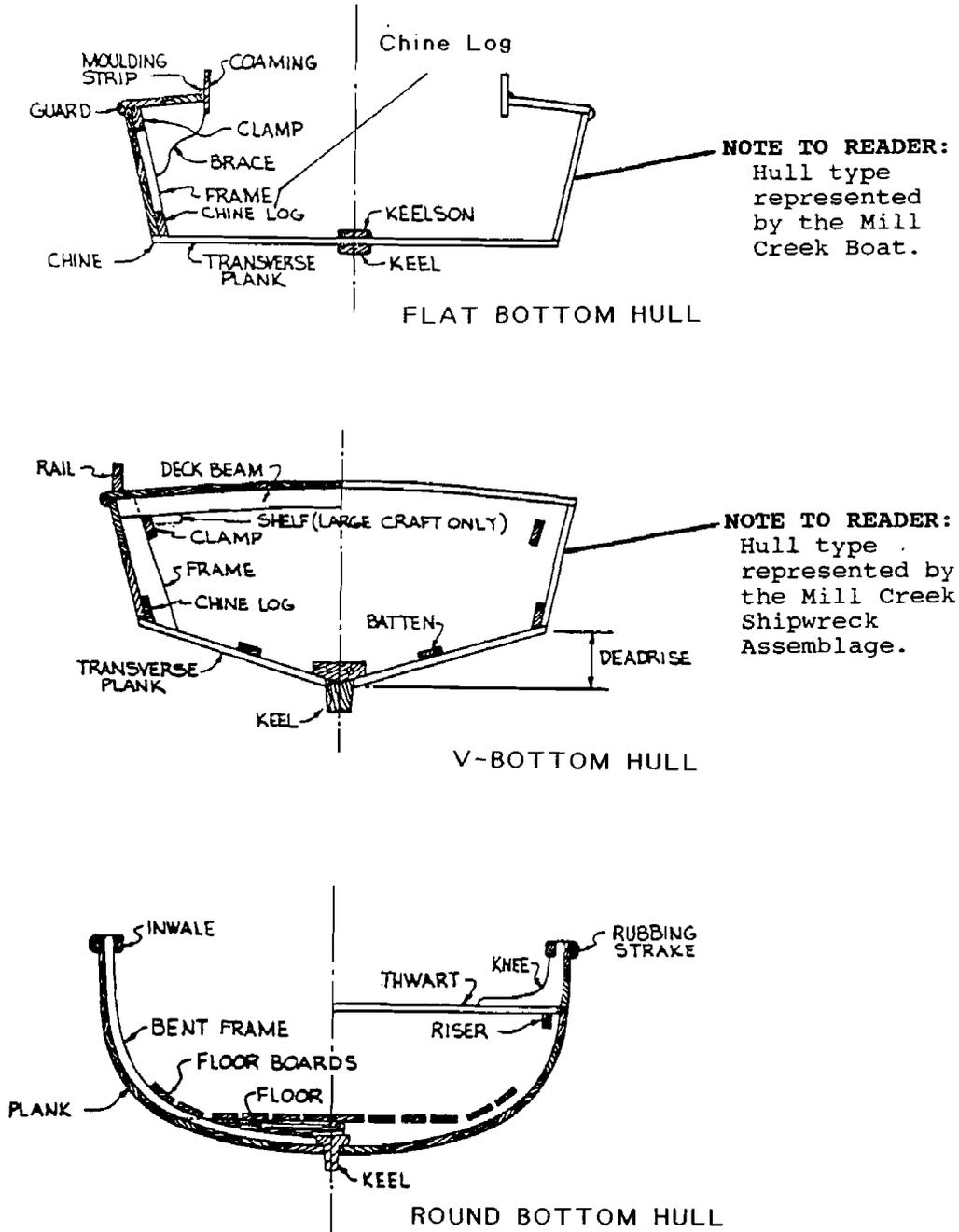
There were fourteen frames on the starboard side and thirteen frames on the port side. Only one vertical frame remained attached to the hull in its original position. It was a small piece of wood measuring 2" wide by 0.75" thick in section. Its preserved length was 12".

Twelve sets of frames were evenly spaced at 18" intervals, as shown by the notches on both the port and starboard chine logs. One additional pair of frames was placed amidships. They were fitted into chine log notches halfway between one of the regular 18" frame intervals. In addition, a singleton frame was placed between the second and third regular frames from the bow on the starboard site. It served as reinforcement for that specific part of the hull.

The port side was articulated only to the top of the lowest side plank. That piece of lumber was 10'9.5" long by 4.75" wide by 0.75" thick. The starboard side was articulated as high as the second side plank. The lowest

starboard plank measured 5.5" wide by 0.75" thick by 10'11.5" long.

FIGURE 103  
Cross Sections of Three Hull Types



(Lankford 1988)

Other disarticulated fragments of wood from the boat were found in and around the partially intact hull assembly. One of these pieces was a broken plank from the port side to which part of a vertical frame was attached. The plank measured 4.75" wide by 0.75" thick by 7'7" long. The frame fragment was 8.25" tall and measured 1" by 0.75" in section.

A skeg was attached to the exterior bottom of the hull near the stern to enhance the vessel's stability (Figure 102). It was a single extended triangular plank having a length of 22" and thickness of 1". Its maximum vertical dimension at the stern was 3.75". From there forward, it narrowed to become flush with the bottom of the boat at the third bottom plank from the stern. The stern end of the skeg was flush with the transom. The skeg was fastened to the bottom with wire nails. It was protected and reinforced with a 31.5" long length of 1" wide steel strapping. The strapping was attached along the bottom of the skeg and extended up the exterior of the boat's transom.

The only traces of paint visible on the craft consisted of white paint on the exterior bottom of the hull. The joints between planks were not caulked. It appears that they were sealed by wet swelling of the planks.

There was no apparent evidence of lateral seating planks or other interior fixtures inside the boat. However, it is likely that seating planks had been present but had been displaced from the boat prior to its discovery.

The articulated and disarticulated portions of the craft were sufficient to determine with reasonable accuracy its original measurements. As built, the boat was 11' long by 3'1" wide amidships and stood about 16" tall. This boat would have accommodated one person comfortably and two persons at the most.

The fastenings indicate that the vessel was built in the first half of the 20th century, possibly between 1920 and 1940. Judging from the depth of burial in the creek's bottom sediments, it is estimated to have been deposited prior to 1950.

The only artifact recovered in direct association with the boat was a length of light-duty chain made from thick steel wire of 20th century vintage. The same type of light chain was found attached to some of the small mammal traps recovered from Smyrna River and elsewhere in Mill Creek during this investigation.

This small wooden row boat was probably constructed locally. It is a good example of Delaware's 20th century rural vernacular small craft boat building. Little or no marine architectural or underwater archeological research has been accomplished in the Middle Atlantic region concerning small watercraft of this class and vintage. As a consequence, information is not readily available to compare this vessel with other similar boats in Delaware or elsewhere in the Middle Atlantic region.

The hull assembly's overall state of preservation is good. If maintained in a stable condition, it will be available for possible further study and

comparative analysis in the future.

In addition to the small wooden boat wreck, a variety of other artifacts were found at Site 7K-A-113. A complete listing is provided in Appendix II. The material recovered was all of 20th century vintage and appears to have been deposited as a consequence of accidental disposal or being transported by stream or flood currents.

These artifacts have been classified into functional categories. The ones associated with hunting and fishing consisted of one lead fishing weight and two brass and plastic shotgun shell casings. There were also several artifacts that had served as containers. These consisted of two corroded fragments of a steel drum marked "EPA Registration," six aluminum beverage cans and can fragments, four glass bottles, four glass bottle fragments, an aluminum sardine can top, twenty-three corroded food can fragments, and one plastic bag.

Several domestic artifacts were also found. They consisted of fifty-six metal bucket and cooking pan fragments, three wooden broom handle fragments, an aluminum pie pan fragment, one television part metal box marked "Zenith," and a rectangular steel barbecue grill.

Personal items and toys were also represented in the artifact collection from Site 7K-A-113. These included a leather shoe fragment, a plastic 45 rpm music record, a yellow plastic toy fish, a metal toy cooking pan, a plastic water nozzle, part of a black plastic ink pen, a plastic band-aid, and a wooden tobacco pipe bowl.

Another category of the artifacts recovered consisted of tools, building materials, and miscellaneous hardware. The following material was collected: a padlock, two rubber hose fragments, a barbed wire fragment, six wire nails, one large cut nail, three broken sections of steel pipe, a 14-inch long steel bolt with nut, three corroded metal strapping fragments, a fragment of steel wire, four pieces of lumber with wire nails and spikes, a brick fragment, a coal fragment, and two cinder fragments.

The cultural material found at Site 7K-A-113 consisted of artifacts that all date to the 20th century. Except for the row boat wreck, the artifacts were widely scattered. This cultural deposit did not have the level of archeological interest that would merit nomination to the National Register of Historic Places. As a consequence, no further investigation of Site 7K-A-113 prior to the proposed bridge construction was recommended.

The largest cultural deposit found in the Mill Creek bridge crossing area was Mill Creek Magnetic Anomaly Site "C" (7K-A-114, K-6428). It consisted of an anomaly complex made up of one large anomaly cluster along with three smaller clusters and two nearby isolated anomalies. These were designated Targets # 12 through # 18.

This anomaly complex was located adjacent to the fast land terrain feature in the southeastern part of the project area. Because of its location, the site

was interpreted to be a cultural deposit that could contain materials associated with a landing place for Belmont Hall. Site 7K-A-114 appeared to have the potential for providing information relating to the nautical commerce of Delaware's interior waters, and was interpreted as being potentially eligible for the National Register. As a consequence, a Phase II site evaluation investigation was performed of it.

The westernmost component of this anomaly complex was Target # 12. It was an isolated anomaly having an observed amplitude of 108 gammas. Its estimated mass was about 60 pounds of iron. During the Phase II investigation, several artifacts were recovered from this location. They included a broken wooden oar (Figure 104) and an oarlock (Figure 105). A complete listing is provided in Appendix II.

FIGURE 104  
Wooden Oar from Mill Creek Target # 12

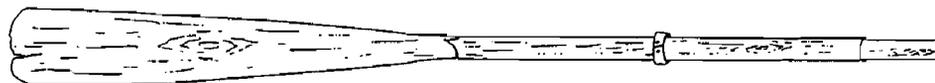
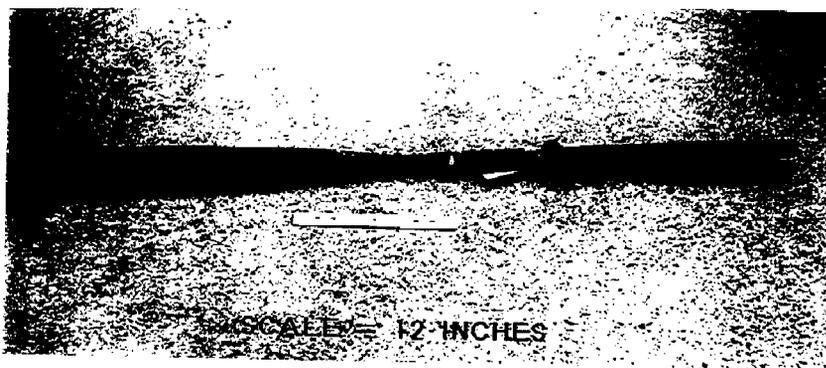
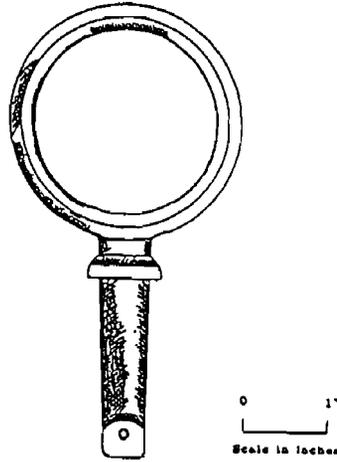


FIGURE 105  
Iron Oarlock from Mill Creek Target # 12



Target # 13 was about 40 feet east of Target # 12. It was located on the west side of the project centerline near the southern shoreline of Mill Creek. The water depth at this location at high tide is about 2.5 feet. Anomalies having observed amplitudes of 102 and 55 gammas were detected. It was estimated that the artifacts causing the anomalies had masses equal to about 20 and 10 pounds of iron, respectively.

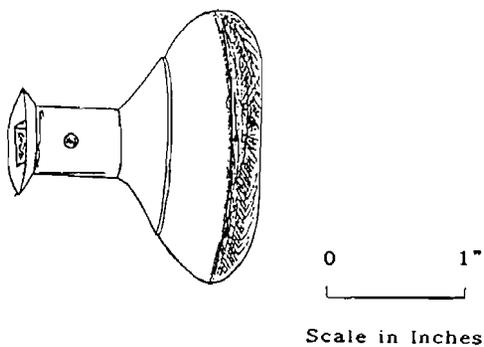
Among the artifacts recovered from Target # 13 were a brass door knob, an iron wagon wheel tire (rim), and a knife handle (Figures 106, 107, 108). The wagon wheel tire was probably from a passenger buggy. It measured four feet in diameter, and its width was 1.25 inches. A complete listing of the artifacts recovered from this feature is provided in Appendix II.

Seventy feet north of Target # 13 was another anomaly cluster. It was designated Target # 14. This cluster was located on the west side of the project centerline about 60 feet from shore where the water was about 3.5 feet deep at high tide. Anomalies having observed amplitudes of 12 and 52 gammas were detected there. It was estimated that the artifacts at this location had masses equal to about 5 and 15 pounds of iron.

Another component of Site 7K-A-114 was Target # 15. It was a single anomaly having an observed amplitude of 94 gammas. Its estimated mass was equal to about 20 pounds of iron.

FIGURE 106

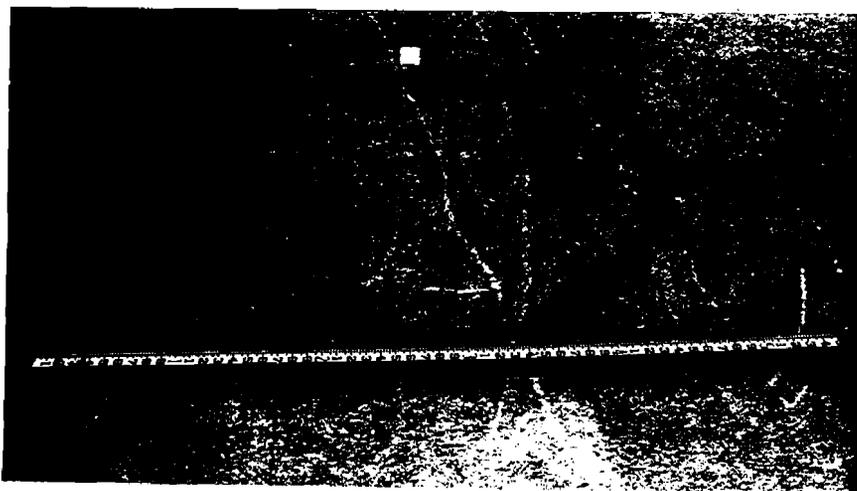
Brass Door Knob from Mill Creek Target # 13



Scale in Inches

FIGURE 107

Iron Wagon Wheel Tire from Mill Creek Target # 13



SCALE = 5.5 FEET

FIGURE 108

Knife Handle from Mill Creek Target # 13



Scale in Inches

The anomaly cluster designated Target # 16 was located a short distance east of Target # 15 on the east side of the project centerline. The water depth there at high water was about 3.5 feet. Anomalies having observed amplitudes of 79 and 55 gammas were detected. It was estimated that the artifacts associated with this target had masses equal to about 15 and 10 pounds of iron.

Among the artifacts recovered from Target # 16 were an iron oarlock, a pistol's revolving cylinder, and a horse shoe (Figures 109, 110, 111). A listing of all the material recovered is provided in Appendix II.

About 50 feet east of Target # 16 there was another anomaly cluster. It was designated Target # 17. This anomaly cluster covered the most territory of all the clusters making up Site 7K-A-114. It was also the cluster closest to the fast land physiographic feature suspected of having served as a landing place. Target # 17 extended from the southern edge of the project area to about 50 feet from shore. The water depth in this vicinity at high water varied from 1 to 3.5 feet depending on the distance from shore. Six anomalies having observed amplitudes of 281 to 63 gammas were detected at this location. It was estimated that the several artifacts associated with these anomalies had masses equal to between 50 and 15 pounds of iron.

The final component of Site 7K-A-114 was Target # 18. It was a single anomaly having an observed amplitude of 59 gammas. Its estimated mass was equal to about 10 pounds of iron.

**FIGURE 109**  
**Iron Oarlock from Mill Creek Target # 16**

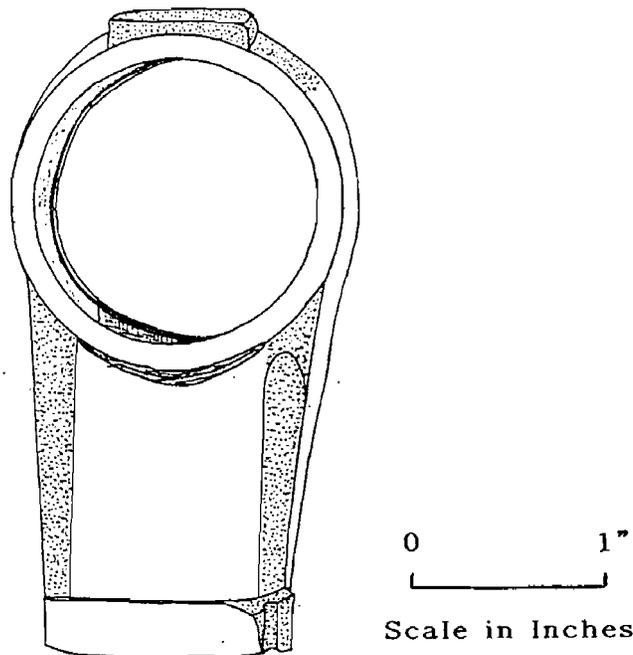
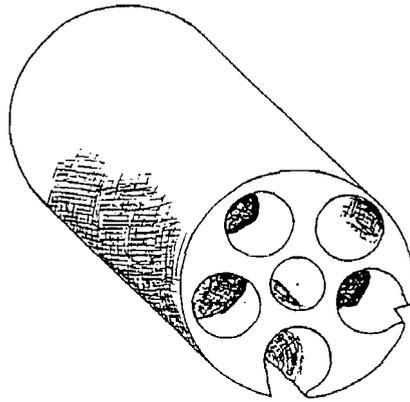
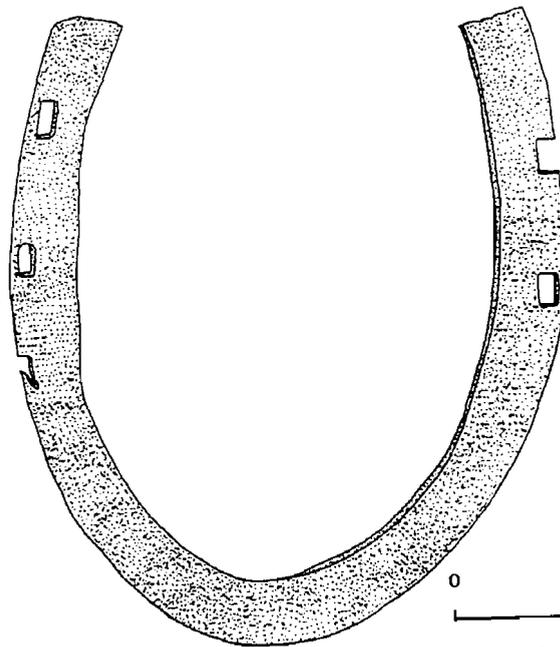


FIGURE 110  
Revolver Pistol Cylinder from Mill Creek Target # 16



0 1"  
Scale in Inches

FIGURE 111  
Iron Horseshoe from Mill Creek Target # 16



0 1"  
Scale in Inches

During the Phase II study a wide variety of cultural materials were encountered at Site 7K-A-114. Nearly all of the diagnostic artifacts were of 20th century vintage. Material that may predate 1900 was rare and limited to a small number of individually scattered items.

The most important find at Site 7K-A-114 was encountered at Target # 17. It was an articulated hull fragment from a wooden vessel of substantial size (Figures 112, 113).

This artifact assemblage consists of a large portion of a vessel hull's skeg assembly. It the part of the hull where the "deadwood" was located and where the vessel's rudder and propeller had been mounted (Figure 114). This skeg assemblage is 10'8" in length. It included four articulated timbers fastened with round iron drift bolts.

**FIGURE 112**  
**Mill Creek Shipwreck Assemblage in Situ**



**FIGURE 113**  
**Recovering the Mill Creek Shipwreck Assemblage**



(Delaware State News Photo/Vicki Cronis 1990)

**FIGURE 114**  
**Photograph of Mill Creek Shipwreck Assemblage**

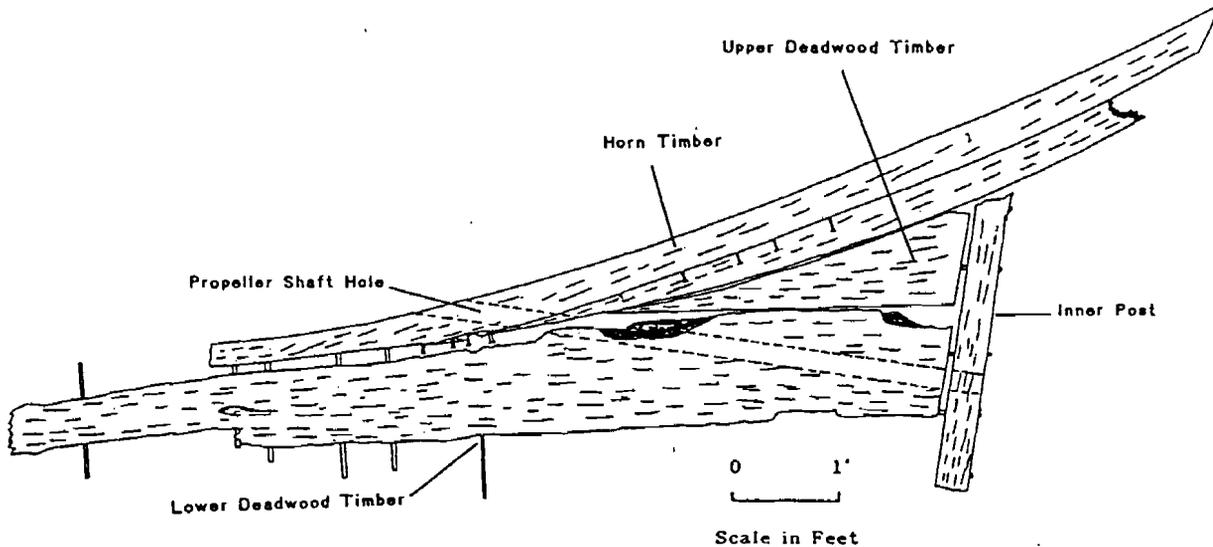


The four timbers present in this assemblage consisted of the following: horn timber, upper deadwood timber, lower deadwood timber, and inner post (Figure 115). The keel timber that had been attached to the underside of this hull section was missing. The vessel's hull planks were also missing, but several of the wire nails and square shanked boat spikes used to fasten them to the skeg area remained embedded in the intact assemblage.

The main member of this articulated skeg assemblage was the horn timber. It measures 9'1" long and had a maximum height of 7". The horn timber was curved in shape to follow the upswept lines of the vessel's stern. Both of its butt ends were beveled.

The horn timber was rabbeted on its underside for attachment of the hull's bottom planks. Several square shanked boat spikes and common wire nails remained embedded in the horn timber, showing where the bottom planks had been fastened. The rabbeted portion started 24" from the forward end of the horn timber and had an overall length of 73". It was beveled flush at its forward end and rose gradually in height to a maximum of 4" tall at the point where it ended at the hole for the rudder post. Whether or not the rabbeting continued sternward of the rudder post was unclear due to poor preservation of the wood there. The horn timber's rabbeting was 3" wide on both the port and starboard sides.

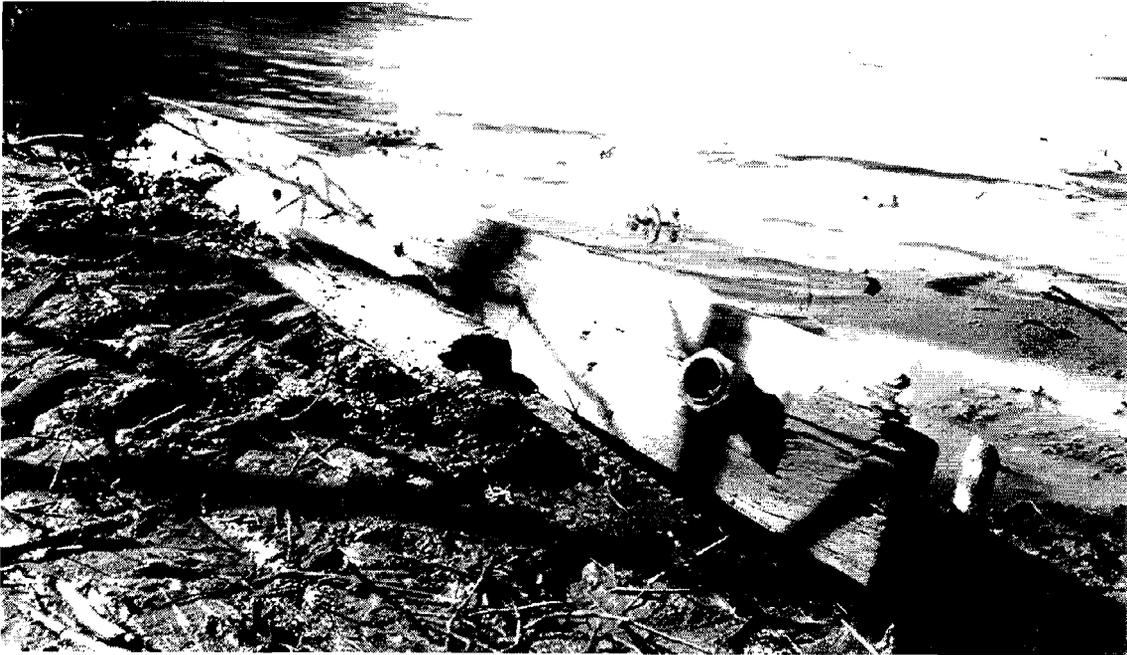
**FIGURE 115**  
**Mill Creek Shipwreck Assemblage**



At a distance of 11.5" from its stern end, the horn timber was pierced by a circular hole 3" in diameter to accommodate the vessel's rudder post. When found, this hole contained an iron pipe 3" in diameter which served as the bearing sleeve for the vertical rudder post (Figures 116, 117). This pipe was fitted with a hexagonal nut at its upper end to prevent it from slipping downward.

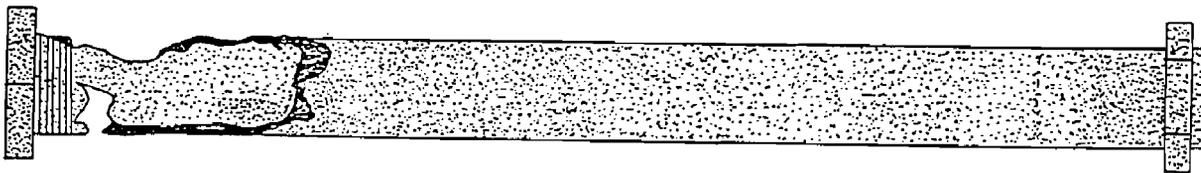
**FIGURE 116**

**Photograph Showing Mill Creek Shipwreck Assemblage Rudder Post Pipe**



**FIGURE 117**

**Rudder Post Pipe from Mill Creek Shipwreck Assemblage**



0 2"  
Scale in Inches

Towards its forward end, the horn timber was pierced by a circular hole 2" in diameter to receive the vessel's propeller shaft and shaft bearing sleeve. At its forward end, it was bevel-cut to fit flush with the lower deadwood timber to which it was fastened with drift bolts. The drift bolts extended through the deadwood and into the keel, which was missing from this assemblage.

The lower deadwood timber was 3" wide by 10.5" tall, and had a maximum length of 7'10". It served as filler between the keel and horn timber, but also was used for the attachment of bottom planks. Though preservation of its forward end was incomplete, it appears that the first 22" of the lower deadwood timber's forward end flared to a width of 9". The flared portion was rabbetted to receive the butt end of the traverse bottom planks that were fastened to the underside of that part of the hull. The rabbetted portion was 4.5" tall and the rabbeting was 3" wide on both port and starboard. This timber was pierced lengthwise by a hole 2" in diameter to receive the propeller's drive shaft and shaft bearing sleeve.

The upper deadwood timber was triangular in shape. It was 3.5" thick with a maximum vertical height of 11.25". Its overall length was 3'2". This part of the assemblage functioned as filler between the horn timber and the lower deadwood timber.

A vertical inner post was attached to the stern end of the skeg in order to reinforce the assembly. It measured 3.5" wide by 2.5" thick and was 2'6" long. Its upper end was attached to the horn timber. The stern end of the upper and lower deadwood timbers were attached horizontally to the inner post with drift bolts.

The inner post was pierced with a hole 2" in diameter to receive the propeller drive shaft. The exterior (sternward) face of the shaft hole was bracketed by four fastening holes (two above and two below) which appear to have used for attaching a metal bearing plate. When found, two of the fastening holes contained wooden pegs, one above and one below the shaft hole. The other holes were empty but identical to the two holes containing the wooden pegs. It appears that the shaft plate had been affixed using wooden pegs exclusively. The propeller shaft hole was not precisely aligned with the vessel's centerline. The inner post had been worn through on the starboard side.

The vessel's fastenings consisted of iron drift bolts, spikes, and nails. The drift bolts were 0.5" in diameter and from 10" to 16" long. Both flat head wire nails and square shanked boat spikes were used for attaching the hull's bottom planks to the horn timber and lower deadwood timber. The square shanked boat spikes were 4.5" long and the nails were 4" in length. They were spaced 1.5" to 8" from each other, most commonly using a spacing of 2" to 3.5". While most of the spikes were aligned fairly evenly, several were offset. This offsetting appears to be evidence of repairs to the hull during the vessel's operational career.

This artifact assembly was part of the stern section of a motorized vessel that probably dated to the first quarter of the 20th century, possibly circa 1910. Figure 118 shows the stern profile of vessels of the "V-bottom Work Boat" design class. That illustration shows the stern's underside at the skeg assembly with the propeller and rudder mounted in position. A scaled drawing of the skeg assemblage from Site 7K-A-114 is included in Figure 118 for comparison.

Though the Mill Creek skeg assemblage represents less than five percent of the original hull structure, it was sufficient to interpret with reasonable confidence the complete vessel's overall measurements. As originally built, this vessel had been a V-bottom Work Boat about 50' long by 14' wide amidships with an unloaded draft of about 3'.

V-bottom Work Boats were a class of intracoastal vessels formerly in widespread use in the Middle Atlantic region (Chapelle 1941). The architecture of the vessel would have been very similar to the plans of a representative Work Boat of this class drawn in the 1930's by Howard I. Chapelle when he worked as a Marine Architect in Cambridge, Maryland. Copies of those marine architectural drawings are provided in Figures 119 and 120.

In profile, these vessels were characterized by a tall derrick mast, a long open deck with hatch providing access to the hold, and a prominent pilot house at the stern (Figure 121). On the forward side of the pilot house, there was a low cabin containing the vessel's below deck engine room.

Vessels of this type operated in a variety of commercial roles on the waters of the Delaware Bay and Chesapeake Bay regions (Figure 122). They were commonly used for hauling freight and passengers, wholesale purchasing of oysters and crabs (as a "Buy Boat"), and fishing for oyster and crab.

V-bottom Work boats of this type were among the first internal combustion engine-powered craft used in commercial service in the Middle Atlantic region. They were commonly equipped with a thirty to forty horsepower medium duty gasoline engines (Chapelle 1941). When diesel engines became available for installation, they were often preferred over gasoline engines because of their reliability and fuel efficiency.

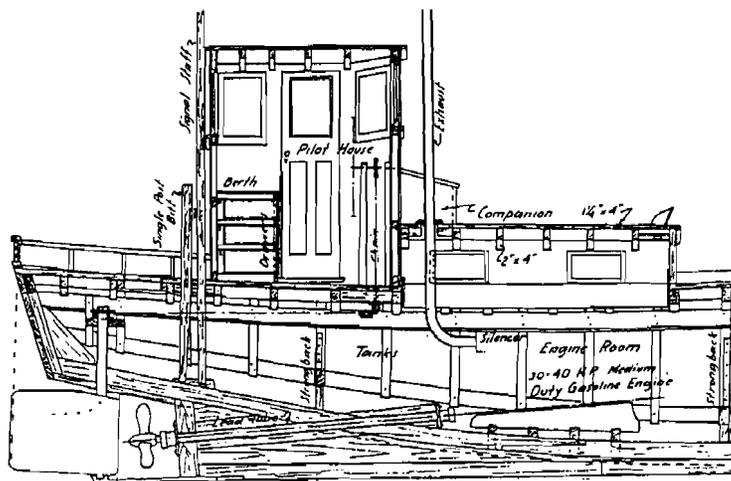
A notable marine architectural feature of these vessels is their hull type, which is called the "V-bottom." Figure 103 illustrates the difference between flat bottom, V-bottom, and round bottom hulls. The V-bottom is characterized by the lower hull rising in a shallow "V" from the keel. The angle of the arms of the "V" is called the "deadrise." At the outer ends of the V-bottom, the sides of the hull rise almost vertically at a sharp angle from the bottom. That sharp angular joint is called the "chine."

The V-bottom hull design did not come into widespread use in the United States until the late 19th century. Prior to that time the predominant hull configuration for ships and other watercraft was the round bottom. Virtually all of the watercraft dating prior to 1900 that are illustrated in this report's

section on general historical background were of the round bottom hull type. Flat bottom vessels were used almost exclusively for shallow draft river craft, and as a rule were not employed in the navigation of unprotected waters.

FIGURE 118

Position of the Skeg on Early 20th Century Work Boat Hulls



(Chapelle 1941)

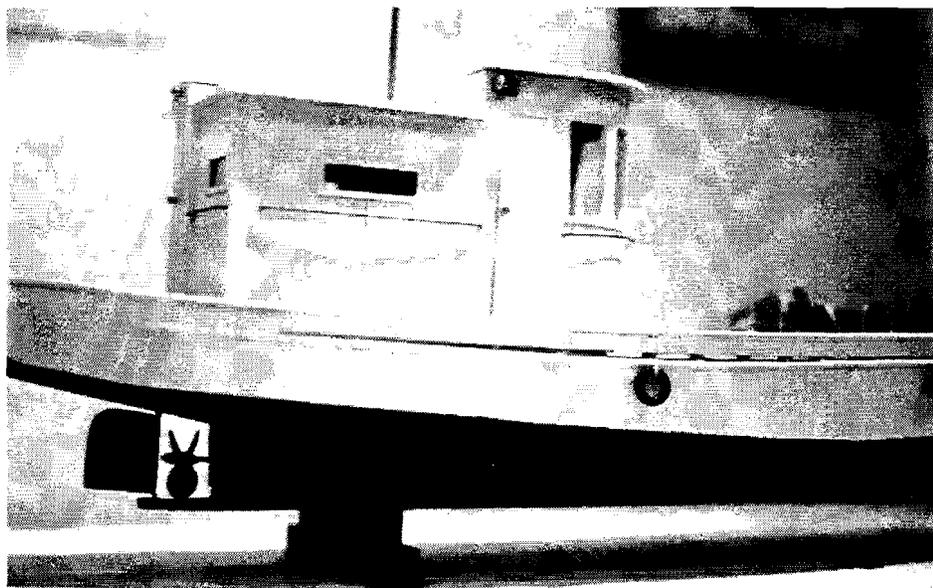
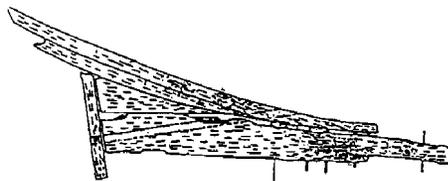




FIGURE 121  
Model of an Early 20th Century Work Boat

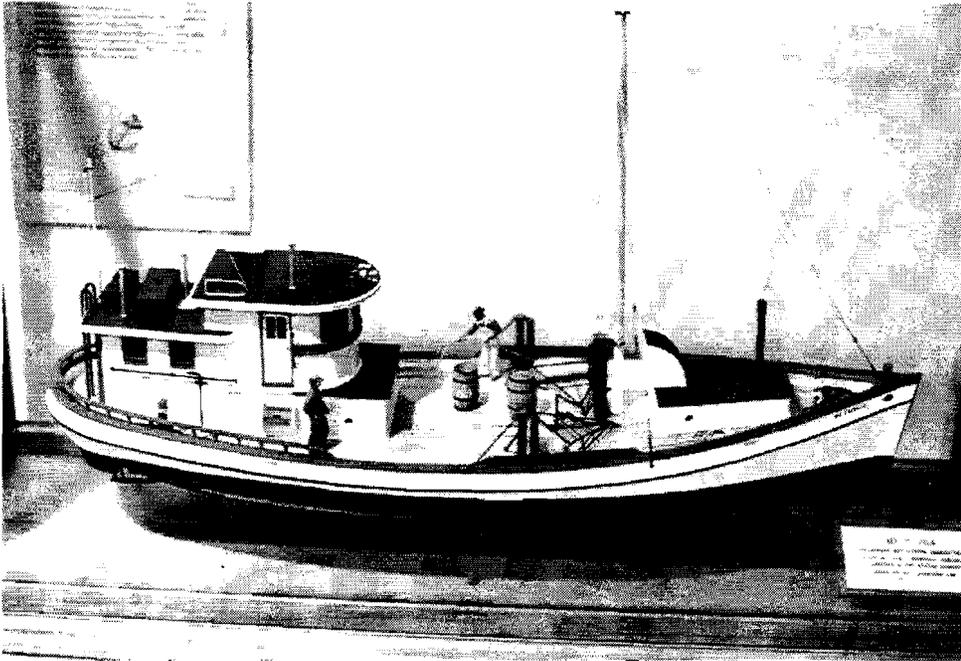
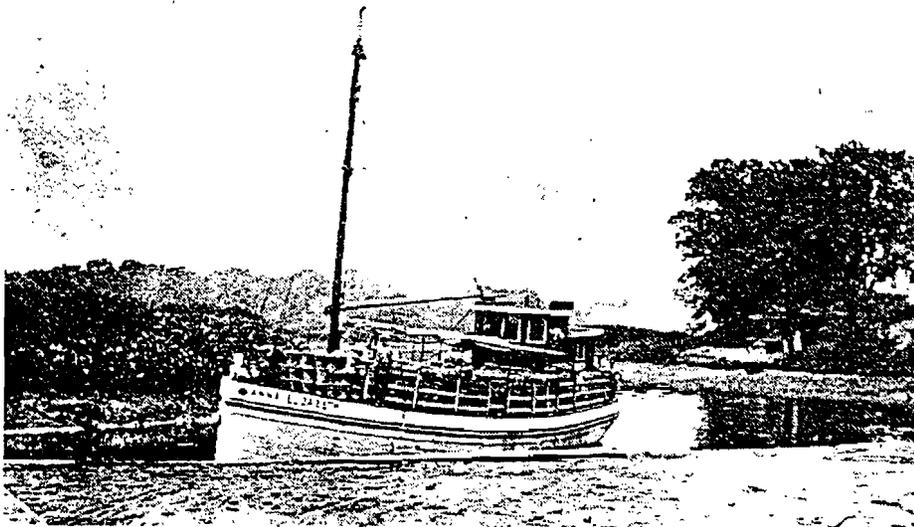


FIGURE 122  
Delaware Work Boat Anna Elizabeth (Early 1900's)



(Jamison and Others 1983)

The V-bottom hull was a late development in American marine architecture. Though it has become widely popular, its evolutionary background and exact origin are unclear (Chapelle 1951). The first published plan for a boat built with a V-bottom hull dates to 1877. It appears that this hull design originated not long before that date along the coasts of southern New England.

V-bottom hulls began to be built in boatyards of the Chesapeake Bay region by the late 1880's. Their construction in eastern Delaware probably began around that time, also. By the beginning of the 20th century, the V-bottom hull had become firmly established in the region's vernacular marine architecture.

The popularity and excellence of the V-bottom hull design is abundantly evident in present day times. Except for round bottomed sailing yachts, most motorized small craft in commercial or recreational use in modern times have hulls of the V-bottom type.

The hull skeg assemblage from Site 7K-A-114 was found resting exposed in a portion of Mill Creek that is mud flat at low tide. That location does not normally have sufficient water depth to float an intact vessel of this type, even at high water. The position of this find indicates either that this assemblage was part of a vessel that was dismantled at this location and almost entirely removed, or that it drifted to this position from elsewhere in Mill Creek.

The absence of additional vessel fragments or concentration of other debris such as would result from dismantling suggests that the skeg assemblage drifted to the place where it was found. If so, other portions of the vessel from which it originated may be situated elsewhere in Mill Creek outside the limits of the bridge crossing area.

The skeg assemblage from Site 7K-A-114 is from a wooden internal combustion engine powered Work Boat that was probably built between 1900 and 1930. This circa 1910 hull fragment is representative of Delaware's vernacular commercial boat building industry around the beginning of the 20th century. It is of a design class that was in widespread use in the Delaware Bay and Chesapeake Bay regions (Delaware, Maryland, Virginia, and New Jersey) during the first half of the 20th century. Several vessels of this general type remain in active operation in the Middle Atlantic region, though their numbers have declined substantially since the 1960's when they were still a fairly common sight.

Fortunately, some nautical researchers in the Middle Atlantic region have investigated and documented this design class (e.g. Chapelle 1941). In addition, at least one Work Boat of this type is preserved by a museum institution as an historic vessel. It is the Wm. B. Tennison which served as an oyster Buy Boat in Maryland's Chesapeake Bay. It is maintained and operated by the Calvert Marine Museum of Solomons, Maryland.

There does not appear to have been any previous underwater archeological investigation of a wreck of the type found at Site 7K-A-114. As a consequence, there is not sufficient information to compare this example to similar shipwreck

sites elsewhere in the Middle Atlantic region. This hull fragment is in a good state of preservation. If it is maintained in a stable condition, it will be available for further study and comparative analysis at some time in the future. It does not, however, appear to be of sufficient archeological or historical significance to merit nomination to the National Register of Historic Places.

A variety of other artifacts were encountered during the investigation of Site 7K-A-114. These have been classified into functional categories and are described below. A complete catalog of that material is provided in Appendix II.

Several artifacts that were used for domestic or personal purposes were found. These included a brass doorknob (Figure 106), two fragments of a knife with a handle bearing a ribbed design (Figure 108), the metal casing of a lipstick, and the cartridge cylinder of a revolver pistol (Figure 110).

Artifacts relating to transportation were also found. One was the iron tire (rim) of a wagon wheel, probably for a passenger buggy (Figure 107). Also found were the two parts of a broken wooden oar complete with a leather chafing guard (Figure 104) and two oarlocks (Figures 105, 109). The other transportation related artifacts were three fragments of a metal motor vehicle license plate and a motor vehicle drive shaft.

Miscellaneous iron and steel hardware and fasteners were also found. Tool, utensil, and machinery parts consisted of the following: a small pulley wheel, a chain link fragment, a kettle with handles attached, and two rusted hardware handles.

Fasteners and other artifacts included one long bar of iron stock, two large square iron spikes, two smaller spikes, three cut nails, one cut nail fragment, four long sections of iron strapping pierced with holes of which some contained bolts, and two rectangular iron box straps with bolts on each side. A large wooden timber with a hole drilled through one end was also found at the place to where it had drifted.

The hull fragment found at Site 7K-A-114 was removed from the project area, as were all the other artifacts of potential interest encountered during the Phase II study. The artifacts remaining at this site consist of 20th century refuse material and are not of archeological or historical interest. This site does not merit being considered eligible for nomination to the National Register.

The remaining seven isolated anomalies in the Mill Creek project area were of small dimension and mass. They were scattered parallel with the creek's southern shoreline. The following table summarizes the remote sensing data compiled for the seven isolated targets that were not associated with any of the designated archeological sites. The interpretations of mass provided in this table were derived from the nomograph and nomogram provided in Figures 49 and 50. These estimates of mass take into consideration the approximate distances from the magnetometer sensor.

Target Number	Maximum Amplitude	Approximate Mass (pounds of iron)
1	151 gammas	50
2	61 gammas	10
3	59 gammas	10
4	51 gammas	10
5	62 gammas	10
6	105 gammas	40
7	19 gammas	5

Each of these seven isolated anomalies had small dimension and mass. They consist of individual iron artifacts. At low tide several of them were seen to be refuse materials of recent vintage. It was unlikely than any of these isolated objects would be determined eligible for nomination to the National Register of Historic Places. As a result, no further investigation of them was conducted.

At the conclusion of the Phase II field work, the three archeological sites in the bridge crossing area had been sufficiently evaluated to assess their eligibility for nomination to the National Register. Site 7K-A-112, Site 7K-A-113, and Site 7K-A-114 were found to be predominantly 20th century refuse deposits probably associated with several ephemeral episodes of artifact deposition. Sites 7K-A-113 and 7K-A-114 also contained the remains of two watercraft. The one at Site 7K-A-113 was a small wooden row boat of vernacular construction. It was well preserved, and based on details of its construction it appears to date from the period 1920-1940. The vessel remains at Site 7K-A-114 were part of the stern section of an engine-powered wooden work boat of early 20th century construction, possibly circa 1910.

Artifacts found in the project area that dated prior to 1900 were few in number, widely scattered, and not of historical significance. In addition, evidence of trapping, fishing, and hunting activity indicated intermittent use of the project area for those activities.

None of the three underwater archeological sites in the bridge crossing area was of sufficient archeological interest to merit nomination to the National Register of Historic Places. It was recommended that no further cultural resources investigation of the Mill Creek bridge crossing area be required prior to the proposed construction.